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**GK** <sup>A</sup>

# GK General Knowledge Awareness

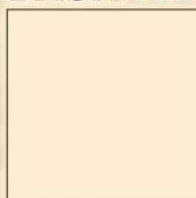
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# *Preface*

**General Knowledge** is a collection of information (facts) about many different things, as opposed to detailed knowledge about one particular subject, while '**General Knowledge Awareness**' means "**Being Aware of Changes**" due to the updated contexts of knowledge. Significantly, access to the right sources is very important for general knowledge awareness.

For example, at present, there are **28 States** and **8 Union Territories** in India. After the formation of **Telangana** state in 2014, the number of States and Union Territories was 29 and 7 respectively. But after the implementation of the **Jammu and Kashmir Reorganization Act, 2019**, the number of states in India was 28 while the number of union territories increased to 9.

Subsequently, under the **Dadra and Nagar Haveli and Daman and Diu Act, 2019** (after the merger of two Union Territories namely Dadra and Nagar Haveli and Daman and Diu) the number of Union Territories again decreased to 8. Being aware of this fact, is an example of **General Knowledge Awareness**.

Similarly, the **date of establishment of Sikkim** state has been shown as 26 April 1975 in many books whereas on official website of Sikkim state it has been mentioned as **16 May 1975**.

In this book, **GKA (General Knowledge Awareness)**, presented by Sam-Samayik Ghatna Chakra, we have tried to encapsulate, different facts and information based on various official data and sources, which will be helpful to you avoiding confusions as mentioned in the above examples.

In this compendium, we have tried to sum up several information related to **Indian Polity and Constitution, World and Indian History, Geography (India and World), General Science (Physics, Chemistry & Biology), Science & Technology, Economics and Indian Economy, Environment & Ecology, Computer, Sports and Miscellaneous**.

We do not want to limit this work, till the date of publication only. Work will continue after the print of this edition.



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# Why? **GK<sup>A</sup>**

General Knowledge Awareness

Generally, while publishing a book of General Knowledge, various publishers are not aware of the concrete facts and publish the wrong information. See some examples-

| Fact                                                     | Wrong Fact                        | True Fact                                          |
|----------------------------------------------------------|-----------------------------------|----------------------------------------------------|
| Highest Lake in India                                    | Cholamu Lake                      | Gurudongmar Lake                                   |
| Longest National Highway in India                        | NH-44                             | N H - 2 7 E W                                      |
| Shortest National Highway in India                       | NH-47A                            | N H - 3 2 7 B                                      |
| Formation of Sikkim State                                | 26 <sup>th</sup> of April, 1975   | 16 <sup>th</sup> of May, 1975                      |
| Formation of the Forward Bloc                            | 1 <sup>st</sup> of May, 1939      | 3 <sup>rd</sup> of May, 1939                       |
| Establishment of Visva Bharati                           | 1912                              | 1921                                               |
| Establishment of Belur Math                              | 1887                              | 1897                                               |
| Book written by Ptolemy in 2 <sup>nd</sup> Century       | Geography of India                | Geography                                          |
| Pushyamitra Sunga                                        | Built Bharhut stupa               | Rebuilt Bharhut stupa                              |
| Lal darwaza masjid was built by                          | Mahamud Shah                      | V.V. Raje, the wife of Sultan Mahamud Shah         |
| Captain William Hawkins came to the court of Jahangir in | 1609                              | 1608                                               |
| Leader of Bhil rebellion                                 | Sevaram 1825-31                   | Trambyak Ji 1813-31                                |
| Leader of Kol Movement                                   | Gomdhar Konwar                    | Buddhu Bhagat                                      |
| Sarda Act was implemented                                | 1930                              | 1929                                               |
| Founder of Veda Samaj                                    | Keshab Chandra Sen                | K Sridharlu Naidu - Inspired by Keshab Chandra Sen |
| Founder of Women's Indian Association (WIA)              | Lady Shadashiva Iyyer             | Annie Besant                                       |
| Downward Filtration Theory                               | Lord Auckland                     | Alexander Duff                                     |
| Chauri Chaura Kand                                       | 5 <sup>th</sup> of February, 1922 | 4 <sup>th</sup> of February, 1922                  |

| Fact                                                                                                                                            | Wrong Fact                         | True Fact                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-----------------------------------------------------------------------------------|
| Article 19 of the Indian constitution mentions six freedoms that are available to the citizens of India. The freedom of the press is vested in- | Article 19 (A-F)<br>Article 19 (A) | Article 19 (A-G)<br>Article 19 (1) A                                              |
| Asia's largest tin producing country                                                                                                            | Malaysia                           | China                                                                             |
| Area of United States of America                                                                                                                | 470131 km square                   | 9833517 km square                                                                 |
| Area of China                                                                                                                                   | 137060 km square                   | 9596960 km square                                                                 |
| Origin of Mississippi River                                                                                                                     | Red Rock                           | Itasca Lake                                                                       |
| The City of Ottawa (Canada) is located on the banks of the river-                                                                               | Saint Lawrence river               | Ottawa River                                                                      |
| Origin of river Periyar is-                                                                                                                     | Periyar Lake                       | From the forest area of Sivagiri peak                                             |
| The number of Lakhimpur-Bhanga National Waterway is-                                                                                            | N.W. 6                             | N.W. 16                                                                           |
| Dhar Fort                                                                                                                                       | Built by Muhammad Tughluq          | Built by Raja Bhoja I                                                             |
| Golconda Fort                                                                                                                                   | Qutb Shahi Dynasty                 | Clay fort built in 1143 by the King of Warangal, Quli Qutb Shah built it of stone |
| Ellora Caves                                                                                                                                    | Built by Buddhist                  | Built by Rashtrakuta rulers                                                       |
| Gateway of India                                                                                                                                | George Vitthal Clarke              | George Wittet (architect)                                                         |
| Jantar Mantar and Nahargarh                                                                                                                     | Built by Sawai Jaisingh            | Built by Sawai Jaisingh II                                                        |
| Tallest Tower in India                                                                                                                          | Qutb Minar (Delhi)                 | Fatehburj (Punjab)                                                                |
| Largest Mosque in india                                                                                                                         | Jama Masjid (Delhi)                | Taj-ul- Masjid (Bhopal)                                                           |

Apart from the above facts, there are many wrong/old facts which are being published continuously. Aspirants memorize same facts and give wrong answers in exams. In the present book- **GK<sup>A</sup>**, we have verified the facts by analyzing them thoroughly. Along with this, we have included the updated version of the facts in this book. That is why we have named this book **GK<sup>A</sup>** instead of GK. You can visit our website [ssgcp.com](http://ssgcp.com) to be aware of the updated status of facts.



# Indian Polity

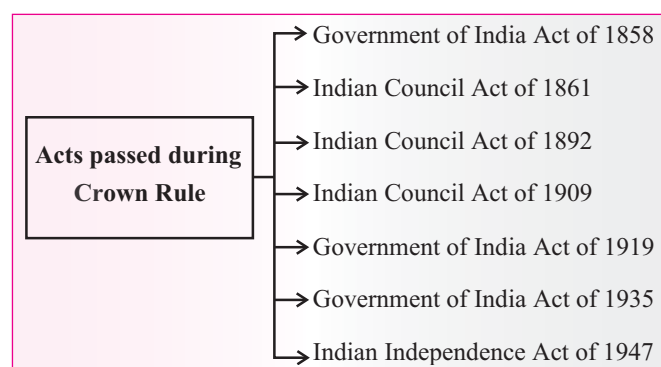
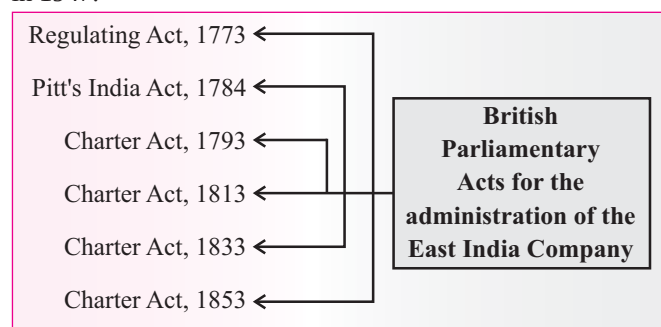


## Topics of the Unit

● Constitutional Development of India ● Source of the Constitution ● The Preamble ● Schedules ● The Union of India and Its Territories ● Citizenship ● Fundamental Rights ● Directive Principles of State Policy ● Fundamental Duties ● Parliament ● Amendment of the Constitution ● Supreme Court ● High Court ● Attorney General and Advocate General ● Comptroller and Auditor General ● State Executive ● Powers and Functions of the Governor ● State Legislature ● National Symbols of India ● Panchayati Raj ● Municipalities ● Consolidated Fund ● Contingency Fund ● Centre-State Relations ● Inter-State Relations ● NITI Aayog ● National Development Council ● Finance Commission ● Public Service Commissions ● Election Commission ● Special Provisions ● Important Constitutional Amendments ● Important Articles of the Indian Constitution

## 1 Constitutional Development of India

A Constitution is a body of rules and laws, based on which a country is governed. Historically, the development of the Indian Constitution began with the establishment of the East India Company's rule in India in the mid-eighteenth century, followed by the direct rule of the British govt. till Indian independence in 1947.



### Regulating Act of 1773 :

- The Regulating Act allowed the British Parliament to regulate the affairs of the East India Company rule in India.
- The Governor of Bengal was subsequently designated as the Governor-General of Bengal with a Council, consisting of four members, entrusted with carrying out legislative and executive functions.

- **Warren Hastings** became the **first Governor-General of Bengal**. His Council consisted of four members - John Clavering, George Monson, Philip Francis and Richard Barewell.
- Presidencies of Madras and Bombay were made subordinate to the Bengal Presidency especially in matters of foreign policy. After this Act, they could not wage war against the Indian States without Bengal's approval.
- Under this Act, the **Supreme Court was established at Calcutta** as the Apex Court in **1774**, with a Chief Justice and 3 other Judges. (UPPCS 2010, 2003; RO/ARO, 2016)

**Note :** First Chief Justice of the Supreme Court was **Elijah Impey** and the 3 other judges were **Chambers, Le Maistre** and **Hyde**.

- It was made mandatory for the Company to provide all information on India related to revenue, citizens and military to the British Parliament.

### Act of Settlement of 1781 :

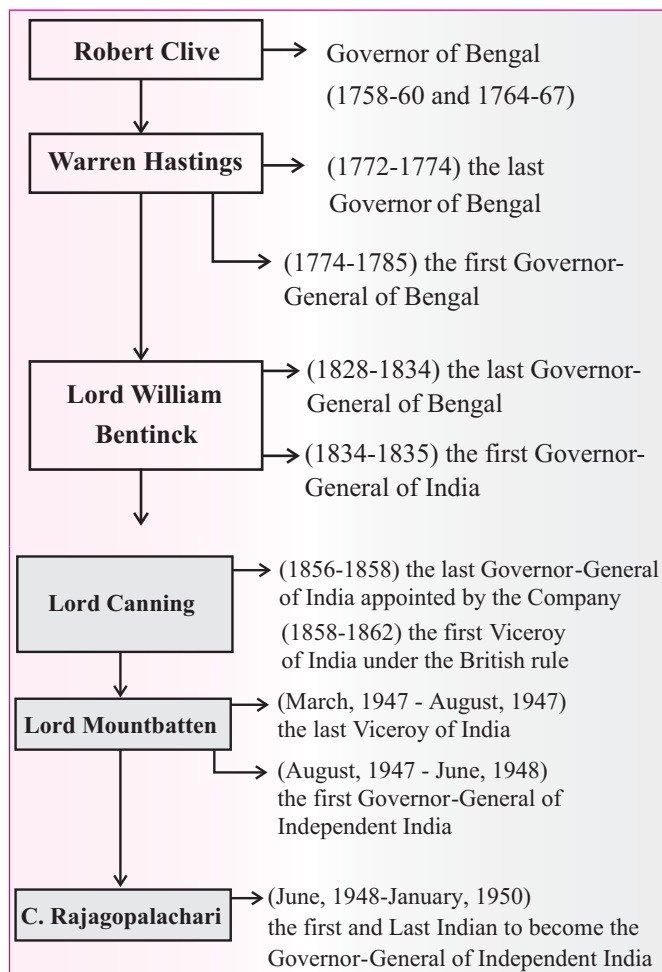
- This Act was passed to remove the defects in the Regulating Act 1773. By this Act, the Government of Calcutta was empowered to make laws for Bengal, Bihar and Odisha. The servants of the company which earlier came within the jurisdiction of the Supreme Court, were now exempted from the jurisdiction of the SC.

### Pitt's India Act of 1784 :

- The British Crown was the Supreme Controller of the Company's affairs and its administration in India.
- **The Commercial and political functions of the Company were separated**. It was called Dual Government (dyarchy).
- Dual government (political and commercial) was started in India which remained in force till 1858.
- It allowed the **Court of Directors** to manage the commercial affairs but created a new body called the **Board of Control** to manage the political affairs. (UPPCS, 2003)

- The territories of the company in India were for the first time called "**The British Possession in India**".

#### India's First/Last, Governor/Governor-General/Viceroy



#### Charter Act, 1786 :

- This Act gave overriding powers to the Governor-General over his council in extraordinary situations.
- Governor General got the power to work as both, Governor-General and Commander in Chief.
- Lord Cornwallis became the first effective ruler under the authority of the Board of control and the Court of Directors.

#### Charter Act, 1793 :

- This Act extended the company's Charter for another 20 years.

#### Charter Act of 1813 :

- This Act **ended the Company's monopoly over trade with India**, except in **tea** and **opium** and trade with China.

(UK PSC, 2016; UPRO/ARO Mains, 2017; UK PSC Pre, 2016; IAS, 2019)

- The Act also required the company to invest one lakh rupees annually in the education of Indians. (IAS, 2018; UPPCS RO, 2017)
- Approval by the British Parliament was made mandatory for laws passed by of Calcutta, Bombay and Madras governments.

(IAS Pre, 2019)

#### Charter Act of 1833 (Saint Helena Act) :

- Governor-General of Bengal became the **Governor-General of India**.
- The Act ended the activities of the East India Company as a commercial body and it became **administrative body properly**. Significantly, the company's trade links with China were also suspended.
- In the Governor-General Council, a law member was added as a fourth member (first law member-**Macaulay**).
- The Governor-general had legislative power over all of British India.
- **Slavery** was declared illegal under this Act and **abolished in 1843**.
- The legislative powers were centralized by this Act.
- This Act stated that merit, not birth, colour, religion or race, should be the basis for the employment of civil services.

(UPPCS, 2012)

- According to Section 87 of the Act, no Indian was to be discriminated against the government jobs on the grounds of religion, place of birth, descent and colour.
- The Charter Act 1833 which was enacted by the British Parliament provided for the establishment of a Law Commission for consolidation and codification of Indian Laws.

#### Charter Act of 1853 :

- This Act laid the foundation of civil service exams and opened the gates of a fair competition system for civil servants.
- For the first time, the legislative and executive functions of the Governor-General's Council were separated.
- A **Central Legislative Council** was created.

#### Government of India Act of 1858 :

- After the First War of Independence in 1857, the British government passed the Government of India Act of 1858.
- This Act is also known as the '**Act for the Better Government of India**'.
- This Act ended the rule of the Company and the British possessions in India were transferred under direct British rule.
- The **Dual Government** by Pitt's India Act of 1784 was **abolished**.
- It changed the designation of Governor-General of India to that of **Viceroy**, of India, who was the direct representative of the British Crown in India.
- The first Viceroy of India was Lord Canning.
- The merchant company's residual powers were vested in the 'secretary of state for India; a minister of Great Britain's Cabinet, who would preside over the India office in London.

#### Indian Councils Act of 1861 :

- Beginning of Indian's representation in the Viceroy's Council legislative.



✎ **Note :** In 1862 Lord Canning nominated three Indians (**Raja Deo Narain Singh of Benares, Maharaja Narendra Singh of Patiala and Sir Dinkar Rao Raghunath of Gwalior**) into the Legislative Council.

- It empowered the Viceroy to **issue ordinances**, without the concurrence of the Legislative Council, during an emergency.
- The Viceroy also got the **right to establish new provinces** and change their boundaries under this Act.
- Viceroy was given the power to establish a legislative council in provinces. (CGPSC, 2021)

✎ **Note :** Legislative councils were formed in Bengal, North-West Frontier Province and Punjab in 1862, 1866 and 1897, respectively.

#### Indian Councils Act of 1892 :

- **Indirect elections** (described as nomination) were **introduced** under this Act.
- The Act provided Indian members with the right to ask questions related to the finances and budgets (however, this right was barred after the amendment in the Act in 1861) and matters of public interest after a notice of 6 days. (UPPCS, 2003)
- significantly, members were restricted from asking supplementary questions. (UPPCS, 2003)

#### Indian Council Act of 1909 :

- This Act is also known as **Morley– Minto Reforms**. Lord Morley was then Secretary of State for India and Lord Minto was the Viceroy of India.
- For the first time, an Indian was made a member of the Viceroy's Executive Council.

✎ **Note :** **Satyendra Prasanno Sinha** was the first Indian member of the Viceroy's Executive Council. He was included as a **law member**.

- Under this Act Indians were provided representation in law making and administration.
- Under this Act the members now could discuss the budget and move resolutions. They could also discuss matters of public interest.
- They could also ask supplementary questions.
- It introduced a system of communal representation for **Muslims** by accepting the concept of **separate electorate**. (MPPCS, 2017, 2019)
- This Act legalized '**Communalism**' and **Lord Minto** came to be known as the '**Father of Communal Electorate**'.

#### Government of India Act of 1919 :

- This Act is also known as **Montagu-Chelmsford Reforms**.

- At this time Montagu was the Secretary of State for India and Lord Chelmsford was the Viceroy of India.
- "Partially responsible" government and 'Dyarchy' was established in provinces. (MPPCS, 2022; IAS, 2013, 2012, 2017)
- The Father of 'Dyarchy' in provinces was **Lionel Curtis**.
- Provincial subjects were divided into two parts : **transferred** and **reserved**. (IAS, 2022)
- The transferred subjects were administered by the Governor with the aid of ministers responsible to the Legislative Council. The reserved subjects were administered by the Governor and his Executive Council without being responsible to the Legislative Council.
- A **bicameral legislature** was introduced for the first time **at the central level**. (UPPCS, 2008; MPPCS, 2013)
- Suffrage rights were given to those paying land tax and income tax. Some women were also given the right to vote.
- The **communal representation** was extended to **Sikhs, Europeans** and **Anglo-Indians**.
- This Act provided for the establishment of the **Public Service Commission**. (UP RO/ARO, 2021)
- Government of India Act, 1919 provided a separate examination for the Indian Civil Service, which was to be held in India. (UP RO/ARO (Pre.), 2021)

✎ **Note :** In **1926** Public Service Commission was established by the recommendation of **Lee Commission**.

- It provided to constitute a Statutory Commission which was to submit its report after 10 years of inquiry.

#### Government of India Act of 1935 :

- It was a detailed document having **321 Articles** and **10 Schedules** but with no Preamble. (UP Lower Pre, 2015)
- It provided for the establishment of an **All-India Federation** consisting of provinces and Princely States.
- However, the Federation never came into existence.
- **Dyarchy** was **abolished at the provincial level** and **introduced at the central level** and provincial autonomy was also introduced. (UPPCS, 2013; IAS (Pre.), 2017)
- It provided for **bicameralism in some provinces**. Six out of eleven provinces – Bombay, Madras, Bihar, Bengal, United Provinces and Assam. They were made bicameral consisting Legislative Council and Legislative Assembly.
- It provided for the establishment of the **Federal Court which was set up in 1937**. (UPPCS, 2014)
- This Act abolished the **Council of India**, established by the Government of India Act of 1858.
- Burma was separated from British India and two **new provinces, Sindh and Odisha** were formed under 1935 Act. (UPPCS, 2011)

- The **Reserve Bank of India** was established to control the currency and credit in the country.
  - The British government under the Act of 1935 had granted women 41 reserved seats in provincial legislature. (IAS (Pre. 2021))
  - About **10 per cent** of the total population got the **voting right under this Act**.
  - It provided for the establishment of the **Federal Public Service Commission** along with Provincial Public Service Commissions and Joint Public Service Commissions.
- Indian Independence Act of 1947 :**
- This Act ended the British Rule in India, partitioning the colony into two independent **Dominion State - India and Pakistan**.
  - It empowered the Constituent Assemblies of both dominions to frame and adopt a new Constitution for their respective nations.
  - Both Dominions were given the freedom to separate from the British Commonwealth.
  - Indian Independence Act, 1947 announced the end of British sovereignty over the princely states of India from 15<sup>th</sup> August, 1947.
  - This Act abolished the title of the 'Emperor of India' from the British crown.
  - Princely states were given the right to join either Pakistan or India, based on two major factors : Geographical contiguity and the people's wishes.
  - It provided for the governance of each of the dominions and provinces by the Government of India Act of 1935, till the new Constitutions were framed.
- Making of the Constitution :**
- The very first demand for the constituent Assembly on behalf of Indians was made by Swaraj Party in Ranchi in 1934. (IAS, 1996)
  - M.N. Roy was the first person who demanded a Constituent Assembly individually.
  - In 1934 the Indian National congress formally demanded that a constituent Assembly composed of Indians be set up to frame a constitution for India. (UPPCS GIC, 2017)
  - Mahatma Gandhi said, "The Constituent Assembly alone can produce a Constitution indigenous to the country and truly and fully representing the will of the people". (MPPCS, (Pre.), 2022)
  - The proposal for framing of the Constitution to India by an elected Constituent Assembly was made by Cripps Mission. (UPPCS Spl. Mains, 2008)
  - The **Constituent Assembly** was constituted under the scheme of the **Cabinet Mission of 1946**. (UK PSC Pre, 2012; UP Lower Sub Pre, 2009)
- According to the Cabinet Mission, the strength of the Constituent Assembly was to be **389**.
  - Out of 296 seats allotted to British India, 292 members were to be drawn from the 11 provinces and 4 from the four Chief Commissioners' Provinces.
  - Generally, **one seat** was to be allotted for **every 10 lakh of the population**. (UPPCS, 2003)
  - Seats allocated to each British province were to be divided among **three** principal communities— **Muslims, Sikhs** and **general** population in proportion to their numbers.
  - The Constituent Assembly held its first meeting on **9<sup>th</sup> December, 1946 in New Delhi**.
  - The Muslim League boycotted the meeting and insisted on a separate State of Pakistan.
  - The first meeting was thus attended by only **207 members** who were Congress members.
  - The province of Hyderabad did not participate in the Constituent Assembly.
  - The Constituent Assembly was not based on adult suffrage. (IAS Pre, 1993)
  - The Constituent Assembly was a result of an indirect election. (IAS Pre, 1993)
  - The oldest member, **Dr. Sachidanand Sinha**, was elected as the **temporary Chairman** of the Constituent Assembly.
  - The first meeting of the Constituent Assembly was held on 9 December, 1946. (UPSC Pre, 2005; UPPCS, 1990)
  - On **11<sup>th</sup> December 1946**, **Dr. Rajendra Prasad** was elected as the Chairman of the Assembly, **HC Mukherjee** as Vice-Chairman and **BN Rau** as a constitutional advisor to the Assembly.
  - The number of **women** in the Constituent Assembly was **15**.
- ✎ **Note :** Women members in Constituent Assembly were Vijaya Lakshmi Pandit, Sucheta Kriplani, Malati Choudhary, Sarojini Naidu, Hansa Mehta, Rajkumari Amrit Kaur, Purnima Banerjee, Renuka Ray, Kamla Chaudhri, Leela Roy, Begam Aizaz Rasul, Ammu Swaminathan, G. Durgabai, Dakshayani Velayudan and Annie Mascarene.
- On **13<sup>th</sup> December, 1946** Jawaharlal Nehru moved the '**Objectives Resolution**', which was unanimously adopted by the Constituent Assembly on **22<sup>nd</sup> January, 1947** and later constituted as the Preamble to the Constitution. (UPPCS, 1998)
  - Various committees were constituted by the Constituent Assembly for deliberations over Constitution-making.
  - In the Interim Government formed in 1946, the Vice President of the Executive Council was Nehru. (IAS Pre, 1995)



### Principal Committees of the Constituent Assembly and Their Presiding Heads

| Committees                                              | Chairman                                  |
|---------------------------------------------------------|-------------------------------------------|
| Union Powers Committee                                  | Jawaharlal Nehru<br>(IAS, 2005)           |
| Union Constitution Committee                            | Jawaharlal Nehru<br>[RAS/RTS (Pre.) 2021] |
| Provincial Constitution Committee                       | Sardar Vallabhbhai Patel                  |
| Drafting Committee                                      | Bhimrao Ambedkar<br>[RAS/RTS (Pre.) 2021] |
| Advisory Committee on Fundamental Rights and Minorities | Sardar Vallabhbhai Patel                  |
| (i) Fundamental Rights Sub-Committee                    | J. B. Kriplani                            |
| (ii) Minorities Sub-Committee                           | H.C. Mukherjee                            |
| Committee on Rules of Procedure                         | Rajendra Prasad                           |
| Committee for the States                                | Jawaharlal Nehru                          |
| Steering Committee                                      | Rajendra Prasad                           |
| Ad-hoc National Flag Committee                          | Rajendra Prasad                           |

- On **29<sup>th</sup> August, 1947**, a drafting committee was constituted through a resolution. (UPPCS, 2008)
- **Dr. Bhimrao Ambedkar** was elected as the chairman of this committee. (UPPCS, 1995; UP RO/ARO, 2014)

✎ **Note :** Dr. Bhimrao Ambedkar was elected from the Bombay Presidency to the Constituent Assembly.

- The function of the drafting committee was to discuss the draft of the Constitution prepared by constitutional advisor B.N. Rau. (UP Lower, 1993; UPPCS, 2014)
- The Drafting Committee submitted its report to the Constituent Assembly on **21<sup>st</sup> February, 1948**.

### Drafting Committee - Total Members - 7

(UP Lower 2008)

|            |                                                                             |
|------------|-----------------------------------------------------------------------------|
| Chairman - | 1. Dr. Bhimrao Ambedkar<br>[UPPCS (Mains), 2008]                            |
| Members -  | 2. N. Gopalaswami Iyengar<br>(UP Lower Sub, 2008)                           |
|            | 3. Alladi Krishnaswami Iyer                                                 |
|            | 4. Dr. K.M. Munshi                                                          |
|            | 5. Syed Md. Sadullah                                                        |
|            | 6. N. Madhav Rao (He replaced B.L. Mitra, who resigned for health reasons.) |
|            | 7. T.T. Krishnamachari (replaced D.P. Khaitan in 1948)                      |

✎ **Note :** The first reading of the Constituent Assembly started from **4<sup>th</sup> November to 9<sup>th</sup> November, 1948**, the second reading from **15<sup>th</sup> November, 1948** to **17<sup>th</sup> October, 1949**, and the third reading from **14<sup>th</sup> November, 1949** to **26<sup>th</sup> November, 1949**.

- The **Constitution was adopted** by the Constituent Assembly on **26<sup>th</sup> November, 1949**.
- A total of **15 Articles** (the provisions relating to citizenship, elections, provisional parliament, temporary and transitional provisions) of the Constitution came into effect on **26<sup>th</sup> November, 1949** while the remaining did on **26<sup>th</sup> January, 1950**.

✎ **Note :** On January 26, 1930, the historic "Poorna Swaraj" declaration was officially promulgated, beginning the final phase of India's freedom struggle where the goal would be complete independence from British rule. So, on this date Republic day was announced.

- The first Republic Day of India was celebrated on 26th January 1950.
- Presently Indian Constitution consists of a Preamble, 468 Articles, 12 Schedules and 25 parts. (from the point of view of enumeration).
- The Constitution was adopted by the Constituent Assembly on November 26, 1949, Originally, it had **22 Parts, 8 Schedules** and **395 Articles**.
- On 26<sup>th</sup> January 1950, Dr. Rajendra Prasad was elected the first President of Independent India.
- The **National Flag** was adopted by the Constituent Assembly on **22<sup>nd</sup> July, 1947** and the **National Song** and **National Anthem** on **24<sup>th</sup> January, 1950**.
- India's membership of the Commonwealth was confirmed in **May 1949** by the Constituent Assembly.
- Prem Behari Narain Raizada (Saxena) is the man who hand wrote the original Constitution of India.

### Exam Oriented Facts

- The Swaraj Party in its conference at Ranchi in May, 1934 presented the policy of Constituent Assembly. [IAS (Pre.), 1996]
- The Idea of the constituent assembly was put forward for the first time by M.N. Roy in 1934. (UPPCS GIC, 2017)
- Indian constituent assembly was constituted under the Cabinet Mission 1946. [MPPCS (Pre.) 2023]
- Frank Anthony was the first nominated temporary Deputy Chairman of the Constituent Assembly. (MPPCS pre 2020)

|                                                                                                                                                                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>Nehru has presented an objective resolution in the fifth meeting of the first session of the Constituent Assembly on 13 December, 1946. (MPPCS Pre 2021)</li> </ul>                                                    |
| <ul style="list-style-type: none"> <li>Sir Benegal Narsing Rau was appointed as the constitutional advisor during the formation of the Constitution. (UPPCS Pre 2014; UP Lower Sub Pre 1998; Jharkhand PCS Pre 2003; Uttarakhand UDA/LDA Pre 2007)</li> </ul> |
| <ul style="list-style-type: none"> <li>Constitution day is celebrated on 26th November. (62<sup>nd</sup> BPSC 2016)</li> </ul>                                                                                                                                |
| <ul style="list-style-type: none"> <li>B.R. Ambedkar was elected to the constituent assembly from the Bombay Presidency. (IAS Pre 1996)</li> </ul>                                                                                                            |

### Important Facts Related to the Constituent Assembly

|                                           |                                |
|-------------------------------------------|--------------------------------|
| First Meeting                             | 9 <sup>th</sup> December, 1946 |
| Temporary Chairman                        | Dr. Sachidanand Sinha          |
| Permanent Chairman                        | Dr. Rajendra Prasad            |
| Vice-President                            | H.C. Mukherjee                 |
| Constitutional Advisor                    | Sir B.N. Rau                   |
| The time was taken in Constitution-making | 2 years, 11 months, 18 days    |
| Duration of debate                        | 114 days                       |
| Total expenditure                         | 63,96,729 Rupees               |
| Total readings                            | Three                          |
| Constitution adopted on                   | November 26, 1949              |
| Constitution came into force on           | 26 <sup>th</sup> January 1950  |

- Interim government for India was formed based on the Cabinet Mission Plan.
- An interim government was formed on **2<sup>nd</sup> September 1946**. On **26<sup>th</sup> October 1946**, the Muslim League also joined it.

### Interim Government

| Ministers                   | Ministry                                   |
|-----------------------------|--------------------------------------------|
| 1. Jawaharlal Nehru         | External Affairs & Common Wealth Relations |
| 2. Sardar Vallabhbhai Patel | Information, Broadcasting and Home         |
| 3. C. Rajagopalachari       | Education Arts                             |
| 4. Liaquat Ali              | Finance                                    |
| 5. Jogendra Nath Mandal     | Law                                        |
| 6. Asaf Ali                 | Railways                                   |

|                           |                               |
|---------------------------|-------------------------------|
| 7. Dr. Rajendra Prasad    | Food and Agriculture          |
| 8. Dr. C.H. Bhabha        | Works, Mines and Power        |
| 9. Baldev Singh           | Defence                       |
| 10. I.I. Chundrigar       | Commerce                      |
| 11. Abdur - Rab - Nishtar | Communication, Postal and Air |
| 12. Ghaznafar Ali Khan    | Health                        |
| 13. Jagjivan Ram          | Labour                        |

✎ **Note** : Liaquat Ali, Jogendra Nath Mandal, I.I. Chundarigar, Abdur-Rab-Nashtar and Ghazanfar Ali Khan were members of the Muslim League.

✎ **Note** : The Princely States were made to join the Union of India under the strong leadership of Sardar Patel. The princely state of Hyderabad was incorporated into India by police action, the princely state of Junagadh through plebiscite and the princely state of Jammu and Kashmir was incorporated into India by signing an **Instrument of accession**.

- The interim government worked from 26<sup>th</sup> January, 1950 till the government formed after the first general election (1951-52).
- The exact constitutional Status on 26-1-1950 was 'A Sovereign Democratic Republic'.  
(IAS (Pre.) 2021; UPPCS (Mains), 2009; UP Lower SDD (Pre.), 2008)

## 2

### Source of the Constitution

The **Indian Government Act, 1935** has the most significant influence on the Indian Constitution. Essential features from the constitutions of various countries were also borrowed and incorporated in the constitution of India. Those countries with their special constitutional features are as follows-

- **Britain** : Parliamentary system of governance, single citizenship and rule of law, etc.
- **United States of America : Fundamental Rights**, Independence of the judiciary, Doctrine of judicial review, Post of Vice-President, Impeachment of President, Removal of Judges of Supreme Court and High Court.  
(UP RO/ARO 2014; UPPCS (Pre.), 1998; UPPCS 2012, 2008; IAS 1993)
- **Canada** : Appointment of the Governor by the centre, Federal system and residual powers vested with the same.  
(UPPCS, 2006)
- **Ireland : Directive Principles of State Policy**, Election System of the President, members nominated by President to the Parliament.  
(UPPCS, 1998)

- **Australia :** Freedom of Trade, commerce and Intercourse, a joint sitting of two houses of Parliament, cooperative federalism, centre - state relations, concurrent list etc.  
[UPPCS, 2016; Jharkhand PCS (Pre.) 2003; UPPCS, 2014, 2011, 2012]
- **Germany:** Suspension of fundamental rights during Emergency, etc.
- **Soviet Union :** Fundamental duties of the citizens.
- **South Africa :** Procedure of Amendment in the Indian Constitution, Election of members of Rajyasabha.
- **Japan :** Procedure established by law.
- **France :** Concept of Republic Ideas of liberty, equality and fraternity in the Preamble.

| Parts of the Indian Constitution |                                                                                                                                                                                                             |                                |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| Indian Constitution              |                                                                                                                                                                                                             |                                |
| Parts                            | Topics                                                                                                                                                                                                      | Articles                       |
| ●                                | Part 1: Union and Its Territories (UPPCS, 2022)                                                                                                                                                             | 1-4                            |
| ●                                | Part 2: Citizenship (UP RO/ARO, 2016)                                                                                                                                                                       | 5-11                           |
| ●                                | Part 3: Fundamental Rights                                                                                                                                                                                  | 12-35                          |
| ●                                | Part 4: Directive Principles of State Policy                                                                                                                                                                | 36-51                          |
| ●                                | Part 4A: Fundamental Duties (UP Lower, 2004)                                                                                                                                                                | 51A                            |
| ●                                | Part 5: Union                                                                                                                                                                                               | 52-151                         |
|                                  | Chapter I - Executive<br>Chapter II - Parliament<br>Chapter III - Legislative Powers of the President<br>Chapter IV - Union Judiciary<br>Chapter V - Comptroller and Auditor General of India               |                                |
| ●                                | Part 6 : States                                                                                                                                                                                             | 152 - 237                      |
|                                  | Chapter I - General<br>Chapters II - Executive<br>Chapter III- State Legislature<br>Chapter IV- Legislative Power of the Governor<br>Chapter V - High Court in the States<br>Chapter VI- Subordinate Courts |                                |
| ●                                | Part 7: (Repeated) The States in Part B: of the first schedule                                                                                                                                              | 238                            |
| ●                                | Part 8: Union Territories                                                                                                                                                                                   | 239-242                        |
| ●                                | Part 9: Panchayats, [UPPCS (Pre.) 2013]                                                                                                                                                                     | 243-243O                       |
| ●                                | Part 9A: Municipalities<br>Part 9 B: Co-operative Societies                                                                                                                                                 | 243P-243 ZG<br>243 ZH - 243 ZT |
| ●                                | Part 10: Scheduled and Tribal Areas                                                                                                                                                                         | 244-244A                       |
| ●                                | Part 11: Relations between the Union and the States                                                                                                                                                         | 245-263                        |

|                                                                                                                                                                          |                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Chapter I- Legislative Relations<br>Chapter II - Administrative Relations                                                                                                |                               |
| ● Part 12: Finance, Property, Contracts and Suits                                                                                                                        | 264-300 A                     |
| Chapter I - Finance<br>Chapter II - Borrowings<br>Chapter III - Properties, Contracts, Rights, Liabilities, Obligations and Suits<br>Chapter IV - Right to Property      |                               |
| ● Part 13: Trade, commerce and intercourse within the territory of India                                                                                                 | 301 - 307                     |
| ● Part 14: Services under the Union and the States                                                                                                                       | 308-323                       |
| Chapter I - Services<br>Chapter II - Public Service Commission                                                                                                           |                               |
| Part 14A: Tribunal                                                                                                                                                       | 323A-323B                     |
| ● Part 15: Election                                                                                                                                                      | 324-329A                      |
| ● Part 16: Special provisions with respect to certain classes                                                                                                            | 330 - 342                     |
| ● Part 17: Official Language                                                                                                                                             | 343-351                       |
| Chapter I- Language of the Union<br>Chapter II - Regional Languages<br>Chapter III - Language of the Supreme Court, High Courts, etc.<br>Chapter IV - Special Directives |                               |
| ● Part 18: Emergency provisions                                                                                                                                          | 352-360                       |
| ● Part 19: Miscellaneous                                                                                                                                                 | 361 - 367                     |
| ● Part 20: Amendment of the Constitution                                                                                                                                 | 368                           |
| ● Part 21: Temporary, transitional and special provisions                                                                                                                | 369-392                       |
| ● Part 22: Short title, Commencement, Authoritative Text in Hindi and Repeals                                                                                            | 393-395 [UPPCS (Mains), 2008] |

### 3

## The Preamble

A Preamble is an introduction to a Constitution. It is an exordium of the Constitution. **N.A. Palkhivala** has called the Preamble as '**Identity Card of the Constitution**'. On **13<sup>th</sup> December 1946**, the **Objective Resolution** introduced by Jawaharlal Nehru became the foundation of the Preamble.

[IAS (Pre.), 2017]

We, the people of India having solemnly resolved to constitute India into a Sovereign, Socialist, Secular, Democratic, Republic and to secure to all its citizens : Justice, social, economic and political; Liberty of thought, expression, belief, faith and worship; Equality of status and opportunity and to promote among them all; Fraternity assuring the dignity of the individual and the unity and integrity of the Nation.



In our Constituent Assembly this **26 November, 1949** (Miti Margashirsha Shukla Saptami Samvat 2006 Vikrami) we do hereby adopt, enact and give to ourselves this Constitution.

[IAS (Pre.) 1997]

- The Preamble to the Indian Constitution is called **its soul**.
- In the **Berubari Case (1960)**, the Supreme Court did not consider the Preamble to be a part of the Constitution.

[UPPCS (Pre.) 2018; UPPCS, 2018; UP RO/ARO

(Pre.) 2023; 42<sup>nd</sup> BPSC, 1997]

- In **Keshavananda Bharti v. State of Kerala (1973)**, the Supreme Court held the Preamble to be part of the Constitution.
- **Basic structure Doctrine** was given by the Supreme Court in this landmark judgement.
- Through the Berubari Union Case, 1960, the Supreme Court stated that 'the Preamble is the key to open the mind of the makers' but it can not be considered as part of the Constitution. (UPPCS, Pre 2017)
- **Golaknath v. State of Punjab (1967)**- In this case, the Supreme Court ruled that the Parliament cannot take away or abridge any of the Fundamental Rights. The Court held that the **Fundamental Rights cannot be amended** for the implementation of the Directive Principles.
- In Bommai vs Union Of India (1994), Supreme Court held that, **the preamble of the Constitution is an integral part of the Constitution**.
- **The Preamble speaks of social, economic and political justice.** (UPPCS RO/ARO Pre, 2021)
- KM Munshi described the Preamble of the Indian Constitution as the **"political horoscope" of the Constitution** (CGPSC Pre, 2013)
- The Preamble is non-justiciable, that is, **its provisions are not enforceable in courts of law**. (UP Lower Sub, 2004)
- **The Preamble was amended only once in 1976 to introduce the words 'socialist' and 'secular' through 42<sup>nd</sup> Constitutional Amendment Act.**
- Parliament can amend the Preamble under **Article 368**, although it cannot make unassertive amendments to the framework contained in it. Parliament can make such changes which lead to expansion and strengthening of the basic structure.
- The expression 'Socialist' was introduced in the Preamble of the Indian Constitution by 42<sup>nd</sup> Amendment.

[60-62<sup>nd</sup> BPSC (Pre.), 2016 Jharkhand PCS (Mains), 2016]

## 4

## Schedules

- Initially, the number of Schedules in the Indian Constitution was **8**, which has now expanded to 12.

[MPPCS (Pre.) 1990; MPPCS (Pre.) 2010; UPPCS (Pre.) 2022]

## Schedules and Its Subjects

| Schedules         | Subject                                                                                                            |
|-------------------|--------------------------------------------------------------------------------------------------------------------|
| First Schedule    | State and Union Territory.[IAS (Pre.), 2003]                                                                       |
| Second Schedule   | Salary of President and Other Higher Officials.                                                                    |
| Third Schedule    | Forms of Oaths or Affirmations.                                                                                    |
| Fourth Schedule   | Allocation of seats in the Rajya Sabha.                                                                            |
| Fifth Schedule    | Provision regarding administration and control of Scheduled Areas and Scheduled Tribes.                            |
| Sixth Schedule    | Provision as to the administration of tribal areas of the states of <b>Assam, Meghalaya, Tripura and Mizoram</b> . |
| Seventh Schedule  | The division of powers between the Center and the State in the Union List, the State List and the Concurrent List. |
| Eighth Schedule   | Languages                                                                                                          |
| Ninth Schedule    | Law Validation of certain Acts and Regulations                                                                     |
| Tenth Schedule    | Provisions as to disqualification on the ground of defection                                                       |
| Eleventh Schedule | Provisions relating to Panchayats.                                                                                 |
| Twelfth Schedule  | Provisions relating to Municipalities.                                                                             |

✎ **Note :** The **Ninth Schedule** was added to the Constitution by the **First Amendment Act, 1951** the **Tenth Schedule** by the **52<sup>nd</sup> Amendment Act, 1985**, the **Eleventh Schedule** by the **73<sup>rd</sup> Amendment Act, 1992** and the **Twelfth Schedule** by the **74<sup>th</sup> Amendment Act, 1992**.

✎ **Note :** The **Eighth Schedule** of the original Indian Constitution contained **14 languages**. The **21<sup>st</sup> Constitutional Amendment, 1967** added Sindhi, the **71<sup>st</sup> Constitutional Amendment, Act 1992** added Konkani, Manipuri and Nepali and the **92<sup>nd</sup> Constitutional Amendment, Act 2003** added Bodo, Dogri, Maithili and Santhali languages. A total of **22 languages** are currently included in the Eighth Schedule.

- The 7th Schedule of the Indian Constitution has three lists namely, the **Union list, state list, and concurrent list**, that show the division of power between the Union and States concerning certain subjects. (UPPCS RO/ARO, 2021)
- The Union List is a list of **98 (originally 97)** subjects numbered items as provided in the Seventh Schedule to the Constitution of India. [BPSC (Pre.) 2016]

- The Concurrent List or List-III (Seventh Schedule) is a list of **52 items (though the last subject is numbered 47)** given in the Seventh Schedule to the Constitution of India. (BPSC (Pre.) 2016)
- The Concurrent List includes subjects that are of common interest to both the central and state governments. Both the Union and state governments have the power to legislate on these subjects.
- However, in case of a conflict between a Union law and a State law on a subject in the Concurrent List, the Union law prevails.
- This means that the Union law will take precedence over the State law.
- Some of the important subjects are: Education, Forest, Trade unions, Marriage, Adoption, Succession.
- Andhra Pradesh is the **first state** to be formed on the basis of language. (MPPCS, 2016)
- The States Reorganisation Commission (SRC) was constituted by the Central Government of India on **22nd December 1953** to recommend the reorganization of state boundaries. (Chhattisgarh PCS, Pre 2021)
- The States Reorganisation Commission submitted its report in **1955**. (Chhattisgarh, PCS Pre 2021)
- The State Reorganization Act was passed by the Indian Parliament in 1956. Under this Act, 14 States and 6 Union Territories were created. (Chhattisgarh, 2021)
- In **November 1954, Pondicherry, Yanam, Chandranagar and Karaikal**, which were French settlements were, handed over to the Government of India by the French Government. They together formed the Union Territory of Pondicherry.
- On December 18, 1961, the govt. of India took military action against the Portuguese and merged their colonies of Goa, Daman and Diu into the Union of India.
- Zonal Councils were **established** in the Union of India by the **States Reorganization Act, 1956**.
- There are **five Zonal Councils** in India. The **Union Home Minister** is the ex-officio chairperson of the Zonal Councils.

## 5 The Union of India and Its Territories

- Under **Part I** of the Indian Constitution, Articles 1 to 4, refer to the Union of India and its territories. India has been declared a **Union of States**. Currently, there are **28 States and 8 Union Territories** in India. (UPPCS 2013, 2007)

✎ **Note :** Under Dadra and Nagar Haveli and Daman and Diu Act, 2019, two Union Territories of Dadra and Nagar Haveli and Daman and Diu have been merged, thus reducing the number of Union Territories to 8. Significantly, this Act came into force on 26<sup>th</sup> of January, 2020. (UPPCS, 2013)

- The name of the Union (India, that is Bharat) and its territory is mentioned under **Article 1**. (UPPCS, 2008)
- Under **Article 2**, the right to admit or establish new States has been conferred on the Parliament. (UPPCS, 2008)
- Parliament has the power to create new States and change the area, extent and name of existing States under **Article 3**. (UPPCS, 2008)

✎ **Note :** Amendments made by Parliament under the provisions relating to Articles 2 and 3 shall not be considered amendments under **Article 368**. It can be amended by the Parliament by a simple majority.

- The **State Reorganization Commission** was established in **1953** for the reorganization of the States of the Union of India. Its president was **Fazal Ali**.
- This Commission submitted its report in the year **1955**.
- Potti Sriramulu, the leader of Telugu speaking people resorted to fast unto death in support of his demand for the formation of states based on language and suffered death after 56 days.
- **Andhra Pradesh** was formed on 1<sup>st</sup> October 1953 based on language after the death of Sriramulu.

| Zonal Council          | Headquarters          |
|------------------------|-----------------------|
| Eastern Zonal Council  | Kolkata               |
| Western Zonal Council  | Mumbai                |
| Central Zonal Council  | Prayagraj (Allahabad) |
| Northern Zonal Council | New Delhi             |
| Southern Zonal Council | Chennai               |

✎ **Note :** North-Eastern States viz. Assam, Arunachal Pradesh, Manipur, Tripura, Mizoram, Meghalaya and Nagaland are not included in Zonal Councils. Their problems are dealt with by the North East Council constituted under the North Eastern Council Act, 1971.

| State                       | Formation Date    |
|-----------------------------|-------------------|
| Andhra Pradesh              | 1 October, 1953   |
| Gujarat, Maharashtra        | 1 May , 1960      |
| Nagaland                    | 1 December, 1963  |
| Haryana                     | 1 November, 1966  |
| Himachal Pradesh            | 25 January, 1971  |
| Manipur, Meghalaya, Tripura | 21 January, 1972  |
| Sikkim                      | 16 May , 1975     |
| Mizoram, Arunachal Pradesh  | 20 February, 1987 |
| Goa                         | 30 May, 1987      |

|              |                                     |
|--------------|-------------------------------------|
| Chhattisgarh | 1 November, 2000                    |
| Uttarakhand  | 9 November, 2000                    |
| Jharkhand    | 15 November, 2000                   |
| Telangana    | 2 June, 2014<br>[UPPCS (Pre.) 2009] |

## 6

## Citizenship

- **Articles 5 to 11** give detailed provisions relating to citizenship. (UPPCS, 2018)
- The Constitution of India grants its citizens **single citizenship**. (UPPSC, 2015, 1994)
- Parliament has the power under Article 11 to legislate on granting and abolishing citizenship and all other matters related to it. (UPPCS, (Pre.) 2013)
- Indian citizenship can be obtained by fulfilling conditions as per **Citizenship Act, 1955** - birth, descent, registration, naturalization and area acquisition being the main criteria. (UPPCS, 2016)
- In December, 2019 the Citizenship (Amendment) Bill received the assent of the President. This Act provides that any person belonging to Hindu, Sikh, Buddhist, Jain, Parsi or Christian community from Afghanistan, Bangladesh or Pakistan who had entered India on or before 31<sup>st</sup> December, 2014 and who has been exempted by the Central Govt. shall not be treated as an illegal migrant.
- In March, 2024 the MHA notified the CAA Amendment Act, 2019.
- Indian citizenship cannot be obtained by depositing money in Indian Banks. (41<sup>st</sup> BPSC, 1996)
- The concept of single citizenship has been adopted in India from the British constitution. (IAS Pre, 2021)
- According to Article 11 of the Indian Constitution, Parliament can make provisions with respect to the acquisition and termination of citizenship.

(Chhattisgarh PCS Pre, 2013)

## 7

## Fundamental Rights

- Magna Carta, the Charter of Rights issued by British king John in 1215, was the first written document relating to the fundamental rights of citizens.
- **Part - III** of the Constitution provides details of the fundamental rights, from **Articles 12 to 35**. They are also known as the '**Magna Carta of India**'. (UPPCS (Pre.) 1998; BPSC, 1994, 2000)
- Martial law affects the Fundamental Rights.
- Article 13 is the guardian of Rights mentioned in Part III of our Constitution. Clause (1) of the said Article emphasises

that all inconsistent existing laws become void from the commencement of the Constitution. (UPPCS 2009)

- At present, **6 Fundamental Rights** have been guaranteed to the citizens under the Constitution, which are as follows:
  - Right to Equality (Articles 14-18)
  - Right to Freedom (Articles 19 - 22)
  - Right Against Exploitation (Articles 23 - 24)
  - Right to Freedom of Religion (Articles 25 - 28)
  - Cultural and Educational Rights (Articles 29-30) and
  - Right to Constitutional Remedies (Article 32)

### i. Right to Equality (Articles 14 to 18)

- **Article 14: Equality before Law**- The state shall not deny to any person equality before the law or the equal protection of laws within the territory of India. (UPPCS, 1999)

✎ **Note :** The idea of '**Equality before Law**' is of British origin, while '**equal protection of law**' is derived from the US Constitution.

- **Article 15:** The State shall not discriminate against any citizen on the grounds only of **religion, race, caste, sex or place of birth or any of them.** (IAS, 2002; UP RO/ARO, 2014)
- **Article 16:** Equality of opportunity in the matter of **public employment**- All citizens will be provided equal opportunities in subjects related to employment or appointment to a post under the State.

(IAS, 2002; UP RO/ARO, 2014)

**Exceptions** - The special provision for **Backward Classes, Scheduled Castes** and **Scheduled Tribes** is mentioned in **Article 15 (4)** and **Article 16 (4)**.

- On 28 June 2021, In the case "State of Kerala v. Leesamma Joseph", the Supreme Court of India held that persons with disabilities have a right to reservation in promotions under Article 16(4) of the Constitution.
- Article 16 (4) mentions that Nothing in this article shall prevent the State from making any provision for the reservation of appointments or posts in favour of any backward class of citizens which, in the opinion of the State, is not adequately represented in the services under the State.
- **Article 17: Abolition of Untouchability** - The practice of untouchability in any form is a punishable offence in accordance with the law.
- **Article 18: Abolition of Titles**- It prohibits the State from conferring any title except a military or academic distinction. It prohibits a citizen of India from accepting any title from a foreign state without the consent of the President of India.

(IAS, 2002; UP RO/ARO, 2014)

## ii. Right to Freedom (Article 19 to 22) -

- **Article 19:** Protection of certain rights related to freedom of speech – Presently, **Article 19(1) guarantees 6 rights.**
- Article 19(1) (a) – Right to freedom of speech and expression.
- Article 19(1) (b) – Right to assemble peacefully and without arms.
- Article 19(1) (c) – Right to form associations or unions.
- Article 19(1) (d) – Right to move freely throughout the territory of India.
- Article 19(1) (e) – Right to reside and settle in any part of the territory of India.
- Article 19(1) (g) – Right to practice any profession, or to carry on any occupation, trade or business.

✎ **Note :** (1) Originally, Article 19 contained seven rights. But, the right to acquire, hold and dispose of property was deleted [Article 19(1) (f) and Article 31] by the **44<sup>th</sup> Constitutional Amendment Act, 1978** and Article 300(A) was added to make it only a legal right.  
(2) Under freedom of speech and expression [Article 19(1) (a)] the **Freedom of Press** is considered implied in it. Under this, Right to Information was also vested by the judiciary.

- **Article 20:** Protection in respect of conviction for offences: Under these three types of protection are given–
  - (i) A person shall be convicted of any offence for violation of a law in force at that time of the commission of the act.
  - (2) No person shall be prosecuted and punished for the same offence more than once.
  - (3) No person accused of any offence shall be compelled to be a witness against himself.

(UPPCS, 2016)

### Article 21: Protection of Life and Personal Liberty

- No person shall be deprived of his life or personal liberty except according to the procedure established by law. (UPPCS, 2003, 2004)
- Supreme court observed that the right to travel abroad is a fundamental right guaranteed under Article 21 of the Constitution. (UPPCS 2003, 2004)
- **Article 21** of the Constitution of India which guarantees the **right** to life further encompasses **right** to marry **partner** of **choice**. (UPPCS 2003, 2004)

✎ **Note :** The Supreme Court has reaffirmed its judgement in the **Menaka Gandhi vs. Union of India**, case that the following rights are part of **Article 21** :

- (1) Right to live with human dignity
- (2) Right to descent environment

- (3) Right to Livelihood
- (4) Right to Privacy
- (5) Right to Health
- (6) Right to free legal aid
- (7) Right to Speedy Trial
- (8) Right to Information
- (9) Right against public hanging etc.

### Article 21(A) : Right to Education -

The State shall provide free and compulsory education to all children in the age group of **six to fourteen years.**

(UPPCS, 2006)

✎ **Note :** **86<sup>th</sup> Constitutional Amendment Act, 2002** inserted Article 21(A), by which the State shall provide free and compulsory education to all children in the age group of 6 to 14 years. (UPPCS, 2006)

- **Article 22 :** Protection against arrest and detention: Following are the rights of an arrested or detained person–
  - (i) Right to be informed of the grounds of arrest.
  - (ii) Right to be produced before a magistrate within 24 hours (excluding the journey time). (Uttarakhand PCS, 2016)

- **Preventive Detention :** In **Clauses 3, 4 and 5 of Article 22**, preventive detention has been dealt with. This is to prevent a person from committing a crime by arresting him before the act of crime is committed but subject to following conditions-
  - The detention of a person cannot exceed three months unless an advisory board reports sufficient cause for extended detention.
  - The detainee must be allowed to make a representation against the detention order.

### (iii) Right against Exploitation (Article 23 to 24):

- **Article 23 – Prohibition of traffic** in human beings and forced labour. (IAS, 2017)
- **Article 24 – Prohibition of employment of children** below the age of 14 years in any factory, mine or other hazardous activities. (UPPSC 2017, 2005, 2000)

### (iv) Right to Freedom of Religion (Article 25 to 28)

- **Article 25** – Freedom of conscience and free profession, practice and propagation of religion. (UP UDA/LDA, 2001)
- **Article 26** – Freedom to manage religious affairs. (UP Lower, 2009)
- **Article 27** – Freedom from taxation for promotion of any particular religion.
- **Article 28** – Freedom as to attendance at religious instruction or religious worship in certain educational institutions.



➤ **Note :** Wearing a kirpan and travelling with it, will be considered to be part of the Sikh religion.

**(v) Cultural and Educational Rights (Article 29 to 30) :**

- **Article 29:** Protection of language, script and culture of minorities. (UPRO/ARO, 2016)
- **Article 30:** Right of minorities to establish and administer educational institutions.

**(vi) Right to Constitutional Remedies :**

(IAS, 2002; UPPCS, 2004)

- To enforce fundamental rights, the Supreme Court has been empowered to issue 5 types of writs (directions or orders) under Article 32 of the Constitution. These are-  
(a) Habeas Corpus (b) Mandamus (c) Prohibition  
(d) Certiorari (e) Quo-Warranto (UP Lower, Sub. 2015)

**(a) Habeas Corpus :**

This order is issued by the court on the request of the detainee to the officer imprisoning him to produce the detained person within 24 hours (excluding travel time) at the respective court and to furnish reasons for his detention.

**(b) Mandamus :** (UPPCS, 2015)

It is a command issued by the court to a public official asking him to perform his official duties that he has failed or refused to perform. (CGPSC, 2016)

**(c) Prohibition :**

It is issued by a higher court to a lower court or tribunal to prevent the latter from exceeding its jurisdiction or usurping a jurisdiction that it does not possess. (CGPSC, 2016)

**(d) Certiorari :**

The writ of certiorari is issued by the Supreme Court, the High Court to some inferior court or tribunal to transfer the matter to it or some other superior authority for proper consideration. (CGPSC, 2016)

**(e) Quo-Warranto :**

When a person or a public institution conducts an act without any legal right the Court may ask by order the former on which he is acting. (CG PSC, 2016)

- **Article 32** (Right to Constitutional Remedies) was called '**Soul of the Constitution**' by **Dr. Bhimrao Ramji Ambedkar**. (UPPCS, 2004)
- Article 359 sanctions the President of India to suspend all the fundamental rights during an emergency except Article 20 and Article 21. (UPPCS 2015, UP Lower, 2002)
- According to Article 64, the Vice President of India is the ex-officio Chairman of the Rajya Sabha. The House also elects a Deputy Chairman from among its members. (BPSC 2001, 2017)

- **In the Keshavanand Bharti case (1973)**, the Supreme Court decided that the Parliament could also amend the fundamental rights except the basic structure of the Constitution.
- Fundamental rights are justiciable rights to be through Court of Law.

**Exam Oriented Facts**

- The resolution on Fundamental Rights was adopted in the Karachi session of Congress in 1931. (Jharkhand PCS Pre, 2023)
- The Fundamental Rights are guaranteed by the Constitution of India against state. (UPPCS Pre, 1998)
- Under the Article 15(5) of the Constitution, reservations in admission of educational institutions, including private and unaided to OBCs/SC/ST is made. (Uttarakhand PCS, 2012)
- Under Articles 16(1) and 16(2) the equal opportunity for all citizens in matters relating to employment or appointment to any office under the state has been ensured. (UPPCS Mains, 2009)
- Under the 77<sup>th</sup> Constitution Amendment Act 1995, the reservation in promotion for the SC and ST was ensured by inserting clause 4A in Article 16. (Jharkhand PCS Pre, 2023)
- Under the Article 21 of the Constitution, Doctrine of Due Process of law is included. (UPPCS Mains, 2014)
- In the case of Menaka Gandhi Vs UOI, 1978 the SC held that the right to travel abroad is a Fundamental Right and is secured by Article 21. (UPPCS Pre, 1997)

**8**

**Directive Principles of State Policy (DPSP)**

The Directive Principles of State Policy are enshrined in **Part-IV** of the Constitution (from **Article 36 to 51**). These were borrowed from the **Irish Constitution**. Their implementation depends on the will of the State. They can neither be enforced by the courts nor enjoy statutory power. (UPPSC, 2010)

- **Article 38** – State to secure a social order for promoting welfare of the people.
- **Article 39** – Certain principles of policy to be followed by the state and **Article 39A** - Equal justice and free legal aid.
- **Article 40** – For the organization of village panchayats. (BPSC, 2001)
- **Article 41** – Right to work, education and public assistance in certain cases. [UP Lower (Sub.) 2013]
- **Article 42** – Provision for just and human conditions of work and maternity relief.

- **Article 43** – To secure a living wage etc. for workers. (UP UDA/LDA, 2010)
- **Article 43(A)** – Participation of workers in the management of industries. (UPPCS, 2019)
- **Article 44** –To secure all citizens a uniform civil code throughout the country. (UPPCS, 2010)
- **Article 45** –To provide early childhood care and education for all children until they complete the age of 14 years. (UP Lower, 2008)
- **Article 46** –To promote the educational and economic interests of SCs, STs and other weaker sections of the society and to protect them from social injustice and exploitation. (IAS, 2012)
- **Article 47** –To raise the level of nutrition and the standard of living, to improve public health, to prohibit the consumption of intoxicating drinks and drugs which are injurious to health. (IAS, 2012)
- **Article 48** –To organise agriculture and animal husbandry on modern and scientific lines. (IAS, 2012)
- **Article 48(A)** –To protect and improve the environment and to safeguard forests and wildlife. (UPPCS, 2019)
- **Article 49** –It provides for the preservation of monuments, places and objects of national importance.
- **Article 50** –It provides for the separation of executive and judiciary. (UPSC, 2020)
- **Article 51** –It makes provisions for international peace and security enhancement. (UPSC, 2002)

9

## Fundamental Duties

- The provision of fundamental duties is mentioned in **Article 51A of Part-IVA** of the Constitution. (MPPCS, 2017)
- Fundamental duties were incorporated into the Constitution by the **42<sup>nd</sup> Constitution Amendment, 1976**. (IAS, 2017)
- The fundamental duties were incorporated on the recommendations of the **Swaran Singh Committee**. (UPPCS, 2012)
- These were inspired by the **Constitution of the Soviet Union**.

### List of Fundamental Duties

**Article 51A**, Fundamental Duties - It shall be the duty of every citizen of India-

- |    |                                                                                                                                   |
|----|-----------------------------------------------------------------------------------------------------------------------------------|
| A. | to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;<br>(UPPCS, 2021) |
| B. | to cherish and follow the noble ideals which inspired our national struggle for freedom;                                          |

- |     |                                                                                                                                                                                                                             |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| C.  | to uphold and protect the sovereignty, unity and integrity of India;                                                                                                                                                        |
| D.  | to defend the country and render national service when called upon to do so;                                                                                                                                                |
| E.  | to promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women; |
| F.  | to value and preserve the rich heritage of our composite culture;                                                                                                                                                           |
| G.. | to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures;                                                                                   |
| H.  | to develop the scientific temper, humanism and the spirit of inquiry and reform;                                                                                                                                            |
| I.  | to safeguard public property and to abjure violence;                                                                                                                                                                        |
| J.  | to strive for excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievement;                                                            |
| K.  | who is a parent or guardian to provide opportunities for education to his child or, as the case may be, ward between the age of six and fourteen years.                                                                     |

✎ **Note** : Originally there were 10 fundamental duties in the Constitution, but the 11<sup>th</sup> fundamental duty was inserted by the 86<sup>th</sup> Amendment, 2002.

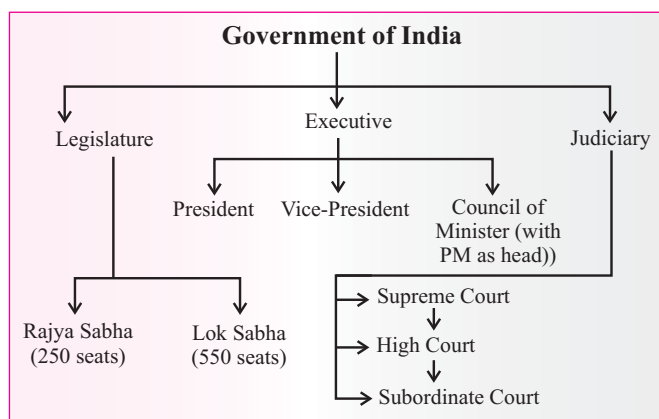
### Exam Oriented Facts

- Fundamental Duties are not enforceable by law. (UPPCS Pre, 2003)
- To vote in General Election is not the fundamental duty. (UPPCS Pre, 2021)
- The 42<sup>nd</sup> Constitutional Amendment Act, 1976 included the fundamental duties of citizens in the Indian Constitution. (Chhattisgarh PCS, 2008)

10

## Union Executive

The **President** is the **head** of the Union executive. The Union executive consists of the **President, Vice President, Prime Minister** and the **Cabinet**. The President is the **nominal head** of the executive due to the adoption of the parliamentary governance system in India, while the real power is vested in Prime Minister and his Council of ministers. **Articles 52 to 78** describe the Union executive under **Part V** of the Indian Constitution.



### A. President :

- There shall be a President of India (**Article 52**). (BPSC, 2016)
- The President is the **first citizen** of the country.
- According to the **Article 53 (1)**, the executive power of the Union rests with the President and he uses it by himself or through his subordinate officers. (BPSC, 2016)

### Qualifications :

- **Article 58** describes the qualifications for occupying the office of the President of India - (UP Lower, 1990)
  1. He must be a citizen of India;
  2. He must have completed the age of **35 years**;
  3. He must be qualified for election as a **member of the House of the people**;
  4. He does not hold an office of profit at the time of election.

✎ **Note :** The post of President or Vice-President or Governor of a State or is a minister either for the Union or for any state is not considered to be an office of profit.

- According to the **Article 59** of the Constitution, the President shall not be a member of either House of Parliament or of a House of the Legislature of any state.

### Election :

- According to **Article 54**, the President is elected by the members of an **electoral college**. (UP VDA/LDA, 2001)
- The electoral college consists of elected members of the **Lok Sabha**, the **Rajya Sabha** and the elected members of the **legislative assemblies of the States**. (UP UDA/LDA, 2001)
- The elected members of the **Delhi** and **Puducherry** legislative assemblies have also been included in the electoral college by the **70<sup>th</sup> Constitutional Amendment Act, 1992**. (UP UDA/LDA, 2001)
- The elected members of the legislative assembly of the Union Territory of Jammu and Kashmir are also included in the electoral college for President's election, while the elected members of its legislative assembly as the state of Jammu and Kashmir were included in the electoral college.
- According to **Article 55**, the President is elected by proportional representation, by means of **single transferable vote and secret ballot**. (IAS, 2018)

- A candidate must have at least **50 proposers and 50 seconders** for nomination for the presidential election.
- Disputes related to the election of the President are settled by the Supreme Court.

### Term of Office :

- The term of office of the President under **Article 56** is **5 years**. However, even after the end of the term, he remains in office until his successor assumes charge. (UPPCS, 2016)
- According to **Article 57**, the President is **eligible for re-election**. The President may resign from his post by writing a letter addressed to the Vice-President.

### Oath :

- As per **Article 60**, the President is administered the oath of office and secrecy by the **Chief Justice of the Supreme Court** or in his absence by the senior-most Judge of the apex court.

### Salary :

- The President's monthly salary is 5 lakh rupees. His salary is income tax free.

### Impeachment :

- **Article 61** describes the process of impeachment of the President.
- Under **Article 61(1)** impeachment of the President can be imposed only on allegations of violation of the Constitution. (UPPCS, 2015)
- An impeachment motion can be brought against the President by any House of Parliament, which must be signed by **one-fourth** of the members of that House. For this, written notice must be given to the President **14 days in advance**.
- Impeachment is a **quasi-judicial process** of Parliament.
- It is necessary to fill the consequent presidential vacancy within **6 months**.

✎ **Note :** If the President is not present or unable to function in his office due to illness or other reasons, the Vice-President shall serve as the acting-President until the incumbent returns to the office. If the post of **Vice-President** is lying vacant, then the **Chief Justice of India** (the senior-most judge of the Supreme Court if CJ's post is also vacant) will discharge the responsibility as the acting-President.

| S.I No. | President                | Tenure                             |
|---------|--------------------------|------------------------------------|
| 1.      | Rajendra Prasad          | 26 January, 1950 to 13 May, 1962   |
| 2.      | Sarvepalli Radhakrishnan | 13 May, 1962 to 13 May, 1967       |
| 3.      | Zakir Hussain            | 13 May, 1967 to 3 May, 1969        |
| 4.      | V.V. Giri                | 24 August, 1969 to 24 August, 1974 |

|     |                           |                                      |
|-----|---------------------------|--------------------------------------|
| 5.  | Fakhruddin Ali Ahmed      | 24 August, 1974 to 11 February, 1977 |
| 6.  | Neelam Sanjiva Reddy      | 25 July, 1977 to 25 July, 1982       |
| 7.  | Giani Zail Singh          | 25 July, 1982 to July 25, 1987       |
| 8.  | R. Venkataraman           | 25 July, 1987 to July 25, 1992       |
| 9.  | Dr. Shankar Dayal Sharma  | 25 July, 1992 to 25 July, 1997       |
| 10. | K.R. Narayanan            | 25 July, 1997 to 25 July, 2002       |
| 11. | Dr. A.P.J. Abdul Kalam    | 25 July, 2002 to 25 July, 2007       |
| 12. | Pratibha Devi Singh Patil | 25 July, 2007 to July 25, 2012       |
| 13. | Pranab Mukherjee          | 25 July, 2012 to 25 July, 2017       |
| 14. | Ram Nath Kovind           | 25 July, 2017 to July, 2022          |
| 15. | Droupadi Murmu            | July 2022 to till now                |

➤ **Note : V.V. Giri** from 3<sup>rd</sup> May, 1969 to 20<sup>th</sup> July, 1969, **Justice Muhammad Hidayatullah** from 20 July, 1969 to 24<sup>th</sup> August, 1969 and **B.D. Jatti** from 11<sup>th</sup> February 1977 to 25<sup>th</sup> July 1977 were the acting- President.

- **Dr. Rajendra Prasad** was the first President to be elected to the office for the **second consecutive time**.
- **Dr. S. Radhakrishnan** was the Vice-President twice and President once.
- The counting of second preference vote's was done during **V.V. Giri's** election.
- **Neelam Sanjeeva Reddy** was defeated in the election during the first time while he was elected unopposed President during the second time.
- **India's first woman President was Pratibha Devi Singh Patil.**

#### Rights and Powers of the President :

**Executive Powers** - The following are the executive powers of the President :

- All executive powers of the govt. are exercised in the name of the President.
- Article 77 of the Indian Constitution provides this.
- He can seek information on administration of the affairs of the Union and proposals for legislation from the Prime Minister. Under **Article 78**, the Prime Minister has to inform the President.
- The President can declare any area as **Scheduled Area**. (Under article 244(1) after consultation with the Governor of that state).
- The **President appoints** various officials, including the Prime Minister of India, other members of the Council of Ministers on the advice of the Prime Minister, judges of the Supreme Court and High Courts, ambassadors and other diplomats, Comptroller and Auditor General, Attorney General, Lieutenant Governors of Union Territories,

members of language commission, members of minority commission, Governors, Chairperson and members of Union Public Service Commission, etc.

- Article 222 of the Indian constitution provides the provision for Judges to be transferred from one highcourt to another.

**Legislative Powers** - The President has the following legislative powers:

- The right to summon, prorogue and dissolve the Lok Sabha and to address the **first session** of Parliament every year and after every new election, right to call a **joint sitting of both Houses (Article 108)**.
- Bill passed by the Parliament becomes a law after the assent of the President.

✎ **Note :** When a Bill is passed by the Parliament it is sent to the President for his assent, he may choose one of the following courses –

- (i) He may **approve** the Bill.
- (ii) He may not give assent to the Bill and keeps it with himself. This is called the **President's Pocket Veto**.
- (iii) He may return the Bill to the Parliament for **reconsideration** (if not a Money Bill).

- If the Parliament sends the Bill again to the President with or without any changes as required, the President is bound to give his assent.
- During a National Emergency in India, the life of Lok Sabha may be extended beyond its normal term of 5 years by a law of Parliament for one year at a time, for any length of time. Notably this extension cannot continue beyond a period of 6 months after the emergency has ceased to operate.
- President **Giani Zail Singh** used the pocket veto in **1986** concerning the **Indian Postal (Amendment) Bill**.

(CGPSC, 2015)

- Bills related to the creation of new states, change of state borders, money bills, etc. are introduced in the House only with the prior permission of the President.
- **The President nominates 12 members to the Rajya Sabha [Act.80(1)(a)]**. They shall consist of persons with special knowledge and practical experience in the fields of arts, science, literature and social service [**Article 80 (3)**].

#### Ordinance Power

- The President has the right to issue an **Ordinance** under **Article 123**. (UP Lower, 2013)
- The President has the power to issue an Ordinance only when either of the two Houses has been prorogued or otherwise not in session and hence, it is not possible for parliament to enact legislation. (UPPCS, 2016)
- It has the effect of a law formulated by the Parliament.



- It is effective only for 6 weeks after the commencement of the Parliament session.
- This ordinance is required to be approved by the Parliament within **6 weeks** of the beginning of the session of Parliament. (Jharkhand PCS, 2013)
- An Ordinance can be withdrawn at any time by the President.
- **Pardoning Power** - Under **Article 72**, the President exercises the judicial powers to pardon, reduce the punishment, remission of the punishment and remit the punishment. The same petition cannot be filed again if the President rejects it. (UPPCS, 2010)
- **Military Powers:** The **President** is the **Supreme Commander** of the three Armed Forces (Army, Air Force and Navy).
- He appoints the chiefs of the Army, Air Force and Navy.
- **Diplomatic Powers:** International treaties and agreements are made in the name of the President. The President approves the appointments of foreign ambassadors appointed in India.

#### Emergency Powers :

- President has extraordinary power during an emergency.
- **Part-XVIII** of the Constitution lays down provisions related to an emergency from **Articles 352 to 360**.
- The President has the right to declare **three** types of emergencies in three following conditions-
  - (1) In the event of war or external aggression or armed rebellion (**Article 352**)
  - (2) In case of failure of constitutional machinery in the States (**Article 356**)
  - (3) In the event of a financial emergency (**Article 360**)

#### Power of Consultation

- The President can **consult the Supreme Court** on any matter of public importance but is not bound to accept advice under **Article 143**. (UPPCS, 2012)

#### Exam Oriented Facts

- According to Article 53 of the Constitution the, Executive power of the Union shall be vested in President. (UPPCS Mains 2012)
- The Chief Minister of a State in India is not eligible to vote in the Presidential election if he is yet to prove his majority on the floor of the lower house of the state legislature. (IAS Pre, 1993)
- A member of Parliament or a state legislature can be elected as President but he will have to relinquish his seat within 6 months of his election (UPPCS Spl Mains, 2008)
- The Constitution of India is silent about the educational Qualification of the President. (UPPCS Pre, 1992)

- The Indian President is eligible for re-election for any number of times. (67<sup>th</sup> BPSC, 2021)
- If there is any doubt or dispute regarding the election of the President, it can be referred to the Supreme Court of India (Art 71) whose decision shall be final. (38<sup>th</sup> BPSC Pre, 1992)
- The Procedure for Impeachment of the President of India is Quasi - Judicial Procedure. (RAS/RTS Pre, 2016)
- The joint sitting of the House of people and the council of state is summoned by President. (UPPCS Pre, 2012; UPPCS Mains, 2015; UPPCS Pre Re-exam, 2015)
- To promulgate ordinance is the legislative power of the President, according to the Constitution. (Chhattisgarh PCS Pre, 2018)
- A pocket veto is a way to restrict passage of a Bill by not providing permission to the Bill. The President of India give the final approval to a Bill or act after Parliament passed the Bill.

#### B. Vice-President

- The office of Vice-President is the **second highest office** in the country. On the lines of the Vice-President of the United States, the Indian Constitution has made provisions related to the election of Vice-President.
- According to **Article 63**, there will be a Vice- President of India.
- According to Article 64, the Vice President of India is the ex-officio chairman of Rajya Sabha. (BPSC, 2001, 2017)
- According to **Article 65** of the Constitution of India, Vice President can act as President or discharge his functions. Vice President can act as President or discharge his functions in the event of the occurrence of any vacancy in the office of the President by reason of this death, resignation or removal, or otherwise. (Chhattisgarh PCS Pre 2021)

#### Election

- According to **Article 66**, the Vice-President is elected by an electoral college consisting of elected and nominated members of both the Houses of Parliament. (UPPCS, 2012)

#### Qualifications

- A person should be a citizen of India and has attained the age of **35 years**. He should be qualified to be a **member of Rajya Sabha** and should not hold any office of profit.
- For the nomination of the Vice-President's election, a candidate must have at least **20 Proposers** and **20 Seconders**.

✎ **Note :** For this purpose, no person shall be deemed to hold any office of profit merely because he/she is the President or the Vice-President or the Governor of a State or a Minister of the Union or a Minister of a State.

### Term of Office

- According to **Article 67**, the term of office of the Vice-President is **5 years**. (UPPCS, 2013)
- Even before that he may tender his resignation to the President any time.
- The Vice-President can be removed from office by passing a resolution with a majority of all the members of the Rajya Sabha. It requires the consent of the Lok Sabha. (UPPCS, 2013)
- But no such resolution may be moved unless at least 14 days advance notice has been given. (UPPCS, 2013)

### Oath

- According to **Article 69**, the oath of office of the Vice-President is administered by the **President or by a person appointed by the President**.

### Salary

- The Vice-President is entitled to the salary and allowance of the **Chairman of Rajya Sabha**. The salary of the Chairman of Rajya Sabha is Rs 4 lakh per month.

**Note** - The period during which the Vice-President serves as the President, he shall not be entitled to the salary or allowances given to the Chairman of Rajya Sabha. During that time he receives the salary of the President.

### Powers and Functions

- The Vice-President is the **ex-officio Chairman** of the Rajya Sabha. (Articles 64 and 89).
- The Vice-President is not a member of the Rajya Sabha. Therefore, he does **not have the right to vote** on any subject but in the case of equal votes, he has a casting vote.
- When the office of the President is vacant due to his **resignation, expulsion, death** and **other reasons**, the Vice-President acts as the acting-President.

| Vice-Presidents of India                             | Term         |
|------------------------------------------------------|--------------|
| 1. Dr. S. Radhakrishnan                              | 1952 to 1962 |
| Serially, first term 1952-57 and second term 1957-62 |              |
| 2. Zakir Hussain                                     | 1962 to 1967 |
| 3. V.V. Giri                                         | 1967 to 1969 |
| 4. Gopal Swarup Pathak                               | 1969 to 1974 |
| 5. B.D. Jatti                                        | 1974 to 1979 |
| 6. Justice Hidayatullah                              | 1979 to 1984 |
| 7. R. Venkataraman                                   | 1984 to 1987 |
| 8. Dr. Shankar Dayal Sharma                          | 1987 to 1992 |
| 9. K.R. Narayanan                                    | 1992 to 1997 |
| 10. Krishnakant                                      | 1997 to 2002 |
| 11. Bhairon Singh Shekhawat                          | 2002 to 2007 |
| 12. Hamid Ansari                                     | 2007 to 2017 |

|                                                      |                                    |
|------------------------------------------------------|------------------------------------|
| Serially, first term 2007-12 and second term 2012-17 |                                    |
| 13. Venkaiah Naidu                                   | 11 August, 2017 to 10 August, 2022 |
| 14. Jagdeep Dhankhar                                 | August 2022 to till now            |

- He can serve as the acting-President for a maximum period of **6 months**. The election of a new President is necessary during this period.
- He cannot act as the Chairman of Rajya Sabha when he is acting President.

### Exam Oriented Facts

- The Vice President is elected by the members of an electoral college comprising all members of both the Houses of Parliament. (UPPCS Mains 2012)
- Article 66(1) of the Constitution provides mechanism for the election of Vice President. (MPPCS Pre, 1996)
- Article 66(3) of the Constitution describes that a person is eligible for election as Vice President if he/she is citizen of India, completed the age of 35 years and is qualified for election as a member of the Council of State. (UP UDA/LDA 2000)
- Article 67 provides a mechanism for the removal of Vice President (UPPCS Mains 2005)
- VP of India can be removed from his office by a resolution of Council of States. (UPPCS Mains, 2013)

**Note** : The final settlement of disputes related to the election of President and Vice-President is done by the Supreme Court. Their election cannot be challenged in case the electorate is incomplete.

### C. Prime Minister and Council of Ministers

- **The parliamentary governance system** has been adopted under the Constitution of India. According to this system, the President is the **head of the executive while the real executive powers are vested in the Prime Minister** and the Cabinet.
- According to **Article 74**, the President shall have a Council of Ministers for assistance and advice headed by the Prime Minister. The President shall act in accordance with such advice while exercising his functions. (UPPCS, 2011, 1996)
- The President appoints the leader of the majority party in the Lok Sabha as the Prime Minister.
- According to **Article 75 (1)**, the Prime Minister is appointed by the President and on the advice of the Prime Minister he/she appoints other ministers. All ministers, including Prime Minister, are administered the oath of office and secrecy by the President.
- If a motion of **no confidence** is passed against the council of ministers in the Lok Sabha, the **entire Council has to resign**.

- According to Article, 75 (3) the Council of Ministers is collectively responsible to the Lok Sabha, the House of the People. (UPPCS 2012)

✎ **Note :** The **91<sup>st</sup> Constitution Amendment Act, 2003** provides that the total number of ministers in the Council of Ministers (including the Prime Minister) cannot exceed 15 per cent of the total members of the Lok Sabha.

| Prime Minister (serially)   | Tenure                                        |
|-----------------------------|-----------------------------------------------|
| 1. Jawaharlal Nehru         | 15 August 1947 to 27 May 1964                 |
| 2. Gulzarilal Nanda         | 27 May, 1964 to 9 June, 1964 (Acting)         |
| 3. Lal Bahadur Shastri      | 9 June, 1964 to 11 January, 1966              |
| 4. Gulzarilal Nanda         | 11 January, 1966 to 24 January, 1966 (Acting) |
| 5. Indira Gandhi            | 24 January, 1966 to 24 March, 1977            |
| 6. Morarji Desai            | 24 March, 1977 to 28 July, 1979               |
| 7. Charan Singh             | 28 July, 1979 to 14 January, 1980             |
| 8. Indira Gandhi            | 14 January, 1980 to 31 October, 1984          |
| 9. Rajiv Gandhi             | 31 October, 1984 to 2 December, 1989          |
| 10. Vishwanath Pratap Singh | 2 December, 1989 to 10 November, 1990         |
| 11. Chandrashekhar Singh    | 10 November, 1990 to 21 June, 1991            |
| 12. P.V. Narasimha Rao      | 21 June, 1991 to 16 May, 1996                 |
| 13. Atal Bihari Vajpayee    | 16 May, 1996 to 1 June, 1996                  |
| 14. H.D. Deve Gowda         | 1 June, 1996 to 21 April, 1997                |
| 15. Indra Kumar Gujral      | 21 April, 1997 to 19 March, 1998              |
| 16. Atal Bihari Vajpayee    | 19 March, 1998 to 22 May, 2004 (twice)        |
| 17. Manmohan Singh          | 22 May, 2004 to 26 May, 2014                  |
| 18. Narendra Modi           | 26 May, 2014 to till now                      |

- It is mandatory for all members of the Council of Ministers to be members of any House of Parliament. According to Article 75 (5), if he/she is not a member of Parliament at the time of becoming a minister then it is mandatory to become a member of Parliament within 6 months otherwise he will have to resign.
- There are **three** kinds of ministers - **Cabinet Ministers, Ministers of State and Deputy Ministers.**
- The Cabinet consists of the Prime Minister and cabinet ministers while the council of ministers consist of all the ministers.

- Under **Article 78**, the Prime Minister informs the President of the decisions of the Government.
- The **Prime Minister** is the ex-officio **Chairman of NITI Aayog** and **Chairman** of National Development Council, National Integration Council and Inter-State Council.
- The Prime Minister can advise the President to sack the ministers and dissolve the Council of Ministers by resigning himself.
- The word 'Cabinet' is mentioned only once in the Indian Constitution in Article 352(3) which states that "the President shall not issue a proclamation unless the Union Cabinet communicates him in writing that such a proclamation may be issued". (BPSC, 1996)
- **Article 75 (5)** describes that, a Minister who for any period of six consecutive months is not a member of either House of Parliament shall at the expiration of that period cease to be a Minister. (UPPCS, 2011)
- **Article 78** lays down a few duties and responsibilities for the Prime Minister as stated: To inform the President of all significant decisions made by the Council of Ministers regarding the management of Union affairs and other legislative proposals.

#### Other Important Facts

- **Jawaharlal Nehru** was the Prime Minister for the **longest time (16 years, 286 days).**
- **Morarji Desai** became the **first non-Congress Prime Minister** and he was the **first** Prime Minister to resign.
- **Chaudhary Charan Singh** was the Prime Minister who did not face the Lok Sabha even once while **Vishwanath Pratap Singh** was the first Prime Minister who failed to get the confidence vote.
- **Indira Gandhi** became the **first woman** Prime Minister of the country.
- Three Prime Ministers (Jawaharlal Nehru, Lal Bahadur Shastri and Indira Gandhi) died during their tenure.
- Morarji Desai (81) became the **oldest** and Rajiv Gandhi (40) became the **youngest** Prime Minister.
- **P.V. Narasimha Rao** was the Prime Minister who was not a member of either House when he assumed office.
- **Atal Bihari Vajpayee** was the Prime Minister for the **shortest term** in a single term for just **13 days.**
- **H.D. Deve Gowda** was a member of the Legislative Assembly while assuming the post of Prime Minister.
- So far, there have seen **six** Prime Ministers, who were also **Chief Ministers before becoming Prime Ministers.** They were - Morarji Desai, Charan Singh, V.P. Singh, P.V. Narasimha Rao, H.D. Deve Gowda and Narendra Modi.
- **Jagjivan Ram** served for the longest time as a minister.

- Parliament is the legislative body of the **union government**. Parliament has special importance in the Indian political system due to the adoption of the parliamentary governance system (**Westminster Model**).
- Under **Part V, Chapter II** of the Constitution, the Constitution, structure, procedure and powers of Parliament are described in **Articles from 79 to 122**.
- According to **Article 79**, the Parliament of India consists of the President, Rajya Sabha and Lok Sabha.  
(UPPCS, 2014; UP Lower, 2013)
- Parliament consists of two Houses, the Upper House is called **Rajya Sabha** and the Lower House is called **Lok Sabha**.
- The **President** is not a member of any House of Parliament. But he/she is an integral part of Parliament.
- **No Bill passed** by Parliament becomes law unless the **President approves** it.

✎ **Note :** Parliament = Loksabha + Rajyasabha + President

### A. Rajya Sabha

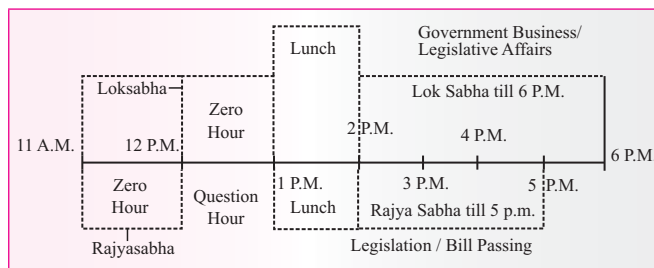
- The structure of **Rajya Sabha** is mentioned in **Article 80**.  
(BPSC, 2011)
- The maximum strength of the Rajya Sabha is **250**.  
(MPPCS, 2010)
- Of these **238 members** are elected indirectly by the States and Union Territories while **12 members** are nominated by the President [**Article 80 (1)**].  
(BPSC, 2011)

### Number of Rajya Sabha Members

| States/ Union Territories      | Number of Members | States/Union Territories | Number of Members |
|--------------------------------|-------------------|--------------------------|-------------------|
| Andhra Pradesh                 | 11                | Arunachal Pradesh        | 1                 |
| Assam                          | 7                 | Bihar                    | 16                |
| Chhattisgarh                   | 5                 | Goa                      | 1                 |
| Gujarat                        | 11                | Haryana                  | 5                 |
| Himachal Pradesh               | 3                 | Jammu & Kashmir          | 4                 |
| Jharkhand                      | 6                 | Karnataka                | 12                |
| Kerala                         | 9                 | Madhya Pradesh           | 11                |
| Maharashtra                    | 19                |                          |                   |
| Manipur                        | 1                 | Meghalaya                | 1                 |
| Mizoram                        | 1                 | Nagaland                 | 1                 |
| National Capital Region, Delhi | 3                 | Odisha                   | 10                |
| Puducherry                     | 1                 | Punjab                   | 7                 |
| Rajasthan                      | 10                | Sikkim                   | 1                 |

|               |    |             |   |
|---------------|----|-------------|---|
| Tamil Nadu    | 18 | Tripura     | 1 |
| Uttar Pradesh | 31 | Uttarakhand | 3 |
| West Bengal   | 16 | Telangana   | 7 |

- Three Union Territories- Delhi, Puducherry and Jammu and Kashmir are represented in Rajyasabha. (MPPCS, 2010)
- The minimum age for membership to Rajya Sabha is **30 years**.  
(UPPCS, 2014)
- Rajya Sabha is a **Permanent House**, which is never dissolved.  
(UPPCS, 2014)
- The term of the members of Rajya Sabha is 6 years. **One-third** of its **members retire every two years**. [**Article 83 (1)**].  
(UPPCS, 1992, 2014)
- According to **Article 89 (1)**, the Vice-President of India is the ex-officio Chairman of the Rajya Sabha. (UPPCS, 1992)
- Members of Rajya Sabha elect one of their members as Deputy Chairman of Rajya Sabha [Article 89(2)].
- The Vice President of India is the ex-officio Chairman of Rajya Sabha. He is not the members of Rajyasabha. The House also elects a Deputy Chairman from among its members.  
(UPPCS 1992)



- Currently, the Deputy Chairman of Rajya Sabha is **Harivansh Narayan Singh**.
- **Article 90** mentions the conditions of the vacancy, resignation and removal of the Deputy Chairman from the post.
  - If he ceases to be a member of the Rajya Sabha, he shall vacate the post.
  - The Deputy Chairman may resign at any time by writing a letter addressed to the Chairman.
  - By passing a resolution to this effect by a majority of all the members, before permitting for the removal of the post of Deputy Chairman by the Rajya Sabha.
  - According to **Article 92**, when a resolution to remove the Chairman or Deputy Chairman is under consideration, he shall not preside.

### Special Powers of the Rajya Sabha

- The Rajya Sabha may make laws on any subject of the State List declared to be of national importance by at **least two-thirds majority** of the members present and voting in the Rajya Sabha (**Article 249**).  
(UPPCS, 2013)



- The law remains in effect for **only one year**, but each time it can be extended for one year if the Rajya Sabha desires so.
- Rajya Sabha can declare a resolution for the creation of **All India Service** under **Article 312** supported by not less than two-thirds of the members present and voting. Only the Rajya Sabha has the right to create **All India Service**. (UPPCS, 2018)
- The **Money Bill** passed by Lok Sabha reaches Rajya Sabha for approval. If the Bill is not returned within 14 days, it is deemed to have been passed. The Rajya Sabha cannot seek amendment in it.
- The Rajya Sabha was constituted on **3<sup>rd</sup> April 1952** and its first meeting was held on **13<sup>th</sup> May 1952**.
- The President convenes a session of the Rajya Sabha **at least twice a year**.
- The difference between sessions should not exceed more than **6 months**.

## B. Lok Sabha

- The composition of Lok Sabha is mentioned in **Article 81**.
- **Lok Sabha** is the Lower House of the Parliament. Its maximum strength is **530 + 20**.

✎ **Note :** The **104<sup>th</sup> Constitutional Amendment Act** extends the reservation of seats for members from Scheduled Castes and Scheduled Tribes in the Lok Sabha and State Legislative Assemblies for a period of 10 years. The amendment does not, however extend the period of reservation of the 2 Lok Sabha seats reserved for members of the Anglo-Indian community and thus the practice of nominating 2 members of the Anglo-Indian community by the President of India on the recommendations of the Prime Minister of India was effectively abolished.

- According to **Article 81 (1)** (Subject to the provisions of Article 331), (a) to represent not more than 530 members elected by direct election from territorial constituencies in Lok Sabha, and (b) to represent the Union Territories, the Lok Sabha shall consist of not more than 20 elected members in such manner as provided by law by the Parliament. (IAS, 2003; CGPSC, 2008)

✎ **Note :** As per the provision of 84<sup>th</sup> Constitutional Amendment, 2001, no change will be made in the seats of Lok Sabha and Vidhan Sabha till 2026.

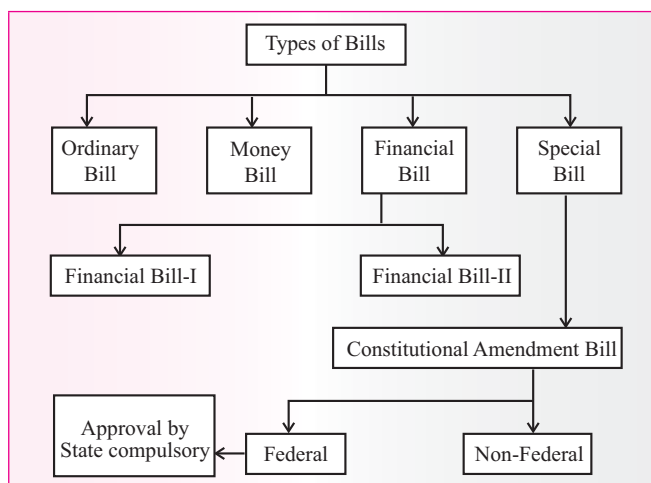
- Currently, the number of Lok Sabha members is 543. Out of this, 524 are from States and 19 from Union Territories.
- In Lok Sabha, **84 seats** are reserved for Scheduled Castes and **47 seats** for Scheduled Tribes. (**Article 330**).

(MPPCS, 2018)

## Number of Members of Lok Sabha

| States / Union Territories |    | Number of Members                        |    |
|----------------------------|----|------------------------------------------|----|
| Andhra Pradesh             | 25 | Arunachal Pradesh                        | 2  |
| Assam                      | 14 | Bihar                                    | 40 |
| Chhattisgarh               | 11 | Gujarat                                  | 26 |
| Goa                        | 2  | Himachal Pradesh                         | 4  |
| Haryana                    | 10 | Jharkhand                                | 14 |
| Jammu & Kashmir            | 5  | Kerala                                   | 20 |
| Karnataka                  | 28 | Meghalaya                                | 2  |
| Maharashtra                | 48 | Manipur                                  | 2  |
| Madhya Pradesh             | 29 | Mizoram                                  | 1  |
| Nagaland                   | 1  | Odisha                                   | 21 |
| Punjab                     | 13 | Rajasthan                                | 25 |
| Sikkim                     | 1  | Telangana                                | 17 |
| Tamil Nadu                 | 39 | Tripura                                  | 2  |
| Uttar Pradesh              | 80 | Uttarakhand                              | 5  |
| West Bengal                | 42 | Andaman and Nicobar Islands              | 1  |
| Delhi (National Territory) | 7  | Dadra and Nagar Haveli and Daman and Diu | 2  |
| Chandigarh                 | 1  | Lakshadweep                              | 1  |
| Puducherry                 | 1  | Ladakh                                   | 1  |

- Members of Lok Sabha are **directly** elected by **secret ballot** on the basis of adult suffrage (18 years).
- It is necessary for a member of the Lok Sabha to be **25 years** of age, a citizen of India, not to be insane or insolvent and not to hold any office of profit. (BPSC, 2001, 2017)



- Lok Sabha is a **temporary house**, which can be dissolved any time by the President on the advice of the Prime Minister.
- The term of the Lok Sabha is **5 years**.
- During the time of emergency, Parliament may by law extend the term of the Lok Sabha, which cannot exceed

one year at a time and not exceed in any case beyond a period of six months after the proclamation of Emergency has ceased to operate.

- The Council of Ministers is collectively responsible to the **Lok Sabha**.
- **Quorum** in Lok Sabha is **1/10 (55 members)** of the total number of members.

### C. Speaker and Deputy Speaker of Lok Sabha

- As per **Article 93**, Lok Sabha elects a **Speaker** and a **Deputy Speaker** from among its members. (IAS, 2009)
- The Speaker and Deputy Speaker of the Lok Sabha are sworn in as members of the Lok Sabha and not as the Speaker and Deputy Speaker. (CGPSC, 2017)
- **Article 94(1)(b)** provides for the resignation of the Speaker or Deputy Speaker by writing under their hand. This means that the resignation must be in writing and addressed to the Deputy Speaker or, in the absence of the Deputy Speaker, to the President of India. (MPPCS 2005)
- The **Speaker** may submit his resignation to the **Deputy Speaker** and the **Deputy Speaker** to the **Speaker**.
- They can be removed from the post by a resolution passed by a majority of all the members of the Lok Sabha but it is necessary to give notice to this effect **14 days** in advance. (MPPCS, 1994)
- **Article 96** in Constitution of India provides that at any sitting of the House of the People, while any resolution for the removal of the Speaker from his office is under consideration, the Speaker, or while any resolution for the removal of the Deputy Speaker from his office is under consideration, the Deputy Speaker, shall not, though he is present, preside, and the provisions of clause (2) of article 95 shall apply in relation to every such sitting as they apply in relation to a sitting from which the Speaker, or, as the case may be, the Deputy Speaker, is absent. (UPPCS 2008)
- The Speaker shall have the right to speak in, and otherwise to take part in the proceedings of, the House of the People while any resolution for his removal from office is under consideration in the House and shall, notwithstanding anything in article 100, be entitled to vote only in the first instance on such resolution or on any other matter during such proceedings but not in the case of an equality of votes. (UPPCS, 2008)

### Other Facts

- A joint session of both the Houses is called under Article 108.
- The **Speaker** of the **Lok Sabha** presides over the joint session of both the Houses. [Article 118 (4)]
- Whether a Bill is a **Money Bill** or not is decided by the **Speaker of Lok Sabha**.
- The term of the first Lok Sabha was from **17<sup>th</sup> April 1952 to 4<sup>th</sup> April 1957**, while the first session of the Lok Sabha started on **13 May 1952**.

| Sl. No. | Speaker                    | Tenure                                                                  |
|---------|----------------------------|-------------------------------------------------------------------------|
| 1.      | G.V. Mavalankar            | 15 May, 1952 to 27 February, 1956                                       |
| 2.      | M. Ananthasayanam Ayyengar | 08 March 1956 - 10 May 1957; 11 May 1957 - 16 April 1962                |
| 3.      | Hukum Singh                | 17 April, 1962 to 16 March, 1967                                        |
| 4.      | N. Sanjeev Reddy           | 17 March 1967 to 19 July, 1969 - 26 March 1977 to 13 July, 1977         |
| 5.      | G.S. Dhillon               | 08 August 1969 to 17 March 1971, 22 March 1971 to 1 December 1975       |
| 6.      | Bali Ram Bhagat            | 15 January 1976 to 25 March 1977                                        |
| 7.      | K.S. Hegde                 | July 21, 1977 to January 21, 1980                                       |
| 8.      | Balaram Jakhar             | 22 January 1980 - 15 January, 1985; 16 January 1985 - 18 December, 1989 |
| 9.      | Rabi Rai                   | 19 December 1989 to 9 July, 1991                                        |
| 10.     | Shivraj V. Patil           | 10 July 1991 to 22 May, 1996                                            |
| 11.     | P.A. Sangma                | 23 May 1996 to 23 March, 1998                                           |
| 12.     | G.M.C. Balayogi            | 24 March 1998 to 19 October, 1999 22 October 1999 to 3 March 2002       |
| 13.     | Manohar Joshi              | 10 May 2002 to 2 June 2004                                              |
| 14.     | Somnath Chatterjee         | 04 June 2004 to 31 May 2009                                             |
| 15.     | Meira Kumar                | June 04, 2009 to June 4, 2014                                           |
| 16.     | Sumitra Mahajan            | June 06, 2014 to June 17, 2019                                          |
| 17.     | Om Birla                   | June 19, 2019 to till now                                               |

- First Lok Sabha Speaker was **G.V. Mavalankar** and the deputy speaker was **M. Ananthasayanam Ayyengar**. (MPPCS, 2012; IAS, 2007)
- The **first woman** speaker was **Meira Kumar**.
- In the new Lok Sabha, the Speaker of the House is decided by a simple majority. Until her selection, the pro-tem Speaker is chosen to administer some important duties. 'Pro-tem' essentially means 'for the time being' or 'temporarily'. (UPPCS 2010)

✎ **Note :** Lok Sabha constituency with the largest number of voters is **Malkajgiri (Telangana)** and the one with the lowest number of voters is **Lakshadweep**.

✎ **Note :** In terms of area, the **largest** Lok Sabha constituency is **Ladakh** and the **smallest** is **Chandni Chowk, Delhi**.

### D. Financial Committees of Parliament

#### Public Accounts Committee

- It consists of **22** members, out of which **15** members are drawn from **Lok Sabha** and **7** members from **Rajya Sabha**. (MPPCS, 1993)
- The **Chairman** of this committee is **appointed** by the **Speaker of the Lok Sabha**. (MPPCS, 1993)

- The term of each of its members is **one year**. (RAS/RTS, 2018)
- It is also known as the '**twin sister**' of the **Estimates Committee**.

#### Committee on Estimates

- It consists of **30** members who are exclusively from the **Lok Sabha**. Each member's tenure is **one year**. (UPPCS, 2018)
- Its Chairman is appointed by the **Speaker of the Lok Sabha**. (RAS/RTS, 2008)
- This committee reports on what economies, improvements in organization, efficiency or administrative reform, consistent with policy underlying the estimates may be effected, etc.

#### Committee on Public Undertakings

- It consists of **22** members, out of which **15** members are from Lok Sabha and **7** are from Rajya Sabha. (RAS/RTS, 2018)
- The Chairman of the Committee is appointed by the Speaker of the Lok Sabha.
- No minister can be a member of this committee.

#### Important Terms

- **Zero Hour** - The time between **12 O'clock and 1 O'clock** after **Question Hour** in Lok Sabha & between 11 - 12 °clock in Rajya Sabha is called Zero Hour. (UPPCS, 2015)
- During this time, **crucial matters** are raised by the members.

#### Starred Questions and Unstarred Questions

- Questions that the member is **required** to **answer immediately** are called Starred Questions. They are answered orally.
- Questions that are **answered** in **writing** are called Unstarred Questions.

#### Appropriation Bill

- Only through this Bill, funds can be withdrawn from the **Consolidated Fund of India**.
- This includes the demand for a grant for weighted **expenditure on accumulated funds**.

#### Finance Bill

- **Article 117** mentions Finance Bills.
- Bills which are related to **revenue or expenditure** are called Finance Bills.

#### Money Bills

- Bills related to the subjects mentioned from sub-division (a) to subdivision (g) of **Article 110 (1)** of the Constitution are called Money Bills.
- These are **introduced** in the **Lok Sabha only**.
- **Vote on Account** - Under **Article 116(1)(a)** of the Constitution, Vote on Account is passed to the government **for advance**.
- Short duration discussion (Rule 193 of Lok Sabha), - Under this provision, an MP can raise a discussion on a matter of

urgent public importance. The time for the discussion is allocated by the Business Advisory Committee.

- **Quorum** - **Quorum** is required in House meetings. It is **one-tenth (1/10)** of the total number of members. In its absence, the meeting is adjourned.

#### Exam Oriented Facts

- The state wise seat allocation in Lok Sabha is based on population. (CGPSC Pre, 2005)
- The strength of the Lok Sabha was increased from 525 to 545 through 31<sup>st</sup> Constitutional Amendment Act. (UPPCS Mains, 2004)
- The maximum representation from the Union Territories to the Lok Sabha is 20. (UPPCS Pre, 2008)
- The arrangement for nominating representatives of the Anglo - Indian community in the Lok Sabha have not been extended beyond the stipulated date (25 January, 2020) by the Constitution (one Hundred and Fourth Amendment) Act, 2019. (44<sup>th</sup> BPSC Pre, 2000)
- The maximum expenditure limit for the Parliamentary Elections of a constituency is upto Rs. 95 Lakh.
- In India Lok Sabha speaker is chosen. (IAS Pre, 2009)
- The speaker doesn't take the oath of the office. (CGPSC Pre, 2017)
- The Representation of states in council of states is based on Ratio of their population. (38<sup>th</sup> BPSC Pre, 1992)
- Rajya Sabha is a permanent House and is not subject to dissolution as per Article 83(1) of the Constitution. (MPPCS Pre, 1994)
- A money Bill cannot be introduced in Rajya Sabha. (UPPCS Pre, 2021)
- A seat of a M.P. can be declared Vacant if he/she absent from the house for a continuous period of two months. (62<sup>nd</sup> BPSC Pre, 2016)
- Under the Article 122 the courts have been prohibited from inquiring the proceedings of the Parliament. (UP UDA/LDA Spl. Mains, 2010)
- The provision of a joint sitting of both the House of Parliament is mentioned in the Constitution under the Article 108. (UP RO/ARO Mains, 2021)
- The committee on Estimates consists 30 members, which is the largest committee. (IAS Pre, 2014; UPPCS Mains, 2017)

12

## Amendment of the Constitution

- Under **Article 368** of the Indian Constitution, two procedures for an amendment to the Constitution are mentioned.

**A. Special Majority Bill passed by a special majority** of each House of Parliament by a majority of total members and a **two-thirds majority of the members present and voting**.

**B. Amendment by a special majority of Parliament and approval by State Legislatures** - Special majority of both Houses of Parliament and amendment with the approval of **half of the state legislatures**. For example, in matters related to the election of the President, expansion of executive power of the Union, Union Judiciary and High Court, amendments are made following this procedure.

✎ **Note : By Ordinary Majority** - Bill passed by Parliament by a simple majority. Such as - **the creation of new states, state territory, border and name changes**, etc. But it will not be considered as an amendment of the Constitution.

13

## Supreme Court

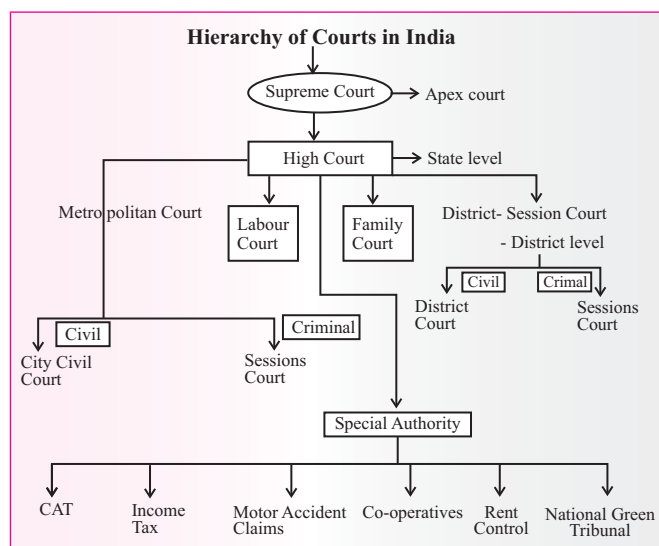
➤ **Chapter IV of Part V** of the Constitution of India mentions the constitution, independence, jurisdiction, powers of the Supreme Court enshrined in **Articles from 124 to 147**. A **integrated justice system** has been established in India, with the Supreme Court at the top and several High Courts under it. The subordinate courts also exist under High Courts. (42<sup>nd</sup> BPSC, 1997)

### Formation

➤ **Article 124** provides for the establishment and constitution of the Supreme Court. (IAS, 2014; BPSC, 2000)

➤ Supreme Court consisted of **a Chief Justice** and **30 Judges**.

➤ The number of judges including Chief Justice has been increased from 31 to 34 by the Supreme Court (Number of Judges) Amendment Act, 2019. Currently number of judges on chair is 34. (IAS Pre, 2014; BPSC, 2000; UPPCS, 2015)



### Term of Office

➤ There is no minimum age criterion to become eligible for a judge of the Supreme Court. However, 65 years, has been fixed as the age for retirement. (UPPCS, 1998)

➤ After retirement, the judges of the Supreme Court cannot plead before any court or any officer in India.

### Appointment

➤ The **Chief Justice** of the Supreme Court is **appointed** by the **President**. (BPSC, 2017)

➤ In the case of other judges, the President appoints them after consulting the Chief Justice. (UK UDA/LDA, 2006, 2007)

### Qualifications

(i) He should be a citizen of India.

(ii) He has been a judge of a High Court or such two or more Courts for at least **five years** or an **Advocate for 10 years** in any High Court or two or more such Courts.

(iii) Or is, in the opinion of the President a distinguished Jurist.

### Oath

➤ The **President** administers the **oath** of office and secrecy to judges of the Supreme Court.

### Salary and Allowances

➤ Salaries, allowances, etc. are decided by the Parliament from time to time.

➤ Currently, the salary of the Chief Justice is **Rs 2.8 lakh** per month and the salary of other Judges is **Rs 2.5 lakh** per month. Apart from this, they are also provided with other allowances.

### Removal of Judges

➤ Judges of the Supreme Court may be removed by the President on charges of **proven misbehaviour** or **incapacity**. A resolution to this effect is passed by a majority of the total members of each Houses of Parliament and by **at least two-thirds majority** of the members present and voting and sent to the President for his approval in the same session.

➤ A judge may resign from his post by sending his resignation to the President. (UPPCS, 2014, 2023; BPSC, 2018)

✎ **Note :** The term impeachment is not mentioned in the Constitution to remove the Judges of the Supreme Court and High Courts.

### Powers and Jurisdiction of Supreme Court

➤ Original Jurisdiction in the following cases

(i) Disputes arising between the **Government of India** and **one or more States**, or

(ii) In disputes between the **Government of India** and anyone State or several States and one or more other States.

(iii) Disputes between **two or more States** where the question of statutory rights is involved.

(IAS, 1996, 2012, 2014; MPPCS Pre, 2021)

### Appellate Jurisdiction

➤ The Supreme Court is the highest **Appellate Court** in the country. It hears against decisions of lower courts.



- This jurisdiction can be divided into four sections, namely- **Constitutional, Civil, Criminal** and **Appeal** by **special permission**. (MPPCS 2016; IAS, 2015, 2010, 2015)

#### Advisory Jurisdiction

- Under **Article 143**, the President has the right to consult the Supreme Court on matters of public importance. However, this advice is not binding on the President. (UPPCS, 2017)

#### Power of Judicial Review

- Under **Article 137**, the Supreme Court is empowered to reconsider its own decisions. (CGPSC, 2015; UPPCS, 2009)

#### Court of Records

- The Supreme Court has been considered as the Court of Records under **Article 129**. Its verdicts will be accepted as all-time records and evidence. (UPPCS, 2008, 2009; IAS, 2022)

#### Writ Jurisdiction

- The Supreme Court of India is the **guardian** of the **Fundamental Rights of Citizens**.

- Under **Article 32**, the Supreme Court can issue **5 types of writs**; eg. Habeas Corpus, Mandamus, Prohibition, Quo-warranto and Certiorari.

(UPPCS, 2006; IAS, 1993; UPPCS, 2008, 2017)

- **Note** - In the context of jurisdiction, the Supreme Court can issue writ only concerning the implementation of fundamental rights, while the High Court can issue not only the order for fundamental rights but may also release it for other purposes.

Thus the power of the High Court in this area is more extensive than that of the Supreme Court.

#### Exam Oriented Facts

- Supreme Court of India was inaugurated on 28 January, 1950. (MPPCS Pre, 2013)
- To become a Judge of Supreme Court, a person must be an advocate in High Court for at least 10 years. (MPPCS Pre, 2002)
- A Judge of the Supreme Court may resign his office by writing a letter to the President. (UPPCS Pre, 2014)
- Salaries of the Judges of the Supreme Court are determined by the Parliament. (UPPCS Mains 2008)
- Acting Chief Justice of India is appointed by the President. (UPPCS Pre, 2000)

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## High Court

- It has been provided by the Constitution of India that there will be a High Court for every State. The Parliament was empowered by the **Seventh Constitution Amendment Act, 1956**, that it could establish a **Joint High Court** for two or more States and a Union Territory.
- The matters relating to the constitution, jurisdiction and powers of the High Courts have been dealt with in articles 214 to 231 of Part VI of the Constitution.

- As per **Article 214**, there will be a **High Court** for each State.
- As per **Article 231**, Parliament can by law establish a single High Court for two or more States and Union Territories.

### High Courts

| Name                   | Year of Establishment | Jurisdiction seat                                          | Principal Bench                                |
|------------------------|-----------------------|------------------------------------------------------------|------------------------------------------------|
| 1. Allahabad           | 1866                  | Uttar Pradesh                                              | Prayagraj (Bench - Lucknow)                    |
| 2. Andhra Pradesh      | 1 January, 2019       | Andhra Pradesh                                             | Amravati                                       |
| 3. Bombay              | 1862                  | Maharashtra, Goa, Dadra and Nagar Haveli and Daman and Diu | Bombay (Bench - Nagpur, Panaji and Aurangabad) |
| 4. Calcutta            | 1862                  | West Bengal, Andaman and Nicobar                           | Kolkata (Bench - Port Blair)                   |
| 5. Chhattisgarh        | 2000                  | Chhattisgarh                                               | Bilaspur                                       |
| 6. Delhi               | 1966                  | Delhi                                                      | Delhi                                          |
| 7. Guwahati            | 1948                  | Assam, Mizoram, Nagaland, Arunachal Pradesh                | Guwahati (Bench - Kohima, Aizwal, Itanagar)    |
| 8. Gujarat             | 1960                  | Gujarat                                                    | Ahmedabad                                      |
| 9. Himachal Pradesh    | 1971                  | Himachal Pradesh                                           | Shimla                                         |
| 10. Jammu and Kashmir* | 1928                  | Jammu-Kashmir and Ladakh                                   | Srinagar and Jammu                             |
| 11. Jharkhand          | 2000                  | Jharkhand                                                  | Ranchi                                         |
| 12. Karnataka          | 1884                  | Karnataka                                                  | Bangalore (Dharwad, Gulbarga)                  |
| 13. Kerala             | 1956                  | Kerala and Lakshadweep                                     | Ernakulam                                      |
| 14. Madhya Pradesh     | 1956                  | Madhya Pradesh                                             | Jabalpur (Bench - Gwalior and Indore)          |
| 15. Madras             | 1862                  | Tamil Nadu and Puducherry                                  | Chennai (Bench - Madurai)                      |
| 16. Odisha             | 1948                  | Odisha                                                     | Cuttack                                        |
| 17. Patna              | 1916                  | Bihar                                                      | Patna                                          |
| 18. Punjab and Haryana | 1966                  | Punjab, Haryana, Chandigarh                                | Chandigarh                                     |
| 19. Rajasthan          | 1949                  | Rajasthan                                                  | Jodhpur Bench - Jaipur)                        |

|                 |                 |             |                            |
|-----------------|-----------------|-------------|----------------------------|
| 20. Sikkim      | 1975            | Sikkim      | Gangtok                    |
| 21. Uttarakhand | 2000            | Uttarakhand | Nainital                   |
| 22. Meghalaya   | March, 2013     | Meghalaya   | Shillong                   |
| 23. Manipur     | March, 2013     | Manipur     | Imphal                     |
| 24. Tripura     | March, 2013     | Tripura     | Agartala                   |
| 25. Telangana   | 1 January, 2019 | Telangana   | Hyderabad<br>(UPPCS, 2016) |

- The **Chief Justice** and **other Judges** of each High Court are appointed by the **President**.  
(BPSC, 2023; IAS, 2002, 2001, 2008)
- The Chief Justice of the High Court is appointed by the President after consulting the Chief Justice of India and the Governor of the State concerned. (MPPCS, 2022)
- The Chief Justice of the High Court concerned is also consulted regarding the appointment of other Judges.
- Different High Courts have a different number of Judges. The **President determines** their **number** from time to time as per the requirement of the work.
- The **High Court Judges** are administered the **oath** by the **Governor** of the State concerned.
- Age limit for the **retirement** of High Court Judges is **62 years**. Even before that, he can address the President by writing under his hand and giving his resignation. (MPPCS, 2023)
- High Court Judges can also be removed by the same process as Judges of the Supreme Court.
- According to **Article 215**, each High Court is a **Court of Record**.
- The **Chief Justice** of the High Court gets a monthly salary of **Rs 2.5 lakh** and **other Judges Rs 2.25 lakh**.
- **Delhi** and **Jammu & Kashmir** have their own **High Court** in the Union Territories.
- India currently has a total of **25 High Courts**.
- **High Courts** were **first** established in the then **Calcutta, Bombay** and **Madras** in **1862**.

#### Powers of High Court

- Election disputes of members of Parliament and State legislature under **original jurisdiction**, enforcement of basic rights of citizens, matters transferred from subordinate courts concerning the interpretation of Constitution, case of jurisdiction, Will, Marriage, Divorce, Company Law, Contempt of Court, etc. (UPPCS, 2007)
- The High Court is an **appellate court** under the **appellate jurisdiction**. Here, an appeal can be made against the orders of the subordinate courts. Civil and criminal cases can also be filed here.

- Under **Article 226**, the High Court has the **right to issue a writ** to **protect** the **fundamental rights** of citizens. (IAS, 1997)
- High Court maintains superintendence Act 227, over its subordinate courts (**Article - 227**).
- The High Court enjoys extensive jurisdictional power which includes judicial as well as administrative jurisdiction.

#### Exam Oriented Facts

- The number of Judges in a High Court may be decided by the President of India. (69<sup>th</sup> BPSC Pre, 2023)
- According to the Article 222 of the Indian Constitution, the President can (in consultation with the Chief Justices transfer a Judge of a Judge of a High Court from one Court to another. (MPPCS Pre, 2022)
- The pension of a retired High Court Judge is charged to the consolidated fund of India. (UPPCS Mains, 2013)
- The number of High Court of Judicature in India is 25. (UPPCS Lower, 2008)

### 15 Attorney General and Advocate General

- **Article 76** of the Constitution deals with the office of **Attorney General of India**. (49<sup>th</sup> BPSC, 2000; UPPCS, 2008)
- He is the highest law officer of the Government of India and his duties include advising the government on law-related matters and performing such other functions of the legal nature as the President from time to time may send to him.
- **Under Article 76(1)** a person, possessing the qualifications necessary for appointment of a Supreme Court judge, is eligible for appointment as Attorney-General of India by the President. (GPSC, 2013; UPUDA/LDA, 2010; UPPCS, 2006, 1995)
- The Attorney General holds office during the **pleasure of the President** and receives such remuneration as the President may prescribe. He is neither a full-time legal advisor to the government nor a government servant. (UPPCS, 2010)
- Attorney General is vested with the right of audience in all courts in India [Article 76(3)]. There is a **Solicitor General** and **Additional Solicitor General** to assist the Attorney General. (CGPSC, 2023; UPPCS, 2023; UP RO/ARO, 2023; UPPCS, 2021, CUPSC, 2003; BPSC, 2016)
- The **Attorney General of India** is **not a member** of Parliament, but he can speak in either House or take part in the proceedings of any committee but does **not** have the **right to vote** (Article-88). (UPPCS, 2020)
- He enjoys all the privileges and immunities that are available to a member of Parliament under **Article 105**.
- The post of **Advocate-General of a State** is provided under **Article 165**. (BPSC, 2001; UP Lower, 2015; UPPCS, 2014; RAS, 2003)
- He is the **Supreme Law Officer** (Advocate General) of the **State**.
- The person having the qualification of High Court Judge can be appointed as the Advocate-General of a State.

- The Advocate General **holds office during the pleasure of the Governor of his state.** (RAS/RTS, 2003)
- The Advocate General is empowered **to hear in any court of the concerned State.** (IAS Pre, 2009)
- Though not a member of either house of the state legislature, the Advocate-General has the privilege to attend and address proceedings in the legislature but has no right to vote.
- Advocate General may **attend** and **address** the proceedings but cannot vote. (UP Lower, 2015)
- The Advocate General performs all the legal functions assigned by the Governor. (UP Lower, 2015)

### Monthly Salary of Important Officials

|                                    |              |
|------------------------------------|--------------|
| 1. President                       | Rs. 5,00,000 |
| 2. Vice-President                  | Rs. 4,00,000 |
| 3. Governor                        | Rs. 3,50,000 |
| 4. Chief Justice of Supreme Court  | Rs. 2,80,000 |
| 5. Other Judges of Supreme Court   | Rs. 2,50,000 |
| 6. Chief Justice of High Court     | Rs 2,50,000  |
| 7. Other Judges of High Court      | Rs 2,25,000  |
| 8. Comptroller and Auditor General | Rs 2,50,000  |
| 9. Chief Election Commissioner     | Rs 2,50,000  |

## 16 Comptroller and Auditor General

- An important post in the Government of India is that of Comptroller and Auditor General who does high quality auditing and accounting (both Union and sub-national).
- As per **Article 148**, there will be a **Comptroller and Auditor General of India**, to be appointed by the **President**. (UP UDA/LDA, 2001; UP Lower, 2015; UPPCS Pre, 2012)
- He is the **protector of public money**. He is an impartial head of Govt. of India's audit and accounting systems.
- He retires after being in office for six years or on attaining the age of sixty-five years, whichever is earlier. (UPPCS, 1993)
- He is debarred from seeking re-employment under any post of the Government of India after retirement.
- Although he is appointed by the President, he can be removed from office following the procedure adopted in the case of removal of Supreme Court judge on similar charges of proved misbehaviour and incapacity. (UPPCS RI, 2014; RAS, 2018, 2021)
- He reports on **account** of the **central government** to the **President** which is then laid on the floor of the Parliament. (MPPCS Pre, 2021; IAS Pre, 2001)
- He also reports on the **accounts** of the **State Government** to the **Governor** who then send it to be laid on the floor of the legislature.

- The CAG Attends the meeting of Public Account Committee. (UPPCS, 2011)

### Consolidated Fund of India

- Under **Article 266**, a provision has been made for the Consolidated fund and public accounts of India and the States.
- Money is spent after withdrawing from the Consolidated Fund of India only after the **Appropriation Bill** is passed by Parliament.
- Items of expenditure on the Consolidated Fund of India are as follows-
  - (i) President's salary, allowance and other expenditure on his establishment.
  - (ii) Salaries and allowances of the Speaker and Deputy Speaker of the Lok Sabha and the Chairman and Deputy Chairman of the Rajya Sabha.
  - (iii) Salary, allowance and pension of Judges of Supreme Court and pension of High Court judges.
  - (iv) Comptroller and Auditor General of India's, salary, allowance and pension. (MPPCS Pre, 2012)

### Contingency Fund

- **Article 267** of the Constitution empowers **Parliament** and the **State Legislature** to create a **Contingency Fund** of India or a State.
- This fund is constituted by the **Contingency Fund of India Act, 1950**.

## 17 State Executive

- Under **Part VI** of the Indian Constitution, **Articles 153 to 167** refer to the State Executive. The State executive consists of **Governor, Chief Minister, Council of Ministers, Advocate General**.
- **Governor** is the **Constitutional Head** of state. (BPSC, 2011, 2001)

### A. Governor

- The Governor of the State is the head of the Executive powers. The Governor himself or through his subordinate officers exercises the executive powers of the State.
- **According to Article 153**, each State has a Governor as its constitutional head.
- Under article 153, a person can be appointed as constitutional head of more than one state simultaneously. (UPPCS, 2016)

**Note :** This provision was inserted by the **Seventh Constitutional Amendment Act, 1956**.

### Qualifications

- A.** He should be a citizen of India and have completed **35 years** of age. (UP Lower, 1996; Jharkhand PCS, 2016)

### Conditions

- Certain conditions have been attached relating to appointment to the post of Governor under **Article 158** -

- (i) The Governor should not be a member of either House of Parliament or a legislature of any State.
- (ii) He should not hold any office of profit.
- (iii) His emoluments and allowances during the tenure cannot be reduced, etc.

### Appointment and Term of Office

- As per **Article 155**, the Governor of a State shall be appointed by the President by warrant under his hand and seal. (UPPCS, 2012; BPSC, 2018; UPPCS, 2015)
- The Governor is **appointed** by the **President** for a term of **five years**. (UPPCS, 2010; UPPCS GIC, 2010)
- The Governor holds office during the **pleasure of the President (Article 156 (1))**. (IAS, 1995; UPPCS, 1992; MPPCS, 2006; UPPCS, 2004)
- He may **resign** from his post by address to the **President**.
- The Governor is administered the oath of office by the Chief Justice of the State concerned or in his absence by the senior-most Judge of the High Court located in the state.

### Salary

- The Governor receives a salary of Rs. 3 lakhs 50 thousand rupees monthly. On assuming the charge of two or more States, he may also be given an additional salary as determined by the order of the President. (Jharkhand PCS, 2003)
- No arrest or criminal action order can be issued by the court against the Governor during his tenure.
- In the Union Territory of **Delhi, Puducherry, Andaman and Nicobar Island, Jammu and Kashmir and Ladakh** there is a provision for the post of **Lieutenant Governor** in place of Governor. (UPPCS, 1995; CGPSC, 2019)
- There is a provision for the post of Administrator in place of the Governor in the Union Territory of Chandigarh, Dadra and Nagar Haveli and Daman and Diu and Lakshadweep.

✎ **Note :** The **Governor of Punjab** is also the **Administrator of Chandigarh**.

## Powers and Functions of the Governor

### Executive Powers

- The Governor appoints the Chief Minister and other ministers on the advice of the Chief Minister.
- The Governor appoints the **Chairman** and **members** of the **State Public Service Commission**.

✎ **Note :** The Governor appoints the Chairman and members of the State Public Service Commission but cannot remove them. They can be removed **only by the President** on the advice of the Supreme Court.

- The Governor appoints Vice-Chancellors of State Universities.
- The Governor advises the President regarding the appointment of Judges to the High Court of the State. (UPPCS, 2017)

- The **Governor** appoints **Advocate-General** of the State. (UK PSC Pre, 2012)
- The Governor acts as the **representative** of the President at the time of the **President's Rule**.
- He may get information from the Chief Minister from time to time regarding the administration of the State.
- The Governor nominates **1/6 of the total members** of the State's Upper House i.e. **Legislative Council**, who have achieved excellence in various fields like education, literature, arts, science, social service, cooperatives. (CGPSC, 2011; UPPCS, 2017)

### Legislative Powers

- The Governor may summon, address, dissolve and prorogue the session of the State Legislature.
- The Bill passed by the State Legislature becomes an Act only after the **assent of the Governor**.
- If immediate action is required on any subject, and the State Legislature is not in session at that time, in such a situation the Governor can issue an ordinance as per **Article 213**. (UPPCS, 2017, 2008; UP RO/ARO, 2016)
- An ordinance issued by him ceases to operate on the expiry of **six weeks** from the reassembly of the state legislature.
- The Governor can send a Bill back to the State Legislature for **reconsideration if it is not a Money Bill**. But the Governor is bound to give his assent if it is sent back to him by the State Legislature. (UP Lower Pre, 2004; CGPSC Pre, 2015; RAS, 2018)
- According to **Article 200**, the Governor gives assent or withholds assent on a Bill or may reserve it for the consideration of the President.

### Judicial Powers

- As per **Article 161**, the Governor shall have the power to pardon, reprieve, respite besides remissions of the punishment of a person convicted of an offence against any law on subjects on which the executive power of the State is extended, or shall have the power to suspend, remit or commute the sentence.
- Supreme court in August 2021 observed that the Governor of a State can pardon prisoners, including death row ones, even before they have served a minimum 14 years of prison sentence.
- The President also consults the Governor in appointing the Chief Justice and other Judges of the High Court of the State.

✎ **Note :** The Governor does not have the power of pardon in respect of the order passed by the Army Court.

### Financial Powers

- No **Money Bill** is introduced in the Legislative Assembly without the prior consent of the Governor.
- The Governor submits the **annual financial statement of the State** to the legislature every financial year [Article 202].



- Governor can take money in advance from the Contingency Fund of the State for any **unexpected expenditure**.
- He constitutes the **State Finance Commission** every **5 years**.

### Emergency Powers

- If the President receives a report from the state's Governor that the state's situation is such that the state government cannot carry on the governance according to the provisions of the Constitution, President's Rule can be imposed. [Article 356]

### B. Chief Minister

- The Chief Minister is the **head** of the Council of Ministers who is **appointed by the Governor**.
- Other ministers are appointed by the Governor on the advice of the Chief Minister.
- Oath of office and secrecy to the Chief Minister and other ministers is administered by the Governor.
- As per **Article 164 (2)**, the Council of Ministers is collectively **responsible to the Legislature** of the State.
- Whenever a motion of no confidence is passed the entire Council of Ministers has to resign.
- The **Chief Minister presides** over the meetings of the Council of Ministers.
- According to **Article 167**, Chief Minister provides information to the governor about administration and legislative work.
- Chief Minister is a link for exchange of information between the Council of Ministers and the Governor.

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## State Legislature

- State Legislature consists of the **Governor** and the **House of the State Legislature** (Legislative Assembly) or **two Houses** (Legislative Assembly and Legislative Council). Currently, **six** (effective 31 October 2019) States have Legislative Councils namely in **Andhra Pradesh** (58), **Uttar Pradesh** (100), **Karnataka** (75), **Telangana** (40), **Bihar** (75) and **Maharashtra** (78).

(BPSC, 1996, 2000; MPPCS, 2014; IAS, 1998;

UPPCS, 2013, 2008, 2006; UP Lower, 2013, 2008; BPSC, 1995)

### A. Legislative Council

- According to **Article 169**, Parliament may constitute and dissolve the Legislative Council. If the resolution in this regard is passed by the Legislative Assembly of the respective State by a majority of the total membership of the assembly and **at least two-thirds majority of the members present and voting**. (Jharkhand PCS, 2013; UP Lower Pre, 2008; BPSC, 1995; UPPCS Pre, 2011, 2013, 2015, RAS, 2021)
- The **Legislative Council** is the **Upper House** of the State Legislature.

- The total number of members of the **Legislative Council** should not exceed more than **1/3 of the total number of members** of the Legislative Assembly of the State concerned and **not less than 40**.
- The minimum age limit to become a member of the Legislative Council is **30 years**.
- The **Legislative Council** is a **Permanent House**, it is never dissolved.
- Each member of the Legislative Council has a term of **6 years**, but every **2 years one-third of the members retire** after completing their term and new members are elected in their place. (CGPSC, 2014, 2015; UPPCS, 2007, 2018; UK PSC, 2021)
- Members of the Legislative Council are elected indirectly.
- Out of total members of the Legislative Council, **1/3 members** are elected by the electoral college of the local bodies, **1/3 members** are elected by the members of the Legislative Assembly, **1/12 members** by teachers of secondary or higher schools working for at least 3 years, **1/12 members** are elected by graduates holding a bachelor's degree for 3 years and the remaining **1/6 members** are nominated by the Governor who achieved excellence in the field of **literature, art, science, cooperative movement and social service**. (UPPCS, 2017, 2015, 2014)
- Members of the Legislative Council elect **one Chairman** and **one Deputy Chairman** of the house.
- The Chairman and the Deputy Chairman of the Legislative Council can **resign** from their posts by **addressing each other**.
- The Chairman and Deputy Chairman can be removed from their posts through a resolution passed by the members of the Legislative Council. But written notice to this effect will have to be given by the House **14 days** in advance.

### B. Legislative Assembly

- The Legislative Assembly is also called the **Lower house**.
- The structure of Legislative Assemblies is mentioned under **Article 170**.
- The term of the members of the Legislative Assembly is **five years**.
- In special case, the Governor can dissolve the Legislative Assembly even before five years.
- The minimum age limit for election as a member of Legislative Assembly is **25 years**. (MPPCS, 1997)
- Members of the Legislative Assembly are **directly elected** by adult suffrage.
- Each state legislative assembly may have a **maximum 500** and a **minimum 60 members**.

✎ **Note :** As an exception, Goa and Mizoram have just 40 legislative assembly seats while Sikkim has 32 members.

### Number of Members of Legislative Assembly in States/UTs

| State/UTs                | LA          | UR          | SC         | ST         |
|--------------------------|-------------|-------------|------------|------------|
| Andhra Pradesh           | 175         | 139         | 29         | 7          |
| Telangana                | 119         | 88          | 19         | 12         |
| Arunachal Pradesh        | 60          | 1           | –          | 59         |
| Assam                    | 126         | 102         | 8          | 16         |
| Bihar                    | 243         | 203         | 38         | 2          |
| Chhattisgarh             | 90          | 51          | 10         | 29         |
| Goa                      | 40          | 39          | 1          | –          |
| Gujarat                  | 182         | 142         | 13         | 27         |
| Haryana                  | 90          | 73          | 17         | –          |
| Himachal Pradesh         | 68          | 48          | 17         | 3          |
| Jharkhand                | 81          | 44          | 9          | 28         |
| Karnataka                | 224         | 173         | 36         | 15         |
| Kerala                   | 140         | 124         | 14         | 2          |
| Madhya Pradesh           | 230         | 148         | 35         | 47         |
| Maharashtra              | 288         | 234         | 29         | 25         |
| Manipur                  | 60          | 40          | 1          | 19         |
| Meghalaya                | 60          | 5           | –          | 55         |
| Mizoram                  | 40          | 1           | –          | 39         |
| Nagaland                 | 60          | 1           | –          | 59         |
| Odisha                   | 147         | 90          | 24         | 33         |
| Punjab                   | 117         | 83          | 34         | –          |
| Rajasthan                | 200         | 141         | 34         | 25         |
| Sikkim**                 | 32**        | 18          | 2          | 12         |
| Tamil Nadu               | 234         | 188         | 44         | 2          |
| Tripura                  | 60          | 30          | 10         | 20         |
| Uttar Pradesh            | 403         | 317         | 84         | 2          |
| Uttarakhand              | 70          | 55          | 13         | 2          |
| West Bengal              | 294         | 210         | 68         | 16         |
| <b>Total</b>             | <b>3933</b> | <b>2787</b> | <b>590</b> | <b>556</b> |
| <b>Union Territories</b> |             |             |            |            |
| Jammu & Kashmir          | 90          | 74          | 7          | 9          |
| Delhi                    | 70          | 58          | 12         | –          |
| Puducherry ***           | 30          | 25          | 5          | –          |
| <b>Total</b>             | <b>4123</b> | <b>2945</b> | <b>613</b> | <b>565</b> |

\*\* 1 seat is reserved for Sangha (Buddhist monks).

\*\*\* Three seats are nominated by centre.

(UPUDA/LDA, 2006; BPSC, 2019, 2022; UPPCS, 2022)

- Members of the Legislative Assembly elect one **Speaker** and one **Deputy Speaker**.
- Whether a Bill is a **Money Bill** or not is **decided by** the **Speaker** of the Legislative Assembly.

- The Speaker of the Legislative Assembly does not normally vote on any subject in the House but in the **case of tie**, he is allowed to cast his vote.
- The **Speaker** and the **Deputy Speaker** of the Legislative Assembly may address each other and resign from their posts by writing under his hand.
- The Speaker and the Deputy Speaker can be removed by the members of the Legislative Assembly with an **effective majority** but they must be informed of it **14 days in advance**.
- A quorum for the meeting of the Legislative Assembly is **1/10** of the total members of the house.

### Functions and Powers of the Legislature

- The legislature has the right to make laws on the subjects mentioned in the **State List**.
- The Legislature also has the right to make laws on subjects in the Concurrent List. But when the law made by it contradicts the law made by the Parliament, the central law prevails over the State law.
- At the beginning of every financial year, the annual accounts of the State are laid on the table of the House by the Finance Minister of the State concerned.
- **Money Bill** is first introduced in the **Legislative Assembly** itself.
- The Money Bill is sent to the Legislative Council only after it has been passed by the Legislative Assembly.
- If the Money Bill is not returned by the Legislative Council within 14 days, then that is deemed to have been passed by both the Houses and is sent to the Governor for his assent.
- Only the elected members of the Legislative Assembly vote in the election of the President.
- **1/3** of the members of the Legislative Council are elected by the members of the Legislative Assembly.

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## National Symbols of India

### National Emblem

- The top portion of Emperor **Ashoka's Lion Pillar** at **Sarnath** was adopted as a national emblem of India on **26<sup>th</sup> January, 1950** by the government. (RAS, 1996; MPPCS, 199)
- '**Satyameva Jayate**' written in **Devanagari script** at its bottom, it is quoted from **Mundakopanishad**.

### National Anthem

- '**Jana Gana Mana**' was adopted as the National Anthem of India on **24<sup>th</sup> January, 1950** by the Constituent Assembly.
- Its author is **Rabindranath Tagore**. (UK PSC, 2021)
- It has a set singing time of **52 seconds** though it can be briefly sung within **20 seconds**.
- It was first sung at the Calcutta Session of the Indian National Congress on **27<sup>th</sup> December 1911**, presided over by **Bishan Narayan Dar**.

### National Song

- 'Vande Mataram' was adopted as the national song on **24<sup>th</sup> January, 1950**.
- It is quoted from **Bankim Chandra Chatterjee's** novel 'Ananda math'.
- It was first sung at the **1896** session of the Indian National Congress presided over by **Rahamatullah Sayani**.

### National Flag

- The national flag was adopted on **22<sup>nd</sup> July, 1947**.
- In the tricolour flag, the saffron colour is a symbol of **courage and valour**, while the **white** colour symbolises **peace** and **truth** and the **green** colour is a sign of **prosperity**.
- In the middle of the white band is a circle with **24 blue sticks** is taken from the **Sarnath pillar** of **Emperor Ashoka**.
- The ratio of the **width** and **length** of the flag is **2:3**.

### National Calendar

- **Gregorian Calendar** which is called the English calendar and Hindu calendar was adopted on **22<sup>nd</sup> March 1957**.
- Hindu calendar's month is **Chaitra** which starts on **22<sup>nd</sup> March** and **21<sup>st</sup> March** in the **Leap Year**.
- \* **Tiger** (Panthera tigris) has been declared India's **national animal**.
- \* **Peacock** (Pavo Cristatus) is the **national bird** of India.
- \* **Ganges river** is named the **national river**.
- \* **Ganges Dolphin** (Susu) has been recognized as a **national aquatic animal**.
- \* **Elephant** has been accorded **National Heritage Animal status**.

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## Panchayati Raj

- Panchayati Raj is the third and the lowest tier of the Indian political system for local self-governance. The provision of Gram Panchayats as a rural body for local governance is mentioned under Directive Principles of State Policy covered by Article 40. (UPPCS, 2015, 2020; BPSC, 1999; CGPSC, 2022)
- The **73<sup>rd</sup> Constitutional Amendment Act, 1992** provides constitutional status to the Panchayati Raj system under **Article 243 (from A to O)** and Eleventh Schedule under **Part-IX** of the Indian Constitution. (BPSC, 2020, 2000)
- Panchayati Raj was inaugurated by the then Prime Minister **Jawaharlal Nehru** in **Nagaur district** of **Rajasthan** on **2<sup>nd</sup> October, 1959**.
- **Andhra Pradesh** was the second state where the Panchayati Raj system of local governance was started on **11<sup>th</sup> October 1959**.
- The **73<sup>rd</sup> Constitutional Amendment Act** provides for the formation of a **three-tier structure (Gram Panchayat** at the village level, **Panchayat Samiti** at the block level and **Zila Parishad** at the district level) of the Panchayati Raj.

- States with a population not exceeding 20 lakhs may not constitute Panchayat at the intermediate level (at secondary level).

### Committees Related to the Panchayati Raj

|                               |      |
|-------------------------------|------|
| 1. Balwantrai Mehta Committee | 1957 |
| 2. Ashok Mehta Committee      | 1977 |
| 3. GVK Rao Committee          | 1985 |
| 4. L.M. Singhvi Committee     | 1986 |
| 5. PK Thungon Committee       | 1988 |

- There is **one-third reservation** for women at every level.
- The tenure of the Panchayats is fixed for **5 years**. It is mandatory to conduct the elections within 6 months if the Panchayats is dissolved before time.
- Panchayats have been empowered to make laws on a total of **29 subjects** mentioned in the **Eleventh Schedule**.
- Panchayats have not been formed in the states of **Meghalaya, Mizoram, Nagaland**. Under 6<sup>th</sup> Schedule Assam, Meghalaya, Tripura and Mizoram have district Councils.

21

## Municipalities

- **Part IX-A** of **Articles 243P to 243ZG** and **12<sup>th</sup> Schedule** have been added to the Constitution by the **74<sup>th</sup> Constitutional Amendment Act, 1992**.
- It contains provisions for municipalities.
- Municipalities are of three types - **Nagar Panchayat, Nagar Palika Parishad** and **Municipal Corporation**
- **One-third** of seats are reserved for **women** in municipalities.
- Municipalities have a term of **5 years**.
- The Municipal Corporation was first established in **Madras** in **1688**.

22

## Consolidated Fund

- Consolidated Fund is covered by **Article 266** of the Constitution.
- Money from the fund cannot be withdrawn without the prior approval of Parliament.

23

## Contingency Fund

- As per **Article 267** of the Constitution of India, a Contingency Fund has been arranged.
- Withdrawal from this fund can be made for meeting unforeseen expenditure pending authorization of such expenditure by parliament by law but not without the prior approval of the President.

## 24

## Centre-State Relations

- Under the Constitution of India, the powers are divided between the Center and the States in the **legislative, administrative and financial areas.**  
(UK PSC, 2002; UPPCS, 2004; UP RO/ARO, 2014)
- Center-State relations can be understood from three perspectives.  
(UPPCS, 2009; Jharkhand, 2021)
- 1. **Legislative Relations - Articles 245 and 255** under **Part XI** of the Indian Constitution deal with legislative relations of Centre and States.  
(UP UDA/LDA, 2001)
- 2. **Administrative Relations - Articles 256 to 263** refer to Centre-State administrative relations only under **Part XI** of the Indian Constitution.
- 3. **Financial Relations -** Under **Part XII** of the Indian Constitution, **Articles 268 to 293** deal with Centre - State financial relations.  
(UPPCS, 2014; Jharkhand, 2016)
- In the **Seventh Schedule** of the Constitution, three lists related to the division of powers between the Centre and the States 1. **Union List** 2. **State List**, and 3. **Concurrent list.**  
(UPPCS, 1993; UP Lower, 2008; UPPCS, 2004; UP RO/ARO, 2014)
- **Union List-** It includes subjects on which **Parliament** has the authority to make laws. There are **97 subjects** (At Present 98) in this list. Defence, post, communication, banking, foreign trade, foreign affairs, rail, air and water transport, citizenship form subject of this list.  
(UP UDA/LDA, 2001)
- **State List** - This includes subjects on which the **State Legislatures** have the authority to make laws. This list consists of **66 subjects** (At Present 59). Agriculture, prisons, land revenue, public order, police, health, local government are subjects in this list.
- **Concurrent List** - Both **Central** and **State** laws can be enacted on the subjects covered by this list. If there is a clash in both laws, the law made by the Centre will prevail. It consists of **47 subjects** (At Present 52), including population control, family planning, education, social and economic schemes.
- In addition, the **Residual List** includes subjects that are not included in the Union list, state list and Concurrent list. The **Central Government** enacts laws on these subjects.
- **Power of Parliament on the subjects of the State List** - Under **Article 249**, if the Rajya Sabha declares by a two-thirds majority of its members present and voting, a subject in a State list as being important for national interest, then Parliament can legislate on it, but this law remains effective for **only one year** but can be re-enacted several times after one year.

- Under **Article 250**, during an emergency, Parliament has the right to make laws on the subjects of the State List.

## 25

## Inter-State Relations

- Under **Article 253**, Parliament is empowered to make law for the entire territory of India or any part thereof to give effect to the international agreement.
- Under **Article 262**, provisions have been made for settlement of disputes related to the sharing of inter-state rivers between two or more states.
- Under **Article 263** the President can constitute the Inter-state Council.  
(UP Lower, 2009; CGPSC, 2019; UPPCS, 2000, 2017, 2000, 2021)
- Its main function is to coordinate between the centre and the states and among the States.  
(Raj. PCS, 2023)
- It was established in **1990**.
- The Prime Minister and the 6 cabinet - level ministers nominated by him, the Chief Ministers of all states and administrators of Union Territories not having a legislative Assembly are its members.
- The meeting of this council of is **held at least thrice a year**. The meeting is chaired by the Prime Minister and in his absence a cabinet-level minister nominated by him presides over.

## 26

## NITI Aayog

- NITI- National Institution for Transforming India was established on **1<sup>st</sup> January, 2015** under a Cabinet resolution.
- NITI Aayog replaced Planning Commission.
- The Planning Commission was established on **March 15, 1950**, by a resolution passed by the Union Cabinet, with **Jawaharlal Nehru** as the first Chairman.
- NITI Aayog is headed by the **Prime Minister**. It acts as a government **think tank**.
- The **First Vice Chairman** of NITI Aayog was **Arvind Panagaria**.
- Currently, the Vice-Chairman of NITI Aayog is **Suman Bery**.
- The Commission advises the central and state governments on national and international issues.

## 27

## National Development Council

- It was constituted on **6<sup>th</sup> August, 1952** by a government resolution.
- The National Development Council acts as a bridge between the Centre and the States.
- It is headed by the **Prime Minister**. Chief Ministers of all the States of the Indian Union are its members.



- Under **Article 280** of the Constitution of India, the President constitutes the Finance Commission every **five years**.
- Its function is to make recommendation to the President for distribution of the revenue receipts between the Centre and the States.
- Its chairperson and four members are appointed by the President.
- The first Finance Commission was constituted in 1951 with Mr. KC Neogy as its chairman.
- The chairman of the Fourteenth Finance Commission was **Y.V. Reddy**.
- **N.K. Singh** was the chairman of the Fifteenth Finance Commission.
- Notably Arvind Panagaria is the Chairman of 16<sup>th</sup> Finance Commission

#### Finance Commission and its Tenure

| Finance Commission | Year of Establishment | Chairman Operational | Duration         |
|--------------------|-----------------------|----------------------|------------------|
| First              | 1951                  | K. C. Neogy          | 1952–57          |
| Second             | 1956                  | K. Santhanam         | 1957–62          |
| Third              | 1960                  | A. K. Chanda         | 1962–66          |
| Fourth             | 1964                  | P. V. Rajamannar     | 1966–69          |
| Fifth              | 1968                  | Mahaveer Tyagi       | 1969–74          |
| Sixth              | 1972                  | K. Brahmananda Reddy | 1974–79          |
| Seventh            | 1977                  | J. M. Shelat         | 1979–84          |
| Eighth             | 1982                  | Y. B. Chavan         | 1984–89          |
| Ninth              | 1987                  | N. K. P. Salve       | 1989–95          |
| Tenth              | 1992                  | K. C. Pant           | 1995–2000        |
| Eleventh           | 1998                  | A. M. Khusro         | 2000–05          |
| Twelfth            | 2002                  | C. Rangarajan        | 2005–10          |
| Thirteenth         | 2007                  | Dr. Vijay L. Kelkar  | 2010–15          |
| Fourteenth         | 2013                  | Dr. Y. V Reddy       | 2020–21, 2021–26 |
| Fifteenth          | 2017                  | N. K. Singh          | 2020–25          |
| Sixteenth          | 2023                  |                      | 2026–31          |

- Under **Article 315** of the Constitution of India, a Public Service Commission has been envisioned for the Union and each of the States. (MPPCS, 2022; UK PSC, 2016; UPPCS, 2014)
- The chairperson and members of the Union Public Service Commission are appointed by the **President**. (BPSC, 2018)
- The President has the power to determine the number of members of the Union Public Service Commission.

- The term of the Chairman and members of the Union Public Service Commission is **6 years** or up to the age of **65 years**, whichever is earlier.
- The Chairman and members of the Public Service Commission can be removed by the **President** on grounds of **misbehaviour**. The Supreme Court prepares an inquiry report and recommends removal.
- The Chairman and members of the **State Public Service Commissions** are **appointed** by respective **Governors**. (MPPCS, 2005, 2021)
- The term of the members of the State Public Service Commission is for **6 years** and the retirement age is **62 years**, whichever is earlier.
- The Chairman and the members of the State Public Service Commission can be removed by the President of India following the same procedure as in the case of removal of the chairman and members of the Union Public Service Commission.
- Under **Article 315 (2)**, a Joint Public Service (JSPSC) Commission can be arranged for two or more States. (MPPCS, 2020; UPPCS, 2020; RAS, 2016)
- It is important to mention here that **JSPSC is a statutory body**. It is not a constitutional body.
- The President and members of the Joint Public Service Commission are appointed by the President. (RAS, 2016)

- Under **Part-XV** of the Constitution (**Articles 324 to 329**), there are provisions for the Election Commission which consists of a **Chief Election Commissioner** and two **other election commissioners (now three)**, appointed by the **President**. (MPPCS, 2014; UPPCS, 2010, 2016, 2016)
- The Chief Election Commissioner can be removed from his post in the same manner as the judge of the Supreme Court.
- Other Election Commissioners can be removed by the President on the recommendation of the Chief Election Commissioner. (UPPCS, 2002, 1991, 2014)
- According to **Article 324**, the Election Commission is responsible for election to both Houses of Parliament, **State Legislatures**, besides election to the post of President and **Vice-President**. (BPSC, 2020, UK PSC, 2010)

**Note :** State Election Commissions are responsible for election to rural Panchayats and urban local bodies.

- Salary and allowances given to the Chief Election Commissioner and other election commissioners are charged on the Consolidated Fund of India.
- The term of the Chief Election Commissioner and other election commissioners is for **6 years** and they retire at the age of 65 years, whichever is earlier.

- The Election Commission is a **Constitutional Body**.
- Preparation of voter lists, granting recognition to political parties, allotment of election symbols, holding elections etc. are the main functions of the Election Commission. The Election Commission of India was established on **25<sup>th</sup> January, 1950**.
- Provision of adult suffrage has been made under **Article 326**.

✍ **Note :** The **61<sup>st</sup> Constitutional Amendment Act, 1988** reduced the minimum voting age from **21 years to 18 years**.

- The number of currently recognized **national political parties is 6**.

| National Party                                  |                         |
|-------------------------------------------------|-------------------------|
| Election                                        | Symbols                 |
| 1. Indian National Congress (INC)               | Hand Claw               |
| 2. Bharatiya Janata Party (BJP)                 | Lotus Flower            |
| 3. Bahujan Samaj Party (BSP)                    |                         |
| 4. Communist Party of India (Marxist) [CPI (M)] | Sickle, Hammer and Star |
| 5. National People's Party (NPP)                | Book                    |
| 6. Aam Aadmi Party                              | Broom                   |

✍ **Note :** (i) Sukumar Sen was the first Chief Election Commissioner of India while currently, the Chief Election Commissioner is Rajiv Kumar.  
(ii) India's only woman Chief Election Commissioner was V.S. Ramadevi, whose tenure was from 26<sup>th</sup> November to 11<sup>th</sup> December 1990.

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## Special Provisions

- Provision for **temporary, transitional** and **special provisions** has been made under **Part-XXI** of the Constitution.

✍ **Note :** In exercise of the power conferred by clause (3) of Article 370 of the Indian Constitution with clause (1) of Article 370, the President announced on the recommendation of parliament that from 6<sup>th</sup> August, 2019, all the provisions of Article 370 will not be enforceable except some provisions. "370: All the provisions of the Constitution as amended at times without any modification or exception shall apply in relation to the State of Jammu and Kashmir".

- Under Article 370, there were originally special provisions with respect to the State of Jammu and Kashmir was enforced
- Special provisions have been made in relation to some other States (**Maharashtra, Gujarat, Nagaland,**

**Assam, Manipur, Andhra Pradesh, Sikkim, Mizoram, Arunachal Pradesh, Goa,** etc.) under Article 371.

## Articles related to Special Provisions

| Article | Description                                                                 |
|---------|-----------------------------------------------------------------------------|
| 370     | Provisions with respect to Jammu and Kashmir *                              |
| 371     | Special provisions with respect to the States of Maharashtra and Gujarat    |
| 371A    | Special provisions with respect to the State of Nagaland                    |
| 371B    | Special provisions with respect to the State of Assam                       |
| 371C    | Special provisions with respect to the State of Manipur                     |
| 371D    | Special provisions with respect to the State of Andhra Pradesh or Telangana |
| 371 E   | Establishment of a Central University in Andhra Pradesh                     |
| 371 F   | Special provisions with respect to the State of Sikkim                      |
| 371 G   | Special provisions with respect to the State of Mizoram                     |
| 371 H   | Special provisions with respect to the State of Arunachal Pradesh           |
| 371 I   | Special provisions in relation to the State of Goa                          |
| 371 J   | Special provisions in relation to the State of Karnataka                    |

\* Major amendments are not enforced from October 31, 2019

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## Important Constitutional Amendments

- **1<sup>st</sup> Amendment Act, 1951** - The Ninth Schedule added to the Constitution. The subjects mentioned in this schedule were excluded from the Supreme Court's power of judicial review.
- **7<sup>th</sup> Amendment Act, 1956** - States were reorganized by it on the basis of language and the three categories of states (Part A Put B and Part C States) were abolished and divided into 14 States and 6 Union Territories.
- **10<sup>th</sup> Amendment Act, 1961** - Dadra and Nagar Haveli were added to the Indian Union.
- **11<sup>th</sup> Amendment Act, 1961** - Election of President or Vice-President cannot be challenged on the basis of a vacancy in the appropriate electoral college.
- **12<sup>th</sup> Amendment Act, 1962** - First schedule of the constitution was amended to include Goa, Daman and Diu as union territories.
- **13<sup>th</sup> Amendment Act, 1962** - Special provision with respect to the state of Nagaland was granted under this act.
- **14<sup>th</sup> Amendment Act, 1962** - Legislature and Council of Ministers were arranged for Himachal Pradesh, Manipur, Tripura, Goa, Daman and Diu and Puducherry.

- **21<sup>st</sup> Amendment Act, 1967** - Sindhi language was included as the 15<sup>th</sup> language in the Eighth Schedule.
- **22<sup>nd</sup> Amendment Act, 1969** - Creation of a separate autonomous state of Meghalaya from Assam.
- **24<sup>th</sup> Amendment Act, 1971** - Parliament can amend any part of the Constitution (also Fundamental Rights).
- **31<sup>st</sup> Amendment Act, 1973** - Number of Lok Sabha seats were increased from 525 to 545.
- **36<sup>th</sup> Amendment Act, 1975** - Sikkim was granted full statehood with the Indian Union.
- **42<sup>nd</sup> Amendment Act, 1976** - The words 'socialist', 'secular' and 'integrity' were added to the preamble.
- \* Part-IVA added as fundamental duties of the citizens.
- \* The President was compelled to accept the advice of the Cabinet.
- The **44<sup>th</sup> Amendment Act, 1978** empowered the President to send the Bill back once for reconsideration.
- In the context of the national emergency, the word '**Armed Rebellion**' was replaced by '**Internal Disturbance**'.
- The **Right to Property** was abolished as a fundamental right and given the status of a **legal right**.
- During the national emergency, the fundamental rights **Articles 20 and 21** cannot be **suspended**.
- **52<sup>nd</sup> Amendment Act, 1985** - Under this act there is a system of disqualifying the members of Parliament and State Legislatures in the case of defection. For this, the Tenth Schedule was added.
- **58<sup>th</sup> Amendment Act, 1987** - Authorized text of Constitution made available in the Hindi language.
- **61<sup>st</sup> Amendment Act, 1988** - The voting age of citizens was reduced from 21 years to 18 years.
- **69<sup>th</sup> Amendment Act, 1991** - Union Territory of Delhi granted National Capital Territory status. In addition, a 70-member legislative assembly was arranged for Delhi.
- **70<sup>th</sup> Amendment Act, 1992** - Elected members of the National Capital Territory of Delhi and the Legislative Assembly of Puducherry were also included in the President's electoral college.
- **71<sup>st</sup> Amendment Act, 1992** - Konkani, Manipuri and Nepali language was included in the Eighth Schedule.
- **73<sup>rd</sup> Amendment Act, 1992** - Panchayats were given constitutional status by adding Part-IX and Schedule 11 to the Constitution.
- **74<sup>th</sup> Amendment Act, 1992** - Part-IXA and Schedule 12 were added in the Constitution.
- \* It gave constitutional status to urban local bodies.
- **84<sup>th</sup> Amendment Act, 2001** - Restoration of Lok Sabha and State Legislative Assembly seats for 25 years (till 2026).
- **86<sup>th</sup> Amendment Act, 2002** - Elementary education was accorded the status of a fundamental right.
- \* It was arranged under Article 21A that states should make arrangements to provide free elementary education for children from 6 to 14 years.
- \* Under **Article 51A**, the **11<sup>th</sup> duty** related to the same was added.
- \* The theme of **Article 45** was changed, under which the State will try to provide for free and compulsory education to all the children till they reach the age of six years.
- **91<sup>st</sup> Amendment Act, 2003** - It limits the size of the Council of Ministers which shall not exceed 15 per cent of the total members of the Lok Sabha.
- \* The State Council of Ministers shall not exceed 15 per cent of the total strength of the Legislative Assembly and shall not be less than 12.
- **92<sup>nd</sup> Amendment Act, 2003** - Bodo, Dogri, Maithili and Santhali languages were included in the Eighth Schedule. Thus, the total number of languages in the Eighth Schedule is 22.
- **97<sup>th</sup> Amendment Act, 2011** - The right to form a **Cooperative Society** became a fundamental right under **Article 19**.
- \* New **Part-9B** named '**Cooperative Societies**' was added.
- **100<sup>th</sup> Amendment Act, 2015** - It deals with land transfer between **India** and **Bangladesh**.
- **101<sup>st</sup> Amendment Act, 2016** - Provisions related to Goods and Services Tax (GST) have been included under it.
- **102<sup>nd</sup> Amendment Act, 2018** - Constitutional status to National Commission for Backward Classes.
- **103<sup>rd</sup> Amendment Act, 2019** - Provision of 10 per cent reservation on the economic basis to the weaker sections of the general category.
- **104<sup>th</sup> Amendment Act, 2020** - It extended the reservation of seats for SCs and STs in the Lok Sabha and State Legislative Assemblies for 10 years and it ended the reservation of 2 Anglo-Indian seats in Lok Sabha nominated by the President. It has also ended reservation of Anglo-Indians in Legislative Assemblies.
- **105<sup>th</sup> Amendment Act, 2021** - This Act restores the power of the State Government and Union Territories to identify and specify socially and Educationally Backward Classes (SEBCs).

### 33

### Important Articles of the Indian Constitution

There were 22 parts, 395 Articles and 8 schedules in the original copy of the Constitution. [Uttarakhand UDA/LDA (Pre.) 2007; Jharkhand PCS (Pre.) 2003, 2017; 53<sup>rd</sup> to 55<sup>th</sup> BPSC (Pre.) 2003]

A number of Articles were added and removed later through amendments. At present, there are around 468 articles but these are added in the form of sub-parts such as A,B,C etc., of the original Articles (395).

### Important articles of the Constitution : At a glance

- |                                                                                                                                     |                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 - Name and territory of the Union.                                                                                                | 53 - Executive power of the Union.                                                                                                                      |
| 2 - Admission or establishment of new States.                                                                                       | 54 - Election of President                                                                                                                              |
| 3 - Formation of new States and alteration of areas, boundaries or names of existing States.                                        | 55 - Manner of Election of President.                                                                                                                   |
| 5 - Citizenship at the commencement of the Constitution.                                                                            | 57 - Eligibility for re-election.                                                                                                                       |
| 14 - Equality before law. [UPPCS (Pre.) 2015]                                                                                       | 58 - Qualifications for election as the President.                                                                                                      |
| 15 - Prohibition of discrimination on ground of religion, race, caste, sex or place of birth.                                       | 60 - Oath or Affirmation by the President.                                                                                                              |
| 16 - Equality of opportunity in matters of public employment.                                                                       | 61 - Procedure for impeachment of the President. [UPPCS (Pre.) 2020]                                                                                    |
| 17 - Abolition of untouchability. [UPPCS Lower (Pre.) 2002]                                                                         | 63 - The Vice-President of India.                                                                                                                       |
| 18 - Abolition of titles.                                                                                                           | 64 - The Vice-President to be ex-officio Chairman of the Council of States.                                                                             |
| 19 - Protection of certain rights regarding freedom of speech etc.                                                                  | 66 - Election of Vice-President.                                                                                                                        |
| 20 - Protection in respect of conviction for offences.                                                                              | 70 - Discharge of President's functions in other contingencies.                                                                                         |
| 21 - Protection of life and personal liberty.                                                                                       | 72 - Power of President to grant pardons, etc., and to suspend, remit or commute sentences in certain cases.                                            |
| 21A - Right to elementary education.                                                                                                | 74 - Council of Ministers to aid and advice President.                                                                                                  |
| 22 - Protection against arrest and detention in certain cases.                                                                      | 75 - Other provisions as to ministers.                                                                                                                  |
| 23 - Prohibition of traffic in human beings and forced labour.                                                                      | 75(1) - The Prime Minister shall be appointed by the President and other ministers shall be appointed by the President on the advice of Prime Minister. |
| 24 - Prohibition of employment of children in factories, etc.                                                                       | 76 - Attorney – General for India.                                                                                                                      |
| 25 - Freedom of conscience and free profession, practice and propagation of religion.                                               | 79 - Constitution of Parliament.                                                                                                                        |
| 26 - Freedom to manage religious affairs.                                                                                           | 80 - Composition of the Council of States.                                                                                                              |
| 27 - Freedom as to payment of taxes for promotion of any particular religion.                                                       | 81 - Composition of the House of the People.                                                                                                            |
| 28 - Freedom as to attendance at religious instruction or religious worships in certain educational institutions.                   | 83 - Duration of Houses of Parliament.                                                                                                                  |
| 29 - Protection of interests of minorities.                                                                                         | 84 - Qualification for Membership of Parliament.                                                                                                        |
| 30 - Right of minorities to establish and administer educational institutions.                                                      | 85 - Sessions of Parliament, prorogation and dissolution.                                                                                               |
| 32 - Remedies for enforcement of fundamental rights including writs.                                                                | 89 - The Chairman & Deputy Chairman of the Council of states.                                                                                           |
| 38 - State to secure a social order for the promotion of welfare of the people.                                                     | 93 - The Speaker & Deputy speaker of the House of the People.                                                                                           |
| 39 - Certain principles of policy to be followed by the State.                                                                      | 100 - Voting in Houses, power of Houses to Act not with standing vacancies and quorum.                                                                  |
| 39A - Equal justice and free legal aid.                                                                                             | 108 - Joint sitting of both the Houses in certain cases.                                                                                                |
| 40 - Organisation of Village Panchayats.                                                                                            | 109 - Special procedure in respect of Money Bills.                                                                                                      |
| 41 - Right to work, to education and to public assistance in certain cases. [UPPCS (Pre.) 2015]                                     | 110 - Definition of 'Money Bills'.                                                                                                                      |
| 43 - Living wage, etc. for workers.                                                                                                 | 111 - Assent to Bills.                                                                                                                                  |
| 44 - Uniform Civil Code for the citizens.                                                                                           | 112 - Annual Financial Statement (Budget).                                                                                                              |
| 45 - Provision for early childhood care and free & compulsory education to children below the age of six years. [UPPCS (Pre.) 2015] | 114 - Appropriation Bills.                                                                                                                              |
| 48 - Organisation of Agriculture and Animal Husbandry.                                                                              | 116 - Vote on account, vote of credit & exceptional grants.                                                                                             |
| 48A - Protection and improvement of environment and safe guarding of forests and wildlife.                                          | 117 - Special provisions as to Financial Bills. [Jharkhand PCS (Pre.), 2013; UP UDA/LDA (spl) (Mains) 2010]                                             |
| 49 - Protection of monuments and places and objects of national importance.                                                         | 122 - Court not to inquire into proceedings of Parliament.                                                                                              |
| 50 - Separation of judiciary from executive.                                                                                        | 123 - Power of President to promulgate ordinances during recess of Parliament.                                                                          |
| 51 - Promotion of international peace and security.                                                                                 | 124 - Establishment and Constitution of the Supreme Court.                                                                                              |
| 51A - Fundamental Duties.                                                                                                           | 129 - Supreme Court to be a court of record.                                                                                                            |
| 52 - The President of India.                                                                                                        | 137 - Review of judgements or orders by the Supreme Court.                                                                                              |
|                                                                                                                                     | 143 - Power of President to consult the Supreme Court.                                                                                                  |
|                                                                                                                                     | 148 - Comptroller and Auditor - General of India. [UPPCS (Pre.) 2016]                                                                                   |
|                                                                                                                                     | 153 - Governors of states                                                                                                                               |



- 154 - Executive power of state.
- 155 - Appointment of Governor.
- 161 - Power of Governor to grant pardons, etc, and to suspend, remit or commute sentences in certain cases.
- 163 - Council of Ministers to aid and advice Governor.
- 164 - Other provisions as to Ministers.
- 165 - Advocate - General for the State.
- 167 - Duties of Chief Minister as respect the furnishing of information to the Governor etc.
- 169 - Abolition or creation of Legislative Council in States.
- 174 - Sessions of the State Legislature, prorogation and dissolution.
- 200 - Assent to Bills.
- 201 - Bills reserved for the consideration of President.
- 213 - Power of Governor to promulgate ordinances during recess of legislature.
- 214 - High Court for States.
- 215 - High Court to be court of record.
- 216 - Constitution of High Court.
- 217 - Appointment and conditions of the office of a judge of a High Court.
- 226 - Power of High Court to issue certain writs.
- 231 - Establishment of a common High Court for two or more States.
- 233 - Appointment of District Judges.
- 239 A - The provision contained in this Article applicable to "Union Territory of Puducherry" shall also apply to the "Union Territory of Jammu and Kashmir". 239 AA - Special provisions with respect to Delhi.
- 241 - High Court for Union Territories.
- 243A - Gram Sabha.
- 243B - Constitution of Panchayat.
- 243H - Powers to impose taxes by, and funds of the Panchayats.
- 243K - Election to the Panchayats.
- 243Z - Audit of accounts of municipalities.
- 243ZA - Elections to the municipalities.
- 243ZD - Committee for district planning.
- 243ZI - Incorporation of Co-operative Societies.
- 249 - Power of Parliament to legislate with respect to a matter in the State list in the national interest.
- 253 - Legislation for giving effect to international agreements.
- 262 - Adjudication of disputes relating to waters of inter – State rivers or river valleys.
- 263 - Provisions with respect to an Inter – State council.
- 266 - Consolidated Funds and Public Accounts of India and of the States.
- 267 - Contingency Fund.
- 280 - Finance Commission.
- [UPPCS (Pre.) 2023; UPPCS (Pre.) 2020]
- 300A - Persons not to be deprived of property save by authority of law.
- 312 - All – India Services.
- [UPPCS (RI) 2014; UPPCS (Mains) 2012]
- 315 - Public Service Commission for the Union and for the States.
- [UPPCS (Pre.) 2023]
- 323A - Administrative Tribunals.
- 323B - Tribunals for other matters.
- 324 - Superintendence, direction and control of elections to be vested in an Election Commission.
- [Chhattisgarh PCS (Pre.) 2008]
- 326 - Elections to the Lok Sabha and to the legislative assemblies of States to be on the basis of adult suffrage.
- 330 - Reservation of seats for scheduled castes and scheduled tribes in the House of people.
- 331 - Representation of the Anglo – Indian community in the Lok Sabha.  
(Provision of repeal by the 104<sup>th</sup> Constitutional Amendment Act, 2019)
- 332 - Reservation of seats for scheduled castes and scheduled tribes in the legislative assemblies of the States.
- 333 - Representation of the Anglo – Indian community in the legislative assemblies of the States.  
(Provision of repeal by the 104<sup>th</sup> Constitutional Amendment Act, 2019)
- 338 - National Commission for scheduled castes.
- [UPPCS (Pre.) 2023]
- 338A - National Commission for scheduled tribes.
- 338B - National Commission for backward classes.
- 343- Official language of the Union.
- 344 - Commission and Committee of Parliament on official language.
- 350A - Facilities for instruction in mother-tongue at primary stage.
- 350B - Special officer for linguistic minorities.
- 351 - Directive for development of the Hindi language.
- 352 - Proclamation of Emergency (national emergency).
- 356 - Provisions in case of failure of constitutional Machinery in States.
- 358 - Suspensions of provisions of Article 19 during emergencies.
- 359 - Suspension of the enforcement of fundamental rights during emergencies.
- 360 - Provisions as to Financial Emergency.
- [UPPCS (Pre.) 2016]
- 365 - Effects of failure to comply with or give effect to directions given by the Union.
- 368 - Power of Parliament to amend the Constitution and procedure there for.
- 370 - Temporary provisions with respect to the State of Jammu and Kashmir. (Declared inoperative through a presidential notification on 6th August, 2019).
- 371 - Special provision with respect to the state of Maharashtra & Gujarat.



# Indian History



## Topics of the Unit

### A. Ancient History of India

● Sources of Ancient Indian History ● Periods of History ● Chalcolithic Age ● Indus (Harappan) Civilization ● Vedic Civilization ● Religious Movement in Sixth Century BC ● The Rise of Magadha ● Foreign Invasions in India ● The Gupta Empire ● Vakataka Dynasty ● Vardhana Dynasty ● History of South India ● Early-Medieval Period ● The Bordering States

### B. Medieval India

● Invasion of Arabs ● Sultanate Period (1206 AD - 1526 AD) ● Khalji Dynasty (1290-1320 AD) ● Tughluq Dynasty (1320-1412 AD.) ● Sayyid Dynasty (1414-1451 AD) ● Lodi Dynasty (1451-1526 AD) ● Delhi Sultanate - Governance System ● Vijayanagara Empire ● Bahmani Kingdom ● The Independent Provincial States ● Bhakti Movement ● The Mughal Empire ● Mughal Government System ● Advancement of Marathas

### C. History of Modern India

● The Decline and Disintegration of the Mughal Empire ● The Arrival of European Trade Companies ● Expansion of British Power in Bengal ● Maratha Empire and Anglo-Maratha Clash under Peshwas ● The Revolt of 1857 ● Religious and Social Reform Movements ● Indian National Freedom Movements ● Important Organizations and Institutions Related to Indian National Movements ● Development of Education during British India ● History of Indian Newspapers ● Important Facts related to the Indian Freedom Struggle ● History from 1947 to 1964 Consolidation of Princely States ● Other Major Historical Facts

### D. World History

● Renaissance ● American Revolution or Freedom Struggle ● French Revolution ● Unification of Italy ● Unification of Germany ● Russian Revolution ● Industrial Revolution ● Industrial Revolution ● World War I ● Nationalism and in Germany, Nazism ● Rise of Fascism in Italy ● Japanese Imperialism ● World War II ● Turkiye ● Miscellaneous Facts

## Indian History

History is the study of past events. The word **history** comes from the ancient Greek word '**historia**', meaning '**inquiry**', 'knowledge acquired by investigation. Herodotus first used the word history in his book 'Historica'. **Herodotus** is, therefore, considered as the '**Father of History**'. (RAS/RTS, 1994) The History can be divided into three periods :

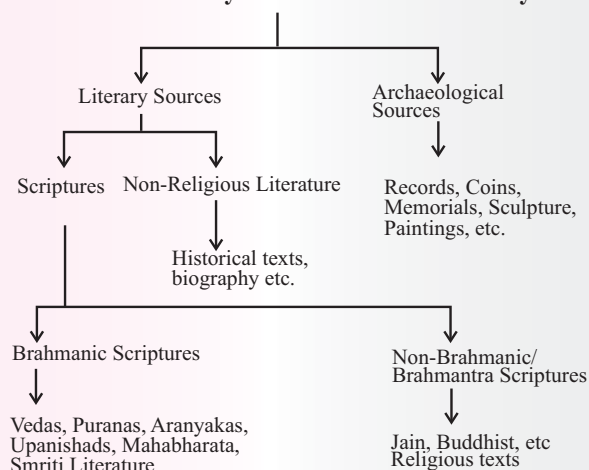
**A. Ancient, B. Medieval, C. Modern**

## A Ancient History of India

### 1. Sources of Ancient Indian History

- There are two primary sources of the history of Ancient India:
  - i. Literary sources ( Indian and Foreign Literature)
  - ii. Archaeological sources
- Literary sources can further be divided into two parts:
  - i. Scriptures
  - ii. Non-religious or Secular literature
- Scriptures again can be divided into two parts:
  - i. Brahmanic
  - ii. Non-Brahmanic /Brahmantra

### Sources for Study of Ancient Indian History



### (i) Brahmanic Literature

- Brahmanic literature plays very significant role in the knowledge of Ancient Indian History.

### Veda (or Vedas)

- The oldest scriptures are the Vedas. The Vedas highlight the religious, social, cultural, economic and political life during the Aryan period.

- **Maharshi Krishna Dvaipayana** Veda Vyasa is said to be the compiler of Vedas.
- The 'Sam No Varunah' an invocation to lord Varun written in the Vedas, was adopted by the Indian Air force. (VDO, 2023)
- **The number of Vedas is four.**
- Vedas are also known as 'Shruti'. The reason behind is that Vedas have been passed on from one generation to another through verbal transmission.
- Rig Veda, Sama Veda and Yajur Veda are called **Vedatrayi**. (UPPCS, 2010)
- The Gayatri Mantra is given in the third mandala of the Rig Veda, which is dedicated to the **Godess Savitri**. (UPPCS, 2013)
- India was named 'Bharat' often the Bharat Dynasty. The first mention of this dynasty is in Rigveda. (SSS, 2023)
- Yajur Veda is written both in prose and poetry.
- The Yajur Veda is broadly grouped into two parts **Shukla Yajur Veda** and **Krishna Yajur Veda**.
- The Maximum hymns of Sama Veda are taken from the Rig Veda. (UPPCS, 1997)

#### Brahmanic Text

- The Brahmanic texts have been composed in simple prose.
- Brahma means 'Yagya', therefore, the texts that have their themes as Yagya are called **Brahmins**.
- There are different Brahmin texts for each Veda.

#### Aranyaka

- There are three parts of Brahmana, as (1) **Brahmana**, (2) **Aranyaka** and (3) **Upanishad**.
- In Mahabharata, Aranyakas are called essence of Vedas.
- Aranyaka is the last part of the Brahmin scriptures, in which philosophical and mystical subjects are described.
- They are called 'Aranyaka' because they were read in the forest.
- The main theme of Aranyakas is not only Yajna, but also the discussion of the spiritual facts presents within Yajna, Yoga etc.
- A total of 7 Aranyakas are available.

#### Upanishads

- The name 'Upanishad' is a combination of the terms 'Upa' (meaning 'near') and 'Nishad' (meaning 'sit').
- The secret knowledge that is acquired by sitting near the teacher is called 'Upanishad'.
- Being the last part of Vedic literature, they are also called 'Vedanta'.
- In the Upanishads, we obtain knowledge about the oldest philosophical ideas.
- The National Motto of India, '**Satyameva Jayate**' is brought from Mundaka Upanishad. (IAS, 2014, UPPCS, 2004)
- The number of Upanishads is **108**.

- The Upanishads contain some of the oldest discussions about key philosophical terms such as Atman (the self), Brahman (ultimate reality), Karma and Yoga etc.
- The largest and the shortest Upanishad are Brihadaranyaka and Mandukya Upanishad respectively.
- The earliest mention of the Vedanga is in Mundaka Upanishad. **Shankara Charya wrote Bhashya for 10 Upanishads.**

#### Vedanga

- There are six Vedangas : Shiksha (Phonetics), Kalpa (Ritual), Vyakarana (Grammar), Nirukta (Etymology), Jyotisha (Astronomy) and Chandas (Meter).

#### Sutra

- Sutra literature was introduced to keep Vedic literature intact.
- The Sutras are derived from a Vedanga called 'Kalpa'.
- Kalpa is classified into three parts-
  1. Shrauta Sutra – Related to sacrificial rituals
  2. Grihya Sutra- Dealing with domestic rituals
  3. Dharma Sutra- Dealing with religious, social and political duties.
- Smritis developed from the Dharma Sutra itself.
- The main smritis are – Manu Smriti, Yajnavalkya Smriti, Parashara Smriti, Narada Smriti, Brihaspati Smriti, etc.
- Manu Smriti is considered to be the most ancient and authentic.
- The commentators of Manu Smriti were : **Medhatithi, Govindraja, Bharuchi and Kulluk Bhatta**.
- The commentators of Yajnavalkya were: Vishwaroopa, Vijnaneshwara and Apararka.
- The most important Sanskrit Vyakaran Sutra of Panini is '**Astadhyayi**'. (Jharkhand PCS 2011)

#### Purana

- The word Purana is found in the Atharva Veda.
- The number of Puranas is **18**. (UPPCS, 2009)
- The author of Puranas was Maharishi Lomharsha or his son Ugrashrava.
- There is a description of the rule of kings of Kalyuga in the Puranas.
- Matsya Purana is the most ancient and authentic.

#### Major Puranas and related Dynasties

| Puranas       | Dynasties                            |
|---------------|--------------------------------------|
| Vishnu Purana | Mauryan Dynasty                      |
| Matsya Purana | Andhra Satavahana and Shunga Dynasty |
| Vayu Purana   | Gupta Dynasty                        |

#### Epic

- Two epics, the Ramayana and the Mahabharata, are important scriptures along with Vedas.

- The Ramayana was composed by Maharshi Valmiki.
- The largest and the smallest Kanda of Ramayana are - Bala Kanda and Kishkindha Kanda respectively. There are total 7 Kandas in Ramayana, initially there were **6000 verses, which later increased to 24000.**
- The Mahabharata was composed by Maharshi Ved Vyas.
- The Mahabharata consists of one lakh Shlokas that's why it is called 'Satasahasra Samhita'. (UPBEO, 2019)
- Epics provide information about the social, religious and political condition of ancient India during that period.

## ii. Brahmantra Literature

### Buddhist Literature

- The most ancient Buddhist literature is '**Tripitaka**'. The three pitakas are: **Sutta Pitaka, Vinaya Pitaka** and **Abhidhamma Pitaka.** (UP Lower 2003, 2004)
- Sutta Pitaka is also called the 'Encyclopedia of Buddhism'.
- Jatakas contain previous births of the Buddha.
- The ancient Buddhist texts are in the Pali language.
- The Deep Vamsa and the Maha Vamsa provide information about Mauryan history.
- Mahavastu and Lalitavistara, written in Sanskrit, give the life story of Mahatma Buddha.

### Jain Literature

- Jain Literature is called '**Agama**'.
- Bhagwati Sutra portrays Mahavira's life.
- Kalpasutra provides the early history of Jainism. Kalpasutra was composed by **Bhadrabahu.**
- Jain texts were composed in **Prakrit** language.
- The most important Jain scripture is Hemchandra's '**Parishishtaparvan**'.
- The final compilation of Jain texts took place in Vallabhi city, Gujarat in the sixth century.

### Non-religious Literature/Secular Literature

- Historical and semi-historical texts, foreign descriptions and biographies belong to secular or non-religious literature, containing the history of ancient India.
- Kautilya's Arthashastra has an important place in historical works.
- **Arthashastra is considered to be India's first Political Text.**
- Arthashastra is an important source of Mauryan history.
- **Mudrarakshasa** by Vishakhadatta, Kathasaritsagara by Somadeva and Brihatkathamajari by Kshemendra are also significant sources of Indian history.
- The history of 11<sup>th</sup> century Kashmir is known by '**Rajatarangini**' written by **Kalhana.** (MPPCS, 2012)

### Details of Foreign Travellers

#### A. Greek and Roman Authors

- Theseus was a physician from Iran.

- Herodotus's book 'Histories' mentions the relationship between India and Persia in fifth century BC.
- Details provided by Alexander's contemporaries Nearchus, Onesicritus and Aristobulus are more authentic and reliable. (UPPCS, 2015)
- Three ambassadors Megasthenes, Deimachus and Dionysios are noteworthy writers after Alexander.
- **Megasthenes**, the **ambassador of Seleucus Nicator**, came to the court of Chandragupta Maurya. (UPPCS, 2017)
- Megasthenes, in his book 'Indica', has described the contemporary Mauryan society and culture.

(UK UDA/UDA 2007)

- Deimachus was the ambassador of the Syrian Monarch Antiochus, who came to Bindusara's court. (UP Lower, 2007)
- Dionysius was the ambassador of the Egyptian king Ptolemy Philadelphus who came to Mauryan Court.
- Ptolemy wrote a book called 'Geography' in the second century BC.
- Pliny wrote a book called '**Naturalis Historia**' (**Natural History**) in the first century BC.
- Natural history provides information about Indian animals, trees, minerals, etc.
- **Pliny the Elder** called India as the country of "the sink of the world's gold."
- Cosmas Indicopleustes wrote Christian Topography.
- There is no information about the author of the book '**Periplus of the Erythraean Sea**'. (64<sup>th</sup> BPSC 2018)
- The author is said to have visited the Indian Ocean in the first century BC and gave information about the Indian ports and merchandise of that period.

#### B. Chinese Author

- **Fa-Hien** came to India in the fifth century AD during the reign of Chandragupta II. In his works, he has described the socio-economic and religious conditions of that period. (63<sup>th</sup> BPSC, 2017)
- **Huien-Tsang** came to India during the reign of Harsha in the seventh century AD. (BPSC, 2015)
- He stayed in India for 16 years and studied at Nalanda University for 6 years. (UPPCS, 1995)
- The accounts of Hiuen Tsang's visit to India are known as 'Si-Yu-Ki'. (UPPCS, 2016)
- Hiuen Tsang is called 'Prince of Pilgrims' or 'Prince of Passengers'.
- **I-tsing** came to India in the second half of the seventh century AD.
- He has given a description of Vikramshila and Nalanda universities, the costumes of Indians wore besides telling what they ate and drank.



- **Ma-Tuan-Lin** has highlighted the history of the eastern campaigns of Harsha and Chau-Ju-Kua has highlighted the history of the Chola Dynasty.
- The Chinese traveller Sung Yun came to India in 518 AD. (Jharkhand PCS 2016)

### C. Arab Author

- **Al-Beruni** came to India with Mahmud of Ghazni in the 11<sup>th</sup> century. (Jharkhand PCS 2011)
- He wrote a book titled '**Tehqiq ma li-al-Hind**' or '**Kitab-al-Hind**' which gives a detailed description of the Rajputa's Period society, religion, customs, etc.
- Al-Beruni was well-versed in Astronomy, Mathematics, Science, Arabic, Persian and Sanskrit.
- Arab traveller Sulaiman, who visited India in the 9<sup>th</sup> century AD, described the economic, political and social conditions of the Pal and Pratihara rulers' period.
- Al-Masudi, who came to India from Baghdad, has given information about the history of the period of Rashtrakuta and Pratihara rulers.

### D. Other Foreign Authors

- The travelogue of **Ibn Battuta**, written in Arabic, is '**Rihla**'.
- It is an important source of information about the social and cultural life of the Indian subcontinent during the 14<sup>th</sup> century.
- Taranath was a Tibetan writer. He authored a book titled '**Kangyur**' and '**Tengyur**'.
- **Marco Polo** came to India during the rule of the **Pandya Dynasty** at the end of the 13<sup>th</sup> century AD.

### Archaeological Sources of History

- Archaeological sources are the most authentic for the study of ancient India.
- It mainly consists of inscriptions, coins, monuments, buildings, sculptures and paintings.

### A. Inscriptions

- The earliest inscriptions were found at Boghazkoi in Central Asia Minor related to 1400 BC.
- Vedic deities **Indra, Mitra, Varuna** and **Nastya** (Ashwin) are mentioned in the Boghazkoi inscriptions. (UPPCS, 2016, 1996)
- The oldest inscriptions in India belong to Ashoka, related to 3<sup>rd</sup> Century BC.
- Ashoka's name is mentioned in inscriptions related to Maski, Gurjara, Nittur and Udegolam.
- The scripts of Ashoka's inscriptions are mainly Brahmi, Kharoshthi, Greek and Aramaic scripts. (UPPCS, 2015, IAS 1997)
- An article, written by Indo-Greek ambassador, Heliodorus on Garuda Pillar found at Besnagar (Vidisha, Madhya

Pradesh) provides evidence of the development of the Bhagvat religion.

- A copper plate found at **Sohgaura** is said to belong to pre-Mauryan period and **mentions famine relief efforts**.
- Mandsaur inscriptions refer to the categories of silk weavers.
- Persepolis and Behistun inscriptions reveal that the Iranian emperor Darius had captured the valley of the Indus River.
- James Prinsep firstly decoded the inscriptions of Ashoka, written in Brahmi script in 1837 AD. (CGPSC, 2003)
- The study of inscriptions is called 'Epigraphy'.
- The first epigraphic evidence of Sati practice has been found from **Eran Pillar Inscription of Bhanugupta, Madhya Pradesh**. (UPPCS, 2010)

### Important Inscriptions

| Inscriptions/Citations                 | Rulers                    |
|----------------------------------------|---------------------------|
| Hathigumpha Inscription                | King of Kharavela         |
| Junagarh (Girnar) Inscription          | Rudradaman                |
| Nashik Prashasti Inscription           | Gautami Balashri          |
| Prayag Prashasti                       | Samudragupta              |
| Mandsaur Stone Inscription             | Malwa Ruler, Yashodharman |
| Aihole Inscription                     | Pulakeshin II             |
| Gwalior Inscription                    | Pratihara King Bhoja      |
| Bhitari or Junagarh Pillar Inscription | Skandagupta               |
| Deopara Prashasti Inscription          | Bengal King Vijayasena    |

### B. Coins

- The study of coins is called '**Numismatics**'.
- In ancient times, coins were made of copper, silver, gold and lead.
- The oldest coins of India are '**Marked**' coins which belong to Seventh to Sixth century BC.
- These are known as '**Punched Marked**' coins in Indian language due to their stamping.
- Satavahana and Gupta rulers issued most coins, in Lead and Gold respectively.
- The Indo-Greeks were the first to issue Gold coins in India.

### C. Sculptures, Memorials, Buildings and Paintings

- In the sculptures of Bharhut, Bodh Gaya and Amravati, there is a lively tableau depicting the life of the people of that time.
- The of palaces and temples building style reveals the level of development of architecture of the time.
- The spread of Indian culture is highlighted by temples and stupas built in **South-East** and **Central Asian countries**.
- Beautiful expressions of human imagination are found in the paintings of Ajanta and Ellora.

## 2. Periods of History

### Division of History

- To understand the vast material of ancient Indian History, historians have divided into three parts -

(A) Pre-historic (B) Proto-historic (C) Historic

### A. Pre-historic

There are no written records available for this period of history. The history of this period is only known only by the archaeological sources.

- Historians have divided this early period of human civilization into three periods-

(i) Paleolithic Period (ii) Mesolithic Period  
(iii) Neolithic Period

- The cave paintings of Bhimbetka belong to the **Palaeolithic period**. (MPPCS, 2004)

- The wheel was used in the **Neolithic period**.

- **Agriculture** originated from the **Neolithic period**. (UPPCS, 2005)

- The earliest evidence of paddy cultivation in India has been obtained from the village of Lahuradeva in around 7000 B.C. (UP Lower, 2008, 2004; UPPCS 2010, 2007; CGPSC 2017; BPSC 2018; UP RO/ARO 2021)

- The earliest plant to be domesticated was Barley. (UPPCS, 1997)

- **The Fire** was first used by humans in the **Neolithic period**. Notably, humans discovered **the fire** in palaeolithic period.

- The earliest Neolithic Settlement was found in **Mehrgarh** in Balochistan province (in Pakistan).

- The earliest evidence of agriculture was found in **Mehrgarh**.

- **Animal Husbandry** began in the **Middle Mesolithic Age**. (UPPCS, 2006)

- Evidence of animal husbandry was obtained from Adamgarh (Narmadapuram, Madhya Pradesh) and Bagore (Bhilwara, Rajasthan), India. (UPPCS, 2018)

- Bone and horn-made equipment related to the Mesolithic age were found at **Mahadaha** (Pratapgarh, Uttar Pradesh).

- **Dog skeleton alongside a human skeleton** was excavated at **Burzahom** (Jammu and Kashmir). (UP Lower, 2008)

- Pit-houses were used in Burzahom. (UPPCS, 2011)

### B. Proto-historic Period

- The art of writing developed during this period, but it has not so far been possible to decipher the script of this period.

- Both literary and archaeological sources are available to know the history of this period.

- The **Harappan Civilization** and **Vedic Civilization** is existed in this period.

- The **Krishna-Lohit Pottery Culture** belongs to this period.

### C. Historic Period

- Literary, archaeological and accounts of foreign writer's descriptions are the main sources of information about this period.

## 3. Chalcolithic Age

- The period in which humans used tools made of **stone** and **copper** is called the '**Copper-Stone Age**' or '**Chalcolithic Age**'. (RAS 2021; 44<sup>th</sup> BPSC, 2000)

- **Copper** metal was first used in this period for making tools.

- The main regions where the traces of copper-stone age are obtained in India are located in south-eastern Rajasthan (Ahar and Gilund), west Madhya Pradesh (Malwa, Kayatha and Eran), Western Maharashtra and South-Eastern India.

- The best pottery of this period is obtained in Malwa.

- **Daimabad** was known as the largest settlement of Jorwe culture.

- The Old name of Ahar is 'Tambavati' which means 'Place of Copper'.

- In Maharashtra, the deceased were buried beneath the floor of the house resting the body in pits.

- The influence of pre- Harappan, Harappan and post-Harappan culture is found on Kayatha's Pottery.

- All Copper Stone age communities used black and red pottery on the wheels.

- The largest copper reserves have been found at Gungeria in Madhya Pradesh.

- Chalcolithic Civilization Navdatoti was excavated under the direction of H.D. Sankalia. (UP Lower 2009)

✎ **Note :** The copper, bronze and iron metals were used by humans in this period.

### Indus (Harappan) Civilization

- Indus civilization is a proto-historical civilization.

(MPPCS, 1990; UPPCS, 1996)

- The period of the Indus civilization is existed between 2300 and 1700 BC based on radiocarbon dating.

- The Red Pottery painted in black is the characteristic of the Harappan Civilization. (40<sup>th</sup> BPSC, 1995)

✎ **Note :** The easternmost site of the Indus civilization is **Alamgirpur** (district Meerut, Uttar Pradesh) on the banks of the Hindon river, **Sutkagendor** (Baluchistan) (Westernmost site) situated on the banks of the **Dashak** (Dasht), **Manda** (Northermost site) (Jammu- Kashmir) near Akhnoor on the banks of the Chenab, and **Daimabad** (District Ahmednagar, Maharashtra) (Southern most site) is situated on the banks of the Godavari.

- The Indus civilization was an **urban civilization**.  
(UPPCS, 2004, 1996, 1994; UPPCS, GIC, 2010)
- The extension of Indus civilization is **triangular**.
- The major cities that flourished during the Indus civilization were Mohenjodaro, Harappa, Rakhigarhi, Dholavira, Kalibangan.

✎ **Note :** In July, 2021 **Dholavira** was named the 40<sup>th</sup> Indian site on UNESCO's World Heritage list.

- After India's independence, the maximum number of sites of Harappan civilization were excavated in Gujarat.
- Gold, Copper, Silver and Bronze metals were known to Indus Valley Civilization but not **Iron**. (IAS, 1994)
- Depictions of cow are not found on the seals and terracotta artifacts of the Harappan Civilization while depictions of Bull, Elephant, Rhinoceros, Tiger, Deer, and Sheep are found in them. (IAS, 2001; BPSC, 2023; CGPSC, 2011)
- **Godiwada** is found during the excavation of **Lothal**.
- A replica of plough was found at **Banawali**, Haryana.  
(62<sup>th</sup> BPSC, 2016)
- Evidence of the great bath of the Indus civilization was obtained at **Mohenjodaro**. (UPGIC 2010, 2007; UPPCS, 1992)
- Evidence of **ploughed field** was found at **Kalibangan** in Rajasthan. (UPPCS, 1991, 2005; BPSC, 2020)
- The Indus civilization was a Bronze Age civilization and its people were unknown to iron.
- Rakhigarhi is situated on the banks of Ghaggar in Hisar, Haryana. (UPPCS 2008, 2009, 2011)
- Evidence of **paddy husk** was found at Rangpur (Gujarat).
- Evidence of **pre-Harappan, Harappan and post-Harappan civilization** have been found at Rangpur.  
(UPPCS, 2010)
- The people of the Indus valley worshipped Pashupati Shiva too. The proof of this is a seal found at Mohenjodaro which shows a yogi in a meditation posture.  
(UK PCS, 2006; UK PSC 2006, RAS, 1993, 1997)
- A **tiger** and an **elephant** on the left, and a **rhinoceros** and a **buffalo** on the right to the meditating Yogi are depicted.
- The yogi, with three faces in three directions, has an ornament, in the shape of a trident, worn over his head.
- Sir John Marshall called the yogi to '**Rudra Shiva**'.
- Harappan roads were almost straight and cutting each other at a right angle.
- Harappan Site, Lothal was discovered by **S.R. Rao**.  
(UPPCS, 1995, 1999)
- Lothal was first excavated in 1957 by S.R. Rao. (UK PSC, 2010)
- Lothal city is called Mini-Harappa or Mini-Mohenjodaro.  
(UPPCS, 1995)
- Rakhigarhi (Hisar District, Haryana), is the largest Harappan site in the Indian Subcontinent.  
(Jharkhand PCS, 1996; UPPCS, 2004)

✎ **Note :** In 1921, on the instructions of the Director-General of Archaeological Survey of India, Sir John Marshall, **Daya Ram Sahni** excavated the Harappan mound on the left bank of Ravi in the then Sahiwal district of Punjab (Pakistan).

(CGPSC, 2003; RAS/RTS 1997; BPSC, 2015)

- In 1922, Rakhaldas Banerjee unearthed the mounds of Mohenjodaro located on the right bank of the Indus River in Larkana (Sindh province). (CGPSC, 2023; MPPCS, 2012)
- Mohenjodaro literally means "**mound of the dead**".
- **Cotton** textiles were first produced in India during Harappan civilization. (UPPCS, 2009)
- There is evidence of cotton production in the Indus Valley.
- Seals in the shape of a humped bull were excavated from Mohenjodaro. (MPPCS, 2012; UPPSC GIC, 2010)
- The one-horned unicorn is the most common motif on Indus seals behind the humped bull.
- The sculpture of a **bronze dancing girl** was excavated in **Mohenjodaro**. Its size is 10.5 × 5 × 2.5 cm.
- The torso of a priest was excavated at Mohenjodaro.
- A large granary was excavated at Mohenjodaro. It is probably the largest building belonging to Indus Valley Civilization.
- Evidence of the use of decorative bricks was found at Kalibangan.
- Evidence of the use of baked bricks was also found at Chanhudaro.
- Fire altars were found at **Lothal and Kalibangan**.
- A great bath was excavated at Mohenjodaro, at the centre of which a bath with a length of 11.88 m. width of 7.01 m and depth of 2.43 m. was found.
- Bead-making factories were found at Lothal and Chanhudaro.
- The script of the Indus Valley civilization was known to be **Pictographic**.
- The people of the Indus civilization adopted the **grid pattern** for city planning.
- The doors and windows of the houses opened towards the streets rather than on the main road.
- **Lothal was the only city where doors of houses opened towards the main road**.
- The main crops of the Indus Civilization were **wheat** and **barley**.
- **Evidence of rice husks found at Rangpur** and **Lothal** prove that paddy cultivation was prevalent.
- The unit of weight was probably in Multiples of 16. The people of the Indus valley civilization used bullock carts or buffalo carts with two and four wheels for transportation.

- On Mesopotamia inscriptions, the word '**Meluhha**' is inscribed refers to the Indus Civilization.
- The rule of Harappan Culture was probably in the hands of the merchant class.

📌 **Note :** Piggot has called Harappa and Mohenjodaro, the **twin capitals** of a vast empire.

- The people of Indus civilization worshipped the **mother Goddess** as the '**Goddess of Fertility**'. (UPPCS, 2012)
- Evidence of mother Goddess worship, snake worship, tree worship and water worship are also found during the Indus Valley civilization. (SSC MTS, 2014)
- Swastika symbol was prevalent in Harappan civilization indicating that the Indus people worshipped Sun. (SSC MTS, 2015)
- The remains of any temple have not been found in any city of the civilization. (CPO SI 2011)
- **Worship of Mother Goddess** was most prevalent.
- The Humped Bull was sacred and worshipped during this civilization. (CPE, 2017)
- It is estimated that the Indus Valley civilization was Matriarchal, based on the presence of a large number of female idols. (CPE, 2017)
- Indus people used cotton and woollen clothes.
- The principal means of entertainment in the Indus Valley civilization were **hunting, animal and bird battles, playing chaupada or chausar and dice.**
- Kalibangan was the only Harappan site, surrounded by a rampart with bastions and salients.
- The last rites took both forms-burial as well as burning.
- The burial of a dead body in Harappa and burning in Mohenjodaro were in practice.
- Evidence of the couple's burial in the same grave was found at Lothal and Kalibangan. (UPPCS, 2016)
- Extreme weather events in the form of floods and droughts were known to have been the cause of the destruction of the Indus valley civilization.

### The Reason for the Decline of the Indus Civilization and Related Scholars

| Reason               | Scholars                  |
|----------------------|---------------------------|
| Climate Change       | Aurel Stein, A.N. Ghosh   |
| Geological Change    | M.R. Sahni                |
| Natural Disaster     | K.U.R. Kennedy            |
| Flood                | Mackey and Marshall       |
| Aryan Invasion       | Gordon Childe and Wheeler |
| Ecological Imbalance | Fairservis                |

### Towns Situated on the Banks of Harappan Rivers

| Towns                | Rivers     | Towns       | Rivers  |
|----------------------|------------|-------------|---------|
| Harappa (JPSC, 2016) | Ravi       | Mohenjodaro | Indus   |
| Ropar                | Sutlej     | Kalibangan  | Ghaggar |
| Lothal (UPPCS 2012)  | Bhogava    | Sutkagendor | Dasht   |
| Sokhta Koh           | Shadi Kaur | Alamgirpur  | Hindon  |
| Rangpur              | Bhadar     | Kot-Diji    | Indus   |
| Kunal                | Saraswati  | Chanhudaro  | Indus   |
| Banawali             | Saraswati  | Manda       | Chenab  |
| Bhagwanpura          | Saraswati  | Daimabad    | Pravara |
| Amri                 | Indus      | Rakhigarhi  | Ghaggar |

### Major Minerals and Its Source Regions

| Metals       | Source Region                                            |
|--------------|----------------------------------------------------------|
| Copper       | Khetri (Rajasthan), Balochistan, Oman                    |
| Lapis Lazuli | Badakhshan (Afghanistan)                                 |
| Tin          | Iran, Afghanistan                                        |
| Silver       | Jawar and Ajmer Mines of Rajasthan, Afghanistan and Iran |
| Lead         | Afghanistan, Iran , Azmer (Rajasthan)                    |
| Bitumen      | Himalaya                                                 |
| Gomed Stone  | Gujarat (India)                                          |

### Major Sites of Indus Valley Civilization, Excavators and Present Condition

| Sites          | Excavators/ Explorer               | Year         | Present Condition                          |
|----------------|------------------------------------|--------------|--------------------------------------------|
| 1. Harappa     | Dayaram Sahni and Madho Sarup Vats | 1921-1926-27 | Sahiwal District, Pakistan                 |
| 2. Mohenjodaro | Rakhaldas Banerjee                 | 1922         | Larkana District, Sindh Province, Pakistan |
| 3. Chanhudaro  | N.G Majumdar                       | 1931         | Sindh Province, (Pakistan)                 |
| 4. Kalibangan  | B.B.Lal and B.K Thapar             | 1961-69      | Hanumangarh, Rajasthan                     |
| 5. Kot-Diji    | Fazal Ahmed                        | 1957-58      | Khairpur, Sindh Province (Pakistan)        |



|                 |                                |                    |                                     |
|-----------------|--------------------------------|--------------------|-------------------------------------|
| 6. Rangpur      | S.R.Rao                        | 1934-35            | Surendranagar, Gujarat              |
| 7. Ropar        | Yagya Dutt Sharma              | 1953-55            | Roopnagar, Punjab                   |
| 8. Lothal       | S.R.Rao                        | 1954-55            | Ahmedabad, Gujarat<br>(UPPCS, 2009) |
| 9. Alamgirpur   | Yagya Dutt Sharma              | 1958               | Meerut, U.P                         |
| 10. Sutkagendor | Aurel Stein, George Dales      | 1927-1962          | Makran Sea coast in Pakistan        |
| 11. Banawali    | Ravindra Singh Bisht           | 1974-77            | Fatehabad, Haryana                  |
| 12. Dholavira   | J.P.Joshi Ravindra Singh Bisht | 1967-68<br>1990-91 | Kutch, Gujarat<br>(UPPCS, 2010)     |

(UP RO/ARO, 2017, 2018)

#### 4. Vedic Civilization

- The Vedic Civilization came into existence after the Indus Civilization.
- The Vedic Period is divided into two parts
  - Rigvedic Period or Early Vedic Period - 1500-BC to 1000 BC.
  - Post-Vedic Period - 1000 BC to - 600 BC.

##### (i) Rigvedic or Early Vedic Period (1500-1000 BC)

- The Vedic civilization was brought to India by Aryans.
- Aryans inhabited a region between Afghanistan to the Ganges valley.
- 'Arya' is a Sanskrit word that literally means 'superior' or 'noble'. (IAS, 1999, UPPCS, 1999, 1998)
- The Vedic culture was rural culture.
- The language of the Aryans was Sanskrit.
- The major source of Vedic civilization is 'Vedas'. This civilization derived its name 'Vedic Age' from the Vedas.
- The number of Vedas are four - Rigveda, Yajurveda, Samaveda and Atharvaveda.

| Vedas, Upavedas and Their Priests |               |                        |
|-----------------------------------|---------------|------------------------|
| Vedas                             | Upavedas      | Priests                |
| Rigveda                           | Ayurveda      | Hota (UP RO/ ARO 2013) |
| Yajurveda                         | Dhanurveda    | Adhvaryu               |
| Samaveda                          | Gandharvaveda | Udgata                 |
| Atharvaveda                       | Arthashastra  | Brahma                 |

- The four Vedas are collectively called 'Samhita'.
- The most important and oldest Veda is the Rigveda. (UK UDA, 2007; UPPCS 1995, UK PSC 2010; MPPCS, 1999)
- The Rigveda was composed during the Rigvedic Period.

- Yajurveda, Samaveda and Atharvaveda were composed in the later Vedic Period.
- The Rigveda, Yajurveda and Samaveda are called 'Vedatrayi'. (UPPCS, GIC 2010)
- The first description of the word 'Varna' is found in Rigveda. (CGPSC, 2014; UK PSC, 2012)
- In Rigveda, the word 'Varna' is used for the 'colour' but sometimes also for 'choosing a business'.
- Initially, three varnas are mentioned as Brahmin, Kshatriya and Vaishya.
- The word 'Shudra' is first mentioned in Purusha Sukta of the Tenth Mandala of the Rigveda.
- Here, the origin of the four varnas is said to be from the various organs of a 'Virata Purusha'.
- Rigveda is composed in the praise of God, Yajurveda for sacrificial prayer and Samaveda for chanting songs (music).
- There are a total of 10 mandalas in the Rigveda.
- There are a total of 1028 hymns and 10552 verses in the Rigveda. (UPPCS, 2016)
- The first and tenth Mandalas are the latest.
- Vishvamitra is the author of the third mandala of Rigveda.
- The famous Gayatri Mantra is found in the third mandala of Rigveda. (CGPSC 2011; BPSC 1994; UK PSC, 2006UPPCS 2013)
- Several contents of the Rigveda are found in 'Avesta'.
  - Avesta is the oldest text in the Iranian language. (UP Lower 2004)
- In Rigveda, a maximum of 250 hymns are dedicated to Indra and 200 hymns to Agni. (UPPCS, 2002)
- The ninth mandala of the Rigveda is dedicated to 'Soma'. (42<sup>nd</sup> BPSC 1997)
- Laws related to 'Yagya' are mentioned in the Yajurveda. (RAS/RTS 1999)
- The Yajurveda has two parts - Shukla (bright) Yajurveda and Krishna (dark) Yajurveda. (UPPCS, 2018)
- Shukla Yajurveda is also known as Vajasaneyi Samhita. (UPPCS 2018)
- Shukla Yajurveda is only in poetry and Krishna Yajurveda is both in poetry and prose.
- The last part of the Yajurveda is the 'Isha Upanishad', which is concerned with spiritual thought rather than Yajna rituals.
- The Samaveda contains 1875 verses, of which all the rest except 99 are mentioned in Rigveda. (UPPCS 1997)
- Indian music has its origin from Samaveda.
- There are 3 main parts of Samaveda - 1. Kauthuma, 2. Ranayaniya and 3. Jaiminiya. (UPPCS, 1994)
- Atharvaveda has a total of 20 chapters, 730 hymns and 5,987 mantras.
  - In Atharvaveda, there is evidence of practices of tantra-mantra and mesmerism.

- The administrative units of the Aryans were divided into several constituents. These were Kula or family, Grama and Jana.
- The head of the village was called '**Gramani**', Vis was headed by '**Vispati**' and people's ruler was called **Rajan**.
- The Purohit (priest) and the Senani (fighters) were the principal authorities during the Rigvedic period.
- The number of Ratnis (officials) was 12 - Senani, Purohita, Yuvraj, Madhyamasi, Suta, Gramini, Kshatri, Sangrihiti, Bhagadugha, Akshavapa, Palagala and Govinkartana.
- Ratni was to be present on the occasion of coronation.
- Vrajapati was an officer in charge of the pasture land.
- Vidatha formed the oldest assembly of Aryans.
- In the **Atharvaveda**, the **Sabhas** and the **Samitis** have been called the **two daughters of Prajapati**. (UPPCS 2009)
- The Sabha was the '**Body of the Elders**' and the Elites. (RAS, 1994)
- The committee was the central political institution (House of Representatives of the general public). The committee used to appoint, depose and control the King.
- The head of the Samiti was known as '**Ishana**'.
- In the Rigvedic period, women used to participate in the Sabha and the Samiti.
- The Dasharajana war (The battle of 10 Kings) is described in the 7<sup>th</sup> Mandala of **Rigveda**. This war was fought between Puru King **Sudas** and the **ten kings** on the banks of the **Parushni (Ravi)**. (UPPCS, 2008, 2011; 42<sup>th</sup> BPSC, 1997)
- The upanishads are philosophical texts. (UPPCS, 2002, 1998, 2004, 2002, 2003)
- The Upanishads are also called '**Vedanta**'. (IAS, 1997; UPPCS, 1999, 2002)
- **For the first time, Salvation** is mentioned in Upanishads. (UPPCS 2003)
- The dialogue between **Nachiketa** and **Yama** is mentioned in **Kathopanishad**. (UPPCS 1999, 2006)
- Some Kshatriya kings are mentioned in the Upanishads.
- King Janaka of Videha, Pravahanjabali, King of Panchala, Ashwapati, king of Kekaya Ajatashatru and King of Kashi are prominent. (UPPCS, 1999)
- The correct sequence of Vedic Literature is Vedic Literature, Brahmanas, Aranyakas and Upanishads in that order.
- **Indus river** is mentioned most often in **Rigveda**. (UPPCS 2014)
- Saraswati was the most sacred river of the Rigvedic Aryans. (IAS 1996)
- Saraswati was called Matetama, Devitama and Naditama. (UPPCS 2008)
- The **Kubha (Kabul)**, **Krumu (Kurram)**, **Gomti (Gomal)** and **Suvastu (Swat)** rivers mentioned in the Rigveda flowed into Afghanistan. (UPPCS, 1999; UP GIC, 2010)
- The Ashrams (stages of life) (Brahmacharya, Grihastha, Vanaprastha and Sanyasa) came into vogue in the post-Vedic period. (IAS, 1994, 2011; UPPCS, 2010)
- Only three ashrams are mentioned in **Chandogya Upanishad**, while in **Jabalopanishad**, for the very first time four Ashrams are mentioned.
- The '**Varuna**' deity was considered as the head of the 'Rita' (moral order) in the Vedic Civilization. (CGPSC 2013)
- Being the head of moral order, Varuna was also called 'Ritasyagopa'.
- Brihaspati was considered a priest of Vedic Gods. (UPPCS, 2013)
- In Vedic Literature, many women are mentioned who composed Vedic mantras such as Apala, Ghosha, Vishwara, Lopamudra, etc. (IAS 1995)
- Lopamudra was the wife of sage Agastya.
- The Aryan society was patriarchal. (UPPCS, 1992)
- The smallest unit of the society was the family or clan, headed by the father, known as '**Kulap**'. (CPO SI, 2007)
- Women had freedom to participate in the yajna with their husbands.
- Child marriage and the Purdah system were not prevalent.
- A widow could remarry her deceased husband's younger brother (Dewar) or some other near relative. This was called '**Niyoga System**'.
- The women who remained unmarried for a lifetime were called '**Amaju**'.
- Aryan's favourite beverage was Somaras.
- The Aryans mainly used three types of clothes - **Vass** (wearing over lower portion), **Adhivaas** (wearing over upper portion) and **Neevee** (wearing as inner).
- The primary means of entertainment of the Aryans were - chariot racing, horse racing, music and gambling.

#### Terms used in Rigvedic Age and Their Meanings

| S.No. | Terms    | Meaning                                   |
|-------|----------|-------------------------------------------|
| 1.    | Aghanya  | Cow (UPPCS, 2008)                         |
| 2.    | Duhitri  | Milker of cow or a Daughter               |
| 3.    | Urvara   | Fertile Land                              |
| 4.    | Langal   | Plough                                    |
| 5.    | Vrik     | Bull                                      |
| 6.    | Yava     | Barley                                    |
| 7.    | Godhuma  | Wheat                                     |
| 8.    | Suvarna  | Gold                                      |
| 9.    | Karesh   | Manure                                    |
| 10.   | Bekanaat | Group receiving interest by lending money |
| 11.   | Tandul   | Grain                                     |
| 12.   | Vrihi    | Rice                                      |

- Animal husbandry and agriculture were the main occupations of the Aryans. (UPPCS 1993)
- Aryan's favourite animal was **horse**. (UPPCS, 1998)
- The most loved deity of the Aryans was Indra. (UPPCS 2008)
- The people of the Rig Vedic Period were not known to iron. (IAS, 1997)
- There is a discussion of Shyam Ayas or Krishna Ayas, a metal used in the later Vedic Period.
- The Barter system was prevalent in the transaction.
- The person giving loans on interest was called **Vecnat (usurer)**.
- People of the 'Pani' (heefCe) class were engaged in commerce. (MPPCS 2019)
- **Agni** was worshipped as an intermediary between humans and deity.
- The Rigveda mentions the Ganges once and the Yamuna three times.
- In Mundakopanishad, the yajna has been compared to a broken boat.
- The famous '**Satyameva Jayate**' is derived from **Mundakopanishad**. (UPPCS Pre, 2004, Mains 2004, 1991; IAS, 2004; MPPCS 1992, 1994; UPPSC RI 2014)
- In Vedic Period, gold ornament or coin was called 'Nishka'.
- Shatapatha Brahmana is the Brahmana Scripture of Yajurveda.

| Vedic Period Samhitas     |                                  |                             |                                              |
|---------------------------|----------------------------------|-----------------------------|----------------------------------------------|
| Vedas                     | Brahmanas                        | Aranyakas                   | Upanishads                                   |
| 1. Rigveda                | Aitareya, Kaushitaki             | Aitareya, Kaushitaki        | Aitareya, Kaushitaki                         |
| 2. Samaveda               | Tanday, Jaiminaya                | Jaiminaya Chhandogy-aranyak | Chandogya (most ancient), Jaiminaya          |
| 3. Yajurveda              | Taittiriya, Shatapatha (biggest) | Taittiriya, Shatapatha      | Birhadaranyaka, Kathopanishad                |
| 4. Atharvaveda (youngest) | Gopath                           | —                           | Mundakopanishad, Mandukyupanishad (smallest) |

- Purushamedha is mentioned in the Shatapatha Brahmana. (UPPCS, 2008)
- The word '**Gotra**' was first mentioned in Rigveda. (UPPCS, 2005)
- The word '**Yava**' mentioned in Rigveda is established by '**Barley**'. (UPPCS, 2008)
- The original script of the Rigveda was **Brahmi**. (UPPCS 2008)
- Aitareya and Kaushitaki are the two Brahmin texts of the Rigveda.

- The goddess of the forest was called '**Aranyani**'.

| Rigvedic Rivers |                          |
|-----------------|--------------------------|
| Old Name        | Modern Name              |
| Krumu           | Kurram                   |
| Kubha           | Kabul                    |
| Vitista         | Jhelum                   |
| Askini          | Chenab (UPPCS GIC, 2010) |
| Parushni        | Ravi                     |
| Shutudri        | Sutlej                   |
| Vipasa          | Beas                     |
| Sadaneera       | Gandak                   |
| Drishadwati     | Ghaggar                  |
| Gomti           | Gomal                    |
| Suvastu         | Swat                     |

| Rigvedic Deities |                                                                                                                                                                                                                                            |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Deity            | About                                                                                                                                                                                                                                      |
| Indra            | War-lord and God of Rain (UPPCS, 2011)                                                                                                                                                                                                     |
| Agni             | The God of Fire, Mediator between God and humans                                                                                                                                                                                           |
| Varuna           | The God of Personified Water, Creator of the Heavens, Earth and Sun, God of the sea, the Controller of the World, the Patron of the Gods, the Ruler of the season, the Symbol of Truth, the Changer of Seasons, the Doer of day and night. |
| Dyaus/Dyu        | The God of Sky                                                                                                                                                                                                                             |
| Soma             | The God of Plants                                                                                                                                                                                                                          |
| Usha             | The Goddess of Dawn                                                                                                                                                                                                                        |
| Ashwin           | The twin god of war and healers of diseases                                                                                                                                                                                                |
| Pushan           | The God of cattles                                                                                                                                                                                                                         |
| Vishnu           | World's Mentor, the preserver and protector of the people.                                                                                                                                                                                 |
| Maruta           | The God of Storm                                                                                                                                                                                                                           |
| Rudra            | Amoral an Archer God whose arrows brought diseases                                                                                                                                                                                         |

- Shatapatha Brahmana is related to Shukla Yajurveda.
- Brahmanas gave a detailed explanation of Vedic rituals and instructions and deal with the science of sacrifice.
- The latter portions of the Brahmanas were called the Aranyakas while the final parts of the Aranyakas and philosophic books named Upanishad.

- The Aranyakas deal with Soul, Birth, Death and life beyond it.
- The institution of Gotra appeared in the later Vedic age.
- A teacher who taught the Veda and a part of it for remuneration was called **Upadhyaya**. (UK UDA/LDA, 2007)
- The Aitareya Brahmana is a Vedic text that explains the Origin of Kingship.
- The Wife was called the '**Ardhangini of the husband**' in Shatapatha Brahmana.
- The Story of the debate between Maharishi Yagyavalakya and Gargi is described in the Brihadaranya Upanishad.
- The 16 Samskaras are mentioned in Grihya Sutra.

(MPPCS, 2015)

## ii. Later-Vedic Period (1000-600 BC)

- The history of the later-Vedic period covers periods of Yajurveda, Samaveda, Atharvaveda and Brahmana texts, Aranyaka and Upanishads.
- Rajsuya Yajna was performed during the coronation of the king.
- In this period, '**Varna**' came to be based on birth rather than occupation.
- The people of this period used iron weapons.
- The expansion of this civilization extended up to the Ganges and Yamuna Doab.
- Agriculture was the chief means of survival for the later Vedic people.
- In the Shatapatha Brahmana, all the four activities of agriculture - ploughing, sowing, harvesting and rigging are mentioned.
- A plough drawn by 24 oxen is mentioned in Kathak Samhita.
- **Painted Greyware Pottery is the speciality of this period.**
- Due to the improvement in agriculture and various crafts during this period, the people of the later-Vedic period now took to settled agriculture and residence.
- In this era, the plough was called **Sira** and the furrow was '**Sita**'.
- In the later-Vedic period, the unit of currency was **Nishka** and **Satanama**. (UPPCS, 2007, 2005; IAS, 1993)
- Sabha and Samiti continued to exist, but 'Vidhata' was completely disappeared.
- The entry of women in Sabha was prohibited.
- The later-Vedic society was divided into four Varnas - **Brahmanas, Kshatriyas, Vaishyas and Shudras**.
- The status of women was declined in the later-Vedic period.
- In the Shatapatha Brahmana, the names of many females of this period like Gargi, Maitreyi, etc. are mentioned.
- The Gotra system Originated in this period.
- Its literal meaning is cow-pen or the place to keep your cows, but with time, it came to be referred as people who were descendants from a common male ancestor or patriline.
- The place of Indra and Agni was taken by 'Prajapati', the creator of the universe.
- Pushana, who became the protector of animals or now the God of Shudras.
- The Upanishads explicitly condemn yajna and rituals and accept the sole authority of Brahma.
- **Six Vedangas** were composed to make the understanding of **Vedas** :

| Sl. No. | Vedangas  | Parts of Vedas     |
|---------|-----------|--------------------|
| 1.      | Shiksha   | Nose (UPPCS, 1997) |
| 2.      | Kalpa     | Arms               |
| 3.      | Nirukta   | Ears               |
| 4.      | Vyakarana | Mouth              |
| 5.      | Jyotisha  | Eyes               |
| 6.      | Chandas   | Foot               |

## Directions and Their Kings

| King    | Later Vedic Word | Emperor |
|---------|------------------|---------|
| East    | Prachi           | Samrat  |
| West    | Pratichya        | Svarat  |
| North   | Udichya          | Virat   |
| Central | Rajya            | Raja    |
| South   | Bhojya           | Bhoja   |

- The state namely Kasi, Kosala, Videha, Magadha and Anga were developed during post Vedic period. (UPPCS, 2007)
- Kuru and Panchala were regarded as the best representatives of the Vedic Culture.
- In the post Vedic period, the position of the king was hereditary.
- In the Aitareya Brahmana, "**the daughter is said to be the root of all miseries**".
- Women are equated with gambling and alcohol in the Maitrayani Samhita.
- The first mention of Child Marriage is in Chhandogya Upanishad.

## 5. Religious Movement in Sixth Century BC

### A. Buddhism

- **Gautama Buddha** was the founder of Buddhism.
- He was born in Lumbini Vana (Rumindei) in Kapilavastu in 563 BCE. (MPPCS 2004, 1992; UPPCS, 2002)
- His childhood name was Siddhartha. (CGPSC, 2014)
- His father's name was **Shudhodana** and his mother's name was **Mayadevi** or **Mahamaya** (the daughter of Kollia Republic).



- Shuddhodana was the head of the **Sakya clan**. (UPPCS, 2008)
- Buddha's mother died a few days after his birth.
  - Therefore, he was brought up by his aunt **Prajapati Gautami**.
- He was married at a young age to Shakya Clan's daughter **Yashodhara** (other names - Gopa, Bimba).
- The son of Gautama Buddha was **Rahula**.
- Distressed by worldly sorrows, Siddhartha left his house forever at the age of 29. This act is known as **Mahabhinishkramana**. (BPSC, 2005; UPPCS 2011, 2009, 2005; UPPCS, 2014)
- After renunciation, Siddhartha studied Sankhya philosophy by Alara Kalama in Vaishali. He got his education from Uddaka Ramaputta of Rajgir. (UP GIC, 2010)
- Later, he moved to Uruvela.
- He attained enlightenment (Nirvana) under a peepal tree on the banks of the Niranjana on the full moon day of Vaishakh at the age of 35 after a hard penance of 6 years without consuming food and water in Uruvela. (BPSC 2001; CGPSC 2011; MPPCS, 1997; IAS, 2015; UPPCS, 2012)
- After attaining enlightenment, Siddhartha was known as 'Buddha' and the place where he attained enlightenment became famous as '**Bodh Gaya**'. (67<sup>th</sup> BPS, 2022)
- This first sermon he preached was called '**Dhammachakra Pravartana**' in Buddhist texts. (UP Lower, 2013)
- Mahatma Buddha preached his **first sermon at Sarnath** (Rishipatnam) in Pali, the language of the ordinary people. (BPSC, 2011, 2005; UPPCS 2004, 1999, 2014, 1993; Jharkhand and PCS, 2013)
- He preached **most of his sermons at Shravasti**, the capital of Kosala. (UPPCS, 2004, 2010, 2011, 2015)
- His prominent followers were the rulers - Bimbisara, Prasenjit and Udayan.
- It was only the request of his stepbrother and assistant Ananda, Buddha agreed to allow female followers into Sangha.
- Devdatta was cousin and **brother-in-law** of **Gautama Buddha** and was the brother of **Ananda**.
- Kosala King Prasenjita adopted Buddhism along with his family.
- Notably, Prasenjita donated a Vihara to Buddha namely 'Poorvaram'.
- Buddha died from an illness, it was tainted pork that led to his demise.
- Mahatma Buddha spent his last rainy season in **Vaishali**. (UPPCS, 2015)
- He died at the age of 80 at '**Kushinara**' in Kushinagar district in 483 BCE. Buddha's departure from this world is called '**Mahaparinirvana**'. (UPPCS, 2011)

### Symbols of Buddhism related to Buddha's Life

| Events          | Symbols                  |
|-----------------|--------------------------|
| Birth           | Elephant                 |
| Birth           | Lotus and Bull           |
| Great Departure | Horse (BPSC, 1996)       |
| Enlightenment   | Bodhi Tree (UPPCS, 2002) |
| Nirvana         | Footprints (UPPCS, 2005) |
| Mahaparinirvana | Stupas                   |

- According to one version, after the death, the remains of Buddha's body were dispersed over eight places and eight stupas were built over them.

✎ **Note :** The balcony like structure representing the abode of the deities over the semicircular mound of the stupa is called '**Harmika**'. (VDO, 2023)

- Detailed knowledge about Buddhism is learnt from **Tripitaka** (Vinaya Pitaka, Sutta Pitaka and Abhidhamma Pitaka).
- Buddhism is basically **atheistic**. It does not believe in the existence of the soul.
- Buddhists were divided into two groups.
  - (a) **Bhikkhus** - For the propagation of Buddhism, one who embraced Mahabhinishkramana was called Bhikshuka.
  - (b) **Upasaka** - Those who adopted Buddhism while living a household life were called Upasaka.
- Entering Buddhist order was called '**Upasampada**'.
- Buddha, Dhamma and Sangha are '**Triratnas**' in Buddhism. (UP RO/ARO 2017)
- After the fourth Buddhist council, Buddhism was divided into two schools of thought-Hinayana and Mahayana.
- The most sacred festival of Buddhism is Vaishakh Purnima, known as '**Buddha Purnima**'.
  - It has importance as Buddha was born on the day of Vaishakh-Purnima, the attainment of knowledge and of Mahaparinirvana.
- Buddha preached four noble truths related to worldly sorrows which are as follows.
  - (1) truth of suffering, (2) truth of the cause of suffering, (3) truth of the end of suffering and (4) path that leads to the end of suffering. (UPPCS, 2006)
- Pratitya-Samutpada is a fundamental concept of Buddhism. It describes the causes of suffering.
- Buddha spoke about the eightfold paths (Astangika-marga) for liberation from worldly sorrows, which are as follows:
  - (1) Right Views (2) Right Resolve
  - (3) Right Speech (4) Right Conduct

- (5) Right Livelihood (6) Right Effort  
(7) Right Mindfulness (8) Right Concentration

- The source of the eightfold path is '**Taittiriya Upanishad**'.
- The ultimate goal of Buddhism is Nirvana which means '**blowing out a lamp or fire**', that is, to be free from the cycle of life and death.
- Mahatma Buddha emphasized the following ten-fold path to attain Nirvana - (1) Truth, (2) Ahimsa, (3) Asteya (nonstealing), (4) Aparigraha (non-covetousness any kind of property), (5) Celibacy, (6) not eating untimely, (7) Not sleeping on a comfortable bed, (8) Renouncing fragrant substances, (9) Renouncing Kamini and Kanchan and (10) Staying away from dancing, music, etc.
  - It is mandatory for the householders to follow the first five paths while it is mandatory for the monks to follow the 10 paths.

| Buddhist Councils |                            |                      |                                         |             |
|-------------------|----------------------------|----------------------|-----------------------------------------|-------------|
| Councils          | Time                       | Place                | Presidents                              | Rulers      |
| First             | 483 BC                     | Rajgriha             | Mahakassapa                             | Ajatashatru |
| Second            | 383 BC                     | Vaishali             | Sabakami                                | Kalashoka   |
| Third             | 247 BC                     | Pataliputra          | Mogaliputta-Tissa                       | Ashoka      |
| Fourth            | 1 <sup>st</sup> Century AD | Kundalvana (Kashmir) | Vasumitra, Vice-President<br>Ashwaghosh | Kanishka    |

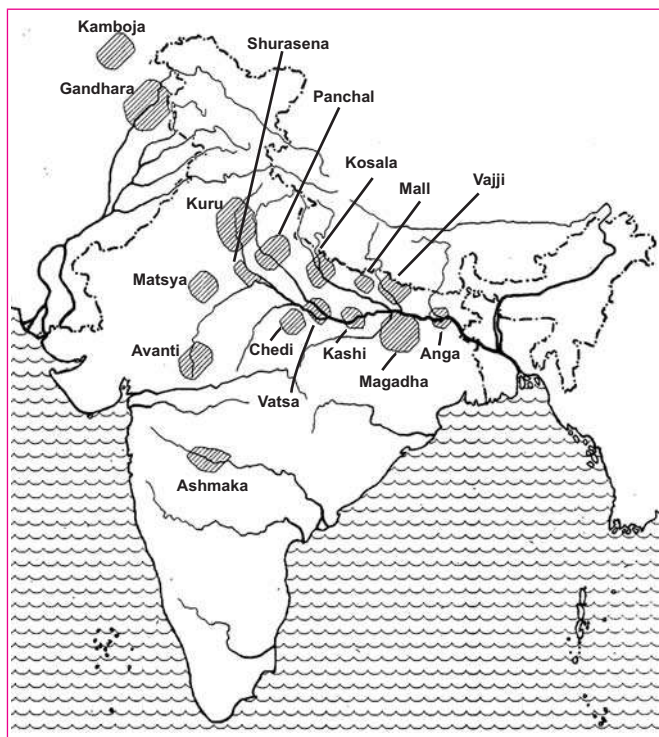
(BPSC, 2002, 2020, 2014, 2018, 2023; IAS 2001; RAS 2010; UPPCS, 2000, 1990, 2091)

- Mahatma Buddha preached the **middle path (Madhyama Pratipada)**.
- Buddhism is **atheistic**, similar to Jainism. (UPPCS, 1992)
- Buddhism does not accept the existence of the soul but **believes in rebirth**. (UPPCS, 2002; CGPSC, 2017)
- The Jataka stories narrate the previous births of Lord Buddha. (RAS, 2012; UPPCS, 1996, 2001)
- Initially, the entry of women was prohibited in the Sangha, but at the request of 'Ananda', women were allowed for admission.
- The **first woman** to enter the Sangha was **Prajapati Gautami**, the maternal aunt of Mahatma Buddha.
- Amrapali, the city courtesan of Vaishali, was also a disciple of Mahatma Buddha.
- Later, Mahayana was also divided into two schools of thought - **Nihilism** (Madhyamika) and **Vijnanavada** (Yogachara).
- Nagarjuna was the propounder of Nihilism. (UPPCS 1998)
- A branch of the Buddhist sect developed in the seventh century called '**Vajrayana**'.

- **The Vajrayana as worshipped woman as a source of power.**
- Buddha attained his final birth as Shakya Muni after a series of reincarnations as Bodhisattvas, but Maitreya, the future Bodhisattvas are yet to incarnate.
- Most of the Buddha sculptures were built in Gandhara style, but the first Buddha statue was probably constructed in the Mathura art form.
- Vasumitra was the first follower of Hinayana, later he followed Mahayana.
- Evidence of Panchsheel sermon given by Buddha is described in Chandogya Upanishad.
- Buddhaghosha's work '**Visuddhimagga**' explains Buddhist principles. It is also known as the 'Path of Purification'. (CGPSC, 2021)
- '**Milindpanha**' Contains the dialogues between the Buddhist monk '**Nagasena and king of Milinda Menander**'. (UK PSC 2012)
- There are 16 Mahajanapadas mentioned in the Bhagavati Sutra of Jainism and the Buddhist scripture Anguttara Nikaya. (UPPCS, 2004)

| The Rise of Mahajanapadas |                |                               |                                                                 |
|---------------------------|----------------|-------------------------------|-----------------------------------------------------------------|
| Sl. No.                   | Maha-janapadas | Capitals                      | Current Status (Mainly)                                         |
| 1.                        | Anga           | Champa                        | Bhagalpur, Munger (Bihar)                                       |
| 2.                        | Avanti         | Ujjain/Mahismati              | Malwa (Madhya Pradesh)                                          |
| 3.                        | Shurasena      | Mathura                       | Brajmandal Area (Uttar Pradesh)                                 |
| 4.                        | Kashi          | Varanasi                      | Near Varanasi (Uttar Pradesh)                                   |
| 5.                        | Koshala        | Shravasti / Saket             | Ayodhya Mandal (Uttar Pradesh)                                  |
| 6.                        | Kuru           | Indraprastha                  | Present Delhi, Meerut and some parts of Haryana                 |
| 7.                        | Kamboja        | Hataka / Rajapur              | Some areas of Jammu and Kashmir and Hazara district of Pakistan |
| 8.                        | Ashmaka        | Potali / Potana               | Narmada and Godavari river area (only districts in south India) |
| 9.                        | Chedi          | Shaktimati                    | Bundelkhand (UP) and (MP)                                       |
| 10.                       | Panchal        | Ahichhatra, Kampilya          | Bareilly, Badaun, Farrukhabad (UP)                              |
| 11.                       | Vajji          | Vaishali                      | Hazipur (Bihar)                                                 |
| 12.                       | Vatsa          | Kaushambi                     | Prayagraj (Allahabad) and Kaushambi                             |
| 13.                       | Magadha        | Girivraj/Rajgriha/Pataliputra | Patna, Gaya (Bihar), Nalanda etc.                               |

|     |          |                                 |                                                                               |
|-----|----------|---------------------------------|-------------------------------------------------------------------------------|
| 14. | Matsya   | Viratnagar                      | Areas near Jaipur, Alwar and Bharatpur (Rajasthan)                            |
| 15. | Malla    | Pawa and Kushinagar (Kushavati) | Kushinagar Devaria, Gorakhpur, Siddharthanagar and Nepal Area (Uttar Pradesh) |
| 16. | Gandhara | Taxila Rawalpindi and Peshawar  | (Pakistan)                                                                    |



## B. Jainism

- The first Tirthankara and founder of Jainism was **Rishabhdeva**. (CGPSC, 2013; UPPCS, 2010)
- The 23<sup>rd</sup> Tirthankara of Jainism was **Parshwanath**.
- Parshwanath was the son of Ikshvaku Dynasty King **Asvasena of Kashi**. (UPPCS, 2016)
- He renounced at the age of 30. He attained enlightenment after 83 days of penance.
  - The teachings given by him are (1) **Satya**, (2) **Ahimsa**, (3) **Asteya** (non-stealing), (4) **Aparigraha** (non-possession property).
- Followers of Parshwanath were called **Nirgrantha**.
- Nirgrantha was divided into four ganas (sanghas), each gana under one ganadhar.
- Mahavira's parents were followers of **Parshwanath**.
- Mahavira Swami was the 24<sup>th</sup> and the last Tirthankara of Jainism. (CGPSC 2022; UPPCS 1993; IAS, 1993)
- He was born at **Kundagram** (Vaishali) in 599 BC. (BPSC, 2005, 1997, 2004, 2017, 2011)

- Mahavir's father **Siddhartha** was a kshatriya king from Jnathrika Clan and mother Trishala was the sister of the Lichchavi king Chetaka.
- Mahavira Swami's childhood name was 'Vardhamana'. The wife of Mahavira was named **Yashoda** and his daughter's name was **Anonja** or **Priyadarsana**. (CGPSC, 2022)
- After the death of his parents at the age of 30, Mahavira led an ascetic life after seeking permission from his elder brother Nandivardhana.
- After 12 years of rigorous penance, Mahavira attained enlightenment under a Sal tree on the banks of the Rijupalika near **Jambhikagrama**. (UPRO/ARO, 2017; UPPCS, 2004)
- After attaining enlightenment, Mahavira was called Jina (conqueror), **Arhant** (blessed one) and **Nirgrantha** (free from bondage).
- Mahavir Swami preached his sermons in **Prakrit** (Ardha - Magadhi) language.
- **Jamali**, the son-in-law of Mahavira became his **first follower**. (BPSC, 2005)

## Six Philosophical Schools and Their Promoters

| Philosophy     | Promoter                  |
|----------------|---------------------------|
| Samkhya        | Kapila (UPPCS, 2010)      |
| Yoga           | Patanjali (UPPCS, 2007)   |
| Nyaya          | Gautama (UPPCS, 2005)     |
| Vaishesika     | Konada or Uluka           |
| Purva- Mimamsa | Jaimini (UK UDA/UDA 2007) |
| Uttara-Mimamsa | Badarayana                |

- Chandana, the daughter of Champa Naresh Dadhivahana became Mahavira's first disciple.
- Mahavira had 11 prominent disciples, who were called Ganadhars. Of these, 9 died during Mahavir's lifetime.
- Only Sudharman and Indrabhuti survived after Mahavira.
- Mahavira died (Nirvana) in 527 BC in Pavapuri, Bihar, at the age of 72. (BPSC, 2017, 2001)
- Around 300 BC, due to a severe famine, lasting 12 years, in Magadha, Bhadrabahu moved to Karnataka with his disciples. (IAS, 1993)
- Some followers stayed at Magadha along with Sthulabhadra.
- On his return, Bhadrabahu differed with the Jaina of Magadha, as a result of which Jainism was divided into two sects named **Shvetambaras** and **Digambaras**.
- The disciples of **Bhadrabahu** are called **Digambaras** (living naked) and the disciples of **Sthulabhadras** are called **Shvetambara** (wearing white clothes).
- Sudharman became the president of the Sangha.

- Triratnas of Jainism are-
  1. Samyak Darshana (right faith)
  2. Samyak Gyana (right knowledge)
  3. Samyak Charitra (right conduct) (CGPSC, 2017; BPSC, 2022)
- Mahavira added the fifth Mahavrata '**Brahmacharya**' to the four Mahavratas.
- In Jainism, following five Anusvratas is mandatory for the householders to attain Triratnas. (UPSC 1995)
- Jainism believes in the existence of **soul**.
- Jainism is **atheistic**.
- Jainism believes in **rebirth** and **karmavada**.
- Doctrine of Jainism was '**Saptabhanginaya**'. (CGPSC, 2018)
- Other Names of Saptabhanginaya were "**Syadvada** and **Anekantvada**". (Jharkhand PCS, 2011; IAS, 2009 2011; RAS, 2021, UK PSC, 2005)
- King's who were ardent followers of Jainism were **Udayan**, **Chandragupta Maurya**, Kalinga King **Kharavela**, Rashtrakuta king **Amoghavarsha** and **Chandela rulers**.
- A monolithic statue of Bahubali referred to as 'Gommateshvara' was built by a minister and a commander **Chamundaraya** of Ganga dynasty king in the 10<sup>th</sup> century AD. (UP Lower, 2009, UPSC, 1994)
- Jain temples were built at Khajuraho by the Chandela rulers.
- Mathura was a famous centre of Jainism in the post-Mauryan era.
- Biographies of Jain Tirthankaras are mentioned in Kalpasutra composed by Bhadrabahu.

### 24 Jain Tirthankaras, Their Symbols and Nirvana Sites

| Sl. No. | Name of Tirthankaras | Symbols            |
|---------|----------------------|--------------------|
| 1.      | Rishabhdeva          | Bull (UPPCS, 2017) |
| 2.      | Ajitnath             | Elephant           |
| 3.      | Sambharnath          | Horse              |
| 4.      | Abhinandanath        | Monkey             |
| 5.      | Sumatinath           | Curlew             |
| 6.      | Padmaprabhu          | Red Lotus          |
| 7.      | Suparswanath         | Swastika           |
| 8.      | Chandraji Prabhu     | Moon               |
| 9.      | Pushpadanta          | Crocodile          |
| 10.     | Sheetalanath         | Kalpa Vriksha      |
| 11.     | Shreyanasnath        | Rhinoceros         |
| 12.     | Vaspujya             | Buffalo            |
| 13.     | Vimalnath            | Boar               |
| 14.     | Anantnath            | Falcon             |
| 15.     | Dharmanath           | Vajra              |

|     |                |                     |
|-----|----------------|---------------------|
| 16. | Shantinath     | Deer                |
| 17. | Kuntunath      | He-Goat             |
| 18. | Arnath         | Fish                |
| 19. | Mallinath      | Waterpot            |
| 20. | Muniswasth     | Tortoise            |
| 21. | Naminath       | Blue Lotus          |
| 22. | Neminath       | Conch               |
| 23. | Parshwanath    | Snake (UPPCS, 2021) |
| 24. | Mahavira Swami | Lion (RAS, 2021)    |

(UP RO/ARO, 2016)

- The place of Nirvana of the 23<sup>rd</sup> Tirthankara, Parswanath is located at Sammed Shikhar (Parasnath Hill) mountain. (UPPCS, 2002)
- Prabhasgiri is a Jain pilgrimage site located in Kaushambi, Uttar Pradesh.
- Prabhasgiri is the site related to the 6<sup>th</sup> Jain Tirthankara Padmaprabhu.
- 'Kaivalya' means omniscience in Jainism and is roughly translated as complete understanding or supreme wisdom. (UPSC, 1995)
- Ahimsa is fundamental to Jainism. (UPPCS, 1993)
- Fourteen Purva Text is the oldest sacred Jain Text. (41<sup>th</sup> BPSC 1995)
- Compilation of 12 Angas was completed at the first Jain Council.

### Jain's Councils

| Council Year Place                            | President               | Ruler               | Work                                            |
|-----------------------------------------------|-------------------------|---------------------|-------------------------------------------------|
| First 310 BC<br>Pataliputra<br>(UK PSC, 2021) | Sthulabhadra            | Chandragupta Maurya | Shvetambara Jain Compilation of Literature      |
| Second 512 AD, Vallabhi                       | Devaradhi Kshamasramana | —                   | Determination and editing of extinct Jain texts |

- Ashoka's grandson Samprati is said to have also promoted Jainism.
- Mount Abu in Rajasthan is known for the Dilwara temple which is dedicated to Jain Tirthankaras.
- These were built in pure white marbles and adorned with exquisite sculptures.
- There are two major temple complexes.
- One was built around 1030 AD by Vimala Shah.
- The later temple, dedicated to the Tirthankara Neminatha, was founded around 1230 AD by Tejapala.
- Acharanga Sutra, Sutrakritanga and Vrihathakatha sutra are part of early Jain literature.
- Jain Literature is called Agama (doctrine).



- **Mahamastakabhisheka**, an important ritual of Jainism, is held at **Sravanabelagola** in Karnataka every 12 years. (UPSC, 2009)

### Major Jain Texts

- Bhadrabahu wrote the Kalpa Sutra. (BPSC, 1995)
- Parishistaparvan was written by Hemachandra.
- Adi Purana was written by Jinasena. (UPPCS, 2006)
  - This treatise is written in Sanskrit language. (UPPCS 2002; IAS, 1996)

### C Shaivism

- Religion-related to Lord Shiva is called **Shaivism**.
- The worshippers of Lord Shiva are called '**Shaiva**'.
- Shiva is called '**Rudra**' in Rigveda.
- The first explicit mention of **Linga worship** is described in **Matsya Purana**.
- From Ramayana, it is known that Shiva was a revered deity in Sri Lanka apart from North and South India.
- In the Taittiriya Aranyaka, Parvati's name is mentioned as Rudra's wife.
- Number of Shaiva sect in Vamana Purana is four - Pashupat, Kapalika, Kalamukh and Shaiva.
- The oldest sect of Shaivism is Pashupata sect.
- The Pashupata sect was founded by **Lakulisha**.
- Lakulisha is also considered as an incarnation of Lord Shiva.
- The followers of the Pashupata sect are called **Pancha-rathiks**.
- The **Pashupata Sutra** is the main theoretical text of this school of thought.
- The second major sect of Shaivism is known as **Kapalika**.
- Its worshipper Bhairava is worshipped as an incarnation of Shiva.
- The Malatimadhav drama of Bhavabhuti shows that the place called Srisail was the main centre of Kapalikas.
- The followers of the Kalamukh sect are called **Mahavratadhars** in Shiva Purana.
- People of the Kalamukh sect used to eat food, drink water and alcohol in the male-cranium itself and rubbed ashes over their bodies.
- **Lingayat** sect was prevalent in South India. They were also known as **Jangams**. The people of this sect worshipped the Shiva Linga. (UPPCS 2007)
- The promoter of the Lingayat sect was **Allama Prabhu** and his disciple **Basava**.
- Lingayat sect was also called **Veerashaiva Sect**.
- In the 10<sup>th</sup> century, **Matsyendranatha** founded the **Nath Sect**.
- The extensive propagation of the Nath sect took place during **Guru Gorakhnath**.

- Shaivism was very popular in south India during the time of **Chalukya, Rashtrakuta, Pallava** and **Chola Kings**.
- The first combined idols of Shiva and Parvati were built during the **Gupta Period**.
- During the Pahlava period, the Nayanar saints contributed significantly to the development of Shaivism. 63 Nayanars were prominent among the saints - Appar, Sambandar and Sundaramurthy. (UP UDA/LDA 2006)
- The famous '**Kailasha Temple**' at Ellora was built by the Rashtrakuta kings.
- The famous **Rajarajeshwar Shaiva temple** at Tanjore, also known as the **Brihadeshwara Temple**, was built by the Chola ruler Raja Raja I.
- Shiva Linga was established at Karamdanda and Khoh during the reign of Kumaragupta I.
- During the **Gupta Period**, temples of **Shiva** and **Nachna Kuthaar** were built in **Bhumra**.
- The figures of Shiva and Nandi are inscribed on the coins of Kushana rulers.

### Major Sects and Founders of Shaivism

| Sects    | Founder        |
|----------|----------------|
| Pashupat | Lakulisha      |
| Lingayat | Basava         |
| Nath     | Matsyendranath |

- Shiva is said Pashupati, Bhawa, Bhupati etc. in Atharva Veda.
- The Virashaiva or Lingayata movement was developed by Basavanna a minister of the Chalukya King Bijala Raya of Kalyana.
- Lingayata sect is influenced by Islam.
- Lingayatas don't believe in Rebirth and they **ceremonially bury their dead**.

### D. Vaishnavism

- The Vaishnava sect developed from the Bhagavata. According to tradition, its founder was descendants of Vrishni (Satvat) Vanshi **Krishna**. (RAS/RTS 1993)
- Krishna is first mentioned in **Chandogya Upanishad**. Here, he is described as Devaki's son and a disciple of Ghor Angiras. (RAS/RTS 1999)
- He is also known as Vasudeva Krishna, being the son of Vasudeva.
- Followers of Krishna called him 'Bhagavata' (Sacred). For this reason, the religion he promoted became '**Bhagavata**'.
- In the Mahabharata period, Vasudeva Krishna was compared to Vishnu and the Bhagavata religion became Vaishnavism.

- The first stone monument related to the **Bhagavata** is the Garuda pillar at **Vidisha** (Besanagar) which was built by Heliodorus, the Greek ambassador. (UPPCS, 2008)
- The Greek ambassador Megasthenes referred to the people of Shursena (Mathura) as worshipers of '**Heracles**', indicating Vasudeva Krishna.
- On the coins of Apollodorus, the first sign of the Bhagavata religion is found.
- Kushan rulers like Huvishka and Vasudeva were Vaishnava followers.
- The Gupta kings were Vaishnava followers and they made it a state religion. Vaishnavism was at its climax during the Gupta rulers.
- Most Gupta rulers assumed the title of 'Param Bhagwat'. The of Vishnu Garuda vehicle was the emblem of the Guptas.
- Amar Singh, the lexicographer of this era, has mentioned 39 names of Vishnu in his book Amarkosh, describing him as a son of Vasudeva.
- The Sangam period's Literature shows that in the first century of Christ, it was an important religion in the Tamil region.
- The **Eastern Chalukya** ruler of **Vengi** was also a Vaishnava follower and his emblem was similar to that of the Guptas '**Garuda**'.
- Rashtrakuta ruler **Dantidurga** had built the famous **Dashavatara Temple** at **Ellora**.
- The propagation of Vaishnavism in the Tamil region was carried out by the **Alvar** saints.
- The number of Alvar saints was 12.
- Among the prominent Alvar saints were Tirumangai, Periyar, Alwar, Andal, Nammalwar, etc.
- The early Alvar saints were - Poyagai, Pudam and Beyara who were residents of Kanchi, Mallai and Mayilapuram, respectively.
- The only female saint among the Alvars was **Andal**.
- Dashavatara of Vishnu as per Matsya Purana are- (1) Matsya (fish), (2) Kurma (Tortoise), (3) Varana (Boar), (4) Narsimha (Man-Lion), (5) Vamana (dwarf priest), (6) Parasurama, (7) Rama, (8) Krishna, (9) Buddha, (10) Kalkin (Kali).
- **Varaha's incarnation** of Vishnu was most famous during **Gupta Period**. (UP UDA/LDA, 2010)
- In Vaishnavism, the highest importance for attaining God has been given to Bhakti.

#### Some Other Sects, Beliefs and Their Founders

| Sects     | Beliefs        | Founders           |
|-----------|----------------|--------------------|
| Dashanami | Advaita        | Adi Shankaracharya |
| Vaishnava | Visishtadvaita | Ramanuja           |

|        |               |                                |
|--------|---------------|--------------------------------|
| Brahma | Dvaita        | Anandtirtha (Madhava)          |
| Rudra  | Shuddhadvaita | Vallabhacharya/<br>Vishnuswami |
| Sanak  | Dvaitadvaita  | Nimbarka                       |

#### Major Sects and Their Founders

| Sects                | Founders            |
|----------------------|---------------------|
| Varkari              | Namdev              |
| Dharkari             | Ramdas              |
| Srivaishnava         | Ramanuja            |
| Parmarth             | Ramdas              |
| Ramavat              | Ramananda           |
| Ajivaka              | Makkhali Gosala     |
| Ucchedavada          | Ajita Kesakambali   |
| Materialism          | Pakudha Kaccayana   |
| Atomist              | Puran Kashyap       |
| Materialism-Cynicism | Sanjay Vethaliputta |

- Angkor Wat temple of Combodia was built by **Suryavarman II**.
- Puri temple was constructed by a famous King of Ganga Dynasty Ananta Varman Chodaganga Deva.
- Buddha is said to be Vishnu Avatar in Dashavatar Charita by Kshemendra and Matsya Purana.

#### 6. The Rise of Magadha

- Magadha, situated between Patna and Gaya districts of modern Bihar, was a kingdom of Ancient India.
- The **first dynasty** to rule Magadha was the **Haryanka dynasty**. (UP Lower 2002; BPSC, 2020; UK Lower, 2010)
- The founder of this dynasty was **Bimbisara**, who made **Girivraja (Rajagriha)** his capital.
- Bimbisara sent his royal physician Jivaka, for the treatment of **Avanti Naresh Chanda Pradyota**. (67<sup>th</sup> BPSC 2022)
- Ajatshatru (Kunik) succeeded his father Bimbisara.
- The last ruler of the Haryanka dynasty was **Nagadasaka**.
- Nagadasaka was overthrown by his official **Shishunaga** who established the **Shishunaga Dynasty**.
- Shishunaga annexed Avanti in Magadha Kingdom. (UP Lower, 2008)
- The last king of the Shishunaga dynasty was **Nandivardhana** or **Mahanandin**.
- The founder of the **Nanda dynasty** was Mahapadmananda. (UK PSC, 2016)
- The last ruler of the Nanda dynasty was **Dhanananda**.
- Dhanananda was a contemporary of Alexander. (44<sup>th</sup> BPSC 2000)

- **Chandragupta Maurya** established the '**Mauryan Dynasty**' after defeating Dhanananda. (BPSC, 2000)

### The Mauryan Empire

- Mauryan Empire was founded by Chandra Gupta Maurya.
- Mauryans are called as 'Shudras' in Puranas.
- Chandragupta Maurya is said to be Kashatriya in Buddhist Literatures like Dipavamsa and Mahavamsa.
- Mudrarakshasa described Chandragupta Maurya as Vrishala (वृषल), son of the Shudra. (46<sup>th</sup> BPSC, 2003)
- Mudrarakshasa is written by Vishakhadatta.
- **Chanakya** (Kautilya/Vishnugupta) helped Chandragupta to defeat Dhananand and occupy the throne. He became Chandragupta's Prime Minister. (UPPCS, 2002, 2006)
- The book written by Chanakya is known as 'Arthashastra'. It is based on polity. (UPPCS, 2012, 2015; BPSC, 2017)
- In Kautilya's Saptanga Siddhanta, '**Amatya**' denotes minister and officer. (BPSC 2001; IAS 2022)
- Chandragupta became the king in 321 BCE.
- In 305 BC, he defeated Seleucus Nicator (the ruler of Babylon), who later married his daughter Cornelia (Helena) to Chandragupta, giving him four provinces Aria (Herat), Arachosia (Kandhar), Paropanisade (Kabul) and Gedrosia (Balochistan) as dowry.
- The battle between Chandragupta and Seleucus is described by the historian **Appian**.
- '**Megasthenes**', the ambassador of Seleucus came to the court of Chandragupta. (RAS/RTS 1997)
- Megasthenes wrote a book named '**Indica**'. (MPPCS, 2015)
- Chandragupta was the disciple of a Jaina Monk **Bhadrabahu**.
- Chandragupta Maurya died in **Shravanabelagola**, Karnataka in 298 BCE.

📌 **Note :** Justin calls Chandragupta Maurya's army a 'gang of robbers'.

### Bindusara

- Bindusara succeeded his father Chandragupta in 298 B.C.
- Bindusara's (follower of Ajivaka) mother was **Durdhara**.
- Bindusara is also known as **Amitrabhata** (enemy destroyer) and Singhasen.
- According to historian Strabo, King Antiochus of Syria sent his ambassador, Deimachus, to Bindusara's court. (UP Lower, 2015)
- According to Pliny, the Egyptian king **Ptolemy** (II) Philadelphus also sent an ambassador, **Dionysius**, to Ashoka's Court.
- Bindusara sent Ashoka first and then Susim to suppress the rebellion at Taxila.
- According to Athenaeus, Bindusara requested Antiochus - I, the ruler of Syria to send him sweet wines, dried figs and a sophist.

- Bindusara was a disciple of **Guru Pingalavatsa**.

### Ashoka

- After Bindusara, his son Ashoka ascended the throne of Magadha. (IAS Pre., 1998)
- Ashoka was coronated in 269 BC. (UPPCS 1993, 1995)
- Before coronation, Ashoka was the viceroy of Avanti (Ujjaini) and Takshila.
- Subhadraangi, was Ashoka's mother.
- In the Puranas, Ashoka is called **Ashoka Vardhana**.
- His name 'Ashoka' is mentioned in the inscriptions of **Maski, Gujri, Nettur and Udagolam**. (IAS, 1997, UPPCS, 2015)
- On records, Ashoka is addressed with the titles of '**Devanampiyaya**' and '**Devanampiyadasi**'. (IAS 1995, MPPCS, 2015)
- In the **eighth year** of his coronation (261 BC) Ashoka attacked Kalinga.
- Ashoka was initiated into Buddhism by Upagupta..
- Ashoka had built four caves in the Barabara hills, named Lomas Rishi, Sudama, Karan Chaupar and Visva Zopri.
  - Ashoka's inscriptions have been found in all caves except Lomas Rishi cave.
- The Nagarjuni Caves were donated to the Ajivaka sect by the Mauryas.

### Missionaries sent by Ashoka to other Countries

| Name of Missionaries     | Country              |
|--------------------------|----------------------|
| Sona and Uttara          | Suvarnabhumi (Burma) |
| Mahendra and Sanghamatra | Sri Lanka            |
| Mahyantika               | Kashmir and Gandhar  |
| Maharakkhita             | Yona (Greece)        |

- Ashoka sent his son **Mahendra** and daughter **Sanghamitra** to Sri Lanka to propagate Buddhism. (CGPSC, 2013)
- Ashoka's inscriptions are written in Brahmi, Kharoshti, Greek and Aramaic scripts.
- Ashoka's inscriptions are divided into three parts - rock edicts, pillars edicts and cave edicts.
- James Princep deciphered '**Rock Edicts of Ashoka**' in 1837. (UPPCS, 2008, 2009; CGPSC, 2003; IAS, 2016; Jharkhand PCS 2021)
- It was about 1750 AD that an Ashokan inscription was first discovered when Padre Tieffenthaler saw fragments of the Delhi-Mirath Pillar at Delhi.

| Inscriptions               | Theme                                                                                                         |
|----------------------------|---------------------------------------------------------------------------------------------------------------|
| The first inscription      | The condemnation of animal sacrifice                                                                          |
| First separate inscription | All human beings are my children                                                                              |
| Second Inscription         | Provides care for man and animals, describes Chola, Pandyas, Satyapura and Keralputra kingdoms of South India |

|                        |                                                                                                          |
|------------------------|----------------------------------------------------------------------------------------------------------|
| Third Inscription      | Yuktas along with Rajukas shall go to all areas of kingdom every five years                              |
| Fourth Inscription     | Dhammaghosa over Berighosa                                                                               |
| Fifth Inscription      | Appointment of Dhammamahamatras (in the 14 <sup>th</sup> year of the coronation)                         |
| Sixth Inscription      | King's desire to be informed about conditions of people regularly. Talks about welfare measures          |
| Seventh Inscription    | Requests, tolerance towards all religions                                                                |
| Eighth Inscription     | Ashoka's first Dhamma Yatra to Bodhgaya and Bodhi Tree                                                   |
| Ninth Inscription      | Condemns popular ceremonies and rituals                                                                  |
| Tenth Inscription      | Preaching of Dhamma                                                                                      |
| Eleventh Inscription   | Explanation of Dhamma Policy                                                                             |
| Twelfth Inscription    | Tolerance among all religions and sects                                                                  |
| Thirteenth Inscription | Ashoka's victory over kings. Victory of Ashoka's Dhamma and Greek Kings<br>(UP Lower, 2008; UPPCS, 2016) |

- The total number of pillar edicts of Ashoka are 7. These are written only in the Brahmi script.
  - These are found at 6 different places - Prayag, Delhi - Topra and Delhi - Meerut highways, Rampurva, Lauriya Nandangarh and Lauriya Areraj.
- Renowned historian D.R. Bhandarkar wrote the history of the Ashoka period only based on records.
- The **Kaushambi** inscription is called the '**Queen's Inscription**'.
- **Rummindei pillar** edict is the **shortest**.
- During Dhamma Yatra, Ashoka mentioned the reduction in the rate of land revenue in Lumbini in the **Rummindei pillar** inscription.
- The **Shar-i-Kuna (Kandahar)** inscription was found in the Greek and Aramaic script. (CGPSC, 2011)
- During Ashoka's reign, the number of provinces in the Maurya Empire was 5 or there were five political centres.
  - The provinces were called '**Chakras**'.
- The strongest evidence of Ashoka being a Buddhist is the **Bhabru Minor Edict (Bairat)**.
- In Maski's minor inscription related to the coronation, Ashoka calls himself '**Buddha Shakya**'.
- The Maski inscription is currently located in the state of Karnataka.
- **Sohgaura** (copper inscription) and **Mahasthan** inscriptions mention the distribution of foodgrains by the State at the time of famine. (IAS 1998)
- The Mauryan pillar capital was found at Sarnath, known as the Singha capital (Lion Capital).

| Provinces             | Capitals    |
|-----------------------|-------------|
| Prachi                | Pataliputra |
| Kalinga               | Tosali      |
| Avanti                | Ujjain      |
| Udichya (Uttarapatha) | Taxila      |
| Dakshinapatha         | Suvarnagiri |

- The administrators of the provinces were called '**Kumara**' or '**Aryaputra**'.
- The provinces were divided into Vishayas (Districts), each headed by the **Vishayapati**.
- The smallest unit of administration was '**Gram**', headed by '**Gramika**'.
- According to Megasthenes, the city was divided into **6 committees** to administer conveniently. Each committee consisted of **5 members**. Provinces were known as 'Chakra'.

### Administrative Committees and Their Works

| Committees | Works                                 |
|------------|---------------------------------------|
| First      | Inspection of Industry and Craft Work |
| Second     | Care of Foreigners                    |
| Third      | Keeping records of Births and Deaths  |
| Fourth     | Supervision of Trade and Commerce     |
| Fifth      | Manufacture and Sale of Goods         |
| Sixth      | Levying of Sales Tax                  |

- Sales Tax was charged at the rate of 4 per cent of the value of domestic goods and 1/10 of the value of imported goods. There was a provision of death penalty for tax evasion. (UPCS 2013)
- **Agronomoi** was the revenue officer who measured the land and levied and collected tax. (UPPCS, 2020)
- In Arthashastra, **secret agents** were named **Guddha Purushas**.
- Stationary detectives were called 'Samasthan' and moving detectives were called '**Sanchari**'.
- Courts were of two types - 1. **Dharmasthiya** (civil court), 2. **Kantakashodhan** (criminal court). (Chhattisgarh PCS, 2014)
- Government land was called '**Sita**'. (UPPCS, 2013)
- The fertile land without rain was called '**Adevamatrika**'.
- The principal officer arranging the State land was **Sita-Adhyaksha**. (RTS/RAS 2010)
- **Sthanika** and **Gopa**, two officials, collected taxes in the provinces.
- Rajuka, Yukta, Pradeshika, Dhamma Mahamatra, Stryadhyaksha and Brajbhumik were principal administrative officials of the Mauryan Empire. (UPPCS, 1996)



- The central administration was divided into several departments to facilitate governance. These departments were called 'Teerths' (departments).
  - The Arthashastra mentions 18 departments and 28 presidents.
- Megasthenes divided Indian society into 7 categories - Soldiers, Magistrates, Philosophers, Herdsmen, Farmers, Artisans and Councillors. (46<sup>th</sup> BPSC, 2003)

### Departments and Their Heads Mentioned in Arthashastra

| Departments         | Heads                              |
|---------------------|------------------------------------|
| 1. Purohita         | Chief Priest                       |
| 2. Yuvraj           | Crown Prince                       |
| 3. Senapati         | Commander-in-Chief                 |
| 4. Samaharta        | Revenue Collector (UP Lower, 2008) |
| 5. Sannidhata       | Treasury Head                      |
| 6. Lakshanadhyaksha | Coin minting                       |
| 7. Akaradhyaksha    | Mining Officer                     |
| 8. Pradeshika       | Chief Justice of Criminal Court    |
| 9. Panyadhyaksha    | Officer of Commerce Department     |
| 10. Sitaadhyaksha   | Supervisor of Agriculture          |
| 11. Vyabharika      | Chief Justice of Civil Court       |
| 12. Karmantika      | Head of Industries and Commerce    |
| 13. Dandapala       | Head of Police                     |
| 14. Vivitadhyaksha  | Head of Pastures                   |
| 15. Antapala        | Guard of Borders                   |
| 16. Sunadhyaksha    | Slaughterhouse Officer             |
| 17. Ganikadhyaksha  | Head of Prostitutes                |

- According to Kautilya's Arthashastra, the officer commanding the cavalry in the Maurya administration was known as Ashwadhyaksha.
- Megasthenes refers to the Six committees of five members each to look after the administration of Army.
- These committees are given below -

| Committees            | Relation             |
|-----------------------|----------------------|
| (i) First Committee   | Navy                 |
| (ii) Second Committee | Transport and Supply |
| (iii) Third Committee | Infantry             |
| (iv) Fourth Committee | Cavalry              |
| (v) Fifth Committee   | War Chariots         |
| (vi) Sixth Committee  | War Elephants        |

- The department was divided into 6 committees of 5 members each. This unit of 30 members looked after the administrative work.

- There were many cities in the Maurya Empire, of which the city of Brahmagiri was located at the Southern most Point.
- The last ruler of the Mauryan dynasty was Brihadratha.

(BPSC, 2008)

- **Brihadratha was killed by his commander Pushyamitra Sunga in 184 BC who founded the Sunga dynasty.**

### Sunga Dynasty

- Pushyamitra Sunga founded the Sunga Dynasty.
- The capital of the rulers of the Sunga dynasty was **Pataliputra**.
- Pushyamitra Sunga performed **two Ashwamedha** Yajnas and was conducted by the priest, Patanjali.
- Pushyamitra got Bharhut Stupa renovated.
- After the death of Pushyamitra, his son **Agnimitra** became the ruler of the Sunga dynasty.
- The ninth ruler of the Sunga dynasty was Bhagabhadra (Bhagavata).
- In the 14<sup>th</sup> year of his rule, Heliodorus, the ambassador of the Yavana ruler Antialcidas of Taxila, installed a Garuda pillar in the honour of Vasudeva in Vidisha.

### Kanva Dynasty

- The last ruler of the Sunga Dynasty was **Devabhuti**, who was assassinated by **Vasudeva** in 75 BC who established the Kanva dynasty.
- Rulers after Vasudeva were Bhumimitra, Narayana, Susharman.

### Satavahana Dynasty

- **Simuka** killed Susharman, the last ruler of the Kanva dynasty, around 60 BC and founded the Satavahana dynasty. (UPPCS, 2008)
- The capital of the Satavahanas was **Pratishthana** (Maharashtra). (UP Lower, 2008)
- Among the important rulers of this dynasty were Simuka, Krishna, Satakarni I, Gautamiputra Satakarni, Vasishthiputra Pulumavi and Yajna Sri Satakarni.
- **Gautamiputra Satakarni was called the lord of the west, had performed two Ashwamedha yajnas and one Rajasuya yajna.**
- Satavahana rulers introduced currencies in silver, copper, lead and potin metals.
- Satavahana rulers were the **first who introduced lead coins**.
- Satavahana dynasty started the practice of **donation of land to Brahmins**.
- The Satvahans had Prakrit as their language written in Brahmi script.
- The Satavahanas built the Karle, Chaitya, Ajanta and Ellora caves.
- The Amravati art style developed under the patronage of the Satavahanas. (SSC MTS, 2023)

- Satavahana rulers were called the '**Lord of Dakshinapatha**'.
- The author of **Gathasaptashati** was 'Hala' and **Brihat-katha's** author was Gunadhyā who belonged to the Satavahana period.

## 7. Foreign Invasions in India

- Indo-Greek, Shakas, Pahlavas and Kushanas invaded India at different times.
- India was invaded first by Indo-Greek ruler Demetrius (Dara I) in 183 BC. He made Sakala his capital.
- The most famous of the Indo-Greek rulers was **Menander**.
- The capital of Menander's kingdom was Sakala (Sialkot).
- Sakala was a major centre of education during this period.
- Menander was converted to Buddhism by Nagasena (Nagarjuna).
- **Milindpanho** (Questions of Menander) describes questions raised by Menander and Nagasena in detail.
- The Indo-Greek rulers issued **scriptured** and **gold coins in India** for the first time.
- Hellenistic art belongs to the period of Indo-Greek rule. Gandhara art represents its best example.

### A. Sakas

- Sakas came to India after the Greeks.
- They originally came from **Central Asia**.
- They were divided into five branches.
- A ruler of Ujjain defeated the Sakas and assumed the title of '**Vikramaditya**' and started **Vikram Samvat** in 57 BC. (UPPCS 1992)
- Rudradaman was the most powerful Saka ruler in India.
- Rudradaman replaced Prakrit with Sanskrit as the language for records first implementing it at Junagarh and Girnar.
- The Sakas ran the Satrapa system of administration.

### B. The Indo-Parthian or Pahlavas

- The Saka's rule was followed by a new invader, the Indo-Parthians or Pahlavas who established their reign in northwest India and formed Pahlava dynasty with Gondophernes being its most powerful ruler between 20 AD and 41 AD.
- During the reign of **Gondophernes**, Christian missionary, St. Thomas came to India to preach Christianity.
- Maues was the first Parthian ruler in India, while the real force behind his power was Mithridates I.

### C. Kushana Dynasty

- The Kushanas came to India after the Pahlavas (Parthians).
- The Kushanas were a clan of the Yuezhi race of China.
- The Kushanas dynasty was founded by **Kujula Kadphises**.
- Among the Kushana rulers, **Vema Kadphises** first issued gold coins. **Vema Kadphises** assumed the title of

**'Maheshwar'**. On his coins, the figure of Shiva, Nandi and Trishul were inscribed. (UPPCS, 2009)

- **Kanishka** was the most powerful ruler of this dynasty.
- The capital of Kanishka was Purushpura (Peshawar) which was later shifted to Mathura.
- Kanishka ascended the throne in **78 AD** and this date is known as the beginning of the **Saka Samvat**. (UP RO/ARO 2013)
- The Kushana ruler, adopted the title of 'Devputra' which means 'Son of God'. (SSC MTS, 2023)
- The **fourth Buddhist council** was organized during his reign.
- They followed the **Mahayana sect** of Buddhism.
- **Charak** was a physician in the court of Kanishka.
- '**Charaka Samhita**' is the most important work by Charak.
- **Mahavibhasa Shastra** is called an encyclopedia of Buddhism. Its creator was **Vasumitra**.
- Ashvaghosha was a poet in the court of Kanishka. His works were **Mahayana, Shraddhotpada-shastra, Buddhacharita, Sundrananda, Sariputra Prakrāna** and **Sutralankara**. (UPPCS, 2008)
- Acharya Nagarjuna, Parshva, Vasumitra, etc. also adorn the court of Kanishka.
- **Nagarjuna** was the propounder of **Middle-way / nihilism**.
- He wrote '**Prajnaparamita Sutra**'.
- The **Gandhara** and **Mathura** styles of sculpture were developed during the reign of Kanishka. (38<sup>th</sup> BPSC, 1992)
- The last ruler of the Kushana dynasty was **Vasudeva**.
- The Kushana rulers issued **pure gold coins** (112.75 grains in 123 grains).
- The Kushana rulers had introduced the copper coins.
- The titles of Kushana rulers were '**Maharaj Rajadhiraj Devaputra**' and '**Kaiser**'.

## 8. The Gupta Empire

- **Sri Gupta** was the founder of the Gupta dynasty.
- After Srigupta, Ghatotkach became the king of this dynasty.
- Pataliputra was the capital of the Gupta Empire.
- Chandragupta-I ruled this dynasty from 319 AD to 335 AD. (CGPSC, 2023)
- He first assumed the title of **Maharajadhiraja** and married Kumaradevi, a princess of the Lichchavi dynasty. (UPPCS, 2009)
- He started the '**Gupta Samvat**' in 319 AD. (MPPCS, 1991)
- Samudragupta, famously known as **Napoleon of India**, followed Chandragupta I. (BPSC, 2015; UP Lower, 2009)
- He defeated 9 kings in the north and 12 kings in the south.
- The coins of Samudragupta had the coins titles inscribed which read as '**Apratirath**', '**Vyaghraprakramank**', '**Parakrananka**'. Samudragupta also assumed the title of '**Kaviraj**'.

- The Sandhivigrahika (Foreign Minister) and Rajakavi Harishena of Samudragupta authored '**Prayag Prasasti**'. (UPPCS 2004, 2006, 2009)
- Samudragupta offered protection to the great Buddhist monk **Vasubandhu**. (UPPCS 2004, 2006, 2009)
- Samudragupta's successor **Chandragupta II** occupied the throne in 375 AD. (CGPSC, 2017, 2015, 2004)
- Samudragupta was the first Gupta King who assumed the title "**Param Bhagawata**". (UPPCS, 2009)

### Samudra Gupta's Contemporary Kings of South India

| Kings      | Their Kingdoms |
|------------|----------------|
| Dhananjaya | Kusthalpura    |
| Nilaraja   | Avamukta       |
| Ugrasena   | Palaka         |
| Vishnugopa | Kanchi         |

- The Chinese traveller **Fa-Hein** came to India during his reign. (BPSC, 2017)
- After defeating the Sakas, he assumed the title of 'Sakari' and issued silver coins.
- Chandragupta II also assumed the title of '**Param Bhagawata**'. (UPPCS, 2008, 2014)
- Kumaragupta I succeeded Chandragupta II. He ruled from 415 AD to 455 AD.
- **Nalanda University** was established by **Kumaragupta I**.
- The region of Chandragupta II's son and successor, Kumargupta I, was a period of peace and relative inactivity.
- Skandagupta succeeded Kumaragupta I. He reigned from 455 AD and 467 AD.
- During the reign of Skandagupta, the Hunnas invaded India. (UPPCS 2006)
- Bhitari pillar inscription of the Gupta ruler Skandagupta describing a battle with the Pushyamitras.
- He renovated the Sudarshan lake at Girnar.

### Construction and Renovation of the Sudarshan Lake

| Rulers              | Officers    |
|---------------------|-------------|
| Chandragupta Maurya | Pushyagupta |
| Ashoka              | Tushashk    |
| Rudradaman          | Suvishakh   |
| Skandagupta         | Chakrapalit |

- Vishnugupta was the last ruler of the Gupta dynasty.
- For administrative purposes, the Gupta empire was divided into several provinces.

- The Gupta Empire was divided into several provinces. The province was known by different names. Desh, Avni or Bhukti.
- The ruler of **Bhukti** was called '**Uprika**'.
- The rulers of the frontier regions were called '**Gopta**'.
- Bhukti was further divided into Vishyas whose head were Vishyapatis.
- **Dandapashika** was the head of the police department.
- '**Gram**' was the smallest unit of administration.
- Small units of village groups were called '**Pethaka**'.
- Generally, the rate of revenue was 1/6 during the Gupta period. (42<sup>nd</sup> BPSC, 1997)
- **Araghatta or Rahat** (Ghati Yantra) was used for irrigation.
- **Ujjain** was a major trading centre during this period.
- The Gupta kings issued the most gold coins, called '**Dinaras**'. (UP RO/ARO 2017)
- The first mention of the Kayastha class is found in **Yajnavalkya Smriti**.
- Kayasthas, as a caste, were first mentioned in Oshanam Smriti.
- Gupta rulers were followers of Vaishnavism.
- The royal emblem used by the Gupta rulers was 'Garuda' on whom Lord Vishnu rode.
- The **Dashavatara temple** of Deogarh was built during the Gupta period when actually the art of temple construction began.
- The present form of the Puranas was composed during Gupta period.
- During their reign, Yajnavalkya, Narada, Katyayana and Brihaspati Smriti were composed.
- **Cave numbers 16, 17 and 19 at Ajanta belong to the Gupta period.**
- This cave depicts various scenes (Birth, Mahabhinishkramana, Mahaparinirvana, etc.) from the life of Mahatma Buddha.
- The caves of Ajanta belong to the Mahayana sect of Buddhism. (UK PCS 2006)
- The great poet **Kalidasa** and famous Ayurveda physician **Dhanvantari** resided at the court of Chandragupta II.
- **Aryabhata** was a renowned mathematician. He wrote the texts '**Aryabhatiya**' and '**Surya Siddhanta**'. (UK, UDA/LDA, 2007)
- Notably, he flourished in Kusumapura - near Pataliputra which was then the Capital of the Gupta Dynasty.
- The Gupta period is called the '**Golden Period of Indian History**'. (UPPCS, 2004)

✎ **Note :** Aryabhata first proclaimed that the Earth revolves around the Sun. (64<sup>th</sup> BPSC 2018)

| Temples of Gupta Period         |                                    |
|---------------------------------|------------------------------------|
| Temples                         | Places                             |
| Vishnu Temple                   | Tigawa (Jabalpur, Madhya Pradesh)  |
| Shiva Temple                    | Bhumra (Nagod, Madhya Pradesh)     |
| Parvati Temple                  | Nachna Kuthaar (Madhya Pradesh)    |
| Dashavatara Temple              | Deogarh (Lalitpur, Uttar Pradesh)  |
| Shiva Temple                    | Khoh (Nagod, Madhya Pradesh)       |
| Bhitargaon Temple               | Bhitargaon (Kanpur, Uttar Pradesh) |
| Laxman Temple (Built of bricks) | Sirpur (Mahasamund, Chhattisgarh)  |

## 9. Vakataka Dynasty

- Vakataka Dynasty was founded around 250 AD by Vindhyashakti.
- Pravarasena-I was the only Emperor of the Vakataka dynasty who has assumed the title of '**Samrat**'.
- He performed four Ashwamedha yajnas.
- The kingdom of Vakataka was divided after the death of Pravarasena-I. His son Rudrasena ruled his capital at Nandivardhana (Pravarpura), while Sarvasena made Vatsagulma his capital.
- Rudrasena-II married Prabhavati Gupta, the daughter of Chandragupta-II.
- Pravarasena-II composed '**Setubandh**' in Prakrit.

## 10. Vardhana Dynasty

- After the fall of Gupta dynasty, Pushyabhuti or Pushyabhuti laid the foundation of the Vardhana dynasty at Thaneshwar. (67<sup>th</sup> BPSC, 2022)
- **Prabhakaravardhana** is believed to be the real founder of the dynasty.
- He had two sons, Rajyavardhana, Harshvardhana and a daughter, Rajyashri.
- **Rajyashri** married King **Grahavarman** of the Maukhari dynasty.
- Huns attacked during the reign of Prabhakaravardhana. Prabhakaravardhan's elder son Rajyavardhana went on a campaign against the Huns. Prabhakaravardhana died during this period.
- After Prabhakaravardhana, Rajyavardhana occupied the throne.
- Devagupta, the ruler of Malwa, captured Rajyashri after killing her husband **Grahavarman**.
- Rajyavardhana killed **Devagupta**, but after a few days, Gauda ruler Shashanka, a friend of Devagupta, cheated and killed **Rajyavardhana**.

- Harshvardhana succeeded the throne after Rajyavardhan's death in 606 AD.
- He was also known by another name **Siladitya**.
- **The accession of Harsha to the throne in 606 AD** is considered the beginning of Harsha Samvat. **He ruled until 647 AD.**
- He assumed the title of **Param Maheshwara, Parama-bhattaraka**.
- He shifted his capital from **Thaneshwar to Kannauj**. (UPPCS, 1992)
- Harsh was a worshiper of **Surya, Shiva** and **Buddhism**.
- He secured the **remains** of Mahatma Buddha's teeth from the ruler of Kashmir forcibly.
- **Banabhatta**, the author of 'Harshacharita', was at the court of Harshavardhana. (BPSC, 2005)
- **Nagananda, Priyadarsika** and **Ratnavali** are works by Harshavardhana. (RAS/RTS, 1999)
- He fought against Pulakeshin-II on the banks of Narmada in a quest to expand his empire to the south.
- Emperor Harshavardhana organized **Mahamoksha Parishad** at Prayag every five years.
- Harshvardhana sent an envoy to China in 641 AD.
- Harsha organized two huge religious assemblies at Kannauj and Prayag in 643 AD. (UP UDA/LDA, 2001)
- The Chinese Envoy arrived at the court of Harshavardhana in 643 AD.
- **Hsien Tsang** visited Nalanda University first in 637 AD and again in 642 AD. His main purpose was to collect Buddhist texts. (BPSC, 2015, UPPCS, 1995)
- He attended the sixth Mahamoksha Parishad.
- He wrote a treatise on his journey, known as '**Si-Yu-Ki**'.
- **Hui - Lee** has written a biography of 'Hsien Tsang'.
- Harsha's empire was divided into provinces, called 'Bhukti'. The ruler of Bhukti was called Uparika, Rajasthaniya or Rashtriya.
- Bhukti was divided into Vishayas, headed by 'Vishyapati'. The Vishaya was divided into Pathakas (modern tehsils).
- The smallest unit of administration was 'Grama', whose head was called '**Gramakshapatrik**'.

| Dynasties                       | Place      | Chief rulers                                                  |
|---------------------------------|------------|---------------------------------------------------------------|
| Parvati Gupta                   | Magadha    | Mahasena Gupta                                                |
| Pushyabhuti or Vardhana Dynasty | Thaneshwar | Pushyabhuti, Prabhakarvardhana, Rajyavardhana, Harshavardhana |
| Maitraka Dynasty                | Vallabhi   | Bhatraka, Dharasena IV                                        |
| Maukhari Dynasty                | Kannauj    | Harivarman, Ishanvarman, Sharvavarman                         |
| Gauda or Chandra Dynasty        | Bengal     | Shashanka                                                     |

- Dhruvasena II belongs to the Maitraka dynasty.



## 11. History of South India

### Sangam Age

- 'Sangam' means Council / Seminar / Conference of Tamil Poets, Scholars and Teachers etc. The literature on subjects discussed during these assemblies was called **Sangam Literature**.
- A total of three councils were held.
- The three Sangams were organized under the patronage of the Pandya rulers.
- The first and the third confluences were held at Madurai, the capital of the Pandyas, while the second was held at **Kapadapuram** (Alavai).
- **Agastya Rishi** was the president of the first Sangam.
- **The first Sangam was patronized by 89 Pandya Kings.**
- The second Sangam was held at Alavai or Kapadapuram. Earlier its president was Agastya Rishi, who was later succeeded by Tolakapiyyar.
- The second Sangam was patronized by 59 Pandya rulers.
- The only scripture composed at this Sangam was **'Tolkappiyam'**.
- It was considered to be the oldest grammar book in the Tamil language. (UPPCS, 1997)

| Sangams in South India   |              |                             |                                                              |
|--------------------------|--------------|-----------------------------|--------------------------------------------------------------|
|                          | First Sangam | Second Sangam               | Third Sangam                                                 |
| <b>Centre</b>            | Madurai      | Kapadapuram                 | Northern Madurai (UPPCS 2006)                                |
| <b>President</b>         | Agastya      | Agastya (later Tolkappiyar) | Nakkirar                                                     |
| <b>Number of Members</b> | 549          | 49                          | 49                                                           |
| <b>Text</b>              | Available    | Tolkappiyam                 | Ettutougai (8 Songs), Pattu Pattu (10 Songs) Paripadal, etc. |

- Third Sangam was held in **North Madurai**.
- The President of the third Sangam was **Nakkirar**.
- The third Sangam had the patronage of 49 Pandya kings.
- 5 epics mentioned in the Sangam period are **Silappadikaram**, **Manimekalai**, **Jivaka Chintamani**, **Valayapati** and **Kundalakesi**.

### Dynasties of South India

#### Chera Dynasty

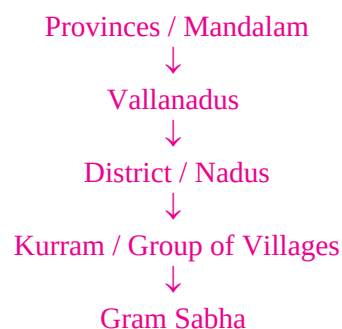
- The Sangam literature outlines the history of the three major kingdoms. These kingdoms belonged to **Chera, Chola and Pandya** dynasties.
- The Chera kingdom was located in present Kerala.
- The **first Chera** ruler during Sangam period was **Udiyangeral**. (UK PCS, 2021)
- The **emblem** of the Cheras was the **bow**.

- The Chera ruler Senguttuvan introduced the practice of the **'Pattini Cult'**.
- The Chera dynasty of South India was known for its maritime trade, the port of Muziris and cultural exchange with different civilizations.

#### Chola Dynasty

- **Karikala** was the prominent among the Chola rulers mentioned in Sangam literature.
- He was called the **'Man with charred leg'**.
- Later, Vijayalaya (846AD–871AD) founded the Chola dynasty on the remains of the Pahlava dynasty. (RAS/RTS, 2016)
- The capital of this dynasty was **Tanjore**. (UP Lower, 2009)
- Vijayalaya assumed the title of 'Narkesari' after taking over Tanjore (Thanjavur).
- Aditya-I established an independent kingdom of the Cholas. He assumed the title of **'Kodandarama'**.
- Paratanka-I, Rajaraja-I, Rajendra-I, Rajendra-II and Kulothunga were the greatest rulers of the Chola dynasty.
- Rajaraja-I created a new province **'Mummudi-chola-mandalam'** after taking over the northern part of Sri Lanka and **Polonnaruwa** was made its capital. (UPPCS, 2014, IAS, 2001)

- The rulers chola dynasty invaded Malaya to free its trade with China. (SSC CHSL, 2023)
- Rajaraja-I built the **Brihadisvara** or **Rajarajeshwara Temple** (Shiva Temple) at Tanjore. (UPPCS, 2008)
- Rajendra-I defeated the ruler of Bengal, Mahipala and assumed the title of **'Gangaikondachola'**.
- The 'Chola dynasty' reached its peak during the reign of Rajendra Chola I, who was known for his naval expeditions and extensive trade with south-east Asia.
- To commemorate the Bengal conquest, he established the new capital at **Gangaikondacholapuram** and built a pond named **Cholagangam** near it. (UPPCS, 2008, 2016)
- Rajendra-III was the last ruler of this dynasty.
- The higher officials of the Chola administration were called **'Peruntaram'** and the lower officials **Siruntaram**.
- The entire Chola empire was divided into following provinces-



- “**Ur**” was the assembly of the common people.
  - The Sabha or Mahasabha was basically the Agrahara (assembly of Brahmin settlements) assembly of villages. Its members were called **Perumakkal**.
  - The assembly of merchants was called ‘**Nagaram**’.
  - The tax-free land donated to Brahmins was called ‘**Chaturvedi Mangalam**’ and the land donated in general was called ‘**Brahmadeya**’.
  - The most commonly mentioned tax in the inscriptions of the Chola dynasty that ruled Tamil Nadu is the ‘Vetti’, which was collected in the form of forced labour rather than cash.
  - Gold coins were called **Kasu**.
  - **Kamban** composed the ‘Tamil Ramayana’.
- (UP UDA/LDA 2010)
- **Kamban**, **Kuttana** and **Pulgalendi** were the ‘**Triratnas**’ of Tamil literature.
  - Nataraja’s statue is said to be a cultural essence of Chola art.
- (UPPCS, 2006)
- The important port in the Chola period was Kaveripattinam.
  - The worshippers of Vishnu were called **Alvars** and those of Shiva are **Nayanars**.

#### The Pandya Dynasty

- The earliest known Pandya ruler was **Palyagasalai Mudukudumi**.
- Nedunjeliyan was also the famous ruler of this dynasty. He was a follower of Brahmana religion.
- The official **symbol** of the Pandyas was a **fish**.
- The first capital of the Pandyas was **Korkai** which was later shifted to **Madurai**.

#### Rashtrakuta Dynasty

- King **Dantidurga** defeated the Chalukya ruler Kirtivarman and established the Rashtrakuta dynasty to rule over the former Chalukya kingdom.
- (IAS, 2006)
- He made **Manyakheta** his capital (present - Malkhed, near Kalaburagi).
  - The Kailash Mandir (Guha Temple) of Ellora was built by Krishna I.
- (UK PCS, 2021)
- **Dhruva Dharavarsha** was the first ruler of the Rashtrakuta dynasty who took part in the tripartite conflict to bring Kannauj under his authority.
  - Amoghavarsha, an adherent to Jain religion, composed ‘**Kavirajamarga**’ in the Kannada language.
  - Amoghavarsha provided shelter to Jinasena, the author of Adi Purana and Mahaviracharya, the author of **Ganitasarasangraha**.
  - The Rashtrakuta dynasty reached its peak under the rule of Amoghavarsha I, who was known for his military conquests and patronage of art and literature.
  - **Almasudi**, an Arab, came to India during the reign of Indra-III.

- The **last great ruler** of the Rashtrakuta dynasty was **Krishna-III**.
  - **Sri Ponna**, the author of “**Shanti Purana**” and the leading poet of Kannada language was in the court of Krishna III.
  - In the Mid-eighth Century, Dantidurga, a Rashtrakuta Chief, overthrew the Chalukya overlord in a ritual literally called Haryana Garbha.
  - The temples in Ellora and Elephanta Caves were built during the reign of the Rashtrakutas.
- (MPPCS, 2021)
- Ellora has 34 rock-cut caves. Among them, the first twelve, are Buddhist caves the next numbering 17 are Hindus caves, and the last five are caves belonging to Jainism.
  - The Jain Temple at Pattadakal was built by the Rashtrakuta dynasty.
- (SSC MTS, 2023)
- Rashtrakutas allowed Muslim traders to settle in their kingdom and propagate Islam.

#### Chalukya Dynasty (Kalyani)

- After the fall of Rashtrakutas, **Tailapa-II** established the Chalukya dynasty of Kalyani (973-997 AD).
  - **Tailapa-II** made Manyakheta his capital.
  - Someshwara-I shifted the capital to Kalyani
  - The most powerful ruler of the Chalukya dynasty of Kalyani was **Vikramaditya-VI**.
  - The Virupaksha Temple of Hampi is of Vijaynagara architectural style. It represents the developed stage of Dravidian architecture.
- (VDO, 2023)
- Bilhana the author of **Vikramankadevacharita** and Vigyaneshwara author of **Mitakhshara Samhita**, resided in the court of Vikramaditya-IV.
  - He established the Chalukya Vikram Samvat at the time of his coronation.
  - The last ruler of the Chalukya dynasty of Kalyani was **Someshwar-IV**, son of Tailapa-III.
  - **Varaha** was the royal symbol of Chalukyas.
  - **Aihole** was called the ‘**City of Temples**’.
  - The Bhakti Saint Basavanna of South India was initially a Jain and was a minister in the Court of a Chalukya King in the 12<sup>th</sup> Century.

#### Chalukya Dynasty (Vatapi)

- **Pulakeshin-I** established the Chalukya Dynasty of Vatapi by making **Badami or Vatapi** (near Bijapur) its capital.
- (UPPCS, 1991)
- The most powerful ruler of this dynasty was **Pulakeshin-II**.
- (UPPCS, 1991)
- **Aihole inscription** shows that Pulakeshin-II defeated **Harshavardhana** on the bank of **Narmada**.
- (UPPCS, 2016)
- Pulakeshin-II defeated hundreds of kings and assumed the title ‘**Parameshvara**’.

- Pahlava ruler Narasimhavarman-I defeated Pulakeshin-II and assumed the title of '**Vatapikonda**'.
- Aihole inscription is related to Pulakeshin-II.
- The languages of **Aihole inscriptions are Sanskrit and Brahmi**. These were written by **Ravi Kirti**.
- Deccan was invaded during the reign of Vikramaditya-II.
- Vikramaditya's first wife Lokamahadevi built the **Virupaksha Shiva Temple** and the **Trilokeshwar Temple** was built by the second wife Trilokadevi at Pattadakal.
- Kirtivarman-II, the last ruler of this dynasty, was defeated by his feudal lord Dantidurga, who established the Rashtrakuta dynasty.

#### Chalukya Dynasty (Vengi)

- The founder of the Chalukya dynasty of Vengi was Vishnuvardhana.
- He made Vengi (Andhra Pradesh) its capital.
- Vijayaditya-II was the most powerful ruler of this dynasty.

#### Pahlava Dynasty

- **Simhavishnu** (575-600 AD) established the Pallava dynasty by making **Kanchi** its capital.
- Simhavishnu was a follower of Vaishnava cult.
- The author of **Kirtarjuniya** and Sanskrit poet **Bharavi** was in the court of Simhavishnu.
- The principal rulers of the Pahlava dynasty were Mahendravarman-I (600-630 AD), Narasimha varman-1 (630-668 AD), Mahendravarman-II (668-670 AD), Parameshwaravarman-1 (670-700 AD), Narasimhavarman-II (700-720 AD), Parameshwaravarman-II (720-731 AD) Nandivarman-II (731-795 AD).
- Mahendra varman-I composed '**Mattavilas Prahasana**'.  
(UP UDA/LDA 2010)
- **Narasimhavarman-I** assumed the title of **Vatapikonda**.
- Nandivarman-II built the **Mukteshwar** and **Vaikuntha Perumala temples** at Kanchi.
- The ruler of the Pahlava dynasty at the time of the Arab invasion was Narasimhavarman-II.
- **Narasimhavarman-I** built the mandapa and monolithic temples by cutting the mountains, which were called **chariot temples**.  
(UPPCS, 2015)
- All the temples of this style exist in Mamallapuram (Mahabalipuram). This style of temple building is also called Mamallapuram style of architecture.
- Among eight chariot temples in this style, Draupadi Ratha, Dharmaraj Ratha, Valyank Utterath, Arjun Ratha, Wakul-Sahdev Rath, Ganesh Ratha, Pidari Ratha and Bhim Ratha. Among them, **(Dharmaraja Yudhishtira's chariot is the largest and Draupadi's the smallest)**.  
(UPPCS, 2011)
- These chariot temples are also known as **Saptapagoda** (seven pagodas).

- Hiuen Tsang visited Kachi, the capital of Pallavas, during the reign of Narasimhavarman I.
- **Narasimhavarman-II** built the **Kailashnatha temple** at Kanchi.
- Gopuram or Temple entrance is characteristic of South Indian temple architecture.
- The author of '**Dasakumaracharita**' was **Dandin** who lived at the court of Narasimhavarman-II.  
(UP Lower, 2008)
- **Aparajitavarman** (879-897 AD) was the last ruler of the Pahlava dynasty.

#### Yadava Dynasty

- During the weak reign of the Chalukya King Someshwara-IV, his Yadava Feudal lord **Bhillama** (1187-1191 AD) was the first ambitious person to establish his independence, and form the Yadava dynasty.
- The capital of the Yadava dynasty was **Devagiri**.
- Simhana was the most powerful king of this dynasty.
- The **last king** of this dynasty was **Ramachandra**, who surrendered to Alauddin's general Malik Kafur.

#### Hoysala Dynasty

- The feudatory Vishnuvardhana of Chalukya declared independence and established the Hoysala dynasty.
- The capital of the Hoysala dynasty was located at **Dwarasamudra** (modern Halebidu).  
(UP RO/ARO 2014)
- **Chennakeshava temple** at Belur was built by Vishnuvardhana.
- The Hoysaleswara Temple was built with black polished stone by the Hoysala king Vishnu Vardhana in 1116 AD to commemorate the victory over the Cholas.
- The last ruler of the Hoysala dynasty, Ballala-III, accepted the suzerainty of Alauddin Khalji after defeat by paying him an annual tax.

#### Kadamba Dynasty

- **Mayurasharma**, a feud of the Pallava dynasty declared his independence and established the Kadamba dynasty.
- The capital of the Kadamba rulers was **Banavasi (Vyjayanti)**.  
(UPPCS, 2005)
- Mayurasharma is said to have performed the rituals of the 18 Ashwamedha Yajnas.

#### Western Ganga Dynasty

- Western Ganga dynasty was contemporary to Kadamba and Pahlava dynasties.
- The first ruler of this dynasty is mentioned in the records as **Konkanivarma**.
- Western Ganga dynasty was founded by Konkanivarma.
- Earlier, the capital of the Ganga dynasty was Kuvalal (Kolar), later Talakadu became the new capital of this dynasty.

- The principal ruler of this dynasty was **Sripurusha**.
- The famous black pagoda temple at Konark is of Kalinga architecture.
- The Chola ruler Rajaraja-I ended the Ganga dynasty and merged it with his empire in 1004 AD.

📌 **Note :** Ganga dynasty was divided into two parts. The western Gangas ruled in Mysore state (Ganga vadi) and the eastern Gangas ruled in Odisha.

## 12. Early-Medieval Period

### Gurjara-Pratihara Dynasty

- The founder of Gurjara-Pratihara dynasty was **Nagabhata-I**. (UPPCS, 2003)
- Vatsraja is said to be the real founder of Gurjara-Pratihara empire.
- **Mihira Bhoja-I** was the most powerful ruler of this dynasty. (UPGIC, 2010)
- **Mihira Bhoja-I** assumed titles of **Adivaraha** and **Prabhas**. (UPRO/ARO, 2017)
- Famous scholar **Rajashekhara** resided at the court of Mahendrapala-I. (RAS/RTS 2013)
- Rajashekhara composed famous texts such as **Karpuramanjari**, **Kavyamimamsa**, **Viddhasalabhanjika**, **Balaramayana**, **Bhuvankosha** and **Harvilas**.

### Gahadavala Dynasty

- The Gahadavala dynasty was founded by **Chandradeva**.
- **Govindchandra** was the most capable and powerful ruler of this dynasty.
- Govindchandra's minister **Lakshmidhar** wrote a treatise called '**Krtyakalpataru**'.
- **Muhammad Ghori** defeated **Jaichand** in the **Battle of Chandawar (1194 AD)**.

### Chahamana Dynasty

- The founder of Chahamana Dynasty was **Vasudeva**.
- Ajayaraja-I established the city of Ajmer and made it his capital.
- **Vigraharaja-IV** was the most powerful ruler of the Chauhan dynasty.
- The play named **Harikeli Nataka** was composed by **Vigraharaja-IV**.
- Somdeva wrote the book titled '**Lalitvighararaj**'.
- Prithviraj Chauhan is also known as Prithviraj-III'. (UPPCS, 2010)

- The famous poet **Chand Bardai** resided at the court of the king of Prithviraj Chauhan.
- The epic called '**Prithviraj Raso**' was composed by **Chand Bardai**. (43<sup>rd</sup> BPSC, 1999)
- **Prithviraj Chauhan** defeated **Muhammad Ghori** in the **First Battle of Tarain (1191 AD)**.

- **Muhammad Ghori** defeated **Prithviraj Chauhan** in the **Second Battle of Tarain (1192 AD)**.

### Paramara Dynasty of Malwa

- Paramara dynasty was founded in the tenth century AD by Upendra or Krishnaraja.
- Dhara was the capital of the Paramara dynasty.
- **Siyaka II** established an independent Paramara dynasty.
- **Bhoja** was the most important ruler of the Paramara dynasty.
- He built the **Saraswati temple** at the capital Dhara.
- He composed texts like **Sarasvati-Kanthabharana**, **Shringara-Prakasha**, **Prakrit Vyakarana**, **Kurma-Sataka**, **Yukti-Kalptaru** and **Samarangana Sutradhara**.
- **Yuktikalpataru** and **Samarangana Sutradhara** contain their subject matter as **Vastushastra**.
- **Bhojtal**, a lake situated in Bhopal, was built by Bhoja.
- The **Tribhuvan Narayan temple** at Chittor was built by Bhoja. (MPPCS, 2019)

### Chandela Dynasty

- The ancient name of Bundelkhand was **Jejakabhukti**. (UPPCS, 2008)
- Chandela dynasty was founded by **Nannuka** in 831 AD.
- King Dhanga shifted the capital of the Chandelas from Kalinjar to **Khajuraho**.
- **Vidyadhara** was the most powerful of the Chandela rulers.
- **Vidyadhara** was the only Indian king who successfully resisted the ambitions of Mahmud Ghaznavi. (MPPCS, 2021)
- The **temples of Khajuraho** were built by the Chandela rulers. (MPPCS, 1993)
- '**Kandariya Mahadev Temple**' is the most famous among the temples of Khajuraho. (UPPCS 1991)
- Among other temples at Khajuraho are Jagadambika temple, Chitragupta temple, Vishwanath temple and Parshwanath temple.

### Kalachuri-Chedi Dynasty of Tripuri

- **Kokalla I** was the founder of the Kalachuri dynasty.
- The capital of the Kalachuri-Chedi dynasty was **Tripuri**.
- The famous '**Chausath Yogini temple**' of Bhedaghat (Jabalpur) was constructed during the rule of **Yuvarajadeva I**.
- Among the Rajput kings, Gangeyadeva introduced gold coins.
- The Karnameru Shiva temple at Banaras was built by Kalachuri ruler Karna (Lakshmikarna).

### Chalukya or Solanki Dynasty of Gujarat

- **Mularaja-I** founded the Chalukya dynasty of Gujarat.
- The capital of this dynasty was **Anhilwara**.
- **Mahmud Ghaznavi** attacked **Somnath Temple** during the reign of **Bhima-I**.
- **Vimal Shah**, Minister of Bhima-I built the famous Jain temple at **Dilwara on Mount Abu**.



- Jayachandra Suri composed **Kumarapala Charita**.
- Bhima II was defeated by Muhammad Ghori in 1178 AD.
- The rulers of the Chalukya dynasty of Gujarat were followers of Jainism and worked for the promotion of the religion.

### 13. The Bordering States

#### State of Kashmir

- The history of the Hindu state of Kashmir is known from the **Rajatarangini**, written by Kalhana.
- Kashmir was ruled by Karkota, Utpala and Lohara dynasties.
- In the seventh century AD, one **Durlabhvardana** founded the **Karkota dynasty** in Kashmir.
- Durlabhvardan's son and successor, **Durlabhaka**, founded a city called **Pratappur**.
- **Lalitaditya Muktapida** was the most powerful among the rulers of the Karkota dynasty.
- The famous **Martand temple of Surya** in Kashmir was built by **Lalitaditya Muktapida**.
- **Avantivarman** (855-883 or 884 AD) was the first ruler of the Utpala dynasty.
- He founded a city called **Avantipur**.
- He built canals for irrigation in Avantipur.
- **Queen Didda** of the Utpala dynasty was an extremely ambitious ruler.
- She was a princess of the Lohara dynasty. She married Ksemagupta, the ruler of the Utpala dynasty.
- The founder of the **Lohara dynasty** was **Sangramraja**.
- Kalhana was a court poet of Harsha, the ruler of Lohara dynasty.

#### Pala Dynasty of Bengal

- The founder of Pala dynasty in Bengal was **Gopala** (750-770 AD). (UPPCS, 2015)
- Gopala built viharas in Nalanda.
- Dharmapala established **Vikramshila** and **Somapuri viharas**. (UPPCS, 1999, 2005)
- Famous Buddhist writer **Haribhadra** resided at Dharmapala's court.
- The poet Sodhdhala of Gujrat calls Dharmapala an Uttarapathasvamin ('Lord of the North') for his suzerainty over North India.
- At the request of Balaputradeva, king Shailendra of Java Devapala donated five villages to build a Buddhist vihara at Nalanda.
- The rulers of the Pala dynasty were **followers of Buddhism**.
- The Siddheshwar Mahadev Temple in Bengal reflects the architecture of the Pala dynasty.
- Vikramashila Vihara was **demolished** by the Muslim invader **Bakhtiyar Khalji**.

- **Sandhyakar Nandi** composed a historical book, a collection of poems, titled '**Ramcharitram**'.
- There was a tripartite conflict between the Gurjara pratiharas in North India, the palas in eastern India and the Rashtrakutas in South India.
- The style of sculpture prevalent in Bengal during the period between the ninth and eleventh centuries is called the Pala Style.

#### Sena Dynasty

- The first important ruler of the Sena dynasty was **Vijaya Sena**.
- **Ballala Sena** wrote the texts titled '**Dan Sagar**' and '**Adbhut Sagar**'.
- Jayadeva, the author of Gita Govinda, Dhoyin, the author of Pavanduta, and Halayudha the author of Brahmanasaras, resided at the court of Lakshmanasena. (UPPCS, 1999)
- The capital of the Sena dynasty was Nadiya.

#### Varman Dynasty of Kamarupa

- **Pushyavarman** founded the Varman dynasty of Kamarupa.
- The capital of Varman dynasty was **Pragjyotishpura**.
- Bhaskaravarman was a contemporary to Harsha.

## B

## Medieval India

### 1. Invasion of Arabs

- The first successful invasion on India by Arabs was led by '**Muhammad Bin Qasim**'.
- He invaded Sindh in 712 AD. (UPPCS, 1991)
- Then the Hindu **king Dahir** was ruling Sindh.
- Dahir was defeated in this battle.
- After the victory over Sindh, Muhammad Bin Qasim was the first who **imposed religious tax jizya**.
- Important information about the Arab invasion is gained from Futul-al-Baladan and Chachnama texts.
- The main objective of this invasion by the Arabs primarily was to loot wealth and propagate Islam.
- The most important impact of the Arab invasion was on Indian culture.
- Arabs were inspired by Indian's knowledge of medicine, philosophy, science, mathematics and administration.

#### Mahmud Ghaznavi (998 - 1030 AD)

- A person named **Alaptagin** established an independent Ottoman empire in Ghazni in 962 AD. (UP Lower, 2015)
- Alaptagin's slave and son-in-law, **Subuktagin** took over the throne in 977 AD.
- After the death of Subuktagin, his son Mahmud Ghaznavi became the ruler at the age of 27 in 998 AD.

✍ **Note :** Subuktagin was given the title of (Al-Hajeb-al-Ajal) **Most Noble Commander**.

- The Khalifa of Baghdad conferred the titles of '**Yamin-ud-Daula**' (the right hand of the empire) and 'Amin-ul-Millat' (Guardian of the Faith) to Mahmud Ghaznavi.
- Mahmud invaded India 17 times, but there is no credible evidence of all these attacks.
- Mahmud started invading India in 999 AD.
- Mahmud Ghaznavi attacked the Hindu Shahi army of Jayapala in 1001 AD, in which **Jaypala was defeated**.
- The main motive behind Mahmud Ghaznavi's invasion on India was his greed for money.
- Mahmud Ghaznavi was known in India as "**robber and idol breaker**".
- Major expeditions of **Mahmud Ghaznavi** were directed at Thaneshwar in 1014 AD, Mathura in 1018 AD and Somnath in 1026 AD.
- His most fierce attack was on Somnath Temple in Gujarat, during the reign of **Bhima I**.
- The last invasion of Mahmud Ghaznavi was on Jats in 1027 AD.
- **Mahmud Ghaznavi died in 1030 AD**.
- Scholars like Alberuni, Firdausi, Utbi and Baihaki resided at the court of Mahmud Ghaznavi.
- Alberuni was also known as 'Abu Rahyan'. He was born at Khwarizmi (present Khiva) in 973 AD.
- Alberuni came to India at the time of Mahmud Ghaznavi's invasion. His book 'Kitab - ul Hind' is an important source to know the history of that time. **(UK PCS, 2010, RAS/RTS 2010)**

### **Muhammad Ghorī (1175 AD - 1206 AD)**

- Muhammad Ghorī was the ruler of the Ghor province under Ghazni. He belonged to the **Ghurid dynasty**.
- The first invasion of **Muhammad Ghorī** occurred in 1175. He was born in Multan. The Muslim rulers of the Karmathi caste were then ruling Multan.
- In 1178, Ghorī invaded Gujarat, but Bhim II defeated Ghorī near Mount Abu under the able leadership of his worthy and courageous mother **Maa Naikidevi**. **(UPPCS, 1990)**
- Punjab, then ruled by the Ghazni dynasty, now passed to **Ghorī**.

#### **Muhammad Ghorī's Major Battles**

| Battles          | Years   | Opposition         | Results                              |
|------------------|---------|--------------------|--------------------------------------|
| Tarain Battle I  | 1191 AD | Prithviraj Chauhan | Victory of Prithviraj Chauhan        |
| Tarain Battle II | 1192 AD | Prithviraj Chauhan | Ghorī's Victory                      |
| Chandawar Battle | 1194 AD | Jaichand           | Ghorī's Victory <b>(UPPCS, 2008)</b> |

- On one side of the coins of Muhammad Ghorī's reign the figure of Kalma was inscribed while on the other side, the figure of Lakshmi was inscribed. **(UK PCS, 2006)**

- Muhammad Ghorī went back to Ghazni entrusted the conquered Indian territories in the charge of his slave commander Qutbuddin.

### **2. Sultanate Period (1206 AD - 1526 AD)**

- After Ghorī's death, Qutbuddin Aybak laid the foundation of the Ghulam or Mamluk dynasty in 1206 AD. **(UPPCS, 1990)**
- His capital was **Lahore**. **(UPPCS, 1990)**
- Qutbuddin Aybak was also known as the founder of the Turkish State of India. He did not assume the title of Sultan while seated on the throne.
- Aybak did not harangue his name nor did he issue coins in his name. Later, Ghorī's successor Mahmud accepted him as Sultan.
- Qutbuddin Aybak was called 'Lakh Bakhsh' (one who gives in lakhs) and 'Kurankhwan'. **(J PCS, 2003)**
- Nalanda university building was demolished by Bakhtiyar Khalji, commander of Muhammad Gori. **(BPSC, 2016)**
- Aybak built mosques called 'Quwwat-al-Islam' and 'Adhai Din ka Jhopra' in Ajmer. **(BPSC, 2015 JPCS, 2021)**

✎ **Note :** Quwwat-al-Islam Mosque was built on the remains of 27 Hindu and Jain temples destroyed by Muslim invaders. 'Adhai Din ka Jhopra' was built on a site where earlier a Sanskrit school and a temple, built by a Chauhan ruler Vigraharaja or Bisaldev, stood.

- Qutbuddin Aybak laid the foundation of Qutb Minar, later which was completed by Iltutmish. **(67<sup>th</sup> BPSC, 2022)**
- He died in 1210 when he fell from his horse while playing Chaugan (a game similar to modern Polo). He was buried in Lahore. **(IAS, 2003)**
- Qutbuddin Aybak was succeeded by Aram Shah who ruled for only a brief period of eight months.

#### **Iltutmish (1211-36 AD)**

- Iltutmish sat on the throne of the Sultanate in 1211 after killing Aram Shah.
- Qutubuddin's slave and son-in-law **Iltutmish Ilbari** was a Turk.
- Iltutmish was the governor of Badaun at the time of Qutubuddin Aybak's death.
- Iltutmish is considered the de **facto founder** of the **Delhi Sultanate**.
- He established **Delhi** as the **capital** of the Sultanate. **(UPPCS, 2012)**
- Muhammad Ghorī freed him from slavery on account of his exceptional abilities displayed during Khokhar Rebellion in 1206.
- The Khalifa of Baghdad conferred the title of '**Sultan-e-Azam**' on Iltutmish and gave statutory approval to his rule in 1229.

- Iltutmish defeated **Yildiz** in the third battle of Tarain (1215–16 AD) at Kalinjar in 1221, at Ranthambore in 1226 and in 1227 conquered Mandore.
- He kept a troop of his loyal slaves called '**Turkan - e - Chahalgani**' or '**Chalisa**'.
- He issued two important coins, silver '**Tanka**' (175 grains) and copper '**Jital**' during the Sultanate period and also started the practice of inscribing the names on coins.
- During the reign of Iltutmish, Mongol leader Genghis Khan reached the northwestern border of India chasing Mangbarni, the ruler of Khwarizm. (UPPCS, 1993)
- Iltutmish is credited with the introduction of the '**Iqta System**' in India. (UPPCS 2010)
- The Iqtadari system of the Delhi Sultanate had an influence on the Bahmani and Vijayanagara empires.
- Iltutmish's tomb was built in 1236 AD.
- He died in 1236.
- After the death of Iltutmish, the Turkish nobles installed his son **Ruknuddin Firuz Shah**.
- Ruknuddin was overthrown by the masses and Raziyya was declared Sultan.

#### **Raziyya Sultan (1236–40 AD)**

- Raziyya was the first Muslim woman ruler of medieval India. (UPPCS, 2004)
- After discarding the **purdah system** by Raziyya, she wore the same clothes, a coat (Kuba) and hat (Kulah), as the men and conducted the task of governance effectively.
- According to Minhaj-i-Siraj (author of Tabaqat-e-Nasiri), Raziyya ruled for 3 years 6 months 6 days.
- She removed Nizamul Mulk Junaidi from the post of Wazir and granted the rank of '**Amir-i-Akhur**' to **Habsi Sardar Malik Yakut** to break **Turkish domination**.
- Tabarhind (Bhatinda) rebelled against Raziyya on instigation by Ikhtiyaruddin Altunia. Raziyya married Altunia and tried to suppress the rebellion of the Turkish chieftains, but she failed.
- Raziyya was murdered in 1240 in Kaithal by bandits while returning from the forest.
- After the death of Raziyya, Bahram Shah sat on the throne in 1240, but he was also killed in 1242.
- Allauddin Masud Shah became the Sultan of Delhi (1242–1246 AD) after the assassination of Bahram Shah.
- Alauddin Masud Shah was overthrown by a conspiracy hatched by Balban and Nasiruddin Mahmud was declared the Sultan in 1246 AD.
- Nasiruddin Mahmud was a ruler of humble origin.
- Minhaj-i-Siraj dedicated his book '**Tabaqat-i-Nasiri**' to him.
- Balban married his daughter to Sultan Nasiruddin in 1249.

- Nasiruddin conferred the title of 'Ulugh Khan' and 'Naib -e- Mumlikat' on Balban.
- On the death of Nasiruddin Mahmud, Balban declared Sultan himself and succeeded in 1266.

#### **Ghiyasuddin Balban (1266-1286 AD)**

- Balban's (1266-1287) name was Ghiyasuddin Balban. He was also a slave to Iltutmish and a member of Chalisa. (Chattisgarh PCS, 2004)
- Balban destroyed **Turkan-i-Chahalgani**.
- Balban ascended the throne of Delhi in 1266 by the name of Ghiyasuddin Balban. He succeeded in protecting Delhi from the Mongols.
- He adopted a policy of '**blood and iron**' for the prestige of the Sultan. (UPPCS, 2009)
- He thought the king to be the representative of God on earth, '**Naib-i-Khudai**'.
- He believed that Sultan is Zil-i-Allah or Zil-i-Ilahi '**meaning**' 'reflection of God'. (IAS, 1997)
- He established a military department called 'Diwan-i-Arz' to counter the Mongols.
- He introduced the practice of '**Sijda**' and '**Paibos**' which were originally picked from Iranian traditions.
- He started the practice of celebrating the Iranian (Persian) festival of '**Navroz**' every year in his court. (IAS, 1993)
- Tughril Beg rebelled against Sultan Balban of Delhi and declared himself the independent ruler of Bengal in around 1279 AD.
- Famous poets Amir Khusrau and Amir Hasan started their literary careers during Prince Muhammad.

✎ **Note :** Amir Khusro was called '**Parrot of India**' or '**Tuti-e-Hind**' and Amir Hasan-e-Dehalavi, 'Saadi of India'. (UPPCS, 2013)

- After the death of Balban, his grandson Kayqubad succeeded him. Thereafter, **Kayumars** became the ruler for a short time.
- Ariz-i-Mamalik (Jalal-ud-din) captured the throne by killing Kayumars.
- Thus, the 'Slave dynasty' came to an end in Delhi.

### **3. Khalji Dynasty (1290-1320 AD)**

- After the fall of the Slave dynasty in 1290, Jalaluddin Firuz Khalji founded the **Khalji** dynasty.
- Sultan Kayqubad assumed the title of '**Shaista Khan**' and '**Ariz-i-Mamalik**' i.e. the post of Army Chief.
- Jalaluddin Khalji made '**Kilokhari**', near Delhi, his capital.
- Jalaluddin adopted the ideal of liberal autocracy.
- He formed a new department, Diwan-i-Waqt to look after the income and expenditure matters.

- His rule saw Delhi's notable saint Sidi Maula crushed by an elephant.
- He was assassinated by his nephew and son-in-law, Alauddin Khalji at Manikpur, in 1296.

#### Alauddin Khalji (1296-1316 AD)

- Alauddin Khalji (Aligurshap) became the ruler after Jalaluddin's assassination. Alauddin Khalji was the first Sultan of Delhi who brought religion under state control.
- The Sultan of Delhi Alauddin Khalji was appointed master of ceremonies before becoming Sultan.
- He had his name inscribed on coins as '**Second Alexander**' (Sikandar-e-Sani)'. (UP Lower, 2008)
- He was the first ruler of Delhi Sultanate who allotted posts on merit.
- The ruler of Devagiri was Ramachandra Deva at the time of Alauddin's invasion.
- The first sultan of the Delhi Sultanate to launch a military campaign in South India was Alauddin Khalji. (SSC, 2023)
- Alauddin conferred the title of **Raya Rayan** to Ramachandra Deva.
- Malik Kafur was a slave commander of Alauddin Khalji who led his army in the battle against Ramachandra of Devagiri.
- He captured Malik Kafur during his Gujarat conquest.
- Malik Kafur was also called '**Hazar Dinari**'. (UK PCS, 2021)
- The Chief Officer of the Intelligence Department was '**Barid-e-Mumalik**'. There were many 'barids' (Sandeshvahak or Harkara) under him.
- Alauddin established a new department '**Diwan-e-Mustakhraj**' to eliminate corruption and clear arrears of revenues.
- Alauddin built the Siri Fort, Thousand Pillar Palace and Alai Darwaza.
- He kept a large and permanent army at the centre, who was paid in cash.
- Khalji introduced the practice of '**Dagh**' (branding of horses) and '**Huliya**' (descriptive roles of soldiers).
- He was the first Sultan who paid attention to **measurement (Paimaish)** of the cultivable land, known as **Zabita**.
- Alauddin Khalji took 50% of the produce as agrarian tax (Kharaj). (Jharkhand PCS, 2013)
- He increased the Sultan's share of the **plundered money (Khums)** to 4/5 from 1/5.
- **Ibn Battuta** authored **Rihla**, **Isami** wrote **Futuh-us-Salatin** and Amir **Khusrau** completed his work **Khazain-ul-Futuh** during Kahaji's reign.
- Amir Khusrau was the court poet to Alauddin Khalji.

(UPPCS, 1995)

- He also introduced the '**Public Distribution System**'.
- In India, Amir Khusro of the Sultanate period popularized Qawwali, a genre of music whose name is derived from the Arabic word '**Qual**'.
- The incident of Jauhar was first mentioned in Persian by Amir Khusro.
- The two new taxes levied by Alauddin Khalji were 1. **Ghari (House) Tax** - which was levied on houses and huts. 2. **Charai (Grazing) Tax** - which was imposed on milch animals. (UPPCS, 2011)

#### Major Taxes during Sultanate Period

| Tax    | Type of Taxes                               |
|--------|---------------------------------------------|
| Jizya  | Tax received from non-Muslims               |
| Zakat  | Religious Tax charged from Muslims          |
| Khums  | Loot money from war                         |
| Kharaj | Tax to be collected from non-Muslim farmers |

- This led to the appointment of an official named 'Parwana - Navis' who issued a permit for goods.
- During this time, there were two types of markets - 1. **Mandi** (food market), 2. **Sarai-e-Adal** (Manufactured goods, garments, herbs, etc.).
- To control the market, Alauddin created a new post called **Diwan-e-Riyasat** (the controller of the entire market system), **Shehna-e-Mandi** (market superintendent).
- Alauddin Khalji died in 1316.
- During the reign of Alauddin Khalji, the textile/cloth market was known as Sarai-i-Adl.
- Mubarak Khalji, the son of Alauddin Khalji, succeeded him on the throne of Delhi in 1316.
- He also used to come to the court wearing women's clothes on occasions.
- Qutbuddin Mubarak Shah Khalji declared himself a Khalifa and held the titles like '**Al Imam**', '**Ul Imam**', '**Khilafat Ullah**', etc. (UP RO/ARO, 2016)
- Qutbuddin Mubarak Shah Khalji was succeeded by Nasiruddin Khusrau Shah (Khusrav Khan), the last ruler of the Khalji dynasty.

#### 4. Tughluq Dynasty (1320-1412 AD.)

- Ghiyasuddin Tughluq or Ghazi Malik was the first ruler of the Tughluq dynasty. (UPPCS, 1999)
- He ruled from 1320-1325.
- He restored the old rights of Khutas and Muqaddans.
- He constructed a new city called **Tughluqabad**.
- Relations between Sultan Ghiyasuddin and Nizamuddin Auliya became bitter. Aulia had said that 'Dilli hanuz dur ast' (Delhi is yet far away).



- He built **canals** for irrigation. He was probably the first ruler to have built canals. (UPPCS, 2017)
  - He was the first Sultan of Delhi who assumed the title of '**Ghazi**'. (UPPCS, 1996)
- Muhammad bin Tughluq (1325–1351 AD)**
- **Juna Khan** or **Muhammad bin Tughluq** (1325-1351 AD) became Sultan after the death of Ghiyasuddin. During his time, the Tughluq empire was divided into 23 administrative provinces.
  - He replaced silver coins with copper token coins.
  - A department called '**Diwan - i - Amir - Kohi**' which looked after agriculture, was established by Muhammad bin Tughluq. (UPPCS, 2004)
  - Ibn Battuta, the Moroccan traveller, came to Delhi in 1333 during the reign of Muhammad bin Tughluq. (UPPCS, 1994, 2011)
  - Muhammad bin Tughluq appointed Qazi, the chief of Delhi. He served for eight years on this post.
  - Muhammad Tughlaq appointed Aziz Khummar, a wine distiller, to a high administrative post.
  - Ibn Battuta has written his travelogue in Arabic in a book titled '**Kitab-ul-Rihla**'.
  - Muhammad bin Tughluq was a learned ruler who was interested in Arabic, Persian languages besides astronomy, medical science, dialectics and philosophy.
  - He patronised many learned saints like Jain Dharmacharya Jina Prabhusuri.
  - Muhammad bin Tughluq often participated in the festivals of Hindus, particularly Holi. (UPPCS, 2004)
  - Major reforms by Muhammad bin Tughluq were **Doab tax increase, Change of capital** (Delhi to Devgiri), **Token currency** and campaigns of **Khurasan** and **Karachi**.
  - During the reign of Muhammad bin Tughluq, Harihara and Bukka brothers established an independent Vijayanagar Kingdom in the south in 1336.
  - Muhammad bin Tughluq died in 1351 AD.
  - Badauni writes on the demise of Sultan 'The King was freed from his people and they from their King'. (MPPCS, 1997, IAS 1999)
- Firuz Shah Tughluq (1351-1388 AD)**
- After the death of Muhammad Tughluq, his cousin 'Firuz Shah Tughluq' became (1351-1388) the Sultan in 1351.

✎ **Note :** Tughluq dynasty came to an end after Nasiruddin Mahmud's death in 1412. Daulat Khan Lodi became Sultan with the consent of the chieftains in 1413 AD., but Khizr Khan invaded Delhi, defeated Daulat Khan and imprisoned him in the fort of Hisar establishing a new dynasty '**Sayyid dynasty**' and ascend the throne of Delhi in 1414.

## 5. Sayyid Dynasty (1414-1451 AD)

- The founder of the Sayyid Dynasty, **Khizr Khan**, supported to the Mongol invader Timur.
  - Khizr Khan was appointed as the Governor of Northwestern frontier province by Timur (Lahore, Multan and Deepalpur).
  - Khizr Khan did not assume the title of Sultan. He retained the title of **Rayat-e-Ala**.
  - After Khizr Khan, Mubarak Shah (1421-1434) ascended the throne. He patronised '**Yahya bin Sirhindi**', the author of '**Tarikh-i-Mubarak Shahi**'.
  - Alauddin Alam Shah (1443–1451) was the last ruler of this dynasty.
- Firuz Shah Tughluq constructed new towns called **Hisar, Fatehabad, Firuzpur, Firozabad** and **Jaunpur** (in the Memory of Jauna Khan) and dug many canals. (UP UDA/LDA 2006)
  - He continuously levied Jizya for irrigation purposes. He levied **Jizya** on **Brahmins**. (UPPCS, 2011)
  - The credit for **establishing the 'Public Works Department'** goes to Firuz Shah Tughluq. (UPPCS, 2000)

## 6. Lodi Dynasty (1451-1526 AD)

- **Bahlul Lodi** (1451-1489) founded the Lodi Dynasty in 1451.
- He brought Jaunpur under the control of the Delhi Sultanate.
- He belonged to 'Shahu Khel' clan of the Afghans.
- He was succeeded by Sikandar Lodi.
- He was the best ruler of the Lodi dynasty produced.
- He started '**Gaz-i-Sikandari**', a scale used for measurement.
- A treatise on 'Ayurveda' was translated into Persian and ordered by Sikandar Lodi, known as '**Farhang-i-Sikandari**'.
- A music work named "**Lahjat-i-Sikandar Shahi**" was developed during his reign.
- Sikandar Lodi was very fond of shehnai.
- He wrote poems under the nickname '**Gulrukhi**'.

(UPPCS, 2015)

✎ **Note :** Sikandar Lodi constructed a new city, Agra in 1504 to secure his authority over the rulers of neighbouring Rajasthan. (UPPCS, 1993)

- He prohibited the removal of the Tajiya and the practice by Muslim women of going to the tomb of the Pirs and Saints.
- Sikandar Lodi reimposed the **Jizya** tax on Hindus.
- Sultan Sikandar abolished Zakat (property tax) imposed on grains. (UP UDA/LDA, 2010)
- **Moth Mosque** was built during the reign of Sikandar Lodi. This mosque is a beautiful example of Lodi architectural style.
- The double-domed feature of the Indo-Islamic architecture was introduced by the Lodi dynasty of the Delhi Sultanate.
- After the death of Sikandar Lodi, his eldest son **Ibrahim Lodi** ascended the throne.
- Ibrahim Lodi was defeated by Rana Sanga in the **Battle of Khatoli** in 1518. (RAS/RTS, 2012)
- In April, 1526, Babur fought in the field of **Panipat**, where Ibrahim Lodi was defeated. The Delhi Sultanate also came to an end with the fall of the **Lodis**.

## 7. Delhi Sultanate - Governance System

- Assuming the title of 'Sultan' title was started by the Turkish rulers.
- The first ruler to hold this title was **Mahmud Ghaznavi**.
- Most of the Delhi Sultanate rulers ruled as the Nayab of the Caliph.
- Alauddin challenged the supremacy of the Caliph, while Qutbuddin Mubarak Khalji declared the Caliph himself.
- The head of the central governance was the Sultan.
- In the Sultanate period, the Council of Ministers was called '**Majlis-e-Khalwat**'.
- Majlis-e-Khalwat used to meet at '**Majlis-e-Khas**'.

- **Wazir** - The Prime Minister of the State was called 'Wazir'. His office was known as Diwan-e-Wizarat (Revenue Department).

### Delhi Sultanate-Main Administrative Departments and Their Founders

| Name                   | Concerned Departments           | Founder                               |
|------------------------|---------------------------------|---------------------------------------|
| Diwan - i - Arz        | Military Department             | Balban<br>(RAS/RTS, 2018)             |
| Diwan - i - Riyasat    | Market Control                  | Alauddin Khalji                       |
| Diwan - i - Waqf       | Expenditure Department          | Jalaluddin Khalji                     |
| Diwan - i - Mustakhraj | Finance Department              | Alauddin Khalji                       |
| Diwan - i - Kohi       | Department of Agriculture       | Muhammad bin Tughluq<br>(UPPCS, 2017) |
| Dewan - i - Bandagan   | Care of Slaves                  | Firuz Shah Tughluq                    |
| Dar - ul - Shifa       | Charity Hospital                | Firuz Shah Tughluq                    |
| Diwan - i - Ishtiaq    | Pension Department              | Firuz Shah Tughluq                    |
| Diwan - i - Insha      | State Correspondence Department |                                       |

- In addition to Wazir, there were many other officers in these departments. Among them, Mushrif-e-Mumalik (Accountant-General) and Mustaufi-e-Mumalik (Auditor-General) were important. Both of them were given the charge of income and expenditure respectively.

### Sultanate Period's Chief Departments

- **Deewan-i-Insha** - Department of Correspondence
- **Deewan-i-Risalat** - Department of Foreign Affairs
- **Qazi-ul-Kazat** - Justice Department
- **Sadr-us-Sudur** - Department to look after religious matters and endowments.
- The head of the state was also the ex-officio of 'Qazi' and 'Sadr-us-Sudur'.
- Dar-ul-Shifa is one part of the old city of Hyderabad, India. This was founded by Mohammed Quli Qutub Shah in 1591 AD.
- **Diwan-i-Barid - Intelligence Department Barid-i-Mumalik** was the principal officer in the Intelligence Department. (J PCS, 2003)
- **Diwan - i - Riyasat** - Alauddin Khalji had set up this department for control of the market.
- **Diwan-i-Amir Kohi** was founded by Muhammad Tughluq to the development agriculture.
- **Diwan - i - Mustakhraj** - This department was founded by Alauddin Khalji to recover revenue dues.
- **Wakil - i - Dar** - It looked after the personal services of the royal palace and the Sultan.

- **Amir-i-Hazib** was the office in charge of the royal court.
- **Amir-i-Shikar** - used to arrange hunting for Sultan.
- **Amir-i-Akhur** - This office commanding the horses.
- **Amir-i-Majlis** - An officer in charge of Royal feasts and festivals.
- **Sar-i-Jandar** - Chief of the royal bodyguards.
- **Shahna-i-Pil** - Superintendent of Royal Elephants.
- **Diwan-i-Istihqak** - belonged to the pension department.
- **Diwan-i-Kaharat** - Department of Charity.
- **Diwan-i-Bandagan** - Department of Slave.
- **Diwan-i-Istihqak, Diwan-i-Khairat and Diwan-i-Bandhgan** were founded by Firuz Shah Tughluq. (RAS/RTS, 1999)
- **Wakil-i-Dar** - Providing royal requirements of and head of factories.

The four sources of Muslim Law were-

- (1) **Quran** - The major source of Muslim Law.
  - (2) **Hadith** - It is a body containing the statements and actions of the Prophet. If the problem is not resolved by the laws of the Quran, then it was resorted to.
  - (3) **Ijma** - The universal and infallible agreement of either the Muslim community as a whole or the Muslim scholars in particular.
  - (4) **Qiyas** - Laws are explained on the basis of logic or analysis.
    - **Qazi-ul-Quzat** was the supreme authority of justice after the Sultan.
    - The cases during the Sultanate period were decided with the help of Qazis and Muftis. The posts of Qazi and Mufti were hereditary.
    - A department called **Amir-e-Dah** used to assist Qazi in court.
    - The Delhi Sultanate was divided into several provinces called '**Iqta**'.
    - The Iqta was in charge of a **Muqti** or **Iqtedar**.
    - Iqta was further divided into **Shiqs** (Janapadas), headed by **Shiqdars**.
    - Mustakhraj were divided into **parganas**.
    - **Amil** used to be the chief officer of the pargana.
    - The smallest unit of administration was the village.
    - In Sultanate period, mainly three types of land revenues existed.
1. **Batai** - The share of the state was decided in the actual yield. This system existed with different names - Kismat-i-Galla, Galla Bakshi or Hasil, etc.
  2. **Masshat** - The yield was decided by the measurement of land.

3. **Muqti** - It was a mixed system of rent fixation. It was based on Batai revenue system.
  - Ghiyasuddin was the first ruler to promote a canal system for irrigation. (UPPCS, 2017)
  - **Sondhar** or **Taccavi** (loan) was started by Muhammad Tughluq.
  - The land under the government's control was called **Khalsa Land**.
  - Alauddin requisitioned the donated land and converted then into Khalsa land.
- **Types of Sultanate Revenue (Tax)-**
  - Jizya** - Protection tax to be charged from non-Muslims.
  - Zakat** - Religious tax (40<sup>th</sup> part of property) to be charged from Muslims.
  - Kharaj** - Land tax to be charged from non-Muslims.
  - Usra** - Land tax to be charged from Muslims.

### Military System of Sultanate

|                 |                                           |
|-----------------|-------------------------------------------|
| 1 Sarkhel =     | Head of ten cavalries                     |
| 1 Sipahasalar = | Head of ten Sarkhels (100 cavalries)      |
| 1 Amir =        | Chiefs of 10 Sipahasalar (1000 cavalries) |
| 1 Malik =       | 10 Amirs (10,000 cavalries)               |
| 1 Khan =        | 10 Maliks ( Chief of 1,00,000 cavalries)  |
| 1 Sultan =      | Chief of Khans (supreme commander)        |

- The army of the Sultan in Delhi was called '**Ishm-e-Kaib**' or '**Kaib-e-Sultani**'.
- The Sultanate military system was based on the '**decimal system**' same as the Mongols used.
- Alauddin provided soldiers with cash salaries.
- **Firuz Shah** Tughluq had **hereditary soldiers**.
- The Sultanate Army mainly consisted of three divisions- the cavalry, artillery and infantry.
- The breeding of silkworms became popular during Sultanate rule.
- A group of traders was called '**Tujjar-i-Khas**'.
- Deval (Gujarat) was considered a prosperous city during the medieval period. It also served as an international port.
- Lahore and Bayana were famous for indigo plantation.

| Delhi Sultanate Buildings                               | Constructors                                  |
|---------------------------------------------------------|-----------------------------------------------|
| Quwwat-ul-Islam Mosque, Adhai Din ka Jhopra, Qutb Minar | Qutbuddin Aybak                               |
| Nasiruddin Mahmud Tomb or Sultanagarhi                  | Iltutmish                                     |
| Alai Darwaza, Jamat Khana Mosque                        | Alauddin Khalji (42 <sup>nd</sup> BPSC, 1997) |
| Tughluqabad                                             | Ghiyasuddin Tughluq                           |

## Sultanate Period and Major Rulers

### Slave Dynasty (1206-1290)

|                       |                |
|-----------------------|----------------|
| Qutbuddin Aybak       | 1206-1210 AD   |
| Aram Shah             | 1210-1211 AD   |
| Sultan Iltutmish      | 1211-1236 AD   |
| Ruknuddin Firuz Shah  | 1236 - 1236 AD |
| Sultan Raziyya        | 1236-1240 AD   |
| Muizuddin Bahram Shah | 1240-1242 AD   |
| Allauddin Masud Shah  | 1242-1246 AD   |
| Nasiruddin Mahmud     | 1246-1266 A.D. |
| Ghiyasuddin Balban    | 1266-1286 AD   |
| Kaikubad              | 1286-1290 AD   |

### Khalji Dynasty (1290-1320 AD)

|                              |              |
|------------------------------|--------------|
| Jalaluddin Firuz Shah Khalji | 1290-1296 AD |
| Alauddin Khalji              | 1296-1316 AD |
| Qutbuddin Mubarak Khalji     | 1316-1320 AD |

### Tughluq Dynasty (1320-1412 AD)

|                          |                     |
|--------------------------|---------------------|
| Ghiyasuddin Tughluq      | 1320-1325 AD        |
| Muhammad bin Tughluq     | 1325-1351 AD        |
| Firuz Shah Tughluq       | 1351-1388 AD        |
| Ghiyasuddin Tughluq II   | 1388-1389 AD        |
| Abu Bakr Shah            | 1389-1390 AD        |
| Nasiruddin Muhammad Shah | 1390-1394 AD        |
| Alauddin Sikandar Shah   | 1394-1394 AD        |
| Nasiruddin Mahmud Shah   | 1394-1412 AD        |
| <b>Sayyid Dynasty</b>    | <b>1414-1451 AD</b> |
| Khizr Khan               | 1414-1421AD         |
| Mubarak Shah             | 1421-1434 AD        |
| Muhammad Shah            | 1434-1445 AD        |
| Alauddin Alamshah        | 1445-1451 AD        |

### Lodi Dynasty (1451-1526 AD)

|               |              |
|---------------|--------------|
| Bahlul Lodi   | 1451-1489 AD |
| Sikandar Lodi | 1489-1517 AD |
| Ibrahim Lodi  | 1517-1526 AD |

## Major Books and Its Authors during Sultanate Period

| Books                          | Authors                                          |
|--------------------------------|--------------------------------------------------|
| Kitab-ul-Hind or Tahqiq-e-Hind | Al Beruni                                        |
| Shahnama                       | Firdausi (MPPCS, 2015)                           |
| Tabaqat - e - Nasiri           | Minhaj - i - Siraj (42 <sup>nd</sup> BPSC, 1997) |

|                                  |                                 |
|----------------------------------|---------------------------------|
| Tarikh - e - Firuz Shahi         | Ziauddin Barani (MPPCS, 2019)   |
| Rihla                            | Ibn Battuta                     |
| Kitab - Ul - Yamini              | Utbi                            |
| Khazin - ul - Futuh, Tughluqnama | Amir Khusro (UPPCS, 2021)       |
| Sri Krishna Vijaya               | Maladhar Basu                   |
| Tarikh-I-Mubarakshahi            | Yahya Bin Abdullah Sarhindi     |
| Fawaid-Ul-Fawad                  | Amir Hassan Sizzi (UPPCS, 2021) |
| Haqiq-e-Hindi                    | Abdul Wahid Bilgrami            |

## 8. Vijayanagara Empire

- The Vijayanagara Empire was founded in which 1336 was contemporary to the reign of Muhammad-bin-Tughluq.
- Although historians use the term Vijayanagara Empire and contemporaries of this temple described it as Karnataka Empire.
- Two brothers, **Harihara** and **Bukka**, founded the Vijayanagara empire. (UK PCS 2004, JPCS, 2021)
- The saint Vidyanarya was the inspiration to Harihara and Bukka behind the empire.
- Harihara and Bukka were earlier feudatories of the Kakatiya ruler Pratap Rudradeva and later rose to become ministers in Kampiliya state.
- The capital of Vijayanagara was Hampi, situated on the banks of the Tungabhadra.
- Harihara-I ruled from 1336 to 1356 and his brother Bukka-I helped him in the administration. Bukka-I ruled from 1356 to 1377.
- Bukka-I assumed the title of '**Vedamarga Prathisthapaka**'.
- Harihara-II was a worshiper of Shiva's Virupaksha.
- Harihara-II was the first ruler in his dynasty who assumed the title of **Maharajadhiraja**.
- Devaraya-I ruled from 1406 to 1422. He suffered the invasion of Firuz Shah Bahman.
- Devaraya-I built a dam on the Tungabhadra river and got canals (water bridge or water system) up to his capital Hampi.
- During the reign of Devaraya-I, **Italian traveller Nicolo Conti** travelled to Vijayanagara. (MPPCS, 2016)
- Famous poet Srinatha, author of **Harivalas** was at the court of Devaraya I.
- Devaraya-II became ruler in 1422.
- Devaraya-II recruited Muslim soldiers in his army.
- The word **Gajabetevara** (hunter of elephants) was used for him on the inscriptions of Devaraya-II.
- During the reign of Devaraya-II, Persian (Iranian) ambassador, **Abdur Razzaq** visited Vijayanagara.

(UP UDA/LDA, 2010)



- **Mallikarjuna** became the ruler in 1446. He is also called '**Praudh Devaraya**'.
- **Virupaksha II** ascended the throne in 1465. He was the **last ruler** of the Sangam dynasty. He ruled until 1485 AD.
- A powerful feudal lord Narasimha Saluva took over the throne in 1485 AD.
- Saluva Narasimha appointed Narasa Nayaka as the guardian of his minor son.
- Vira Narasimha, son of Narsa Nayak, killed Saluva king Immadi Narasimha in 1505.
- Viranarasimha founded the Tuluva dynasty, the third dynasty of the Vijayanagara Empire.
- After the death of **Viranarasimha in 1509**, his younger brother Krishnadeva Raya ascended the throne.
- Krishnadeva Raya was the ruler of the Tuluva dynasty.
- His court was decorated with eight great Telugu scholars and poets called '**Ashtadiggajas**'. (UP UDA/LDA 2010)
- **Peddana** was ranked as the foremost of the Ashtadiggajas.
- Tenali Rama was at the court of Krishnadeva Raya.
- The reign of Krishnadeva Raya was also known as the '**Golden Age of Telugu Literature**'. (UP UDA/LDA 2006)
- Krishnadeva Raya also assumed the titles of '**Andhra Bhoja**', '**Abhinav Bhoja**', '**Andhra Pitamah**' and '**Yavanarajya Sthapanacharya**'. (JPCS, 2013)
- Krishnadeva Raya was an excellent poet and writer.
- His major work is '**Amuktamalyad**' which is one of the five epics in the Telugu language.
- Krishnadeva Raya founded a city named 'Nagalpur' in the name of his mother. (UPPCS, 2016)
- During the reign of Krishnadeva Raya, the **Portuguese Traveller, Domingo Paes** travelled to the Vijayanagara Empire.
- In his autobiography, Babur described Krishnadeva Raya as the most powerful contemporary ruler of India.
- Krishnadeva Raya built **Hazara Rama Temple** and **Vitthal Swamy Temple**. (MPPCS, 2014)
- He died in 1529.
- Achyuta Devaraya (1529–1542 AD) made Ramarai **Jamata of Krishna Devaraya**, a partner in the regime to avert civil war. During his reign, the Portuguese traveller **Fernao Nuniz** travelled to Vijayanagara.
- Sadashiva Raya became the ruler of the Vijayanagara Empire in 1543.
- In the reign of Sadashiva Raya, the real power lay in the hands of **Aravidu dynasty** chief, Rama Raya.
- Rama Raya started recruiting a large number of Muslims in Vijayanagara's Army.
- The **battle of Talikota** (Rakkasagi-Tangodi or Banni Hatti) took place on 23 January, 1565 AD, where Vijayanagara was defeated. (UPPCS, 1993)
- In the Talikota Battle, Golconda, Bijapur, Ahmednagar and Bidar formed a joint front against Vijayanagara, led by Ali Adil Shah.
- In the battle of Talikota, Vijayanagara was **led by Rama Raya**.
- After the Talikota Battle, Sadashiva started to rule by making Penukonda the capital with the help of Tirumala.
- Rama Raya's brother Tirumala founded the Aravidu dynasty in 1570, overthrowing the last ruler of the Tuluva dynasty, Sadashiva Raya.
- The **last ruler** of the Aravidu dynasty was **Sri Ranga- III**.
- For administrative convenience of the Vijayanagara Empire, the province was divided into '**Mandal**', Mandal in 'Kottam' or 'Balnadu' (District), Kottam into 'Nadu (**Pargana or Tehsil**)', Nadu into '**Melagram**' (cluster of villages) and The Melagram into 'Ur' (Gram).
- The smallest unit of administration was **Ur or Gram**.

#### Foreign Travellers who visited Vijayanagara

|              |          |                   |
|--------------|----------|-------------------|
| Nicolo Conti | Italy    | Devaraya-I        |
| Abdur Razzaq | Persia   | Devaraya-II       |
| Domingo Paes | Portugal | Krishnadeva Raya  |
| Barbosa      | Portugal | Krishnadeva Raya  |
| Fernao Nuniz | Portugal | Achyuta Deva Raya |

- Assemblies of Brahmadeya villages (villages given as grants to Brahmins) were called '**Chaturvediamangalam**'.
- The assembly of Non- Brahmadeya villages was called '**Ur**'.
- The Vijayanagara rulers introduced the system of governance in local territories through the **Iyengar system**.
- In Iyengar system, each village was organized as an independent unit, where twelve officers were appointed to administer.
- **The group of these twelve governing officers was called 'Iyengar'**. In return for their service, the king gave them land free of rent.
- The rank of Iyengar was hereditary. Documents relating to the purchase and sale of land with the Iyengars were called 'Karnik'.
- **Social and community taxes were imposed.**
- 'Marriage tax' was imposed on both the bride and bridegroom.
- Lands that were given to soldiers and civilian officers in **return** for their **special services** were called '**Amaram**'.
- The Amaram recipients were called '**Amaranayakas**'.
- At the time of gallantry in battle, the martyrs who showed heroism were donated land called '**Rakta Kodge**'.
- Tax exempted land offered for special services in the village was called '**Umbali**'.

- **'Kuttagi'** land was the land of Brahmins, temples or big landowners who themselves did not engage in agricultural work and had others to do it for themselves on a sharing basis.
- Farmers engaged in farming works were called **'Kudi'**.
- Agricultural labourers engaged in land, were also subjected to sale.
- The most famous gold coin of Vijayanagara was **'Varaha'** which was mentioned by foreign travellers. It was known as Hun, Pardaas or Pagoda.
- **'Pagoda'** was the principal currency of the **Vijayanagara** and **'Hun'** of **Bahmani states**.
- Small gold coins were called **'Pratap'** and **'Phanam'**.
- Small coins of silver were called **'Taar'**.
- Among the middle classes, there was a group called Chetti.
- Chetti was excellent in clerical and business work. The people doing business equivalent to the Chetti and the artisan class were called **'Veerpanchal'**.
- Slavery existed in Vijayanagara.
- The origin of Carnatic music belongs to the Vijayanagara dynasty.
- The buying and selling of human beings was called **'Besabaga'**.
- Nicolo Conti wrote- "There are a large number of slaves in the Vijayanagara Empire."
- Purdah System was prevalent in society.
- The game of chess and dice was prevailing.
- People who migrated from North to South India were called **'Badwa'**.
- The practice of Sati was common in Vijayanagara which was described by Barbosa.
- There was a military commander named Amra in Vijayanagara Empire.
- **Talar** was known as the chowkidar of the village.
- The military department was called **'Kandacara'**.
- Sadashiva Raya abolished the tax on rivers in the 16<sup>th</sup> century.

### Major Rulers of Vijayanagara Empire

| Ruler            | Year         |
|------------------|--------------|
| Harihara-I       | 1336-1356 AD |
| Bukka            | 1356-1377 AD |
| Harihara-II      | 1377-1404 AD |
| Virupaksha-I     | 1404-1405 AD |
| Bukka-II         | 1405-1406 AD |
| Devaraya-I       | 1406-1422 AD |
| Devaraya-II      | 1422-1446 AD |
| Mallikarjuna     | 1447-1465 AD |
| Virupaksha       | 1465-1485 AD |
| Praudha Devaraya | 1485-1485 AD |

- In 1485, Virupaksha II was killed by one of his sons. But the killer offered the throne to his younger brother Praudha Devaraya. But soon Narasimha Saluva de-throned him in 1485 AD and usurp the throne and laid the foundation of the Saluva dynasty, the second dynasty of Vijayanagara.

### Saluva Dynasty (1485 - 1505 AD)

Narasimha Saluva 1485 - 1490 AD

Immadi Narasimha 1490 - 1505 AD

- In 1490, Narsimha Saluva appointed Narasa Nayaka as the guardian of both his minor sons before his death in 1485. Narasa Nayaka placed the elder son Immadi Narasimha on the throne, but retained the real power himself.
- In 1500, Narsa Nayaka died. His son Veer Narasimha killed Immadi Narasimha and founded Tuluva dynasty in 1505 himself and occupied the throne.

### Tuluva Dynasty (1505-1570 AD)

|                                              |                |
|----------------------------------------------|----------------|
| Veer Narasimha Tuluva                        | 1505 - 1509 AD |
| Krishnadeva Raya                             | 1509-1529 AD   |
| Achyuta Raya                                 | 1529-1542 AD   |
| Sadashiva Raya                               | 1543-1570 AD   |
| <b>Aravidu dynasty</b>                       |                |
| Tirumala → Ranga II → Venkata II → Ranga III |                |

- Amuktamalyada, a Telugu epic Poem, was composed by Raja Krishnadeva Rai.

## 9. Bahmani Kingdom

- The rebellion of the Amiran-i-Sadah (administrator of 100 villages) of the Deccan resulted in the establishment of the Bahmani kingdom in the last days of Muhammad bin Tughluq's reign.
- In 1347, assuming the title of **'Alauddin Hasan Bahman Shah'**, a chieftain Zafar Khan (Hassan Gangu, 1347-1358), occupied the throne and laid the foundation of the Bahmani kingdom. (UK PCS, 2002)
- He made **Gulbarga** the capital of his kingdom and gave it the new name **'Ahsanabad'**. (Chattisgarh PCS, 2014)
- **He exempted Hindus from Jizya tax.**
- Alauddin Hasan Bahman was succeeded by his son Muhammad Shah-I who ruled from 1358 to 1375.
- He divided the empire into **four provinces or tarafs** of Gulbarga, Daulatabad, Berar and Bidar.
- Each province was under a ruler.
- The province of Gulbarga was the most important. Bijapur was annexed with it.
- He subdued the Hindu rulers of south India and started a new practice of **granting posts** and **jagirs** to his supporters.

- **Tajud-din Firuz Shah** became the ruler of the Bahmani sultanate in 1397 AD. He encouraged Asian foreigners or Afaqis to stay back and integrate them into the society of his Sultanate.
- As a result, the rich class in Bahmani Sultanate was divided into two groups called Afaqi and Deccan.
- This division led to the gradual decline of the kingdom and subsequently, it was disintegrated.
- Firuz Shah Bahmani built an observatory at **Daulatabad**.
- Shihabuddin Ahmad I ascended the throne in 1422 AD.
- He first shifted his capital from Gulbarga to Bidar.
- This new capital of the Bahmani kingdom was named **Muhammadabad**.
- His reign was noted for being fair, just and pious.
- He was also called Ahmad Shah Wali or Saint Ahmad.
- Alauddin Ahmad II assumed the title of Sultan in 1436 AD.
- During the time of Alauddin Ahmad, an Iranian (Afaqi) resident, Mahmud Gawan, flourished.
- Mahmud Gawan assumed the title of '**Malik-ut- Tujjar**'.
- After Alauddin's death, his eldest son Humayun became the ruler.
- **Humayun** was a ruthless ruler. His nickname was '**Zalim**' for this trait.
- Humayun was also called **Nero of Deccan**.
- After Humayun, Muhammad III ascended the throne.
- **Russian traveller Nikitin** travelled to the Bahmani kingdom during Muhammad-III rule.
- Mahmud Gawan was the Governor of Bijapur during **Muhammad-III rule**.
- Mahmud Gawan established a **Madrasa in Bidar**.
- Mahmud Gawan's letters, written under the name of Riyaz'l Insha were collected.
- Muhammad III hanged Mahmud Gawan (in 1481 AD.) on the charge of treason.
- During the reign of **Shihabuddin Mahmud Shah (1482-1518 AD.)**, the provincial governors started declaring independence.
- The Bahmani Empire was disintegrated by the end of the fifteenth century.
- The last Sultan of this dynasty was Kaleemullah Shah.
- After his death in **1527 AD**, the Bahmani empire came to an end and five independent states were formed on its ashes.

### Major Dynasties and Its Founders of the Independent States

| Sl. No. | Dynasty    | State      | Founder        | Year of Establishment |
|---------|------------|------------|----------------|-----------------------|
| 1.      | Adilshahi  | Bijapur    | Yusuf Adilshah | 1490 AD               |
| 2.      | Nizamshahi | Ahmadnagar | Malik Ahmad    | 1490 AD               |

|    |            |          |                      |         |
|----|------------|----------|----------------------|---------|
| 3. | Imadshahi  | Berar    | Fatahullah Imad Shah | 1490 AD |
| 4. | Qutbshahi  | Golconda | Quli Qutb Shah       | 1512 AD |
| 5. | Baridshahi | Bidar    | Amir Ali Barid       | 1523 AD |

- The Bahmani kingdom ruled for around 180 years and had 18 rulers.
- The Bahmani kingdom was divided into four provinces (Tarafs) and their governors (Tarafdars) assumed special titles.

### Provinces and Titles of Their Governors

| Sl.No. | Provinces  | Titles         |
|--------|------------|----------------|
| 1.     | Daulatabad | Masnad-i-Ali   |
| 2.     | Berar      | Majlis-i-Ali   |
| 3.     | Bidar      | Azam-i-Humayun |
| 4.     | Gulbarga   | Malik Naib     |

## 10. The Independent Provincial States

### Kashmir

- **Suhadeva** founded the Hindu kingdom in Kashmir in 1301 AD.
- **Shah Mir** fraudulently captured Kashmir and established the Shah Mir dynasty in 1339 AD.
- Shah Mir ruled under the assumed name of Shamsuddin Shah.
- Shamsuddin Shah (Shah Mir) was the first Muslim ruler of Kashmir.
- Shamsuddin Shah made **Indrakot** his capital.
- He transferred his capital from **Indrakot** to **Alauddinpur** (Srinagar).
- Sultan Sikandar was called a '**Butshikan**' for breaking Hindu temples and idols.
- After Sikander's death, his son Ali Shah ascended the throne.
- Ali Shah was captured by **Khokhars** while struggling with his brother and died at Chatura.
- Ali Shah's brother Shahi Khan ascended the throne under the assumed name of '**Zain-ul Abidin**' in 1420 AD.
- **Zain-ul-Abidin** was the master of many languages.
- **Zain-ul-Abidin** got '**Mahabharata**' and '**Rajatarangini**' translated into Persian.
- Zain-ul-Abidin was a tolerant ruler, and was called '**Akbar of Kashmir**'. (RAS/RTS 1993)
- Zain-ul-Abidin stopped the collection of Jizya tax in Kashmir. (UK UDA/LDA 2006)
- The Mughal emperor Akbar annexed Kashmir to the Mughal Empire in 1586.

### Jaunpur

- **Firuz Shah Tughluq** founded the city of Jaunpur in memory of his brother 'Jauna Khan' or Juna Khan (Muhammad bin Tughluq). (UPPCS, 2003)
- Sultan Mahmud, the son of Firuz Tughluq, conferred the title of **Malik-us-Sharqi** (Lord of the East) on his Wazir **Khwaja-e-Jahaan** (Malik Sarwar).
- Taking advantage of the weakness of the later-Delhi Sultanate, Malik Sarwar declared independence and laid the foundation of the **Sharqi dynasty** in Jaunpur.
- Malik Sarwar never assumed the title of Sultan.
- After Malik Sarwar, Mubarak Shah, Ibrahim Sharqi, Mahmud Shah Sharqi, Muhammad Shah Sharqi and Husain Shah Sharqi were followed.
- Under Sharqi's rule, Jaunpur developed immensely in the field of literature and architecture, especially during the period of **Ibrahim Shah**.
- Due to the advancements in literature and architecture, Jaunpur was called '**Shiraz of India**'. (UPPCS, 2005)
- **Atala Masjid** was built by Ibrahim Shah in 1408.
- The Atala Mosque was built after demolishing the temple of Atala Devi, built by King Vijaychand of Kannauj.
- **Hussain Shah Sharqi** was the last ruler of this dynasty. Hussain He built the **Jama Masjid in Jaunpur**.
- **Jhanjhari Masjid** was built by Ibrahim Sharqi in 1430 AD and **Lal Darwaza Masjid** was built by the wife of Mahmud Shah in 1455 AD.
- Jaunpur was annexed by **Bahlul Lodi** in 1484.

### Bengal

- In the first decade of the 13<sup>th</sup> century, 'Muhammad bin Bakhtiar Khalji' annexed Bengal to the Delhi Sultanate.
- Ghiyasuddin Tughluq divided Bengal into three parts **Lakhnauti** (North Bengal), **Sonargaon** (East Bengal) and **Satgaon** (South Bengal).
- Haji Ilyas reunited Bengal and ruled under the assumed name of Shamsuddin Ilyas Shah in 1342 AD.
- **Sikandar Shah** (1358-1390 AD.) built the '**Adina Masjid**' (in 1364-74 AD.) in Pandua.
- Ghiyasuddin Azam Shah ruled Bengal from 1390-1409 AD.
- Ghiyasuddin was entertained at his court by the Persian poet 'Hafiz' and many other scholars.
- The Chinese emperor requested Sultan **Ghiyasuddin to send Buddhist monks** in 1409 AD.
- Alauddin Husain Shah (1493-1518 AD.) shifted the capital from Pandua to Gaur.
- Mahaprabhu Chaitanya was a contemporary of Alauddin.
- Alauddin Husain started a movement called **Satyapir**.
- Nusrat Shah was the ruler of Bengal during Babur's invasion.

- Mughal Emperor Akbar annexed Bengal to the Mughal empire.

### Malwa

- Alauddin Khalji took Malwa under his control in 1305 AD.
- **Firuz Tughluq** appointed **Dilawar Khan** as the Subedar of Malwa in 1390 AD.
- Dilawar Khan (Husain Khan Ghori) declared his independence and became its ruler in 1401 AD.
- After Dilawar, his son **Alp Khan** became the ruler of Malwa and assumed the title of **Hoshang Shah**.
- Hoshang Shah shifted his capital from Dhar **to Mandu**.
- Hoshang Shah's son Ghazni Khan renamed Mandu **Shadiabad**.
- Mahmud Khalji laid the foundation of Khalji dynasty in Malwa in 1436 AD.
- He was the most powerful Sultan of this dynasty.
- By 1531, the Khalji Sultans had started ruling Malwa. Subsequently, Sher Shah conquered Malwa and appointed Sujaat Khan as governor. His son Baz Bahadur became the ruler after his father Sujaat Khan's death. Roopmati was his wife. Their love story and their love for music have become part of folklore.
- **Hoshang Shah** built the **Fort of Mandu**.
- **Ghiyasuddin Khalji** built **Hindola Palace** at Mandu.

### Gujarat

- Alauddin Khalji, defeated king Karan (Rai Karan), the ruler of Gujarat and brought it under his control in 1298 AD.
- In 1391AD., Sultan Nasir-Ud-din Muhammad Shah III appointed Zafar Khan, the son of Wajih-ul-Mulk as governor of Gujarat and conferred him the title of Mujaffar Khan.
- After Zafar Khan, **Ahmad Shah** (1411–1441 AD.), **Mahmud Shah Begada** (1458–1511 AD.) and **Bahadur Shah** (1526–1537 AD.) ruled Gujarat.
- **Ahmad Shah** settled a city called **Ahmedabad** on the banks of Sabarmati near Asawal.
- Ahmad Shah made Ahmedabad his capital by shifting it from Patan.
- Mahmud Begada was the famous ruler of Gujarat.
- He laid out **Mustafabad**, a city near Girnar and **Muhammadabad** in Champaner.
- Akbar annexed Gujarat to the Mughal empire in 1573.

### Mewar (Modern Udaipur)

- Alauddin annexed Mewar to Delhi Sultanate by defeating Ratan Singh, the ruler of the Gehlot dynasty of Mewar in 1303 AD.
- **Hamir Deva** of 'Sisodia dynasty' (branch of the Gehlot dynasty) conquered **Chittor** and made the whole of Mewar independent.



- Rana Kumbha built a **Vijay Stambha** (victory tower) at Chittor in 1448 AD. (UPPCS 2008, 2010, 2011)
- The **Kirti Stambh** was dedicated to **Adinath**, the first Tirthankara of Jainism. This seven-storied pillar was built by Jain traders in the 12<sup>th</sup> century.
- The **Battle of Khanwa** was fought between **Rana Sanga** and **Babur** in 1527 AD, in which Babur defeated the Rajput king, Rana Sanga.
- The **Battle of Haldighati** took place on 18<sup>th</sup> of June, 1576 AD. between **Rana Pratap** and **Akbar**.
- The capital of Mewar was **Chittorgarh**.
- During the reign of Jahangir, Mewar accepted the suzerainty of the Mughal Empire.

#### Khandesh (South India)

- During the decline of Tughluq dynasty, **Malik Ahmad Khan Raza**, the Subedar of Firuz Shah Tughluq, created Khandesh in the territory falling between Narmada and Tapi rivers.
- The capital of Khandesh was **Burhanpur**.
- Khandesh was annexed to the Mughal empire by Akbar in 1601.

#### Odisha

- Before the Mughal rulers captured Odisha, multiple regional dynasties ruled it.
- **Anantavarman Chodaganga** (ruler of the east Ganga dynasty) established a powerful kingdom in Odisha.
- Anantavarman ruled from 1076 for about 70 years.
- He built the Jagannath temple in Puri.
- Other dynasties that ruled Odisha were - **Eastern Ganga**, and **Suryavanshi Gajapati**.

### 11. Bhakti Movement

- The great philosopher Sankaracharya was born in Kerala in the 8<sup>th</sup> century. His father's name was Sivaguru and mother's name was Aryamba. (UPPCS, 1999)
- Sankaracharya propounded the philosophy of Advaitavada to counter the influence of Buddhism in the 8<sup>th</sup> century. (Chhattisgarh PCS, 2014)
- The following four views were articulated by Vaishnava Acharyas in opposition to the Advaita philosophy of Sankaracharya.

| Founder                              | Philosophy       | Sect                   |
|--------------------------------------|------------------|------------------------|
| Ramanujacharya<br>(UPPCS, 1991)      | Vishishtadvaita  | Shri Sect              |
| Madhwaacharya                        | Dvaitvada        | Brahma Sect            |
| Vallabhacharya<br>(UP UDA/LDA, 2002) | Suddha Advaitvad | Pushtimarga Sampradaya |
| Nimbarkacharya                       | Dvaita-Dvaitvad  | Sanaka Sect            |

- The Bhakti Movement was started by the Vaishnava Alvara saints and Shaiva Nayanara saints of south India.
- 'Chaitanya Mahaprabhu', Vidyapati Thakur and Chandidas were the exponents of Bhakti in Bengal with their great devotion to Lord Krishna.

#### Important Saints of the Bhakti Movement

##### Ramanujacharya:

- The propagator of the Bhakti movement was Vaishnava Acharya **Ramanuja**. He advocated the philosophy of Vishishtadvaita. (UPPCS, 2021)
- According to Vishishtadvaita philosophy, brahmana is eternal but he also included an element of plurality.
- Acharya Ramanuja was born at **Sriperumbudur** in Madras (Chennai) in 1017 AD.
- His father was **Asuri Kesava** and his mother's name was **Kanthimathi**.
- He died in 1137 AD.
- Ramanuja emphasized the worship of a virtuous God.
- According to him, the path of salvation lies in karma, knowledge and devotion.

##### Vallabhacharya:

- Vallabhacharya was the son of **Sri Lakshmana Bhatta**, a Telang Brahmin of Somayazi clan.
- He propounded the philosophy of Shuddha Advaitvad.

##### Ramananda:

- Ramananda was the first promoter of the Bhakti Movement in North India.
- He was born at Prayag (Allahabad) in 1299 A.D. and studied at Prayag and Varanasi. (UPPCS, 2010)
- Ramananda first preached his sermon in Hindi. (IAS, 2002)
- He said that devotion is the only means of salvation.
- He worshipped Rama and Sita as ideals for society.
- **Padmavati** and **Surasari** (Women), **Kabir** (Weaver), **Raidas** (Cobbler), **Sena** (Barber) and **Pipa** (Rajput) were amongst twelve prominent disciples of Ramananda. (UP Power, 2002)
- The Bhakti movement was reborn in the fifteenth- sixteenth century. It was led by Kabir, Nanak, Tulsidas, Surdas and Mirabai.

##### Kabir :

- Kabir was a saint associated with **Nirguna Bhakti**, who, despite being a saint, continued to live a family life.
- He considered Rama, Rahim, Hazrat, Allah as different forms of the same God.
- He did not believe in the Vedas and the Quran.
- '**Bijak**' is a compilation of sermons of Saint Kabir. (MPPCS, 2020)
- 'Amarmool' is a compilation of dialogues of Kabir Das and his disciple Dharmadas. (UPPCS, 2008)

- Kabir Das was a **contemporary** to **Sultan Sikandar Lodi**.

#### **Malukdasa :**

- Saint Malukdasa was born in **Lala Sunderdas Khatri's house** in 1574 at Kada (present Kaushambi district).

#### **Guru Nanak :**

- Guru Nanak was born in 1469, at Talwandi (Nankana Sahib in Pakistan) in Punjab of undivided India. (UPPCS, 2007)
- His father's name was **Mehta Kalu Chandra Khatri**, and mother's name was Tripta.
- Guru Nanak (1469–1539 AD) founded Sikhism.
- He believed in '**Monotheism**' and emphasized the worship of Nirguna Brahma.
- He started a shared community kitchen called **Guru Ka Langar**.
- He was influenced by the Sufi saint Baba Farid.
- He strongly advocated Hindu-Muslim unity and condemned the fanatics of both religions and stressed on truth.

#### **Chaitanya Mahaprabhu :**

- Chaitanyadeva, a sixteenth century bhakti saint from West Bengal, preached selfless devotion to Krishna bhakti.
- He was the originator of Bhakti movement in Bengal.
- He was born in a Brahmin family in Nadia (Bengal), in 1485.
- After his retirement, he moved from Bengal to Puri (Odisha). His childhood nickname was **Vishwambhar Mishra**.
- He opposed caste system rituals, untouchability.
- He established '**Gaudiya Vaishnavism**' and also popularized the '**Sankirtan System**'.

#### **Surdas :**

- Surdas was a poet of the Krishna Bhakti cult.
- He was a **contemporary of Akbar**.
- The life story of Krishna is presented in his famous work '**Sur Sagar**'.
- His compositions, compiled in Sursagara, Surasaravali and Sahitya Lahari.

#### **Mirabai :**

- Mirabai was the only daughter of **Ratan Singh Rathore** of Merta.
- She married **Bhoj Raj**, the elder son of Rana Sanga in 1516 AD. (RAS/RTS, 1997)
- She was born in a village called Kurki of Merta in 1498.
- She was a Hindu spiritual poetess whose hymns were dedicated to Lord Krishna, and were popular in north India.
- **Ravidas** was her mentor.
- Mirabai composed four texts, and these were Narsi ka Mayra, Geet Govind Teeka, Raga Govind and Raag Sorath Ke Pad. (Chattisgarh PCS, 2014)
- She was a contemporary of Hindi poetess, Tulsidas and often communicated with him through letters.

#### **Tulsidas :**

- Tulsidas was born in 1532 AD. in a village, Rajapur, in the Banda district of Uttar Pradesh.
- The famous saint-poet, Goswami Tulsidas, was a contemporary of **Akbar** and **Jahangir**. (UPPCS, 2004)
- He wrote many texts, among which '**Ramcharitmanas** and **Vinayapatrika**' are famous. (UK UDA/LDA, 2007)
- Abul Fazl has mentioned him in his work, '**Ain-i-Akbari**'.

#### **Namdev :**

- Namdev was instrumental in popularizing the Bhakti movement in Maharashtra.
- His teacher was Visoba Khechara.
- He belonged to the Varkari sect. (UPPCS, 2002, 04)
- Among the saints of the Bhakti Movement, Namdev was highly influenced by Islam. (UP UPA/LDA, 2010)
- His compositions are famous as '**Abhyanga**'. Some of his verses are compiled in Guru Granth Sahib.

#### **Ravidas :**

- Ravidas belonged to **Kutbandhla chamar caste** and resided at **Kashi**.
- He was one of the twelve disciples of Ramanand.
- His **father's** name was **Raghu**, and his **mother's** name was **Ghurbiniya**. They used to make a living by repairing shoes.
- He founded the Raidasi sect.

#### **Dadu Dayal**

- He was born at Ahmedabad in 1544 and belonged to the **Tanner caste**.
- Dadu's childhood nickname was **Mahabali**.
- After coming to Sambhar, he founded the Brahma sect, later called **Dadu Panth**.
- He was a **Nirguna** worshipper. He also opposed discrimination based on caste.
- He met Akbar in Amer in 1586.
- He started a movement called '**Nipakh**'.
- Anubhav Vani and Kambli are his works.

#### **Sufi Movement**

- Islamic mysticism is called '**Sufism**' or '**Sufi religion**'.
- The word 'Sufi' originates from the Arabic word 'Safa', meaning '**Purity**'.
- '**Abul Fazl**' mentions fourteen Silsilahas in '**Ain-i-Akbari**'.
- **Chishti, Suhrawardi, Qadri, Shattari** and **Naqshbandi** were the most important among the fourteen orders (Silsilhas) or mystic organizations.
- A **Murid**, literally means "one who seeks", is a novice committed to spiritual enlightenment by **suluk** (traversing a path) under a spiritual guide, who may assume the title **Murshid, Pir** or **Shaykh**.
- The monasteries where the Sufis inhabited were called '**Khanqahs**'.

- The Sufis' religious associations were divided into **Ba-Shara** (proponents of Islamic doctrine) and in **Be-Shara** (not associated with Islamic doctrines).

### 1. Chishti order

- According to Sayyid Muhammad Hafiz, Chishti was the first Sufi order had come to India.
- Abu Ishaq Shami and Abu Ahmed Abdal founded the Chisti order.
- **Khwaja Muinuddin Chishti** laid the foundation of Chisti order in India. (UPPCS, 2002)
- Khwaja Muinuddin Chishti came to India with Ghori's army.
- He was followed by Khwaja Bakhtiar Kaki, Sultan Qutbuddin Aybak and Sultan Iltutmish.
- **Sheikh Fariduddin - Ganj-i-Shakar** was a Sufi saint of Chishti Silsilah who was famous as "**Baba Farid**".
- Some of the compositions and ideas of 'Baba Farid' were compiled in Adi Granth of the religious text of Sikhism. He was the son-in-law of Balban. (UPPCS, 1994)
- Nizamuddin Auliya's acclaimed disciples were **Sheikh Salim Chishti, Amir Khusrau** and **Hassan Dehlavi**. (UPPCS, 2006)
- Baba Farid had two prominent disciples, Nizamuddin Auliya (1238-1325 AD) and Nasiruddin Chirag-e-Dehlavi, the famous saints of the Chishti sect.
- Some of the famous disciples of Nizamuddin include Sheikh Nasiruddin Chirag Dehlavi, Amir Khusro and Shaikh Salim Chisti.
- Nizamuddin Auliya was followed by Sheikh Nasiruddin and Sheikh Salim Chishti, the famous Chishti saints.
- Sheikh Salim Chishti lived at **Fatehpur Sikri**. (RAS/RTS, 1999)

### 2. Suhrawardi Order

- Abu-al-Najib Suhrawardi established this order.
- This sect was propagated in India by Jalaluddin Tabrezi, Bahauddin Zakariya and Hamiduddin Nagori. (61<sup>th</sup> BPSC, 2018)
- Saharuddin Arik, Sayyid Jalaluddin, Khursh Jalaluddin Tabrezi, etc. were the prominent saints of the Suhrawardi sect.

### 3. Qadri Order

- The founder of the Qadri sect was **Sheikh 'Muhiuddin Qadir Jilani'** of Baghdad.
- In India, this order was established by '**Sayyid Muhammad Gilani**' and '**Shah Niyamat Ullah**'.
- The most famous saint of the Qadri Order was '**Sheikh Mir Muhammad**' or '**Miyan Mir**'.

- **Dara Shukoh**, the son of Mughal emperor Shah Jahan, was a follower of the Qadri order.

### 4. Naqshbandi Order

- Naqshbandi order was founded by **Khwaja Bahauddin Naqshbandi**.
- A prominent saint of this order '**Khwaja Baqi Billah**' came to Delhi from Kabul.
- **Sheikh Ahmad Sirhindi**, a disciple of Khwaja Baqi Billah, became a famous saint of the Naqshbandi order.
- **Sheikh Ahmad Sirhindi** was a contemporary of Mughal emperor Akbar.
- Sheikh Ahmad Sirhindi opposed Akbar's liberal policies.

✎ **Note :** Naqshbandi opposed the music. (UPPCS, 2003, 13)

### 5. Shattari Order

- In 15<sup>th</sup> century, **Sheikh Abdullah Shattari** established Shattari order in India.
- Shattari order was centred at Bengal, Jaunpur and Malwa.
- Shah Mohammad Ghaus, the saint of the Shattari order, believed Lord Krishna in the form of Auliya.

✎ **Note :** Pranayama and Yoga practices were accepted by almost all Sufi sects, except Naqshbandi.

## Major Sufi Orders and Their Founders

| Sects      | Founders                  |
|------------|---------------------------|
| Chishti    | Abu Ishaq Shami Chisti    |
| Suhrawardi | Abu-al-Najib Suhrawardi   |
| Qadri      | Sheikh Abdul Qadir Gilani |
| Shattari   | Sheikh Abdullah Shattari  |
| Firdausi   | Badruddin                 |
| Naqshbandi | Bahauddin Naqshband       |

## Sufi Saints and Their Titles

|                                   |                                                 |
|-----------------------------------|-------------------------------------------------|
| 1. Khwaja Qutbuddin Bakhtiar Kaki | Qutb-ul-Aqtab                                   |
| 2. Sheikh Hamiduddin Nagori       | Sultan Tariken                                  |
| 3. Sheikh Nizamuddin Auliya       | Mehboob-e-Ilahi, Sultan ul-Auliya (UPPCS, 2014) |
| 4. Sheikh Sirajuddin Usmani       | Aina-e-Hind                                     |
| 5. Nasiruddin Chirag Dehlavi      | Chirag-e-Delhi (UPRS/ARO 2017)                  |
| 6. Sheikh Salim Chishti           | Sheikh-ul-Hind (UP Lower, 2004, 08)             |
| 7. Abdul Qadir Jilani             | Peeran-e-peer, Mehboob-e-Subhani                |
| 8. Sheikh Ahmad Sirhindi          | Mujaddid-e-Alfsani                              |

## 12. The Mughal Empire

- Babur established the Mughal Empire in India in 1526.
- The Mughal rulers did not accept the authority of the Caliphate and considered themselves independent kings.

### Babur (1526-1530 AD)

- **Zahiruddin Muhammad Babur** was born on 14<sup>th</sup> February, 1483, in the small state of **Ferghana**.  
(Chattisgarh PCS, 2003)
- He was the fifth **descendant of Timur** from the paternal side and the **fourteenth descendant of Chengiz Khan** from the maternal side.
- His father's name was **Umar Sheikh Mirza** and his mother's name was **Qutlugh Nigar Khanum**.
- Babur ascended the throne of Fergana in June 1494, at the age of eleven.
- He annexed Kabul in 1504 and assumed the title of '**Padshah**' in 1507. (UPPCS, 2015)
- He invaded five times to establish an empire in India.
- He defeated the **Yusufzai clan** in his first campaign in 1519 and went back after taking possession of Bajaur and Bhira.
- In the First Battle of Panipat in 1526 **Babur first used the Tughlama battle tactic** and the '**Usmani**' tactic to strengthen the artillery. (UPPCS, 1996)

### Major Battles of Babur

| Battle                  | Date             | Between                | Conqueror           |
|-------------------------|------------------|------------------------|---------------------|
| First Battle of Panipat | 21 April, 1526   | Ibrahim Lodi and Babur | Babur               |
| Battle of Khanwa        | 16 March, 1527   | Rana Sanga and Babur   | Babur (UPPCS, 2004) |
| Battle of Chanderi      | 29 January, 1528 | Medni Rai and Babur    | Babur               |
| Battle of Ghaghra       | 6 May, 1529      | Afghan and Babur       | Babur               |

- After the Battle of Khanwa, Babur abolished the tax on Muslims '**Tangha**'.
- He assumed the title of '**Ghazi**' after his victory in the battle of Khanwa.
- At the time of the Khanwa battle, Babur declared jihad (crusade to protect Islam). (UPPCS, 2009)
- He mentioned two Hindu kingdoms along with five Muslim ones in his autobiography **Babur Nama**, one is Vijayanagara and the other is Mewar. (UPPCS, 1995)
- He wrote his autobiography **Tuzuk-i-Baburi** (Babur Nama in Persian) in the Turkish language. (BPSC, 2015)
- His autobiography was translated into Persian by **Abdul Rahim Khane Khanan**. Payanda Khan also assisted in this work.

- He was given the title of **Kalandar** due to his generosity.
- He **died** on 26<sup>th</sup> December 1530, **at Agra**.
- His body was first **buried at Arambagh** in Agra.
- Later, he was buried in Kabul, a place that he chose in his former will.
- He was a follower of the famous Naqshbandi Sufi saint Khwaja Ubaidullah Ahrar.
- He was succeeded by Humayun.

### Humayun (1530-1540, 1555-1556 AD)

- After Babur's death, the eldest son Nasiruddin Muhammad Humayun ascended the throne at the age of twenty-three.
- Humayun was born in **Kabul** in 1508.
- His mother **Maham Begum** belonged to the Shia sect.
- He gave **Kabul** and **Qandahar** to his brother **Kamran**, **Sanbhal** to **Mirza Askari Alwar** and **Mewat** to **Mirza Hindal** out of his empire.
- He gave the kingdom of **Badakhshan** to his cousin **Suleiman Mirza**.
- His contemporary Afghan leader was Sher Khan, known as **Sher Shah Suri**.
- He established a new city called **Dinpanah**.

### Major Battles of Humayun

| Battle            | Year          | Between               | Conqueror               |
|-------------------|---------------|-----------------------|-------------------------|
| Battle of Chausa  | 26 June, 1539 | Sher Khan and Humayun | Sher Khan               |
| Battle of Bilgram | 17 May, 1540  | Sher Khan and Humayun | Sher Khan (UPBEO, 2019) |

- After winning the **Battle of Chausa**, Sher Khan assumed the title of '**Sher Shah**'.
- In the Bilgram Battle, Sher Khan defeated Humayun and annexed Agra and Delhi.
- After his defeat in the Bilgram battle, Humayun migrated to Sindh and later to Iran, where he continued to live in exile for 15 years (1540–1555).
- Humayun married Hamida Banu Begum, the daughter of the spiritual Guru of Persia Mir Ali Akbar Jami on 29<sup>th</sup> August, 1541, while in exile.
- Akbar was born to **Hamida Banu Begum**.
- On 22<sup>nd</sup> June, 1555, Humayun defeated **Sikandar Shah Suri** in the **Battle of Sirhind** and annexed Delhi.
- **Humayun Nama** was written by his sister Gulbadan Begum. (UPPCS, 2002)
- Humayun believed in astrology. Thus, he made it a point to wear clothes of seven colours in a week with colour changing each day of the week.
- On 27<sup>th</sup> January, 1556, Humayun died after falling from the stairs of the library at **Dinpanah Palace**.



- In the words of historian Lane-Poole, he "tumbled out of life as he had tumbled through it".
- The first garden tomb of the Indian Subcontinent is Humayun's Tomb.

#### Sher Shah Suri (1540-1545 AD)

- Sher Shah was born in 1472 at a place called **Bajwara** (Hoshiarpur) of an Afghan wife of **Hasan Sur**.
- His childhood nickname was **Farid**. He belonged to the **Sur Dynasty**.
- His father was **Hassan Khan**, a landlord of Sasaram.
- **Bahar Khan Lohani**, the then ruler of southern Bihar, was pleased with his bravery and conferred on him the title of '**Sher Shah**'.
- Sher Shah established **Sur Dynasty** and the second Afghan Empire in North India in 1540.
- He ascended the throne of Delhi after defeating Humayun in the **Battle of Bilgram** in 1540.
- He built '**Rohtasgarh Fort**'.
- He defeated Maldeo in 1543-44 and annexed Ajmer, Jodhpur and Marwar.
- The battle at **Kalinjar** in 1545 is considered his last campaign. (UPRO/ARO, 2016)
- He died in a gunpowder explosion on 13<sup>th</sup> May, 1545.
- Kalinjar was ruled by **Kirat Singh** at the time of this campaign.
- Sher Shah's tomb was built on the high mound in the middle of the lake in '**Sasaram**' in Bihar. (UPPCS, 2002, MPPCS, 2016)
- He studied in Jaunpur which was an important centre of higher education at that time. (RAS/RTS, 2013)
- He is considered to be the **precursor of Akbar** as emperor and administrator.
- He built the mosque named **Rohtasgarh Fort, Qila-i-Kuhna (Delhi)**. (UPPCS, 2016)
- He built the buildings of Purana Qila in Delhi.
- He used 30.36-inch **Gaj-e-Sikandari** and **Flax stem** for land measurement.
- He introduced **Kabuliyat** and **Patta System**. (UPPCS, 2008)
- He introduced **silver** and **copper coins**. (UPPCS, 1991)
- He re-established **Pataliputra as Patna** in 1541.
- He defeated the ruler of Bengal, **Nusrat Shah**, and assumed the title of '**Hazrat-i- Ala**'. (44<sup>th</sup> BPSC, 2000)
- He was impressed by the valour of the Rajputs in the war of Marwar, said that "for a handful of Bajra, I nearly lost the Kingdom of Hindustan". The ruler there at that time was Maldeo. (UPPCS, 2007)
- Sher Shah was succeeded by his son **Islam Shah**. (MPPCS, 2018)

- Islam Shah erected five forts there to protect the north-west border. These forts were built at Shergarh, Islamgarh, Rashidgarh, Firuzgarh and Mankot. These were jointly called the '**Forts of Mankot**'.

#### Akbar (1556-1605 AD)

- Akbar was born on 15<sup>th</sup> October, 1542, of **Humayun's** wife **Hamida Banu Begum** at Amarkot.
- His childhood nickname was **Jalal**.
- He was in Punjab when Humayun died.
- He was crowned at the age of 13 on 14<sup>th</sup> February, 1556, at **Kalanaur** on the throne of bricks by his **patron Bairam Khan**. (Chattisgarh PCS, 2015)
- Jalaluddin Muhammad Akbar ascended the throne assuming the title of **Ghazi**.
- His **teacher Abdul Latif** was an Iranian scholar.
- Bairam Khan remained a patron of Akbar from 1556 to 1560.
- **Bairam Khan** was killed by an Afghan in Gujarat during a pilgrimage to Mecca.
- In a bid to expand the empire, Akbar made his first attack in 1561 against Baz Bahadur, the ruler of Malwa.
- The Mughal army conquered **Ahmadnagar** in 1600 despite facing strong opposition from **Chand Bibi**.
- **Abdul Rahim** had conferred the title of **Khan-i- Khanan**.

| Important Works by Akbar                        |                       |
|-------------------------------------------------|-----------------------|
| Work                                            | Year (AD)             |
| Abolition of Slave Practice                     | 1562                  |
| Abolition of Purdah System                      | 1562                  |
| Abolition of Pilgrimage Tax                     | 1563<br>(BPSC, 2011)  |
| Abolition of Jizya Tax                          | 1564                  |
| Foundation of Fatehpur Sikri                    | 1571                  |
| Change of capital from Agra to Fatehpur Sikri   | 1571                  |
| Establishment of Ibadatkhana (House of Worship) | 1575<br>(MPPCS, 1981) |
| Proclamation of Mazhar                          | 1579                  |
| Din-i-Ilahi was established                     | 1582                  |
| Beginning of Ilahi Era                          | 1583                  |

- On 5<sup>th</sup> November, 1556, the **second battle of Panipat** took place between **Akbar** and **Hemu**.
- **Raja Birbal died** in an attack by the **Yusufzais**.
- Akbar built the **Buland Darwaza** at the capital at **Fatehpur Sikri** in commemoration of **Gujarat victory**. (UPPCS, 1993)

- Kandahar province first came under the Mughal rule in 1595 during Akbar's reign.
  - Akbar's Rajput policy was based on repression and settlement.
  - Akbar won **Khandesh**, a southern kingdom, in 1601.
  - Malik Ambar, who opposed the Mughals in the Deccan, was an efficient administrator of the Ahmednagar State.
  - The first rebellion during Akbar's reign occurred in 1564 when Uzbeks rose in revolt.
  - In the **Battle of Haldighati** (1576), the commander of Akbar was **Man Singh**. (UPPCS, 2010)
  - Akbar conferred the title of '**Amir-ul-Umra**' on Bhagwan Das, the son of Raja Bharmal of Amer.
  - During the conquest of Gujarat, Akbar **first time saw the sea** and met the Portuguese.
  - Akbar was the principal patron of the **Din-i-Ilahi** religion which he started in 1582. (Chattisgarh PCS, 2011)
  - **Abul Fazl** was the chief priest of the Din-i-Ilahi religion. He also composed **Akbar Nama**.
- 📌 **Note :** Smith said- 'Din-i-Ilahi is a memorial to Akbar's stupidity, not his intelligence'.
- Faizi, the elder brother of Abul Fazl, held the position of poet laureate at the court of Akbar.
  - **Birbal** was the first and last Hindu to accept **Din-i-Ilahi** religion.
  - His childhood nickname was **Mahesh Das**.
  - Akbar conferred the titles of '**Jagadguru**' on Jain Acharya **Hari Vijaya Suri** and '**Yug Pradhan**' on Jin Chandra Suri. (UPPCS, 2002)
  - Akbar conferred the titles of '**Raja**' and '**Kavi Rai**' on Birbal.
  - '**Rahim**' or Abdul Rahim was a famous Hindi poet at Akbar's court.
  - Sheikh Mubarak drafted the document titled '**Mazhar**'.
  - Sheikh Mubarak was the father of Abul Fazl and Faizi.
  - Diwan Todar Mal of Akbar gained fame in the field of land revenue collection. (UPPCS, 1992)
  - He implemented the **Dahsala system** for land revenue.
  - Todar Mal was known as **Mushrif-i-Diwan**. (VDO, 2023)
  - In 24<sup>th</sup> year of his rule, Akbar introduced a new tax system called '**Ain-i-Dahsala**' or '**Zabt System**'. (BPSC, 1994)
  - Under this system, revenue was charged one-third of the average by taking the standard of the last ten years production of different crops and their prevailing prices at the same time.
  - Coins with figures of Rama and Sita and Ram Siya written in Devnagari script were issued during **Akbar's** reign. (UPPCS, 2011)
  - Famous musician **Tansen** lived in Akbar's court.
  - Akbar conferred the title of '**Kanthabharan Vani Vilas**' on Tansen.
  - His original name was **Ramtanu Pandey**. (UPPCS, 2011)
  - The main works of Tansen are **Miyan Ki Todi**, **Miyan Ki Malhar**, **Darbari Kanhara** and **Miyan Ka Sarang**, etc.
  - Tansen, one of the Nauratnas of Akbar's court, was expert in playing the Rudra Veena or Rabab.
  - Swami **Haridas** was a great musician during Akbar's reign. He lived in Vrindavan and sang devotional songs of Lord Krishna.
  - The famous painters of Akbar's court were **Abdus Samad**, **Daswanth** and **Basawan**. (RAS/RTS, 1992)
  - **Baz Bahadur**, **Baba Ramdas** and **Baiju Bawra** were prominent composers during Akbar's reign.
  - The main feature of Akbar's system of governance was the **Mansabdari System**.
  - The Mansabdari System was borrowed from Central Asia (Mongolia), and its inspiration came from the Caliph '**Abba Said**'.
  - Adham Khan, the son of Maham Anga was killed by Akbar in 1562. (UPPCS, 2010)
  - Adham Khan had killed Akbar's lawyer Ataga Khan.
  - The state of Mewar did not accept Akbar's Suzerainty. (UP Lower, 2004)
  - After the death of Rana Pratap, his son **Rana Amar Singh** concluded a treaty with Jahangir in 1615.
  - In 1580, a religious teacher of Jaunpur, Mulla Yazdi issued a fatwa for all Muslims to rise in revolt against Akbar. (UPPCS, 2011)
  - The style of the **Panchmahal** building at Fatehpur Sikri built by Akbar is similar to a **Buddhist Vihara**.
  - **Birbal**, **Abul Fazl**, **Tansen**, **Todar Mal**, **Faizi**, **Man Singh**, **Abdul Rahim Khan-i-Khanan**, **Mulla do Piazza**, and **Fakir Azizuddin** were the **nine jewels** at Akbar's Court.
  - **Abul Fazl was killed** by a Sardar named **Vir Singh Bundela** in 1602 while returning to Agra from the south under Jahangir's instructions. (JPCS, 2013)
  - Akbar set up a translation department headed by Faizi.
  - As wished by Akbar, **Abdul Qadir Badauni** translated the **Ramayana** written in Sanskrit **into Persian**. (UPPCS, 2013, 15)
  - Faizi translated **Leelavati**, and **Abul Fazl** translated **Kalia Daman** into Persian.
  - Akbar's reign is called the '**golden period of Hindi Literature**'.
  - Akbar conferred the title of '**Kavipriya**' on Birbal and '**Mahapatra**' on Narahari.

- Akbar conferred the title of ‘**Zari Kalam**’ on **Muhammad Hussain** and ‘**Sirin Kalam**’ on **Abdus Samad**.  
(UPPCS, 1995)
- Akbar’s contemporary was the famous Sufi Saint Sheikh Salim Chishti.
- Akbar was a contemporary of Queen **Elizabeth-I** of England.  
(UPPCS 2002)
- At the time of the establishment of the East India Company in December 1600, the Queen of England was Elizabeth.
- **Ralph Fitch** was the first English merchant to reach Fatehpur Sikri and Agra.  
(UPCS, 2003)
- The official language of the Mughals was **Persian**.  
(UPPCS, 2012)
- Akbar used to play an instrument called **Nakkara (Nagara)**.
- Akbar died on 16<sup>th</sup> October, 1605, after suffering from **dysentery**.
- Akbar was buried at **Sikandra** near Agra.

#### **Jahangir (1605-1627 A.D.)**

- **Jahangir (Salim)**, the son of Mughal emperor **Akbar**, was born on 30<sup>th</sup> August 1569, at **Sheikh Salim Chishti’s** hut located at Fatehpur Sikri of **Mariam-uz-Zamani**, the daughter of **Raja Bharmal of Amer (Jaipur)**.
- Mariam-uz-Zamani’s real name was **Harkha Bai**.
- Jahangir was named Salim after the Sufi saint Salim Chishti.
- Salim’s main teacher was **Abdul Rahim Khan-i-Khanan**.
- He was crowned at **Agra Fort** on 12<sup>th</sup> October, 1605.
- After the coronation, he assumed the title of ‘**Nuruddin Muhammad Jahangir Badshah Ghazi**’.
- The twelve declarations of Jahangir were called **Tuzk-e-Jahangiri**.
- Jahangir’s eldest son **Khusrau** revolted against his father in 1606. Khurram killed Khusrau in 1622.
- Arjun Dev, the fifth Guru of the Sikhs, was executed for the crime of assisting Khusrau.
- Amar Singh, the Sisodiya Rajpur ruler of Mewar, accepted the Service of the Mughal’s during the reign of Jahangir.
- Jahangir married **Mehrunnisa** (Nur Jahan) in 1611 and conferred the title of ‘**Nur Mahal**’ on her.
- Mehrunnisa was the former wife of Ali Quli Beg.
- Jahangir conferred the title of ‘**Sher Afghan**’ on Ali Quli Begh for killing a lion.
- After the death of Sher Afghan, Mehrunnisa was employed in the service of Salima Begum, Akbar’s widow.
- Lado Begum, the daughter of Mehrunnisa from Sher Afghan, was married to Shaharyar, the son of Jahangir.
- Jahangir appointed Nur Jahan’s father **Ghiyas Begh** as diwan and conferred the title of ‘**Itimad ud-Daulah**’ on him.
- Jahangir **banned the use of tobacco** in his empire.  
(UPPCS, 2005)

📌 **Note :** Nur Jahan formed a group called ‘**Junta Group**’.

- **Do - Aspa** and **Shi-Aspa** were introduced during the reign of Jahangir.  
(16<sup>th</sup> BPSC, 2004)
- First, this post was given to Mahavat Khan, the commander of Jahangir.
- The Treaty of Chittorgarh was signed between Rana Amar Singh and the Mughal Emperor Jahangir in 1615.  
(UPPCS, 2008)

| <b>Sikh Gurus</b> |               |                                                 |
|-------------------|---------------|-------------------------------------------------|
| <b>Guru</b>       | <b>Period</b> | <b>Achievements</b>                             |
| Nanak             | 1469-1539     | Founder of Sikhism                              |
| Angad             | 1539-1552     | Father of Gurmukhi script<br>(UPPCS, 2017)      |
| Amar Das          | 1552-1574     | Construction of 22 preaching centres            |
| Ram Das           | 1574-1581     | Founder of Amritsar City<br>(UPPCS, 1996)       |
| Arjan Dev         | 1581–1606     | Built the Golden Temple                         |
| Hargobind Singh   | 1606–1644     | Erected the Akal Takht                          |
| Har Rai           | 1644–1661     | Participated in the war of succession           |
| Har Krishan       | 1661-1664     | Died at a young age                             |
| Tegh Bahadur      | 1664-1675     | Hanged by Aurangzeb<br>(Chhattisgarh PCS, 2004) |
| Gobind Singh      | 1675-1708     | Establishment of Khalsa Panth<br>(MPPCS, 2014)  |

- Jahangir had five sons- 1.Khusrau, 2.Parviz, 3. Khurram, 4.Shaharyar and 5.Jahandar.  
(MPPCS, 2015)
- Khurram (Shah Jahan) revolted, but the revolt was suppressed by Mahabat Khan in 1623.
- Mughal **painting** reached its **climax** during the **reign of Jahangir**.  
(IAS 1996)
- Jahangir’s reign is considered the **golden period of painting**.
- **Ustad Mansoor** and **Abul Hasan** were the best painters during the reign of Jahangir.
- Emperor Jahangir conferred the title of ‘**Nadir-ul-Asr**’ on Ustad Mansur and ‘**Nadir-ud-Jama**’ on Abul Hasan.  
(UPPCS, 2013, 04)
- **Ustad Mansur** was a famous painter of birds’ pictures, while **Abul Hasan** had mastered in painting of human pictures.  
(UPPCS, 1998)
- Jahangir wrote his autobiography ‘**Tuzuk-e-Jahangiri**’ in Persian.  
(UPPCS, 2001)
- Mutamid Khan wrote the biography of Jahangir, known as Iqbalnama-i-Jahangiri.
- **Nur Jahan** built the tomb of his father “**Itmad-ud-Daulah**” between 1622 and 1628.  
(BPSC, 2008)

✎ **Note :** Notably, it is the first building finished in white marble.

- The tomb of Itmad-ud-Daulah was the first work in **Pietra Dura style (inlay)** of construction.

### Mughal Rulers and Their Nick Names

| Ruler           | Nickname          |
|-----------------|-------------------|
| Aurangzeb       | Zinda Pir         |
| Jahandar Shah   | Lustful stupid    |
| Farrukhsiyar    | Disgusting coward |
| Rafi-ud-Darjat  | Puppet ruler      |
| Muhammad Shah   | Rangila           |
| Bahadur Shah-I  | Shahi-i-Bekhabar  |
| Bahadur Shah-II | Zafar             |

- Jahangir's scripture is engraved on Ashoka's **Kaushambi Pillar**.
- William Hawkins came to the Mughal emperor Jahangir's court.
- Jahangir offered the mansab of 400 to Hawkins.
- He conferred the title of '**English Khan**' on Hawkins and married him to a woman from Armenia. (UPPCS, 2015)
- He was buried in a garden at **Shahdara** (Lahore). (UK Lower, 2010)
- His **tomb** was built by **Nur Jahan**.
- Sir Thomas Roe was the first ambassador of the British Emperor, who came to the court of Jahangir. (UPPCS, 2008)

### Major Architecture

| Architecture        | Builder                        | Year (A.D) |
|---------------------|--------------------------------|------------|
| Agra Fort           | Akbar                          | 1565-73    |
| Fatehpur Sikri      | Akbar                          | 1571-85    |
| Taj Mahal           | Shah Jahan                     | 1631-48    |
| Jama Masjid (Delhi) | Shah Jahan                     | 1644-56    |
| Red Fort            | Shah Jahan                     | 1639-48    |
| Bibi Ka Maqbara     | Azam Shah<br>(Aurangzeb's son) | 1651-61    |

### Shah Jahan (1628–1658) AD

- Shah Jahan was born in **Lahore** on January 1592 to Jahangir's wife **Jagat Gosain Manavati** (Rajput).
- Jagat Gosai was the daughter of **Mota Raja Udai Singh**, the ruler of Jodhpur.
- The childhood name of Shah Jahan was **Khurram**.
- In 1612, Khurram married **Arjumand Banu Begum**, the daughter of Asaf Khan.
- 'Arjumand Banu Begum' was later known as '**Mumtaz Mahal**'. (JPCS, 2003)
- **Shah Jahan** conferred the title of **Wazir** on Asaf Khan and Khan-i-Khanan on **Mahabat Khan**.

- After Jahangir's death, his son, Shah Jahan ascended the throne in 1628.
- In 1632, Shah Jahan waged a campaign against the **Portuguese** at Hooghly, where the Portuguese were defeated.
- Mumtaz Mahal died in June, 1631 due to labour pain.
- After the death of **Mumtaz Mahal**, Shah Jahan built the **Taj Mahal** in her memory.
- **Ustad Ahmad Lahori** was the chief architect to build the Taj Mahal.

✎ **Note :** **Humayun's Tomb** is considered to be the precursor of the Taj Mahal.

- Shah Jahan's reign is called as the '**golden period of** Mughal rule for its architectural beauty.
- Shah Jahan built **Moti Masjid** at **Agra Fort**.

✎ **Note :** The construction of the Red Fort was completed under the supervision of '**Hamid Ahmad**'.

### Major Books During Mughal Period

| Book Name                             | Author               | Language |
|---------------------------------------|----------------------|----------|
| Tuzuk-i-Baburi (Babur Nama)           | Babur                | Turkish  |
| Tarikh-e-Rashidi                      | Mirza Haider Dughlat | Persian  |
| Humayun Nama                          | Gulbadan Begum       | Persian  |
| Tarikh - i - Salatin - i - Afghaniyah | Ahmad Yadgar         | Persian  |
| Habib - Us - Siyar & Khondmir         | Sayyid Khundmir      | Persian  |
| Qanun-i-Humayuni                      |                      |          |
| Tarikh-i-Sher Shahi                   | Abdas Khan           | Persian  |
| Tohfa-i-Akbar Shahi                   | Sarwani              |          |
| Akbar Nama                            | Abul Fazl            | Persian  |
| Tobaqat-i-Akbari (UPPCS, 2016)        | Nizamuddin Ahmad     | Persian  |
| Muntakhab-ul-Tawarikh                 | Abdul Qadir Badauni  | Persian  |
| Iqbalnama-i- Jahangiri                | Mutamad Khan         | Persian  |
| Tazkirat-ul-Waqiat                    | Jauhar Aftabchi      | Persian  |
| Waqiat-e-Mushtaqi                     | Rizaqulla Mushtaqi   | Persian  |

- Mughal emperor Shahjahan built Sheesh Mahal in Agra.
- Shah Jahan first invaded **Ahmadnagar** in south India and conquered and annexed it to the Mughal Empire in 1636.
- Shah Jahan was presented the **Kohinoor diamond** by **Muhammad Sayyid** (Mir Jumla). (UPPCS, 2015)
- Mir Jumla was the Prime Minister of Sultan Abdullah Qutb Shah of Golconda.
- Shah Jahan shifted his **capital** from Agra to **Delhi** in 1638. (UPPCS, 2008)
- He laid the foundation stone of **Shahjahanabad** on the right bank of Yamuna.



- During the reign of Shah Jahan, Dara Shukoh translated the Upanishads into Persian titled **Sirr-e-Akbar**. (UPPCS, 2000)
- He appointed an Iranian who composed poems in Persian style, **Kalim** as a '**royal poet**'. (UPPCS, 2015)
- He **abolished the court custom 'Sijda'** started by Balban. (UPPCS, 2010)
- He had four sons - Dara, Shah Shuja, Aurangzeb and Murad.
- In September 1657, Shah Jahan fell seriously ill. Rumours of his death resulted in a war of succession among his sons.
- Shah Jahan conferred the title of "**Shah Buland Iqbal**" on **Dara Shukoh**. (UP RO/ARO, 2014)
- In April 1658, the **Battle of Dharmat** was fought between the imperial army and Aurangzeb, where the royal army was defeated. (IAS, 2003)
- In May 1658, the **battle of Samugarh** between Dara Shukoh and Aurangzeb where Dara was took place in which defeated.
- The last battle of succession was fought between Dara and Aurangzeb in the **Valley of Deorai** in March, 1659.
- Dara was defeated in the Battle of Deorai and while wandering in the wilderness, he reached Malik Jeevan Khan, the zamindar of Dadar.
- Malik Jeevan fraudulently handed Dara over to Aurangzeb.
- Aurangzeb killed Dara after insulting him.

✍ **Note :** 'A.L. Srivastava has called the reign of Shah Jahan the 'golden period' of the Mughal empire. (41<sup>th</sup> BPSC, 1996)

- Shah Jahan died on 22<sup>nd</sup> January, 1666.
- He was buried at the Taj Mahal near the tomb of his wife.

#### Dara Shukoh

- Dara Shukoh was born in 1615 of Shah Jahan's beloved wife **Mumtaz Mahal**.
- For Dara's tolerance and generosity, Lane-Poole has called him '**Little Akbar**'.
- Daras Shukoh translated **Upanishads**, **Bhagavad Gita**, **Yoga Vashishth** and **Ramayana** into Persian.
- **Majm-ul-Bahrain** is the original creation of Dara Shukoh. (Chhattisgarh PCS, 2018)

| Prominent Women During Mughal Period |                |                                                                                                                  |
|--------------------------------------|----------------|------------------------------------------------------------------------------------------------------------------|
| Sl. No.                              | Woman          | Work                                                                                                             |
| 1.                                   | Gulbadan Begum | Composed Humayun Nama. She was a fiery scholar of Arabic and Persian.                                            |
| 2.                                   | Maham Anga     | Till 1560-62 AD, she ran the petticoat government Established 'Madrassa-i-Begum' in Delhi. (UPPCS, 2012)         |
| 3.                                   | Nur Jahan      | Jahagir's wife, led 'Junta Group' which brought about an elegant transformation in many cosmetics and jewellery. |

|    |              |                                                                                                                                                       |
|----|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4. | Mumtaz Mahal | Dear wife of Shah Jahan. She was also a prominent expert in cosmetics and jewellery.                                                                  |
| 5. | Jahanara     | Jahanara was the eldest daughter of Shah Jahan, a woman of very high religious and moral ideology. She remained with Shah Jahan during his captivity. |
| 6. | Zebunnisa    | The daughter of Aurangzeb, she established a library called "Betul-ul-Uloom" in Delhi.                                                                |
| 7. | Asmat Begum  | Invented the method of making perfumes.                                                                                                               |

#### Aurangzeb (1658–1707) AD

- Muhiuddin Muhammad Aurangzeb was born on 3<sup>rd</sup> November, 1618, of Mumtaz Mahal, the wife of Shah Jahan, near Ujjain, at a place called 'Dohad'.
- Aurangzeb was first coronated on 21<sup>st</sup> July, 1658, and the second at Delhi on 5<sup>th</sup> June, 1659. (UPPCS, 2002)
- He was called **Zinda Pir**. (UP RO/ARO, 2017)
- **Treaty of Purandar** was signed on 11<sup>th</sup> June, 1665, between **Jai Singh** and **Shivaji**.
- On the assurance of Mirza Raja Jai Singh, on 12<sup>th</sup> May, 1666, Shivaji along with his son Shambhaji appeared at the court of Aurangzeb where he was fraudulently arrested and kept in Jaipur Bhavan.
- Shivaji escaped from Aurangzeb's arrest through a stratagem.
- **Guru Teg Bahadur** was the ninth of ten Gurus of the Sikh religion. He was publicly beheaded by the orders of Aurangzeb in 1675 for refusing to convert in to Islam. (Chattisgarh PCS, 2005)
- Aurangzeb abolished major **Abwabas** (local taxes), such as '**Rahadari**' (inland transport duty) and **Paandari** (mercantile taxes) for the redressal of the economic sufferings of the subjects.
- He **re-imposed Jizya tax** in April 1679. (UP PCS, 2002)
- He was a staunch conservative Sunni Muslim.
- In 17<sup>th</sup> century, **Bibi Ka Maqbara** was built in Aurangabad (Maharashtra) by Aurangzeb's son Azam Shah. This Maqbara was commissioned by Aurangzeb and built by Azam Shah.

✍ **Note :** Bibi Ka Maqbara is also known as the '**Second Taj Mahal**'. (UPPCS, 2013)

- Aurangzeb annexed **Bijapur** to the Mughal Empire in 1686. (UPPCS, 1992)
- **Golconda** was annexed to the Mughal Empire in 1687 by Aurangzeb.
- The Brahmins named Madanna and Akana were related to Abul Hasan, the ruler of Golconda.
- During the reign of Aurangzeb, the Mughal army had the maximum number of Hindu commanders. (UPPCS, 2000)

- Aurangzeb stopped the practice of lighting diyas on Thursday (Jumerat) night on pirs and other graves.
- His goal was to make India country **Dar-ul-Islam** in place of **Dar-ul-Harb**.
- He prohibited Hindu festivals and celebrations.
- During the reign of Aurangzeb, there was a rebellion led by Jat leaders **Gokul** and **Rajaram**.
- This rebellion was suppressed in 1670 where Gokul died.
- Taking advantage of Aurangzeb's engagements in southern campaigns, a rebellion against started led by Rajarama, in which the Jats looted Akbar's tomb at Sikandra.
- The foundation of **Bharatpur dynasty** was laid by **Churaman**, a Jat leader and nephew of Rajaram, during the reign of Aurangzeb.
- Aurangzeb appointed Raja Bishan Singh Kachwaha of Amer to eliminate the Jats.
- Bishan Singh defeated Churaman and annexed his kingdom.
- Aurangzeb was skilled at playing **Veena**. (UPPCS, 2010)
- He banned writing the history of that time in his court.
- **Music** was **banned** by Aurangzeb.
- During the reign of Aurangzeb, most books of classical music were written in Persian.
- He banned Kalma inscriptions on coins, celebrating Navroz festival, cultivating hemp, Jharokha darshan, song-music, etc.
- Mughal Emperor Aurangzeb attempted to demolish the Kailash temple in Ellora.
- His physician was '**François Bernier**', a French traveller.
- He died on 3<sup>rd</sup> of March, 1707 at Ahmadnagar.
- He was buried near the tomb of Sufi saint **Zain-ud-din Shirazi**, four miles away from Daulatabad.

### 13. Mughal Government System

- The basis of Mughal kingship was '**Shariat**' (combined name of Quran and Hadis).
- The Mughal regime was highly centralized.
- The word '**Wizarat**' was used for the Council of Ministers.
- The Mughal Prime Minister was called '**Wakil**'.
- The Diwan, Mir Bakhshi, Mir Saman and Sadr-us- Sudur were assistants to the Wakil.
- Akbar increased the powers of the Diwan to limit powers of Wakil.
- Akbar established a new post '**Diwan-i-Wazarat-i- Kul**' in the 8<sup>th</sup> year of his reign.
- During the reign of Aurangzeb, Asad Khan served as Diwan for 31 years.
- **Mir Bakhshi** was the head of the **military department** in the Mughal period. (IAS, 1997)
- Mir Bakhshi was in charge of military payments and accounts.

- After issuing the certificate called 'Sarkhat', the soldiers were paid salaries.
- In Mughal administrative parlance the word '**Mal**' was related to land revenue. (UP Lower, 2009)

#### Some Mughal Officials

|               |                          |
|---------------|--------------------------|
| Mustaufi      | Auditor                  |
| Mushrif       | Accountant               |
| Mir-e-Barr    | Forest Superintendent    |
| Mir-i-Bahar   | Chief of the Naval Staff |
| Wakia Navis   | News Reporter            |
| Sawaneh Nigar | Biographer               |
| Khufia Navis  | Secret Writer            |
| Harkarah      | Verbal Reporter          |

- In the Mughal administration, **Muhtasib** was the **Chief of the Inspection Department of Public Conduct**. (47<sup>th</sup> BPSC, 2005)
- Akbar expelled the prostitutes from the city and settled them in a new place and named it '**Shaitanpuri**'.
- The **Mansabdari system** was a special administrative system, introduced by **Akbar**. (UPPCS, 1992)
- The Mughal military system was based on the **decimal system**.
- The word **Mansab** means '**category**' or '**Rank**'.
- There were 33 categories under the Mansabdari System.
- Akbar introduced the dual system of **Zat** and **Sawar** in the 40<sup>th</sup> year of his rule.
- Land revenue was the major source of income of the State during the medieval period.
- An order given by a prince was called '**Nishaan**'.
- The royal order was called '**Farman**'.
- '**Al-tamgha Jagir**' was started in the time of **Jahangir**.

#### Medieval Currencies

| Currency | Dynasty   | Metal                     |
|----------|-----------|---------------------------|
| Muhar    | Akbar     | Gold Coin                 |
| Shamsab  | Akbar     | Gold Coin (Largest)       |
| Ilahi    | Akbar     | Gold Coin                 |
| Rupaya   | Sher Shah | Silver Coin               |
| Dam      | Akbar     | Copper Coin (UPPCS, 2008) |
| Jital    | Iltutmish | Copper Coin               |
| Nisar    | Jahangir  | Copper Coin               |

- The Judicial Department was headed by **Qazi-ul-Quzat**.
- The principal officer of the Royal Home Department was also known as '**Mir Saman**' or '**Khan-i- Saman**'.

- **'Tanab'** was a bamboo rod with iron rings used for land measurement.
- **Takavi** was an agricultural loan given by the government to farmers.
- **Khut** was the title of revenue collector of the village.
- **Zaribana** was a fee paid to the employees measuring the land from Jarib.
- **Madad-i-Mash** was a grant of land or pension provided to saints and scholars. (46<sup>th</sup> BPSC, 2003)
- During Akbar's rule, the land was divided into four categories on the basis of the yield - **Polaj**, **Parati**, **Chachar** and **Banjar**.
- Akbar started using **Ilahi Gaj** (41 Angul or 33 inches) in place of **Sikandari Gaj** (30.36 inches) in the 31<sup>st</sup> year of rule (1686-87) for land measurement.
- During the Mughal Period, the major system of land revenue determination was **Batai** or **Ghalla Bakhshi**. (BPSC, 2008)
- The offerings made by the rich to the emperor on various occasions in the Mughal period was called **Nazarana** or **'offering'**.
- The foundation of Jagirdari system was laid during the reign of Akbar.
- Jagirs used to have hereditary officers called **'Chaudhuri'** and **'Qanungo'** related to the Land Revenue Administration.
- Jahangir appointed a Hindu named **'Srikanth'** as the 'Judge' to decide the cases of Hindus.
- In the **Kankut System**, cultivation was measured by steps or rope, and then revenue was estimated by estimating the yield per bigha.

### Mughal Emperors and Their Provinces

| Name of Emperor | Number of Subahs                                    | Newly joined Subah                   |
|-----------------|-----------------------------------------------------|--------------------------------------|
| Akbar           | 12 Provinces (12+3=15)<br>Described in Ain-i-Akbari | 3 (Barar, Khandesh and Ahmadnagar)   |
| Jahangir        | 15 Provinces (Kangra Jeetak merged with Lahore)     |                                      |
| Shah Jahan      | 18 Provinces                                        | 3 (Kashmir, Thatta and Odisha)       |
| Aurangzeb       | 20 Provinces                                        | 2 (Bijapur- 1686 and Golconda- 1687) |

### Mughal Revenue Officers

- The main unit of land revenue was the village which consisted of two officers belonging to Malguzari (Revenue) - **Muqaddam** and **Patwari**.

- In Pargana, **Amil**, **Qanungo** and **Amin** were the principal officers for land revenue collection.
- Akbar employed an officer named **Karori** in all areas of northern India except Bengal, Bihar and Gujarat to implement his Dahsala system in 1573.
- **Akbar** introduced **'Jharoka Darshan'** and **'Tuladan'**.
- **Aurangzeb** stopped **Jharoka Darshan** and **Tuladan**.

### Women in Mughal Period

- Akbar's foster mother Maham Anga ran the **Purdah government** from 1560-62 AD and established the 'Khair-ul-Manzil Madrasa' in Delhi.
- Nur Jahan was the wife of Jahangir who led the **'Junta group'**.
- Nur Jahan's mother, Asmat Begum invented the art of extracting perfumes from rose flowers.

### Peshwa Battles and Its Consequences

| Battle                           | Year      | Between                   | Conqueror                      |
|----------------------------------|-----------|---------------------------|--------------------------------|
| Kheda                            | 1707      | Tarabai and Shahu         | Shahu                          |
| Varna                            | 1731      | Shambhaji and Shahu       | Shahu                          |
| Sangola                          | 1750      | Peshwa and Chhatrapati    | Peshwa                         |
| Third Battle of Panipat          | 1761      | Abdali and Balaji Bajirao | Abdali                         |
| I- Anglo-Maratha Battle          | 1775-1782 | British and Maratha       | The British (Treaty of Salbai) |
| Maratha II- Anglo-Maratha Battle | 1803-1805 | British and Maratha       | The British                    |
| III-Anglo-Maratha Battle         | 1817-1818 | British and Maratha       | The British                    |

### Real Names and Titles of Mughal Rulers

| Ruler          | Real Name        | Titles                                                                         |
|----------------|------------------|--------------------------------------------------------------------------------|
| Babur          | Babur            | Padshah, Mirza, Ghazi                                                          |
| Humayun        | Humayun          | Nasiruddin Muhammad                                                            |
| Akbar          | Jalal            | Jalal-ud-din Muhammad Akbar Badshah Ghazi                                      |
| Jahangir       | Saleem           | Nuruddin Muhammad Jahangir Badshah Ghazi                                       |
| Shah Jahan     | Khurram          | Abul Muzaffar Shahabuddin, Muhammad Sahib, Qiran-i-Sani                        |
| Aurangzeb      | Aurangzeb        | Abul Muzaffar, Muhi-ud-Din Muhammad, Aurangzeb Bahadur, Alamgir, Badshah Ghazi |
| Bahadur Shah-I | Mohammad Muazzam | Shah Alam-I, Shahi-i-Bekhabar                                                  |

|               |                |                   |
|---------------|----------------|-------------------|
| Jahandar Shah | Muizuddin      | Lustful Stupid    |
| Farrukhsiyar  | Farrukh-siyar  | Abominable Coward |
| Alamgir-II    | Aziz-ud-din    | Alamgir-II        |
| Shah Alam-II  | Ali Gauhar     | Shah Alam-II      |
| Shah Jahan-II | Rafi-ud-dawlah | Shah Jahan-II     |
| Muhammad Shah | Muhammad Shah  | Rangeela          |

### Mughal Emperors and Their Mausoleums

| Mughal Emperor | Tomb                    |
|----------------|-------------------------|
| Babur          | Kabul                   |
| Humayun        | Delhi                   |
| Akbar          | Agra (Sikandra)         |
| Jahangir       | Lahore (Shahdara)       |
| Shah Jahan     | Agra                    |
| Aurangzeb      | Aurangabad (Daulatabad) |

## 14. Advancement of Marathas

- **Shivaji** is said to have been the founder of the **Maratha Empire**.
- He was born on 19<sup>th</sup> February 1630 in the **fort of Shivneri**.
- His **father's** name was **Shahji Bhonsle** and **mother's** name was **Jija Bai**.
- **Samarth Ramdas** was the **teacher** of Shivaji.
- Shivaji captured the forts of '**Kalyan**' and '**Javali**' in Konkan in 1656.
- The Sultan of Bijapur sent his commander Afzal Khan to subjugate Shivaji in 1659. (UPPCS, 1999)
- Aurangzeb appointed **Shaista Khan**, as the Governor of Deccan to subdue Shivaji.
- Shivaji entered into a treaty with Raja Jai Singh on 11<sup>th</sup> June, 1665. This treaty became famous as the '**Treaty of Purandar**'.
- Aurangzeb imprisoned Shivaji in 1666 at Jaipur Bhavan in Agra, from where he managed to escape. (MPPCS, 2005)
- Shivaji was coronated in 1674 and assumed the title of '**Chhatrapati**' which made **Raigad** his capital. (UPPCS, 1996)
- Pandit **Vishweshwar** alias '**Ganga Bhatta**' of Banaras declared him a Kshatriya and crowned him.
- Shivaji entered Poona stealthily in the night and suddenly attacked Shaista Khan in 1663. Shaista Khan panicked and ran away.
- He invaded Surat in 1664.
- He attacked Surat again in 1670.
- He used to give salary in cash to the officers by abolishing the practice of granting jagir.

- There was a council of ministers named **Ashta Pradhan** during the Maratha rule. (UPPCS, 2013)

### Ashta Pradhan

|                          |                                                                     |
|--------------------------|---------------------------------------------------------------------|
| Peshwa                   | Minister of King                                                    |
| Amatya                   | Revenue and Finance Minister                                        |
| Waqia-Navis              | King's day-to-day operations and the daily proceedings of the court |
| Sachiv                   | Head of Royal Correspondence                                        |
| Samant or Dabir          | Foreign Minister (MPPCS, 2014)                                      |
| Senapati or Sar-i-Naubat | Military recruitment, organization, logistics, etc.                 |
| Pandit Rao               | Head of religious affairs                                           |
| Nyayadhish               | Chief Justice                                                       |

- **Shivaji died in 1680.**

### Successors of Shivaji

|               |                                                                                                                                                                                   |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Shambha ji | Shambha ji was the eldest son of Shivaji who ruled between 1680 and 1689.                                                                                                         |
| 2. Rajaram    | Maratha freedom struggle against the Mughals continued under the leadership of Rajaram. Shivaji's younger son Rajaram ruled as the representative of Shahu, the son of Shambhaji. |
| 3. Tarabai    | After the death of Rajaram, his widow Tarabai's four-year-old son Shivaji-II ascended the throne and the struggle continued.                                                      |
| 4. Shahuji    | Maratha power expanded during the reign of Shahuji.                                                                                                                               |

- After Shivaji's death, Power in the Maratha state effectively passed into the hands of the Peshwas. Peshwa Chitpavan was from a Brahmin Family who served Shivaji's Successors.
- During the Maratha period, **Saranjami System** was related to **land revenue administration**. (BPSC, 1994)
- Shivaji's land revenue system was influenced by the one adopted by Malik Ambar.
- The income of the land was determined by '**Kadi**' and '**Zarib**'.
- '**Chauth**' and '**Sardeshmukhi**' were the second- largest source of state's income apart from land tax.

### Peshwas

|                               |                                                                                                               |
|-------------------------------|---------------------------------------------------------------------------------------------------------------|
| Balaji Vishwanath (1713-1720) | Balaji Vishwanath is famous as the second founder of the Maratha Empire.                                      |
| Peshwa Bajirao-I (1720-1740)  | Bajirao proved to be the best Maratha general. Maratha dominated the entire Malwa region and Gujarat in 1733. |



|                               |                                                                                                 |
|-------------------------------|-------------------------------------------------------------------------------------------------|
| Balaji Bajirao (1740-1761)    | During the period of Balaji Bajirao, the Chauth and Sardeshmukhi were recovered from the south. |
| Madhav Rao-I (1761-1772)      | —                                                                                               |
| Narayan Rao (1772-1773)       | —                                                                                               |
| Raghunath Rao (1773-1774)     | —                                                                                               |
| Madhav Ravnarayan (1774-1796) | —                                                                                               |
| Bajirao-II (1796-1818)        | —                                                                                               |

- The post of Peshwa was abolished in 1818.
- **Peshwa Bajirao-II** was exiled to **Bithur** in Kanpur on an annual pension of eight lakh rupees.
- **Modi script** was used in Maratha inscriptions.

## C History of Modern India

### 1. The Decline and Disintegration of the Mughal Empire

- Aurangzeb's death was followed by a war of succession among his three sons - Muazzam, Azam and Kam Bakhsh.
- His elder son, Muhammad Muazzam (Shah Alam) was victorious in the war of succession.
- **Muhammad Muazzam** assumed the title of **Bahadur Shah-I** after occupying the throne in Delhi.
- Bahadur Shah I freed Shivaji's son Shahu from prison.
- He was also known as '**Shahi-i- Bekhabar**'.
- He abolished jizya tax levied by Aurangzeb.
- After the death of **Bahadur Shah I**, **Jahandar Shah** became the emperor with the help of **Zulfiqar Khan**.
- **Jahandar Shah** is also known as '**lustful stupid**'.
- He had allowed a prostitute named **Lal Kunwari** to interfere in his administration.
- He conferred the title of '**Mirza Raja**' on **Jai Singh**.
- He conferred the title of **Maharaja** on Marwar ruler **Ajit Singh**.
- Sayyid brothers **Hussain Ali Khan Barha** and **Abdullah Khan** were known as king-makers. (UPRO/ARO, 2017)
- **Farrukh Siyar** was called a **despicable coward** among Mughal rulers.
- **Farrukh Siyar** executed **Banda Bahadur** in 1716.
- **Muhammad Shah** got the nickname **Rangeela**, because of leading a very luxurious life. (MPPCS, 2014)
- **Sayyid brothers witnessed their end** during the reign of **Muhammad Shah**.
- Hussain Ali Khan was assassinated by the Turani soldier Haider Quli Khan in 1720.

- During the reign of Muhammad Shah, the Persian ruler Nadir Shah attacked Delhi in 1739. (UPPCS, 2004)
- The **Battle of Karnal** took place on 24<sup>th</sup> February 1739, when the Mughal army was defeated.
- **Nadir Shah** is known as the **Napoleon of Iran**.
- He returned to Iran with Takht-i-Tavous and Kohinoor diamonds that adored the court of Shah Jahan.
- Muhammad Shah was the last Mughal ruler who enthroned the Takht-i-Tavous.
- **Rafi-ud-Daulah** assumed the title of **Shah Jahan II**.
- In the reign of Muhammad Shah in 1748, Ahmad Shah Abdali attacked India but returned after being defeated in the **battle of Manupur**.
- Ahmad Shah Abdali is known as Durr-i - Durrani (the pearl of the era).
- During the battle of Plassy, Alamgir II was ruling the Mughal empire.
- The third battle of Panipat and the Battle of Buxar were fought during the reign of Shah Alam II (Ali Gauhar).
- The third battle of Panipat was fought between **Ahmad Shah Abdali** and the **Marathas**, in which the Marathas were defeated.
- During the reign of Shah Alam II, the British took over Delhi in 1803.
- Shah Alam-II granted Clive the Diwani (civil administration) of Bengal, Bihar and Odisha. (UP UDA/LDA, 2006)
- Slave Qadir Khan killed Shah Alam-II in 1806.
- Akbar-II conferred the title of Raja on Ram Mohan Roy.
- The last Mughal emperor Bahadur Shah-II got the nickname **Zafar**.
- Bahadur Shah Zafar was imprisoned by the British for taking part in the revolt of 1857 and exiled to Rangoon.
- He died there in 1862.

### The Later Mughal Emperors (in AD)

|                                   |           |
|-----------------------------------|-----------|
| Bahadur Shah-I (Shah-e-Bekhabar)  | 1707-1712 |
| Jahandar Shah (Dissolute Fool)    | 1712-1713 |
| Farrukh Siyar (Abominable Coward) | 1713-1719 |
| Muhammad Shah (Rangeela)          | 1719-1748 |
| Ahmad Shah                        | 1748-1754 |
| Alamgir-II (Azizuddin)            | 1754-1759 |
| Shah Alam-II (Aligauhar)          | 1759-1806 |
| Akbar-II                          | 1806-1837 |
| Bahadur Shah Zafar                | 1837-1857 |

✎ **Note** : Farrukh Siyar was succeeded by Rafi - ud - Darajat (February, 1719 - June, 1719) and Rafi - Ud - Daulah (June, 1719 - September, 1719).

### Independent States (from Mughals)

|               |                                         |
|---------------|-----------------------------------------|
| 1. Awadh      | Saadat Khan (Burhan-ul-Mulk)            |
| 2. Hyderabad  | Chinkilich Khan or Nizam-ul-Mulk        |
| 3. Ruhelkhand | Daud Khan and Ali Muhammad Khan Bangesh |
| 4. Bengal     | Murshid Quli Khan                       |
| 5. Karnataka  | Saadatullah Khan                        |
| 6. Bharatpur  | Chudaman and Badan Singh                |

## 2. The Arrival of European Trade Companies

### A. The Portuguese

- Portuguese came to India at the end of the fifteenth century. They were the first amongst Europeans.
- **Vasco da Gama** reached Calicut Port on the west coast of India on 20<sup>th</sup> May 1498, discovering a new sea route to India from Europe.  
(MPPCS, 1995; UPPCS, 1992; Chattisgarh PCS, 2004, 2022)
- The Hindu king **Zamorin** of Calicut warmly welcomed Vasco da Gama, while the Arab merchants settled in Calicut adopted an attitude of disloyalty towards him.  
(CGPSC, 2022; UP Lower, 2013)
- **Francisco de Almeida** was appointed the first Portuguese Viceroy to India in 1505 AD. (BPSC, 2001, UP Lower, 2013)

➤ **Note :** The order of the European companies to arrive in India were **Portuguese, Dutch, English** and **French**.  
(UPPCS, 1997)

- Francisco de Almeida is known for the '**Blue Water Policy**'. (Uttarakhand PCS, 2016)
- **Afonso de Albuquerque** arrived in India as the Viceroy of Portugal in 1509 AD.
- He is considered the de facto founder of Portuguese rule in India. (UP Lower, 2003)
- He conquered Goa from the Adilshahi Sultan of Bijapur in 1510 AD. (IAS, 2003; UPPCS, 2010; UK PSC, 2004)
- The Portuguese opened their first trading factory at **Cochin**. (UPPCS, 2010)
- The Dutch came to India after the Portuguese.
- The Portuguese started the **printing press** in India.

### B. The Dutch

- They were residents of the Netherlands or Holland.
- The Dutch East India Company was established in 1602.
- They opened their first trading factory at Masulipattam in 1605 AD.
- They established another factory at **Pulicat** and made it their headquarter.
- Dutch established their first factory in Bengal (1627 AD) at **Pipli**.
- The Dutch fort of Chinsurah near Hooghly is known as '**Gustavus Fort**'.

- Gustavus Fort was founded in 1653.
- They employed industrial workers on pay for the first time in India.
- They eventually suffered a decline in India in 1759 AD. The battle was fought between the British and the Dutch.

### C. The English

- **Queen Elizabeth I** of England granted the charter of authority to the **East India Company** on 31<sup>st</sup> December, 1600 AD. (IAS Pre, 1993, 1997, 1999)
- Captain Hawkins came to the court of Jahangir in 1608 as an ambassador of the British East India Company.
- Jahangir permitted the British to establish a permanent factory at **Surat** in 1613 AD. (UPPCS, 2011, 2018; IAS, 2006, 2010)
- **Sir Tomas Roe** came to the court of Jahangir in 1615 and obtained some facilities for English trade.
- The Sultan of Golconda issued a golden decree to the British in 1632 AD, according to which, by paying 500 pagodas annually, the British could trade freely at the Port of Golconda state. (CPF, 2007, 2011, 2017)
- Englishman Francis Day took Madras on lease from the King of Chandragiri in 1639 AD. The British built a fortified factory in Madras.
- This fortified **factory** was named **Fort St. George**.
- King Charles II of England was married the Portuguese princess Catherine of Braganza in 1662 AD. (CAPE, 2003, 2007)
- The Portuguese gifted Charles II with Bombay Island as dowry in 1662 AD.
- Charles II gave Bombay to the East India Company in 1668 AD with an annual rent of 10 pounds. (UK PSC, 2010)
- In 1651, Shah Shuja, the Subahdar of Bengal, granted the English permission of trade in Bengal in exchange for annual payment.
- The foundation of modern Calcutta was laid by **Job Charnock**, combining **Kalikata, Gobindpur** and **Sutanati** villages. Later, the foundation of Fort William was laid at Calcutta. (UP Lower, 2008; UPPCS, 2004)
- The **first President** of Fort William was **Charles Eyre**.

### D. The French

- The first factory of the French was founded at **Surat** in 1668 by **Francois Caron**.
- **Francis Martin** founded Pondicherry in 1674.

### European Trade Companies

|                            |                     |
|----------------------------|---------------------|
| English East India Company | 1600 (CAPE, 2007)   |
| Dutch East India Company   | 1602 (CPO SI, 2008) |
| Danish East India Company  | 1616                |
| French East India Company  | 1664                |
| Swedish East India Company | 1731                |

### Anglo-French Clash (Carnatic Battles)

- **The First Battle of Karnataka (1746-1748 AD)** was merely an extension of the succession of Austria. (BPSC, 2000)
- The **Treaty of Aix-La-Chapelle** in Europe (1748) ended the war for succession of Austria, resulting in the end of the first battle of Karnataka. (UPPCS, 1995, 2016, 2017)
- French Governor-General **Dupleix** was defeated in the **Second Battle of Karnataka (1749-54 AD)**. (CGPSC, 2023)
- He was called back to France. He was replaced by Charles-Robert **Godeheu** who signed the **treaty of Pondicherry** (1755 AD). (UPPCS, 2016; UPGIC, 2017)
- The **Third** (1758-63 AD) and decisive Battle of Karnataka took place in Wandiwash. (UPGIC, 2017; UPPCS, 2012)
- In the **Battle of Wandiwash (1760 AD)**, the English Army led by Eyre Coot crushed the French Army led by Count de Lally. (UK PCS, 2016)
- In 1761, the British captured the French territory of Pondicherry.
- The Third Battle of Karnataka ended in the **Treaty of Paris (1763 AD)** between the British and the French. (UPPCS, 1990)
- Through the Treaty of Paris, the British returned Pondicherry and some other territories to the French except Chandranagar. (UPPCS, 1995, 1997, 2001)

| Carnatic Battles       |           |                                  |
|------------------------|-----------|----------------------------------|
| Battle                 | Year (AD) | Treaty                           |
| First Carnatic Battle  | 1746-48   | Treaty of Aix La Chapelle (1748) |
| Second Carnatic Battle | 1749-54   | Treaty of Pondicherry (1755)     |
| Third Carnatic Battle  | 1758-63   | Treaty of Paris (1763)           |

### 3. Expansion of British Power in Bengal

- Bengal was highly fertile and the most prosperous among the provinces of India.
  - The British established their first factory in Bengal after the permission of Shah Shuja in 1651 AD. (MPPCS, 2008)
  - **Murshid Quli Khan** was the independent ruler of Bengal.
  - He shifted his capital from **Dacca** to **Murshidabad**. (UPPCS, 2013)
  - He started the monopoly system and provided Takavi (advance agricultural tax) loans to the farmers. (MPPCS, 2009)
- 📌 **Note :** The Izaredari System was called 'contractual practice'.
- After Murshid Quli Khan, his son-in-law **Shuja-ud-din** ascended the throne of Bengal. (CAPE, 2013, 2019)
  - Sarfaraz Khan became the Nawab of Bengal after Shuja-ud-din. (CPO SI 2007, 2009, 2013, 2019)

- Alivardi Khan, the Subadar of Bihar, became the Nawab of Bengal by killing Sarfaraz Khan in the Battle of Giria in 1740.
- During his reign, Bengal became so prosperous that it came to be known as the '**Paradise of India**'.
- Alivardi Khan compared the Europeans to bees and said that "if they are not pierced, they will give honey and if teased, they will bite and kill".
- Alivardi Khan stopped paying taxes to the Mughals during his reign.
- After Alivardi Khan's death, his grandson (son in law's son) **Siraj-ud-daulah** succeeded him.
- On the night of 20<sup>th</sup> June 1756, 146 Britishers were locked in a small room by Siraj-uddaulah, leaving only 23 Britishers alive the next day. This incident is known as the '**Black Hole**' tragedy. (SSC MTS, 2017)
- **J Z Holwell** was the eyewitness of the Black Hole tragedy.
- The **Battle of Plassey** was fought on 23<sup>rd</sup> June, 1757, between the British commander Robert Clive and the Nawab of Bengal, Siraj-ud-daulah. (MPPCS, 2006, 2008, 2007)
- The battle of Plassey occurred in the Present Indian State of West Bengal.
- In the Battle of Plassey, the commander of Siraj-uddaulah's army was Mir Jafar. (UPPCS, 2005, 2007, 2014)
- The treachery of Mir Jafar preceding the Battle of Plassey resulted in the defeat of Siraj-ud-daulah.
- A small army led by Mohan Lal and Mir Madan remained loyal to the Nawab in the Battle of Plassey. Mir Madan was killed fighting. (UK PSC, 2010; IAS, Pre, 2005)
- The British appointed Mir Jafar the Nawab of Bengal, in return for which Mir Jafar gave the land of 24 Parganas to the British.
- The British despised Mir Jafar and installed his son-in-law Mir Qasim as the Nawab of Bengal in 1760.
- Mir Qasim was the second most qualified Nawab of Bengal after Alivardi Khan. (UPPCS Lower 2003; IAS, 2005)
- Mir Qasim moved his capital from Murshidabad to Munger.
- On **22<sup>nd</sup> October 1764**, the **Battle of Buxar** was fought between the British on one side and the combined forces of Mir Qasim, Nawab Shuja-uddaulah of Awadh and the Mughal Emperor Shah Alam II on the other. (UPPCS, 2003, 1990)
- Under the leadership of Hector Munro, the English army defeated the combined forces of Mir Qasim. (UPUDA, 2002)
- After the Battle of Buxar, the East India company's rule was firmly established in India. (UPPCS, 1990, 03)
- In 1765 AD the East India company obtained diwani rights in Bengal. (SSC MTS, 2023)
- In Bengal, Diarchy lasted from 1765 and 1772. (SSC MTS, 2019)

📌 **Note :** Diarchy was introduced by **Lord Clive** in 1765, and abolished by Warren Hastings in 1772.

| Nawabs of Bengal      |           |
|-----------------------|-----------|
| 1. Murshid Quli Khan  | 1717-1727 |
| 2. Shujauddin         | 1727-1739 |
| 3. Sarfaraz Khan      | 1739-1740 |
| 4. Alivardi Khan      | 1740-1756 |
| 5. Siraj-ud-daulah    | 1756-1757 |
| 6. Mir Jafar          | 1757-1760 |
| 7. Mir Qasim          | 1760-1763 |
| 8. Mir Jafar          | 1763-1765 |
| 9. Nizam-ud-daulah    | 1765-1766 |
| 10. Saif-ud-daulah    | 1766-1770 |
| 11. Mubarak-ud-daulah | 1770-1772 |

#### Anglo-Mysore Relations (Karnataka PCS, 2014)

- Wadiyar dynasty was established in Mysore in 1399.
- **Haider Ali** started his career as a horseman.
- He became the ruler of Mysore in 1761. (Karnataka PCS, 2008)
- He was defeated and died in the **Battle of Porto Nova** during the **Second Anglo-Mysore War**. (Jharkhand PCS, 2003)
- He was victorious in the **First Anglo-Mysore War (1767-1769)**. (Karnataka PCS, 2009; UPPCS, 2015)
- After his death, his son **Tipu** ascended the throne of Mysore.
- Tipu Sultan was born in 1750. (BPSC, 1992, 1996)
- By the **Treaty of Mangalore**, Tipu Sultan and the British exchanged conquered territories. (UPPCS, 2014, 2017; UK PSC 2016, 2018; IAS 2005, 2003)
- He assumed the title of **Padshah** in 1787.
- Due to the treaty of Srirangapatnam in 1792 AD, almost half the area of Mysore state was handed over to the East India Company. (UPPCS, 2009; BPSC, 1997)
- He planted a tree of freedom in his capital **Srirangapatnam**.
- Tipu himself became a member of the **Jacobean Club** and started calling himself Citizen Tipu.
- He died in Seringapatam during the **Fourth Anglo-Mysore War** in 1799. (CGPSC, 2014, 2016; MPPCS, 2000)

| Anglo - Mysore Wars     |                |                 |                                |
|-------------------------|----------------|-----------------|--------------------------------|
| Major War               | Year General   | Governor-Treaty | Important                      |
| First Anglo-Mysore War  | (1767-1769AD)  | —               | Treaty of Madras (1769)        |
| Second Anglo-Mysore War | (1780-1784 AD) | Warren Hastings | Treaty of Mangalore (1784)     |
| Third Anglo-Mysore War  | (1790-1792 AD) | Lord Cornwallis | Treaty of Seringapatnam (1792) |
| Fourth Anglo-Mysore War | (1799 AD)      | Lord Wellesley  | —                              |

✎ **Note :** Lord Cornwallis commented on the Treaty of Seringapatnam, "We have effectively crippled our enemy without making our friends too formidable."

#### 4. Maratha Empire and Anglo-Maratha Clash under Peshwas

- Peshwas were the propagators of the new Maratha Empire in the leadership of Shahu. (IAS, 2000; UP RO, 2016)
- The Maratha leader Shahu appointed **Balaji Vishwanath** as Peshwa in 1713. (UPPCS, 2014, 2023, 2005, 1997)
- Balaji Vishwanath is considered the **second founder of the Maratha Empire**.
- Peshwa was the Prime Minister of Chhatrapati.
- The post of Peshwa became hereditary with the first Peshwa.
- Balaji Vishwanath died in 1720. (UPPCS, 2004, 2023)
- Shahu appointed Balaji Vishwanath's elder son Baji Rao - I as Peshwa in 1720. (UPPCS, 2004, 2007)
- Baji Rao - I propagated and popularized the idea of the **Hindu rank of Padshahi**.
- The **Battle of Palkhed** was fought between Baji Rao - I and Nizam-ul- Mulk in 1728.
- The **First Peshwa** who invaded Delhi on 29<sup>th</sup> March, 1737 was Baji Rao I.
- Bajirao I died in 1740.
- After his death, his son, Balaji Baji Rao became Peshwa.
- After the **Treaty of Sangola** (1750), all rights to the Peshwas were secured.
- Maratha kingdom expanded the most during the reign of Balaji Bajirao.
- **Balaji Baji Rao** is also known as **Nana Saheb**.
- During the reign of Peshwa Balaji Baji Rao reign, the third battle of Panipat (14 January, 1761) was fought between the Marathas and Ahmad Shah Abdali.
- Marathas were defeated in the third Battle of Panipat.
- Sadashivrao Bhau led the Marathas in the third Battle of Panipat.

| Anglo-Maratha War        |             |                  |
|--------------------------|-------------|------------------|
| War                      | Year (AD)   | Governor-General |
| First Anglo-Maratha War  | (1775-1782) | Warren Hastings  |
| Second Anglo-Maratha War | (1803-1805) | Wellesley        |
| Third Anglo-Maratha War  | (1817-1818) | Lord Hastings    |

- Madhav Rao-I became the Peshwa in 1761.
- Madhav Rao-I attempted to restore the lost prestige of the Marathas.
- After the death of Madhav Rao, his younger brother Narayan Rao became the Peshwa.



- Peshwa Narayan Rao (1772-73) was killed by his uncle Raghunath Rao.
- Madhav Rao Narayan was appointed Peshwa in place of Raghunath Rao with the active intervention of the Britishers.
- Due to the minor age of Peshwa Madhav Rao Narayan, the Maratha state was looked after by a council of 12 members named **Barbhai Council**.
- There were two important members in this council- Mahadji Scindia and Nana Fadnavis.
- The **First Anglo-Maratha War** was fought during the reign of **Madhav Rao Narayan**.
- Baji Rao II, son of Raghunath Rao, was the last Peshwa.
- Baji Rao II was the first Maratha chief to accept the second subsidiary alliance. **(41<sup>st</sup> BPSC, 1996)**
- Under the Treaty of Purandar in 1776, the company withdrew its support from Raghunath Rao.
- The First Anglo-Maratha War ended in 1782 with the **Treaty of Salbai**.

✎ **Note :** The Treaty of Salbai was signed on 17<sup>th</sup> May, 1782 with the effort of Mahadji Scindia.

- The Second Anglo-Maratha War was fought during 1803-1805.
- Bhonsle (Nagpur) challenged the British in the second war.
- The Second Anglo-Maratha War was concluded by the Treaty of Rajpur Ghat between the temporary Governor-General of the Company, George Barlow and Holkar in January 1806.
- After the third Anglo - Maratha War (1817-1818), the hereditary post of Peshwa was abolished.
- Peshwa Baji Rao II was the last Peshwa.

## 5. Relation between Sikh and British

- Guru Nanak was the **founder of Sikhism**.
- He was born in 1469 AD at **Talwandi in Punjab** (now in Pakistan).
- He introduced the Sangat (Dharamshala) and Mangat (Langar) System.
- He died at **Kartarpur** in 1539 AD.
- **Guru Angad** (1539–52 AD) was the second Guru of the Sikhs.
- His earlier name was **Lahna**.
- Guru Angad invented the **Gurmukhi Script**. **(UPPCS, 2017)**
- **Amardas** (1552–74 AD), the third Guru of the Sikhs, established his throne at Goindwal.
- Mughal emperor Akbar went to Guru Amardas Goindwal and granted some land to his daughter **Bibi Bhani**.
- The fourth Guru of the Sikhs was **Ramdas** (1574–81 AD).

- Guru Ramdas was a contemporary of Akbar and the son-in-law of Amardas.
- Akbar granted 500 bighas of land to Guru Ramdas. On this land, he settled in **Amritsar** city. **(UK UDA/LDA, 2007)**

✎ **Note :** Guru Nanak was a contemporary of Babur and Humayun.

- Guru Ramdas nominated his son Arjan Dev as his successor and made the post of Guru hereditary.
- The fifth Guru of the Sikhs was **Arjan Dev** (1581–1606).
- Guru Arjan Dev built **Harminder Sahib** in the middle of Amritsar pond.
- Guru Arjan Dev compiled the **Adi Granth**. **(Uttarakhand PCS, 2004)**
- **Jahangir** awarded the death penalty to Guru Arjan Dev in assisting Prince Khusrau in 1606. **(UP UDA/LDA, 2002)**
- The sixth Guru of the Sikhs was **Hargobind** (1606–1644).
- He created a martial spirit among the Sikhs and ordered them to carry weapons to protect themselves.
- Guru Hargobind ordered the fortification of Amritsar city and constructed '**Akal Takht**' here.
- The seventh Guru of the Sikhs was **Har Rai** (1644–61 AD).
- The eighth Sikh Guru **Harkrishan** (1661–64) died of smallpox.
- The ninth Sikh Guru was Guru Tegh Bahadur (1664-1675 AD).
- Aurangzeb killed **Guru Tegh Bahadur** for not accepting Islam. **(Chattisgarh PCS, 2004)**
- **Guru Gobind Singh** (1675–1708 AD) was the tenth and the last Guru of the Sikhs.
- He was born in Patna in 1666 AD. **(BPSC, 2015)**
- His original name was Gobind Rai.
- He established **Anandpur City** and his throne there.
- The autobiography of Guru Gobind Singh is titled **Bichittar Natak**.
- He founded the **Khalsa Panth** on Baisakhi Day in 1699 AD. **(MPPCS, 2014)**
- He asked the followers of Sikhism to add the word Singh to their names.
- He introduced the **Pahul System**.
- He told Sikh followers to carry five things - **Kesh (Hair), Kanga (Comb), Kachera, Kirpan** and **Kara**.
- He gave the present form to Adi Grantha (Guruvani), the religious text of the Sikhs.
- **Fateh Singh** and **Zorawar Singh**, the sons of Guru Gobind Singh, were done to death by erecting bricked walls around them by Sirhind Mughal Fauzdar Wazir Khan.
- Guru Gobind Singh was assassinated in 1708 AD by a Pathan at **Nanded** in South India.

- Banda Bahadur's childhood name was **Lakshmanadeva** or **Laksman Das**. (UPPCS, 2014)
- Banda Bahadur established the first Sikh kingdom.
- He **introduced coins with the names** of Guru Nanak and Guru Gobind Singh inscribed on them and made the seal of Sikh State.
- He was awarded the death penalty during the rule of Farrukh Siyar.
- After the death of Banda Bahadur, small Sikh states were established in Punjab, known as **Misls**.
- At that time, 12 misls existed in Punjab.

### Sikh Misls and Its Founding Leaders

| Misls            | Founder/ Leader       |
|------------------|-----------------------|
| Ahluwalia        | Jassa Singh           |
| Sukerchakia      | Charat Singh          |
| Faizullapuria    | Nawab Kapoor Singh    |
| Phulkian         | Ala Singh             |
| Kanheya /Dhaniya | Jai Singh             |
| Bhangi           | Hari Singh            |
| Ramgarhia        | Jassa Singh Ramgarhia |
| Nakai            | Heera Singh           |
| Nishanvali       | Sardar Sangat Singh   |
| Shahidi          | Gurubakhsh Singh      |
| Crore Scindia    | Baghel Singh          |
| Dalle Walia      | Tara Singh            |

### Ranjit Singh

- Ranjit Singh was born of Maha Singh, the head of the Sukerchakia Misl in November, 1780. (UPPCS, 2004)
- In 1798, the ruler of Kabul, Jamshana, conferred the title of '**Raja**' on him for his services.
- Ranjit Singh became the ruler of Lahore in 1799.
- Treaty of Amritsar was signed between **Charles Metcalfe** and **Ranjit Singh** on **25<sup>th</sup> April, 1809**. (UPPCS, 1997)
- Ranjit Singh's kingdom was divided into four states - Peshawar, Kashmir, Multan and Lahore.
- **Lahore** was the capital of Ranjit Singh's empire. (UPPCS, 1995, 1996; UPSI, 2009; UK PCS, 2006)
- He received a **Kohinoor** diamond from **Shah Shuja**. (41<sup>st</sup> BPSC, 1996)
- He died in June, 1839.
- The Foreign Minister of Ranjit Singh was Fakir Azizuddin.
- The First Anglo - Sikh War was fought from 1845 to 1846.
- The Second Anglo - Sikh War was fought from 1848 to 1849.
- The First Anglo - Sikh War ended with the Treaty of Lahore (9<sup>th</sup> March, 1846).

- In March 1849, Lord Dalhousie annexed the Sikh State to the English empire.
- Maharaja Dilip Singh was given an annual pension of 50 thousand pounds and was sent to England to pursue education.
- He took the Kohinoor diamond and gave it to Queen Victoria.

### Major Rebellions Against the British Rule

| Revolt                | Affected Areas       | Related Leaders                     | Time      |
|-----------------------|----------------------|-------------------------------------|-----------|
| Sanyasi Rebellion     | Bihar, Bengal        | Kena Sarkar and Dirji Narayan       | 1763-1800 |
| Fakir Rebellion       | Bengal               | Majmun Shah and Chirag Ali          | 1776-77   |
| Chuar Rebellion       | Bankura (Bengal)     | Durjan Singh                        | 1798-99   |
| Poligar Rebellion     | Tamil Nadu           | Veer P. Kattabomman                 | 1799-1801 |
| Bhil Rebellion        | Western Ghats        | Triyambak G.                        | 1818-31   |
| Ramosi Rebellion      | Western Ghats        | Chittur Singh, Umaji                | 1822-26   |
| Pagalpanthi Rebellion | Bengal               | Karamshah and Tipu (BPSC, 2013)     | 1825-33   |
| Ahom Rebellion        | Assam                | Gomadhar Kunwar, Roop-Chandra Konar | 1828-33   |
| Wahabi Movement       | Bihar, Uttar Pradesh | Sayyed Ahmad Bareilvi               | 1820-70   |

✎ **Note :** The Wahabi agitators wanted to reestablish Islam of Muhammad's time.

|                   |                         |                                  |           |
|-------------------|-------------------------|----------------------------------|-----------|
| Kol Rebellion     | Chotanagpur (Jharkhand) | Budhu Bhagat                     | 1831-32   |
| Khond Rebellion   | Tamil Nadu to Bengal    | Chakra Bisoi                     | 1837-56   |
| Khasi Rebellion   | Meghalaya               | Tiruth Singh                     | 1833      |
| Farizi Movement   | Bengal Shariatullah     | Dadu Mir                         | 1818-62   |
| Santhal Rebellion | Bengal and Bihar        | Siddha - Kanhu                   | 1855-56   |
| Munda Rebellion   | Bihar                   | Birsa Munda                      | 1899-1900 |
| Paika Rebellion   | Odisha                  | Bakhshi Jagabandhu               | 1817-1825 |
| Indigo Rebellion  | Bengal                  | Digambar Vishwas, Vishnu Vishwas | 1859-60   |
| Pabna Rebellion   | Pabna (Bengal)          | Ishan Chandra Rai & Shambhupal   | 1873-76   |
| Deccan Rebellion  | Maharashtra             | —                                | 1875      |
| Moplah Rebellion  | Malabar (Kerala)        | Ali Musliyar                     | 1920-22   |
| Kuka Movement     | Punjab                  | Bhagat Jawahar Mal               | 1840-72   |

|                      |                |              |           |
|----------------------|----------------|--------------|-----------|
| Rampa Rebellion      | Andhra Pradesh | Sitaram Raju | 1922-1924 |
| Tana Bhagat Movement | Bihar          | Jatra Bhagat | 1914      |
| Tebhaga Movement     | Bengal         | —            | 1946      |

✎ **Note** : Ram Singh, a disciple of Bhagat Jawahar Mal, fought with the British bravely in 1872, but was imprisoned and sent to Rangoon. He died in 1885.

✎ **Note** : Bankim Chandra Chatterjee's novel, **Anandamath**, is based on the Sanyasi rebellion. Warren Hastings suppressed this rebellion.

### Military Rebellion Before the Revolt of 1857

|                                |                    |                                                          |
|--------------------------------|--------------------|----------------------------------------------------------|
| 1806                           | Vellor             | Revolt against the order to remove religious symbols     |
| 1824                           | Barrackpore        | Opposition of the order to go to Burma by sea route.     |
| 1844, 1849, 1850, 1852         |                    | Rebellion for not getting remote area service allowance. |
| 23 <sup>rd</sup> January, 1857 | Dum Dum (Calcutta) | The cartridges were greased with cow's and pig's.        |
| 26 February, 1857              | Berhampur (Bengal) | The cartridges were greased with cow's and pig's fat.    |

## 6. The Revolt of 1857

- The immediate cause of the revolt of 1857 was the loading Enfield rifle required tearing open the greased cartridges with one's teeth, and many sepoys believed that the cartridges were greased with the **fat of cows and pigs**. (RAS, 1993)
- On 29<sup>th</sup> March, 1857, **Mangal Pandey**, a soldier of the 34<sup>th</sup> Bengal Native Infantry Barrackpore, attacked his officers, Lieutenant **Baugh** and Sergeant Major **Hewson**. Consequently, he was arrested and hanged on 8<sup>th</sup> April, 1857. (UK PCS, 2002; UPPCS, 2010, 2014, 2016, 1990)

- On 10<sup>th</sup> May, 1857 occurred the revolt of the Third Bengal Light Cavalry of Meerut marked the beginning of the Revolt of 1857. (UPPCS 1990, 1994)
- Charles Canning was the Governor-General of India and Palmerston was the Prime Minister of England during the revolt of 1857. (UPPCS 1990, 1991, 2012)
- Deccan rebellion of 1857 took place in Maharashtra.
- Madras remained untouched by the revolt of 1857.

### Historians' Opinions Regarding the Nature of the Revolt of 1857

| Nature                                                         | Opinion                              |
|----------------------------------------------------------------|--------------------------------------|
| This was the first freedom struggle of India.                  | V.D. Savarkar (MPPCS, 2008)          |
| This was a national rebellion.                                 | Disraeli                             |
| It was a full-fledged Sepoy Mutiny.                            | Sir John Lawrence and Seale          |
| It was a conspiracy of Hindus and Muslims against the British. | James Outram, W. Taylor (BPSC, 1995) |
| The war between barbarism and civilization.                    | T.R. Holmes                          |
| This was a war of Fanatic religionists against the Christians. | L.E.R. Rees                          |

### Important Books and Their Authors

| Books                                      | Authors                     |
|--------------------------------------------|-----------------------------|
| 1. The Indian War of Independence 1857     | V.D. Savarkar (UPPCS, 2004) |
| 2. The Great Rebellion                     | Ashok Mehta                 |
| 3. The Sepoy Mutiny and the Revolt of 1857 | R.C. Majumdar               |
| 4. Eighteen Fifty-Seven                    | S.N. Sen                    |

### Important Events and Personalities related to the Revolt of 1857

| Centre of Revolt        | Led by                          | Date of Revolt             | British who suppressed the Revolt | Date of Suppression              |
|-------------------------|---------------------------------|----------------------------|-----------------------------------|----------------------------------|
| Delhi (UPPCS, 1994)     | Bahadur Shah Zafar, Bakht Khan  | 11 <sup>th</sup> May, 1857 | Nicholson and Hudson              | 21 <sup>st</sup> September, 1857 |
| Kanpur                  | Nana Saheb, Tatya Tope          | 5 <sup>th</sup> June, 1857 | Campbell                          | 6 <sup>th</sup> December, 1857   |
| Lucknow (UPPCS, 2015)   | Begum Hazrat Mahal              | 30 <sup>th</sup> May, 1857 | Campbell (UPPCS 1990)             | March, 1858                      |
| Jhansi                  | Rani Lakshmi Bai                | June, 1857                 | Huge Rose (UPPCS, 1992)           | 1858                             |
| Allahabad               | Liyaqat Ali (UPPCS, 2015)       | June, 1857                 | Colonel Neil                      | 1858                             |
| Jagdishpur (BPSC, 2014) | Kunwar Singh                    | June, 1857                 | William Taylor and Vincent Eyre   | 1858                             |
| Bareilly                | Khan Bahadur Khan (UPPCS, 1998) | 1857                       | Campbell                          | 1858                             |
| Faizabad                | Maulavi Ahmad Ulla              | 1857                       | Campbell                          | 1858                             |

- At the time of the mutiny, the Company's chief commander was George Annison.
- The commander after the start of the rebellion was Colin Campbell.
- The Emperor of India during the mutiny was Bahadur Shah Zafar.
- The real name of Tatya Tope was **Ramchandra Pandurang**. (UPPCS, 2011)

✎ **Note :** By Changes in the Home Government, the Secretary of State for India was made responsible to the government of British India in the year 1858.

- He was hanged by the British at Shivpuri on 18<sup>th</sup> April, 1859.
- Rani lakshmi Bai of Jhansi, a brave warrior and key figure of the Indian Independence rebellion of 1857, is often remembered for her courage in leading the resistance against the British. He fought his last battle in Gwalior city.
- Rani Lakshmi Bai received martyrdom on 18<sup>th</sup> June, 1858.

## 7. Religious and Social Reform Movements

### Brahmo Samaj

- Brahmo Samaj was founded by **Raja Rammohun Roy** on 20<sup>th</sup> August, 1828. (MPSC, 1992)
- Brahmo Samaj is credited with writing literary works for the abolition of Sati Pratha. (BPSC, 2005, 2007)
- It opposed idol worship, pilgrimage, rituals, etc.
- Raja Rammohan Roy formed the **Atmiya Sabha** in 1815. (BSSC, 2023; BPSC, 1996, 2019)
- **Vedanta College** was founded by Rammohan Roy in 1825.
- Raja Rammohan Roy is called the **Pioneer of the Indian Renaissance**, the originator of the reform movements, the father of modern India and the star of the new morning. (RAS, 1996; UPPCS, 1996; UPPCS, 2000)
- He is considered the '**Forerunner of Indian Journalism**'.
- He founded the **Hindu College at Calcutta in 1817** with the help of David Heyer. (UP RO, 2013; UP RO/ARO, 2021)
- He authored **Tuhfat-ul Muwahhidin** and the Precepts of Jesus books besides publishing **Sambad Kaumudi**, **Mirat-ul-Akbar** and **Brahmanical Magazine** in English.
- Raja Rammohan Roy is the author of the book Gift to Monotheists, written in Persian, which condemns polytheism. (UPPCS, 2005, 2007, 2013)
- Mughal emperor **Akbar-II** conferred the title of Raja on Rammohan Roy. (BPSC, 1998, 2000; UPPCS, 2012)
- After Raja Rammohan Roy, Devendranath Tagore took the leadership of the Brahmo Samaj. (BPSC, 2001, 2003)
- **Devendranath Tagore** founded the **Tattvabodhini Sabha**.
- After Devendranath Tagore, Keshav Chandra Sen led the Brahmo Samaj.

- Keshav Chandra Sen's liberalism caused the first division in the Brahmo Samaj as the books of Christians, Islam, Parsi and Chinese religion began to be read at the gatherings of the Brahmo Samaj.
- Devendranath Tagore removed Keshav Chandra Sen as a trustee of the Brahmo Samaj and withdrew his title of Hierophant (Acharya) in 1865.
- Keshav Chandra Sen formed a new Brahmo Samaj. (UPPCS, 2008)
- Shivrath Shastri and Anand Mohan Bose founded the **Sadharan Brahmo Samaj** in 1878.

### Prarthana Samaj

- **Atmaram Pandurang** established '**Prarthana Samaj**' in **Mumbai** in 1867. (UP UDA/LDA, 2010)
- Mahadev Govind Ranade is called the '**Pioneer of Cultural Renaissance in Western India**'.
- He founded **Poona Sarvajanic Sabha** in 1870. He was also called '**Socrates of Maharashtra**'.
- On 31<sup>st</sup> December 1893, **DK Karve** formed the **Widow Reunification Association**.
- Balgangadhar Tilak and other peoples established the **Deccan Education Society** in 1884, and later it was transformed into **Fergusson College Pune**.
- Ramakrishna Gopal Bhandarkar and Mahadev Govind Ranade did their work related to religious reforms in Maharashtra through Prarthana Samaj.

### Social Reforms

| Year of Abolition                | Governor-General      | Subject                                                                     |
|----------------------------------|-----------------------|-----------------------------------------------------------------------------|
| Infant Slaughter (1795, 1804 AD) |                       | Prohibition of Infant Slaughter                                             |
| Sati Practice (1829 AD)          | Lord William Bentinck | Prohibition of Sati Tradition                                               |
| The Slavery System (1843 AD)     | Alan Burrows          | Prohibition of Slavery                                                      |
| Widow Remarriage (1856 AD)       | Lord Canning          | Widow Marriage Permitted                                                    |
| Native Marriage Act (1872 AD)    | Northbrook            | Encouragement to Intercaste Marriage                                        |
| Age of Consent Act (1891 AD)     | Lansdowne             | Marriage age for girls was fixed at 12 years                                |
| Sarda Act (1929 AD)              | Irwin                 | Marriage age for girls was fixed at 14 years (and for boys it was 18 years) |

### Veda Samaj

- **K. Shri Dharalu Naidu** founded the Veda Samaj in Madras in 1864 inspired by Keshav Chandra Sen.



- Veda Samaj of Madras was inspired by Brahmo Samaj.

(SSC, 2023)

### Arya Samaj

- **Swami Dayanand Saraswati** established Arya Samaj in Bombay in **1875**. (UP Lower, 2009)
- He gave the slogan, '**Back to the Vedas**'. (MPPCS, 1997)
- Arya Samaj raised its voice against untouchability, caste discrimination, child marriage and advocated widow remarriage and inter-caste marriage. (CAPE, 2015, 2017)
- The '**Shuddhi Andolan**' was launched by Swami Dayanand Saraswati, which reopened Hinduism and opened the doors for the return of people from other religions. (UPPCS, 2010)
- Arya Samaj founded the **Gau Raksha Andolan** and the **Gau Rakshini Sabha**. (SSC MTS, 2019, 2022)
- Swami Dayanand Saraswati was the first reformer who was in favour of Shudra and women reading Vedas, getting higher education, wearing Yajnopavit.
- Mool Shankar was the childhood name of Swami Dayanand Saraswati.

### Major Books by Swami Dayanand Saraswati

|                                   |                                               |
|-----------------------------------|-----------------------------------------------|
| 1. Satyarth Prakash (1875),       | 3. Paakhand Khandan (1866),<br>(UK PCS, 2006) |
| 2. Panch Maha Yajya Vidhi (1874), | 4. Advaitmat Khandan (1877)                   |

- He hoisted the **Paakhand Khandani Pataka** at the Kumbh of Haridwar in 1867 to symbolise his denial of fake religions.
- In the political arena, Arya Samaj believed that 'the worst of a bad country is better than the best of a foreign state'.
- The word **Swaraj** was first used by Dayanand.

(RAS/RTS, 1999)

### Young Bengal Movement

- This movement was started by **Henry Vivian Derozio** in 1826.
- Surendranath Banerjee accepted Derozio as "the pioneer of the modern civilization of Bengal.
- **Derozio** is also called the **first national poet of Modern India**.

### Ramakrishna Mission and Swami Vivekananda

- **Swami Vivekananda** was the disciple of Ramakrishna Paramahansa called **Swami of Dakshineswar**.
- Swami Vivekananda's childhood name was **Narendranath**.
- He represented India at the **World Religion Conference** held in Chicago, USA, in **1893**. (MPPCS, 1993, 2013; UPPCS, 2015; UPPCS, 2008; BPSC, 2020)
- Before joining this conference, Swami Vivekananda changed his name from '**Narendranath**' to **Swami Vivekananda** at the suggestion of **Khetri Maharaj**.

- Swami Ji established the **Vedanta Society** in America in 1894. (CGPSC, 2019; UP Lower, 2015)

- He founded the **Ramakrishna Mission in 1897**.

(UPPCS, 2004)

- The headquarter of the Ramakrishna Mission was established at Belur in Howrah. (UPPCS 2004, MPPCS, 1996, 1999)

- Subhash Chandra Bose called Swami Vivekananda the '**Spiritual Father of the Modern National Movement**'.

### Theosophical Society

- **Madame Blavatsky** and **Colonel Alcott** established the **Theosophical Society** in 1875 in New York.

(BPSC 2005, UP RO, 2016; 53<sup>rd</sup> to 55<sup>th</sup> BPSC, 2011)

- International Office of Theosophical Society was opened in Adyar (Madras) in 1882.

- Mrs. Annie Besant became a member of the Theosophical Society in 1889 and came to India in 1893.

- After the death of Alcott, Annie Besant became the President of this society in 1907.

- For development in the field of education in India, Annie Besant established the Central Hindu College in Benares in 1898 which became the '**Banaras Hindu University**' in 1916 by the efforts of Pt. Madan Mohan Malviya. Both Hindu religion and scientific subjects are taught here.

### Other Religious Movements

- Radhakant Deb established Dharma Sabha in 1830.
- Gopal Hari Deshmukh became famous as Lokhitwadi. (UPPCS, 2015)

- The Paramhansa Mandali Organization was established in Poona, Satara and other cities of Maharashtra, which worked against Brahminical orthodoxy and attempted to reform Hinduism.

- Deva Samaj was founded by Shiv Narayan Agnihotri in Lahore in 1887. (CAPE, 2014, 2016; UPPCS, 2002)

- Behramji Malabari founded **Seva Sadan** in Bombay in 1908. (CPOSI, 2008, 2010, 2017)

- **Servants of India Society** was founded by **Gopal Krishna Gokhale** in 1905. (BPSC, 1998, 1999; UPPCS, 2016)

- The **Indian National Social Conference** was founded by M.G. Ranade and Raghunath Rao in 1887. This movement started as a pledge movement to stop child marriage.

- **Social Service League** was established in 1911 by N.M. Joshi.

- Hridaynath Kunzru established the Seva Samiti in Allahabad (now Prayagraj) in 1914.

- **Rahunmai Mazdayasnan Sabha** was associated with the Parsi Reform Movement which was started in 1851. Naoroji Fardun Ji, Dadabhai Naoroji and SS, Bengali, etc. founded it in Bombay.

- Rahanumai Mazdayasnan published the **Rast Goftar** ("The Truth Teller") magazine.

### Muslim Reform Movement

- **Sir Syed Ahmad Khan** launched the **Aligarh Movement**.
- He advocated for the abolition of the Piri Muridi system and published a magazine called **Tehzib-ul-Akhlaq** (Civilization and Ethics).
- **Muhammad Qasim Nanautvi** and **Rashid Ahmad Gangohi** in 1866 established Islamic seminary at Deoband.
- The Moplah or Muslim farmers launched a powerful anti-landlord movement in the state of Kerala.
- Shibli Nomani was a supporter of Deoband.
- He founded **Nadwatul-'Uloom** and **Darul Uloom**.

(BPSC, 1997, 1998; UPPCS, 2014)

- **Mirza Ghulam Ahmad** founded the **Ahmadiyya Movement** in 1889.
- In 1864, Sir Syed Ahmad Khan founded the 'Scientific Society' and '**Aligarh Muslim - Anglo Oriental College**' in 1875. This college was transformed into **Aligarh Muslim University** in 1920. (BPSC, 1996; UPRO/ARO, 2016)
- Sir Syed Ahmad published a magazine named **Tehzeeb-ul-Akhlaq** in 1870.
- Ahmadiyya movement opposed Jihad.
- Mirza Ghulam Ahmad claimed to be the incarnation of Krishna and Jesus Christ on the Earth after being the Messiah and the Mahdi.
- At the annual session of the Muslim League, the idea of a separate nation for Muslims in India was first time conceived by the poet Muhammad Iqbal in 1930.

(UPPCS, 2003)

- Iqbal used the word '**Inquilab**' for the first time in his Urdu book '**Bang-i-Dara**'.

### Lower Caste Movement

- Lower caste movement first started in Maharashtra.
- **Jyotiba Phule** founded the **Satya Shodhak Samaj** in 1873 in Bombay to fight against the caste system. (UPPCS, 1997)
- He wrote a book, 'Ghulamgiri'. (UPPCS, 2000)
- In 1924, Babasaheb Ambedkar founded the Bahishkrit Hitakarini Sabha in Bombay and started the publication of a magazine **Bahishkrit Samaj** in Marathi in 1927.

(UPPCS, 1991, 04)

- In 1932, Mahatma Gandhi named the untouchables as 'Harijan', (Children of God) and also established the **Harijan Sevak Sangh**. (UPPCS, 2017)
- In South India, **EV Ramaswamy** Bald Naicker started the Self-Respect Movement in 1920.

### Other Movements and Reforms

- **Ishwar Chandra Vidyasagar** worked tirelessly for widow remarriage.

- D.K. Karve established the first Women's University in Mumbai in 1916. (UPPCS, 2002, UP GIC, 2010)
- Inter-caste marriage was recognized by the enactment of the Native Marriage Act in 1872. (UPPCS, 2019)
- Ramkrishna Gopal Bhandarkar was a popular leader of the reformist organization Prarthana Samaj.

| Social Reformer  | Related Governor-General               |
|------------------|----------------------------------------|
| Sati Practice    | Lord William Bentinck                  |
| Thuggee Practice | Lord William Bentick (Colonel Sleeman) |
| Slavery Practice | Lord Ellenborough                      |
| Sarda Act        | Lord Irwin                             |

## 8. Indian National Freedom Movements

The Indian National Freedom Movement is mainly divided into three phases in chronological order –

1. First Phase (1885–1905)
2. Second Phase (1905–1919)
3. Third Phase (1919–1947)

- Indian National Union, the precursor of the Indian National Congress (INC), was formed at the initiative of A.O. Hume in 1885 and it held its first session at Gokuldas Tejpal Sanskrit Vidyalaya, Bombay on 28<sup>th</sup> December, 1885.

(BPSC, 1997, 2000, 1999; UPPCS, 2007, 10)

- At the first Conference, the name of the Indian National Union was changed into "Indian National Congress" by the suggestion of Dadabhai Naoroji.
- Dadabhai Naoroji, Rahnumai, was one of the founders of Majdayasan Sabha or Religious Reform Association.
- **Self rule or Swaraj as the ultimate goal of the Indian National Congress** - this was announced by Dadabhai Naoroji at the Calcutta session of the Indian National Congress (INC).

(UPPC 2010; UK PSC 2006; Jharkhand PC 2003; BPSC 1999)

| Titles Received by and Given by |                      |                                    |
|---------------------------------|----------------------|------------------------------------|
| Title                           | Received by          | Given by                           |
| Gurudev                         | Rabindranath Tagore  | Mahatma Gandhi                     |
| Mahatma                         | Mahatma Gandhi       | Rabindranath Tagore                |
| Netaji                          | Subhash Chandra Bose | Adolf Hitler                       |
| Sardar                          | Vallabhbhai Patel    | Women of Bardoli                   |
| Deshratna / Ajatashatru         | Dr. Rajendra Prasad  | Mahatma Gandhi (BPSC, 2000)        |
| Quaid-i-Azam                    | Muhammad Ali Jinnah  | Mahatma Gandhi                     |
| Desh Nayak                      | Subhash Chandra Bose | Rabindranath Tagore                |
| Vivekananda                     | Swami Vivekananda    | Maharaja Khetri                    |
| Father of the Nation            | Mahatma Gandhi       | Subhash Chandra Bose (UPPCS, 2009) |
| Raja                            | Ram Mohun Roy        | Akbar-II (CPO SI 2004)             |

## 9. Important Organizations and Institutions Related to Indian National Movements

| Establishment                             |      |                                                          |
|-------------------------------------------|------|----------------------------------------------------------|
| Institution                               | Year | Founder                                                  |
| Asiatic Society                           | 1784 | William Jones<br>(UPPCS, 2006)                           |
| Atmiya Sabha                              | 1815 | Raja Ram Mohun Roy                                       |
| Young Bengal Movement                     | 1826 | Henry Louis Vivian Derozio                               |
| Brahmo Samaj                              | 1828 | Raja Ram Mohun Roy                                       |
| Tatvabodhini Sabha                        | 1839 | Devendranath Thakur                                      |
| Paramahansa Mandali                       | 1840 | Atmaram Pandurang, Balakrishna Jayakar, Dadoba Pandurang |
| Rahnumai Mazdayasnan Sabha                | 1851 | Dadabhai Naoroji                                         |
| Balika Vidyalaya                          | 1851 | Jyotiba Phule                                            |
| Mohammadan Literary Society               | 1863 | Abdul Latif                                              |
| Veda Samaj                                | 1864 | K. Sridharalu Naidu                                      |
| Scientific Society                        | 1864 | Sir Syed Ahmad Khan                                      |
| East India Association                    | 1866 | Dadabhai Naoroji                                         |
| Poona Sarvajanic Sabha                    | 1870 | G.V. Joshi, H.S. Sathe                                   |
| Prarthana Samaj                           | 1867 | Atmaram Pandurang                                        |
| Satya Shodhak Samaj                       | 1873 | Jyotiba Phule                                            |
| Aligarh Mohammadan Anglo-Oriental College | 1875 | Sir Syed Ahmad Khan                                      |
| Indian League                             | 1875 | Shishir Kumar Ghosh                                      |
| Arya Samaj                                | 1875 | Swami Dayanand Saraswati                                 |
| Theosophical Society                      | 1875 | Madam Blavatsky and Colonel Olcott                       |
| Indian Association                        | 1876 | Anand Mohan Bose, Surendranath Banerjee                  |
| Indian National Congress                  | 1885 | A.O. Hume                                                |
| Bombay Presidency Association             | 1885 | Ferozshah Mehta, Taillang and Badruddin Tyabji           |
| Belur Math                                | 1899 | Swami Vivekananda                                        |
| Indian Social Conference                  | 1887 | Mahadev Govind Ranade                                    |
| Sarda Sadan                               | 1889 | Ramabai                                                  |
| Ramakrishna Mission                       | 1897 | Swami Vivekananda                                        |
| Abhinav Bharat Society                    | 1904 | Vinayak Damodar Savarkar                                 |

|                                                                                                             |      |                                       |
|-------------------------------------------------------------------------------------------------------------|------|---------------------------------------|
| Servants of Indian Society                                                                                  | 1905 | Gopal Krishna Gokhale                 |
| Muslim League                                                                                               | 1906 | Agha Khan and Salimullah              |
| Social Service League                                                                                       | 1911 | Shri Narayan Malhar Joshi             |
| Visva Bharati University*                                                                                   | 1921 | Rabindranath Tagore                   |
| Gadar Party                                                                                                 | 1913 | Lala Hardayal                         |
| Hindu Mahasabha                                                                                             | 1915 | Madan Mohan Malviya                   |
| Home Rule League                                                                                            | 1916 | Tilak and Annie Besant                |
| Women's India Association                                                                                   | 1917 | Annie Besant                          |
| Khilafat Movement                                                                                           | 1919 | Ali Bandhu                            |
| All India Trade Union                                                                                       | 1920 | N.M. Joshi                            |
| Swaraj Party                                                                                                | 1923 | Motilal Nehru and Chittaranjan Das    |
| Hindustan Republican Association                                                                            | 1924 | Sachindra Nath Sanyal                 |
| Bahishkrit Hitakarini Sabha                                                                                 | 1924 | B.R. Ambedkar                         |
| Rashtriya Swayamsevak Sangh                                                                                 | 1925 | Dr. Hedgewar                          |
| Naujawan Sabha                                                                                              | 1926 | Bhagat Singh, Chhabil Das and Yashpal |
| Hindustan Socialist Republican Association                                                                  | 1928 | Bhagat Singh                          |
| Khudai Khidmatgar                                                                                           | 1929 | Abdul Ghaffar Khan                    |
| Harijan Sevak Sangh (Pune)                                                                                  | 1932 | Mahatma Gandhi                        |
| Swatantrata Shramik Party                                                                                   | 1936 | B.R. Ambedkar                         |
| Forward Block                                                                                               | 1939 | Subhash Chandra Bose                  |
| Azad Hind Sarkar                                                                                            | 1943 | Subhash Chandra Bose                  |
| <p>📌 <b>Note :</b> In September 2023, Shantiniketan became India's 41<sup>st</sup> world Heritage List.</p> |      |                                       |

## 10. Development of Education during British India

- Warren Hasting, the Governor-General established the 'Calcutta Madrasa' in 1780 where Persian and Arabic languages were taught. (UPPCS, 2006)
- William Jones founded the "Asiatic Society of Bengal" in 1784. It is now known as Asiatic Society. (UPPCS, 2006, 2004; CGPSC, 2003; RAS, 1999)
- The British Resident Jonathan Duncan founded Sanskrit College to educate Hindu Law and Philosophy in Varanasi in 1791. (UPPCS, 2017, 2019; UK PCS, 2006)

- **Lord Wellesley** founded **Fort William College** in 1800 to educate the Company's civil officers.
- Lord Macaulay presented the Macaulay Minute in 1835 which criticized the Indian language and literature and praised the Anglo language and literature.
- As a result of the British Education Act of 1835, English was made the medium of higher education.
- The theory of downward filtration of education was formulated by **Alexander Duff**.
- '**Charles Wood's Despatch**' (1854) is called the '**Magna Carta of Indian Education**'.  
(IAS, 2018; MPPCS, 2015; UPPCS, 2004; UP Lower, 2004)
- The **Hunter Commission** was formed in 1882 which suggested measures for the expansion of primary education.  
(UPPCS, 2004)
- The **University Commission** was formed in 1902 under the chairmanship of **Thomas Raleigh**. (BPSC, 2008; SSC MTS, 2009)
- **Department of Agriculture and Archeology** was established during Lord Curzon's tenure.
- **Calcutta University Commission** or **Sadler Commission** was formed in 1917.  
(48<sup>th</sup> to 52<sup>nd</sup> BPSC, 2008)
- For the first time, at the government level, the cause of women's education was taken up and arrangements were made in the 'Wood's Despatch', the report of Hunter Commission and Sadler Commission for promoting women's education.  
(IAS, 2018, 1996, 1999)
- On the pattern of the University of London, **Wood's Despatch** suggested the establishment of Universities in **Calcutta, Bombay** and **Madras** Presidencies.
- For the first time, a provision was made by the company to spend Rs 1 lakh on education in the Charter Act of 1813.  
(UPPCS, 2009)
- Among the supporters of oriental learning were - H.T. Prinsep and H.H. Wilson.
- The Government of India established the **University Grants Commission (UGC)** in 1953 at the suggestions of **Radhakrishnan Commission (1948)**.
- The first Indian effort toward women's education was made by 'Brahmo Samaj'.
- The Indian Public Service in India was formed by Cornwallis. Thus, he is considered the **Father of the Indian Public Service**.
- Under British rule in India, Governor General Lord Cornwallis professionalized, bureaucratized and Europeanized the administration of the East India Company.
- **Hartog Committee** was constituted in 1929 under the Chairmanship of **Philip Hartog** to report on the **development of education** in India.
- The Central Education Advisory Board was reorganized in 1935 by the recommendation of this committee.
- **Sargent Scheme** was introduced in 1944.

## 11. History of Indian Newspapers

- The Portuguese introduced the printing press in India in sixteenth century.  
(UPPCS, 2004; Jharkhand PCS, 2021)
  - The clergy of Goa printed the first book in India in 1557.  
(UDA, 2010; UPPCS, 2001)
  - James **Augustus Hicky** published '**Hicky's Bengal Gazette**' in 1780 which is said to be the **first newspaper in India**.  
(UPPCS, 2004)
  - The first newspaper published in English by an Indian was the '**Bengal Gazette**', published by **Gangadhar Bhattacharya** in 1816.  
(WBPSC, 2007, 2009, 2011)
  - The establishment of a national press in India is attributed to **Raja Rammohan Roy** who published **Sambad Kaumudi** and **Mirat-ul-Akhbar**.  
(UPPCS, 2000)
  - **Ishwara Chandra Vidyasagar** published **Som Prakash** in Bangla.  
(IAS, 2007)
  - The action was taken against Som Prakash and Bharat Mihir under Lytton's Vernacular (native language) Press Act, passed in 1878.
  - The editor of the **Hindu Patriot** was **Kristo Das Pal** who was called the '**Prince of Journalism**'.
  - **Motilal Ghosh** published '**Amrita Bazar Patrika**' in Bengali from Calcutta in 1868.
  - To avoid Lytton's Vernacular Press Act, this (Amrita Bazar) Patrika changed into an English daily overnight.
  - '**Maratha**' in English and '**Kesari**' in Marathi were published by Bal Gangadhar Tilak from Bombay.  
(UPPCS, 1990)
  - **Udant Martand** was the first Hindi language newspaper published in India in 1826, from Calcutta by **Pt. Jugal Kishore Shukla**.  
(UPPCS, 2016)
  - **Gadar** was published from **San Francisco** (USA), in 1913. Its publication started in Urdu, English and Punjabi.
  - **Gadar** was also published though not regularly in Hindi, Marathi, Gujarati and Pashto (only one issue).
- Ban imposed against the Press**
- Lord Wellesley controlled newspapers by enacting the Press Control Act (censorship) in 1799.  
(UPPCS, 2001)
  - **Lord Hastings abolished the Act in 1818**.
  - Governor-General, Adams made it mandatory to obtain a licence for setting up a printing press and a licence for publications by enacting a licence rule in 1823.
  - The **Mirat-ul-Akhbar**, newspaper of Raja Rammohun Roy was banned under the **License Rule**.  
(IAS, 2006)
  - Governor-General, William Bentinck's approach was liberal towards Indian Newspapers.
  - Charles Metcalfe has been called the '**Liberator of Indian Newspapers**'.
  - Metcalfe implemented the '**Liberation of the Indian Press Act**'.



- The **Registration Act** was passed in 1867.
- The **Vernacular Press Act** was passed in 1878 during Lord Lytton's reign, it was called the '**Silencing Act**'.  
(IAS, 2005; BPSC 1994; UPPCS, 2007, 2009)
- Lord Ripon abolished this Act in 1882. (UPPCS, 2007)
- In 1908, the **Newspaper Act** was passed. (BPSC, 2023)
- The **Indian Press Act** was passed in 1910.
- A press committee was appointed under the Chairmanship of **Tej Bahadur Sapru** to review newspaper related laws in 1921.
- Lord Wellesley, Minto, Adam, Canning, Lytton, are known to have opposed the freedom of the Indian Press.
- Lord Hastings, Bentinck, Metcalfe, Macaulay and Ripon were known as proponents of the freedom of the Indian Press.

| Important Newspapers, Magazines and Books                              |                                                                         |
|------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Papers Magazines and Books                                             | Authors / Editors                                                       |
| Abhyudaya, Leader, Hindustan                                           | Madan Mohan Malviya                                                     |
| Indian Mirror                                                          | Manmohan Ghosh, Keshav Chandra Sen (UPPCS, 2007)                        |
| Independent                                                            | Motilal Nehru (UPPCS, 2012)                                             |
| Kaal                                                                   | Shivram Mahadev Paranjape                                               |
| Comrade, Hamdard                                                       | Muhammad Ali                                                            |
| Kesari (Marathi), Maratha (English), Geeta Rahsya                      | Bal Gangadhar Tilak (UPPCS, 1990; UK PSC, 2010; MPPCS, 2008; IAS, 2005) |
| Karmayogi, Yugantar, Vande Mataram, Life Divine, Savitri               | Arvind Ghosh (UPPCS, 1996)                                              |
| Bengali, A Nation in Making                                            | Surendranath Banerjee                                                   |
| Bhawani Mandir                                                         | Barindra Kumar Ghosh                                                    |
| Young India, Harijan, Navjeevan, Hind Swaraj, My Experiment with Truth | Mahatma Gandhi                                                          |
| Sambad Kaumudi                                                         | Raja Ram Mohan Roy                                                      |

|                                                            |                                              |
|------------------------------------------------------------|----------------------------------------------|
| Som Prakash                                                | Ishwar Chandra Vidyasagar                    |
| Amrita Bazar Patrika                                       | Sisir Kumar Ghosh                            |
| Commonweal, New India                                      | Annie Besant                                 |
| Free Hindustan                                             | Tarak Nath Das (39 <sup>th</sup> BPSC, 1994) |
| The Revolutionary                                          | Sachindra Nath Sanyal                        |
| Poverty and Un-British Rule in India, Rasta Gofar          | Dadabhai Naoroji (UPPCS, 2016)               |
| India Divided                                              | Dr. Rajendra Prasad                          |
| Unhappy India                                              | Lala Lajpat Rai                              |
| India Wins Freedom, Ghubar-e-Khatir, Al-Hilal              | Abul Kalam Azad                              |
| Discovery of India, Glimpses of World History, Meri Kahani | Jawaharlal Nehru                             |
| Hints for Self Culture                                     | Lala Hardayal                                |
| Indian Unrest                                              | Sir Valentine Chirol                         |
| India for Indians                                          | Chittaranjan Das                             |
| The Indian War of Independence, 1857                       | Veer Savarkar                                |
| Home and the World, Gitanjali                              | Rabindranath Tagore                          |
| Nil Darpan                                                 | Dena Bundhu Mitra                            |
| Soje Watan, Karmabhoomi, Shatranj Ke Khiladi               | Premchand (UK PCS, 2010)                     |
| Bang - e - Dara, Taran - e - Hind                          | Muhammad Iqbal                               |
| Bharat Bharti                                              | Maithili Sharan Gupt                         |
| Bharat Durdasha                                            | Bharatendu Harishchandra                     |
| History of Indian National Congress                        | B. Pattabhi Sitaramayya                      |
| Satyarth Prakash                                           | Dayanand Saraswati                           |
| Indian Struggle                                            | Subhash Chandra Bose (UPPCS, 2000)           |
| Anandmath, Devi Chaudharani                                | Bankim Chandra Chattopadhyay                 |
| Bandi Jeevan                                               | Sachindra Nath Sanyal                        |

## 12. Commissions/Committees during the British Period

| Commission                              | Year | President         | Governor-General | Objective                                                                                               |
|-----------------------------------------|------|-------------------|------------------|---------------------------------------------------------------------------------------------------------|
| Strachey Commission (Famine Commission) | 1878 | Richard Strachey  | Lytton           | Famine Prevention                                                                                       |
| Hunter Commission                       | 1882 | William Hunter    | Ripon            | Development of Education                                                                                |
| Aitchison Commission                    | 1886 | Charles Aitchison | Dufferin         | A scheme for fulfilling the claims of Indians to higher and more extensive employment in public service |
| Opium Commission                        | 1893 | Mackworth Young   | Lansdowne        | To stop opium consumption                                                                               |
| Harshell Commission                     | 1893 | Harshell          | Lansdowne        | Suggestions related to taksal                                                                           |
| Famine Commission                       | 1898 | James Lyall       | Elgin            | Consideration of the report of the first Famine Commission                                              |
| Famine Commission                       | 1900 | Anthony McDonnell | Curzon           | Suggestions on the report of the second Famine Commission                                               |

|                                                    |             |                       |                |                                                                                                            |
|----------------------------------------------------|-------------|-----------------------|----------------|------------------------------------------------------------------------------------------------------------|
| Irrigation Commission                              | 1901        | Colin Scott-Moncrieff | Curzon         | Financial considerations to improve irrigation                                                             |
| University Commission                              | 1902        | Thomas Raleigh        | Curzon         | Inquiry into the conditions and prospects of Universities in India                                         |
| Fraser Commission                                  | 1902        | Fraser                | Curzon         | Police Reforms                                                                                             |
| Butler Commission                                  | 1927        | Harcourt Butler       | Irwin          | Indian State's relations with British Crown<br>(IAS, 2017)                                                 |
| Islington Commission                               | 1912        | Islington             | Hardinge       | Recommendation for the participation of Indians in Civil Services                                          |
| Calcutta University Commission (Sadler Commission) | 1917        | Michael Sadler        | Chelmsford     | Review the conditions of Calcutta University Commission                                                    |
| <b>Lee Commission</b>                              | <b>1924</b> | <b>Lord Lee</b>       | <b>Reading</b> | Recommended for setting up of a Public Service Commission.                                                 |
| Butler Commission                                  | 1927        | Harcourt Butler       | Irwin          | To investigate and clarify the relationship between the paramount power and the Princes of Princely States |
| Simon Commission                                   | 1927        | John Simon            | Irwin          | To review the Act of 1919                                                                                  |
| Linlithgow Commission                              | 1928        | Linlithgow            | Irwin          | Suggestions on agricultural problems                                                                       |
| Whitley Commission                                 | 1928        | J.H Whitley           | Irwin          | Considerations for the status of workers                                                                   |
| Lindsay Commission                                 | 1929        | Lindsay               | Irwin          | For the development of Higher missionary education                                                         |
| Sapru Commission                                   | 1934        | Tej Bahadur Sapru     | Willington     | Review of Unemployment problem                                                                             |
| <b>Sargent Plan</b>                                | <b>1944</b> | John Sargent          | Wavell         | For the division of Education                                                                              |

### 13. Congress Sessions and related Major Facts

| Sessions        | Year | Place     | President                                 | Special Point                                        |
|-----------------|------|-----------|-------------------------------------------|------------------------------------------------------|
| 1 <sup>st</sup> | 1885 | Bombay    | Womesh Chandra Bonnerjee<br>(UPPCS, 2004) | Attended by 72 delegates<br>(UPPS, 2003; BPSC, 2011) |
| 2 <sup>nd</sup> | 1886 | Calcutta  | Dadabhai Naoroji (BPSC, 2001)             |                                                      |
| 3 <sup>rd</sup> | 1887 | Madras    | Syed Badruddin Tyabji<br>(UPPCS, 2003)    | First Muslim President                               |
| 4 <sup>th</sup> | 1888 | Allahabad | George Yule                               | First English President (UP RO/ARO, 2013)            |
| 5 <sup>th</sup> | 1889 | Bombay    | Sir William Wedderburn                    |                                                      |
| 6 <sup>th</sup> | 1890 | Calcutta  | Feroz Shah Mehta                          | (W.B. PCS, 2007, 2009)                               |
| 7 <sup>th</sup> | 1891 | Nagpur    | P. Ananda Charlu                          |                                                      |

📌 **Note :** In this conference, Chairman P. Anand Charlu said that the second name of Congress is 'Nationality'.

|                  |      |           |                          |                                                       |
|------------------|------|-----------|--------------------------|-------------------------------------------------------|
| 8 <sup>th</sup>  | 1892 | Allahabad | Womesh Chandra Bonnerjee |                                                       |
| 9 <sup>th</sup>  | 1893 | Lahore    | Dadabhai Naoroji         |                                                       |
| 10 <sup>th</sup> | 1894 | Madras    | Alfred Webb              |                                                       |
| 11 <sup>th</sup> | 1895 | Poona     | Surendranath Banerjee    |                                                       |
| 12 <sup>th</sup> | 1896 | Calcutta  | Rahimtullah M. Sayani    | Sung Vande Mataram for the first time<br>(BPSC, 2020) |
| 13 <sup>th</sup> | 1897 | Amravati  | C. Sankaran Nair         |                                                       |
| 14 <sup>th</sup> | 1898 | Madras    | Ananda Mohan Bose        |                                                       |
| 15 <sup>th</sup> | 1899 | Lucknow   | Romesh Chunder Dutt      | (BPSC, 2002, 2007)                                    |
| 16 <sup>th</sup> | 1900 | Lahore    | N G Chandavarkar         |                                                       |
| 17 <sup>th</sup> | 1901 | Calcutta  | Dinshaw Eduljee Wacha    | (CAPE, 2007, 2013; CPO SI, 2018)                      |

|                  |      |                   |                                             |                                                              |
|------------------|------|-------------------|---------------------------------------------|--------------------------------------------------------------|
| 18 <sup>th</sup> | 1902 | Ahmedabad         | Surendranath Banerjee                       |                                                              |
| 19 <sup>th</sup> | 1903 | Madras            | Lal Mohan Ghosh                             | (T.N. PCS 2015, 2017, 2019)                                  |
| 20 <sup>th</sup> | 1904 | Bombay            | Sir Henry Cotton                            |                                                              |
| 21 <sup>st</sup> | 1905 | Banaras           | Gopal Krishna Gokhale                       | (UP Lower, 2003, 04)                                         |
| 22 <sup>nd</sup> | 1906 | Calcutta          | Dadabhai Naoroji                            | The word 'Swaraj' was used for the first time                |
| 23 <sup>rd</sup> | 1907 | Surat (Suspended) | Dr. Rash Behari Ghosh                       | First division of Congress<br>(Gujarat PCS, 2006, 08, 11)    |
| 23 <sup>rd</sup> | 1908 | Madras            | Dr. Rash Behari Ghosh                       | Formation of Congress Constitution<br>(UPPCS, 2007)          |
| 24 <sup>th</sup> | 1909 | Lahore            | Madan Mohan Malviya                         |                                                              |
| 25 <sup>th</sup> | 1910 | Allahabad         | William Wedderburn                          |                                                              |
| 26 <sup>th</sup> | 1911 | Calcutta          | Bishan Narayan Dar                          | Jana Gana Mana was sung for the first time                   |
| 27 <sup>th</sup> | 1912 | Bankipore         | R. N. Mudholkar (BPSC, 2011)                | (BPSC, 2009, 2006)                                           |
| 28 <sup>th</sup> | 1913 | Karachi           | Nawab Syed Mohammed Bahadur                 |                                                              |
| 29 <sup>th</sup> | 1914 | Madras            | Bhupendra Nath Bose                         |                                                              |
| 30 <sup>th</sup> | 1915 | Bombay            | Satyendra Prasanna Sinha                    |                                                              |
| 31 <sup>st</sup> | 1916 | Lucknow           | Ambica Charan Mazumdar,                     | Congress Muslim League Pact                                  |
| 32 <sup>nd</sup> | 1917 | Calcutta          | Annie Besant                                | First Woman President                                        |
| Special Session  | 1918 | Bombay            | Hasan Imam                                  | Second division of congress<br>(Maharashtra PCS, 2006, 2009) |
| 33 <sup>rd</sup> | 1918 | Delhi             | Madan Mohan Malviya                         |                                                              |
| 34 <sup>th</sup> | 1919 | Amritsar          | Motilal Nehru                               |                                                              |
| 35 <sup>th</sup> | 1920 | Nagpur            | C. Vijayaraghavachariar                     | Changes in Congress Constitution (UPPCS, 2016)               |
| Special Session  | 1920 | Calcutta          | Lala Lajpat Rai                             | (W.B. PCS, 2008, 2007)                                       |
| 36 <sup>th</sup> | 1921 | Ahmedabad         | C.R. Das                                    | (Acting-President-Hakim Ajmal Khan)                          |
| 37 <sup>th</sup> | 1922 | Gaya              | Deshbandhu Chittaranjan Das<br>(BPSC, 2015) |                                                              |
| 38 <sup>th</sup> | 1923 | Kakinada          | Maulana Mohmmad Ali                         |                                                              |
| Special session  | 1923 | Delhi             | Abul Kalam Azad                             | Youngest President                                           |
| 39 <sup>th</sup> | 1924 | Belgaum           | Mahatma Gandhi (UPPCS, 2011)                |                                                              |
| 40 <sup>th</sup> | 1925 | Kanpur            | Mrs. Sarojini Naidu                         | First Indian woman President                                 |
| 41 <sup>st</sup> | 1926 | Guwahati          | S. Srinivasa Iyengar                        | Khadi Clothing made compulsory for the members               |
| 42 <sup>nd</sup> | 1927 | Madras            | M.A. Ansari                                 | Demand for complete Independence                             |
| 43 <sup>rd</sup> | 1928 | Calcutta          | Pandit Motilal Nehru                        | (W.B. PCS, 2003, 05)                                         |
| 44 <sup>th</sup> | 1929 | Lahore            | Pt. Jawaharlal Nehru                        | Demand for Complete Swaraj (UPPCS, 2013)                     |
| 45 <sup>th</sup> | 1931 | Karachi           | Sardar Vallabhbhai Patel                    | Demand for Fundamental Rights (UPPCS, 2005)                  |
| 46 <sup>th</sup> | 1932 | Delhi             | Amrit Ranchardas Seth                       |                                                              |
| 47 <sup>th</sup> | 1933 | Calcutta          | Mrs. Nellie Sengupta                        |                                                              |
| 48 <sup>th</sup> | 1934 | Bombay            | Dr. Rajendra Prasad                         |                                                              |
| 49 <sup>th</sup> | 1936 | Lucknow           | Pt. Jawaharlal Nehru                        |                                                              |
| 50 <sup>th</sup> | 1937 | Faizpur           | Pt. Jawaharlal Nehru                        | The First session was held in the village                    |

|                  |      |          |                                       |                                                                                 |
|------------------|------|----------|---------------------------------------|---------------------------------------------------------------------------------|
| 51 <sup>st</sup> | 1938 | Haripura | Subhash Chandra Bose<br>(UPPCS, 2008) |                                                                                 |
| 52 <sup>nd</sup> | 1939 | Tripuri  | Subhash Chandra Bose                  | Rajendra Prasad became the President after Bose's resignation (UPPCS, 1997, 07) |
| 53 <sup>rd</sup> | 1940 | Ramgarh  | Maulana Abul Kalam Azad               |                                                                                 |
| 54 <sup>th</sup> | 1946 | Meerut   | J.B. Kriplani                         |                                                                                 |
| 55 <sup>th</sup> | 1948 | Jaipur   | B. Pattabhi Sitaramayya               |                                                                                 |
| 56 <sup>th</sup> | 1950 | Nasik    | Purushottam Das Tandon                |                                                                                 |

#### 14. Important Facts related to the Indian Freedom Struggle

- The credit for raising the revolutionary spirit in Maharashtra goes to **Tilak's** newspaper '**Kesari**'.
- Tilak started the celebration of **Ganapati Festival** in 1893 and **Shivaji Festival** in 1895. (UPPCS, 2005)
- Valentine Chirol called Bal Gangadhar Tilak the '**Father of Indian Unrest**'. (UPPCS, 2013)
- Lord Dufferin called Congress only represents the microscopic minority. (UPPCS, 2012)
- Bankim Chandra Chatterjee said that Congressmen are hungry for posts.
- The famous novel Durgeshnandini was written by Bankim Chandra Chatterjee (Bankim Chandra Chattopadhyay).
- Curzon said that "The Congress is tottering to its fall and one of my great ambitions in India, is to assist it to a peaceful demise." (UPPCS, 2002)
- **Dadabhai Naoroji** formulated the 'drain of wealth' theory. (UK UDA/LDA 2007)
- He (1892) was the first Indian to win the election for the **British House of Commons** representing the Liberal Party. (JPCS, 2013)
- Angry with the adverse effects of the Plague, the **Chapekar Brothers** of Pune (Damodar and Balakrishna) killed the plague officers **Rand and Amherst in 1897**.
- Rabindranath Tagore started Shantiniketan Institute in the year 1901. (SSC MTS, 2023)
- The first revolutionary organization **Anushilan Samiti** was established in Bengal in 1902 by Gyanendranath Basu at Midnapore and Pramathnath Mitra at Calcutta, Jatindranath Banerjee and Barindranath Ghosh.
- Another Anushilan Samiti was formed under the leadership of Satish Chandra Basu at Calcutta in March 1902.
- Pulin Bihari Das formed the Dacca Anushilan Samiti in 1906.
- Aurobindo Ghosh wrote a pamphlet '**Bhavani Mandir**'.
- **Vinayak and Ganesh Damodar Savarkar** founded the **Abhinav Bharat Samaj** in Maharashtra in 1904. (UPPCS, 2000, 15)
- **Shyamji Krishna Verma** founded the India **Home Rule Society** in London in 1905. (UPPCS, 2002, 04, 07)
- The partition of Bengal was announced in July, 1905 by Lord Curzon. (UPPCS, 2011)
- The call for Swadeshi Movement was given at the Town Hall in Calcutta on 7<sup>th</sup> August 1905 to protest against the partition of Bengal. (UPPCS, 1994)
- The partition of Bengal came into effect on 16<sup>th</sup> October, 1905 and this day was observed as a **National Mourning day**. (IAS, 2009)
- The idea of the Swadeshi Movement was first published in 1905 by Krishna Kumar Mitra in his newspaper **Sanjeevani**. (UPPCS, 2014)
- **Barindranath Ghosh** and **Bhupendranath Dutt** published a newspaper named **Yugantar** in 1906.
- Dadabhai Naoroji, while presiding over the Calcutta Session of Congress in 1906, demanded Swaraj for the first time. (UPPCS, 2014)
- In Surat Session of Congress in 1907, the party split into **Moderates** and **Extremists**. (IAS, 2015)
- The Swadeshi Movement in Andhra Pradesh was called **Vandemataram Movement**.
- **Rabindranath Tagore** wrote **Amar Sonar Bangla**, a famous song during the Swadeshi movement which became the national song of Bangladesh in 1971.
- Vishva-Bharati University was founded by Rabindranath Tagore.
- Hemachandra, a revolutionary of the Anushilan Samiti, went Russia to learn the art of bomb-making from Russian revolutionaries.
- A conference was held in Dacca on 30<sup>th</sup> December, 1906 by **Salim Ulla Khan**, the Nawab of Dhaka, presided over by **Bakar-ul Mulk**. (UPPCS, 2006, 07)
- **All India Muslim League** was established at the Dhaka Conference presided over by Salim Ulla Khan.
- The Constitution of the Muslim League was formed in Karachi in 1907. (UP Lower, 2008)
- Under the Constitution of the Muslim League, its first session was held in Amritsar in 1908, in which Agha Khan was appointed as the President.



- **The Muslim League** supported the partition of Bengal.
- **Prafulla Chaki** and **Khudiram Bose** attempted to assassinate the magistrate, Kingsford of the Bengal Presidency on 30<sup>th</sup> April, 1908. Prafulla Chaki committed suicide to escape his arrest while Khudiram Bose was hanged. (48<sup>th</sup> to 52<sup>nd</sup> BPSC, 2008)
- Khudiram Bose was the **youngest revolutionary** to be hanged.
- **Bhikaji Rustom Cama** (mother of Indian revolution) hoisted the Indian National Flag at Stuttgart, Germany, in 1907. (56<sup>th</sup> to 59<sup>th</sup> BPSC, 2015)
- Madan Lal Dhingra shot and killed William Curzon Wylie. He was later hanged on 1<sup>st</sup> July, 1909. (63<sup>rd</sup> BPSC, 2017)
- Ajit Singh established an organization called Anjuman-e-Mohisban-e-Watan in Lahore.
- Viceroy Lord Hardinge organized a grand court in Delhi in 1911 to welcome Emperor George V of England and Queen Mary.
- In this court, the partition of Bengal was annulled. (UPPCS, 1991, 1993)
- It was announced to shift the capital from Calcutta to New Delhi. During the time of Viceroy Lord Hardinge, Delhi became the capital of India. (Uttarakhand PCS, 2006)

🔗 **Note :** The Delhi Town Planning Committee was set up in 1912 to plan, develop and design the major buildings like Viceroy's House, the Secretariat buildings etc. Edwin Lutyens became a member of this committee in March, 1912.

- Viceroy Lord Hardinge was attacked in Delhi on 23<sup>rd</sup> December, 1912, by Rash Behari Bose.
- Basanta Kumar Biswas (Servant of Rash Behari Bose), a woman in disguise threw a bomb at Lord Charles Hardinge.
- The case related to the attempted murder of Lord Hardinge is known as **Delhi Conspiracy Case**.
- **Basanta Biswas, Balamukund, Awadh Bihari** and **Master Amirchand** were hanged in the case of throwing bombs on Hardinge. Rash Behari Bose fled to Japan.
- On 1<sup>st</sup> November 1913, Sohan Singh Bhakna and Lala Hardayal founded the **Pacific Coast Hindustan Association**, which brought out **Ghadar Patrika** in different languages, after which the name of this institution came to be known as 'Ghadar Movement'. (IAS, 1998)
- In 1915, the British Government conferred the title of **Kaiser-e-Hind** on Mahatma Gandhi.
- Significantly, Hindu Mahasabha was founded in 1915.
- **Kamagata Maru** was a Japanese ship, hired by Gurdit Singh of Punjab in March 1914 with 376 passengers aboard sailing towards the Canadian port of Vancouver. Upon

reaching the coast, the Canadian police sieged the Indian ship and prevented passengers from entering the country. The **Shore Committee** was formed under Hussain Rahim, Balwant Singh and Sohan Lal Pathak to fight for the rights of travellers. After the refusal of the Canada govt., the British India govt. ordered the ship to be brought directly to Calcutta. When the ship reached **Budge-Budge (Calcutta)**, there was a scuffle started between the angry passengers and the police, in which 18 passengers were killed and the rest were put in jail. (IAS, 2005)

- King Mahendra Pratap, along with his associate Barkatullah, formed India's first provisional government in **Kabul in 1915**. (UPPCS, 2012)
- In the **Lucknow Session** of the Congress (1916), there was unity between the two factions of Congress-Moderates and Extremists.
- **Bal Gangadhar Tilak** founded **Home Rule League** in April, 1916.
- Bal Gangadhar Tilak was associated with the establishment of Fergusson college.
- **Annie Besant** founded **Home Rule League in Madras**, in September, 1916. (UPPCS, 2010)
- Gandhiji established **Sabarmati Ashram** in Ahmedabad, in **1917**.
- Gandhiji went to Champaran on the insistence of Rajkumar Shukla of Bihar. (UPPCS, 2016)
- Gandhiji's first 'Satyagraha' was organised in Africa in 1906, while in India, it was first observed in 1917 at Champaran (Bihar). (69<sup>th</sup> BPSC, 2018)
- Mainly at the behest of Rajkumar Shukla, Mahatma Gandhi went to Champaran to understand the problems of the farmers.
- Mahatma Gandhi first organized a hunger strike in 1918, in support of Ahmedabad Mill workers. (UPPCS, 2010)
- Gandhiji launched 'no tax' campaign from Kheda district of Gujarat in 1918.
- Sardar Vallabh Bhai Patel and Indulal Yaghik helped Gandhiji by arranging for him to visit villages in Kheda and encouraging the farmers to stand strong against the government.
- The **Rowlatt Act** was passed on **18<sup>th</sup> March, 1919**. It was called "**No Lawyer, No Appeal, No Arguments**". (UPPCS, 1993)
- On **6<sup>th</sup> April, 1919**, Gandhiji organized a nationwide strike against the Rowlatt Act.
- On **13<sup>th</sup> April, 1919**, General Dyer opened fire on a public meeting at Jallianwala Bagh, Amritsar opposing the arrest of **Dr. Satyapal** and **Saifuddin Kitchlew**, killing 1000 innocent people according to Congress and 379 according to

- government reports. The incident is known as the infamous Jallianwala Bagh Massacre. (UPPCS, 2002)
- Shankaran Nair resigned from Viceroy's Executive Council in protest against this incident. (UPPCS, 2007)
  - As a mark of protest against this gruesome massacre, Gandhiji, Jamnalal Bajaj and Rabindranath Tagore returned their titles to the colonial rulers. (IAS, 2004, UPPCS, 2016, 2022)
  - A committee was formed under the chairmanship of **Lord Hunter** to investigate the causes of the Jallianwala Bagh massacre. (IAS, 2001)
  - A probe committee (1919) was set up under the chairmanship of **Madan Mohan Malviya** to investigate this incident on behalf of Congress.
  - The Khilafat movement was a movement of Indian Muslims against the European allies especially against Britain in support of the Turkish Khalifa.
  - Khilafat Day was celebrated on **17<sup>th</sup> October, 1919**.
  - Muhammad Ali Jinnah, Annie Besant and Bipin Chandra Pal did not agree with Gandhiji for launching the Non-Cooperation Movement.
  - Gandhiji started the **Non-Cooperation Movement** on **1<sup>st</sup> August, 1920** to oppose the Rowlatt Act, Jallianwala Bagh massacre and in support of the Khilafat movement. Unfortunately, Bal Gangadhar Tilak died on the same day. (UP Lower, 2008)
  - M.N. Roy founded an overseas Indian communist party in Tashkent in 1920.
  - Bipin Chandra Pal, Annie Besant and Muhammad Ali Jinnah left the Congress for being dissatisfied with the Non-Cooperation Movement.
  - On **4<sup>th</sup> February, 1922**, at **Chauri-Chaura** in Gorakhpur district, agitators set on fire a police station in which 5 British policemen were burnt alive. (UPPCS, 2006, 2008)
  - The Non-Cooperation Movement was suspended by Gandhiji on 12<sup>th</sup> February, 1922 on being hurt by the Chauri-Chaura incident. (UPPCS, 2006)
  - In Gaya, **Chittaranjan Das** and **Motilal Nehru** founded the **Congress Khilafat Swaraj Party** in March 1923. (UP Lower, 1998)
  - Sachindranath Sanyal established the '**Hindustan Republican Association**' at Kanpur in 1924. (40<sup>th</sup> BPSC, 1995)
  - The **Kakori Train Action Day** occurred on 9<sup>th</sup> August, 1925, in which the government treasury inside the train was looted by the revolutionaries. (UP Lower, 2008)
  - **Ram Prasad Bismil, Ashfaq Ullah Khan, Rajendra Lahiri, Roshan Singh** were involved in the act, therefore hanged whereas **Sachindranath Sanyal** was sentenced life imprisonment. (65<sup>th</sup> BPSC, 2019)
  - On 3<sup>rd</sup> February, 1928, the **Simon Commission** came to India (Mumbai). It is also called the **White Man Commission**. (UPPCS, 1996)
  - **Lala Lajpat Rai** was injured and later died in a police lathi charge during the protest against the Simon Commission on 30<sup>th</sup> October, 1928, at Lahore. (UPPCS, 2008, 2016)
  - **Chandrashekhar Azad** and **Bhagat Singh** founded the '**Hindustan Socialist Republican Association**' at Feroz Shah Kotla, in Delhi, in 1928.
  - Revolutionaries, led by Bhagat Singh shot and killed the then Assistant Superintendent of Police, Saunders, at Lahore, on 17<sup>th</sup> December, 1928.
  - On **8<sup>th</sup> April, 1929**, in protest against the passing of the Public Safety Bill, Batukeshwar Dutt and Bhagat Singh threw bombs and pieces of paper on the empty benches of the Central Legislative Assembly in Delhi, in which it was written that our objective is not to kill anyone, but have to make a voice to the ears of the deaf. (UP UDA/LDA, 2013)
  - **Purna Swaraj** was declared its goal in the Lahore Session of the Congress in 1929. The session was presided over by **Jawaharlal Nehru**. (UK PCS, 2021)
  - The tricolour flag (Tiranga) was hoisted by Jawaharlal Nehru on the banks of the **river Ravi** at 12 noon on **31<sup>st</sup> December, 1929**. (UP Lower, 2004)
  - Urdu Poet Mohammad Iqbal spoke in the year 1930 about the need for a 'North-West Indian Muslim State' within the sovereign Indian confederation. (SSA, 2023)
  - It was decided to celebrate 26<sup>th</sup> January, 1930 as the **First Independence Day** in the Lahore Session. (66<sup>th</sup> BPSC, 2020)
  - On 12<sup>th</sup> March, 1930, about 390 km from Sabarmati Ashram, Mahatma Gandhi started the march to Dandi and after reaching there on 6<sup>th</sup> April 1930 (24 days of journey), Gandhiji broke the Salt Law and started the **Civil Disobedience Movement**. (UK PCS, 2005, 2006)
  - The Muslims of the North-Western Frontier Province organized a civil disobedience movement under the leadership of **Khan Abdul Ghaffar Khan** (Frontier Gandhi).
  - The '**Khudai Khidmatgar**' or '**Lal Kurti**' 'organization was formed under the leadership of Khan Abdul Ghaffar Khan who played an active and vital role in this movement. (UP Lower, 2009)
  - American journalist **Web Miller** was related to the 'Civil Disobedience Movement'.
  - In Tamil Nadu, **C. Rajagopalachari** started a salt march from Trichinapalli to Vedaranyam.
  - On **5<sup>th</sup> March, 1931**, the **Gandhi-Irwin** Pact was concluded. After this, **Gandhiji** suspended the Civil Disobedience Movement. (67<sup>th</sup> BPSC, 2021)
  - Gandhi - Irwin Pact is also known as **Delhi Pact**.

- The First Round Table Conference was held in London from 12<sup>th</sup> November, 1930 to 19<sup>th</sup> January, 1931. This was the first such dialogue in which Indians were given equal status by British rulers. (UPRO/ARO, 2014)
  - The Second Round Table Conference took place from 7<sup>th</sup> September, 1931 to 1<sup>st</sup> December, 1931. Mahatma Gandhi participated in this as a Congress representative. (RAS/RTS, 2008)
- 📌 **Note :** In the Second Round Table Conference, Gandhiji arrived in England as the sole representative of Congress by a ship called '**S.S. Rajputana**'. (UPPCS, 2000)
- The Second Round Table Conference failed due to **Communal Representation**. (41<sup>st</sup> BPSC, 1996)
  - After the failure of the Second Round Table Conference, Gandhiji again started the **Civil Disobedience Movement** on 3<sup>rd</sup> January, 1932.
  - The Third Round Table Conference took place from 17<sup>th</sup> November, 1932 to 24<sup>th</sup> December, 1932.
  - The Prime Minister of England was **James Ramsay MacDonald** during all the three Round Table Conferences.
  - **Dr. Bhimrao Ambedkar** participated as a representative of the untouchables in all the three Round Table Conferences in London. (UPPCS, 2011)
  - On 16<sup>th</sup> August 1932, the then British Prime Minister Ramsay MacDonald presented the Communal Award. Under this, along with Muslims and Sikhs, the Dalit class was also considered a minority and separated from Hindus. (UPPCS, 1999)
  - In protest against this decision, Gandhiji started a fast unto death on 20<sup>th</sup> September, 1932 in Yerwada Jail in Poona. (IAS, 2012)
  - On 24<sup>th</sup> September, 1932, on behalf of Gandhiji, there was an agreement between **Madan Mohan Malaviya** and other leaders and **Ambedkar** which was known as '**Poona Pact**'. Under this pact, separate electorates of Dalit class were abolished, but the number of seats reserved for Dalit sections in the provincial legislatures was increased from 71 to 148. The number of seats reserved for Harijans in the Central Legislature was increased by 18 per cent. (47<sup>th</sup> BPSC, 2005)
  - The civil Disobedience Movement was finally withdrawn by Gandhiji on 7<sup>th</sup> April, 1934.
  - All India village Industries Association was started by **Mahatma Gandhi** in the year 1934.
  - The soldiers of the **Garhwal Rifles** refused to shoot at the Pathan Satyagrahis of the **Civil Disobedience Movement**.
  - On 23<sup>rd</sup> March, 1931, **Bhagat Singh, Sukhdev** and **Rajguru** were hanged. (67<sup>th</sup> BPSC, 2021)
  - **Congress Socialist Party** was established in May, 1934.
  - The first conference of **All India Kisan Sabha** was held in 1936 in Lucknow, under the chairmanship of Swami Sahajanand. **N.G. Ranga** was elected as its General Secretary. (BPSC, 2016)
  - In the **Tripuri Session** of Congress, Subhash Chandra Bose became the President of Congress defeating **Pattabhi Sitaramayya**, a candidate proposed by Mahatma Gandhi in 1939. (UPPCS, 2004)
  - On 3<sup>rd</sup> May, 1939, **Subhash Chandra Bose** established the **Forward Block**.
  - On 13<sup>th</sup> March 1940, **Udham Singh** of Punjab shot and killed former Lieutenant Governor of Punjab, Dyer in London. (Uttarakhand PCS, 2006)
  - Gandhiji started **Individual Satyagraha** on **17<sup>th</sup> October, 1940** in Pavnar, Maharashtra.
  - Sucheta Kripalani established the women's wing of congress in the year 1940.
  - The first, second and third Satyagrahi of the individual Satyagraha movement was **Vinoba Bhave, J.L. Nehru** and **Brahma Dutt** respectively. (IAS, 2009)
  - Quit India Movement resolution was passed in Congress Working Committee (CWC) meeting on 14<sup>th</sup> July 1942 in Wardha. (RAS/RTS, 2010)
  - On **7<sup>th</sup> August 1942**, the Congress met at the historical Gwalia Tank Ground in Bombay where the '**Quit India proposal**' was accepted on 8<sup>th</sup> August. (Chhattisgarh PCS, 2015)
  - The Quit India Movement was started on 9<sup>th</sup> August, 1942.
  - In the Quit India Movement, Gandhiji gave the slogan of '**Do or Die**'. (IAS, 2009)
  - All prominent Congress leaders were arrested in the night on 8<sup>th</sup> August, 1942 under **Operation Zero Hour**.
  - Gandhiji was kept in the Agha Khan Palace in Pune and other members of the Congress Executive were kept in the Fort of Ahmadnagar. (41<sup>st</sup> BPSC, 1996)
  - After escaping from the prison of Hazaribagh, Jayaprakash Narayan went underground and took the charge of this movement. (67<sup>th</sup> BPSC, 2021)
  - During this movement, parallel governments were formed in **Ballia, Tamluk** and **Satara**. (UPPCS, 2002)
  - In June 1942, the **Indian Independence League** was formed under the leadership of Rash Behari Bose. Rash Behari Bose went to Japan to escape the Delhi Conspiracy Case.
  - The idea of the formation of **Indian National Army** first struck in the mind of **Captain Mohan Singh** and it was established on 1 September, 1942 by Rash Behari Bose. Mohan Singh was appointed the Commander-in-Chief. (BPSC, 1994)
  - On 4<sup>th</sup> July, 1943, Subhash Chandra Bose was appointed the supreme commander of the Azad Hind Fauj.

- Azad Hind Government was formed in Singapore on 21<sup>st</sup> October, 1943 by Subhash Chandra Bose. (42<sup>nd</sup> BPSC, 1997)
- Three **Brigades of Azad Hind Fauj** were named **Subhash Brigade, Gandhi Brigade and Nehru Brigade** and **Women's Brigade** were named as '**Lakshmibai Brigade**'.
- On 6<sup>th</sup> of November, 1943, Japan handed over Andaman and Nicobar to the government of Subhash Chandra Bose, which he named '**Shaheed Dweep** and **Swaraj Dweep**' respectively. On 30<sup>th</sup> of 1943, Netaji hoisted the Tiranga at Port Blair.
- Azad Hind Fauj officials **P.K. Sehgal, Colonel Gurudyal Dhillon** and **Major Shahnawaz Hussain**, were trialled at the Red Fort in Delhi on charges of treason. Later, due to public opposition, the Viceroy waived his sentence. (UPPCS, 2019, IAS 2021)
- **Tej Bahadur Sapru, Jawaharlal Nehru, Bhula Bhai Desai, K.N. Katju** etc. pleaded on behalf of Azad Hind Fauj.
- On behalf of the accused (Azad Hind Fauj), **Bhula Bhai Desai** presided over the group of lawyers. (UP GIC, 2010)
- On 18<sup>th</sup> February 1946, the Navy revolted in Mumbai on a ship named **H.M.I.S. Talwar**.
- On 19<sup>th</sup> February 1946, the Air Force soldiers went on strike against the British government demanded equal treatment for both Indian and British soldiers. The strike soon started in Lahore, Delhi and Bombay also.
- Under the pressure of Sardar Patel, the Navy stopped the rebellion.
- On 24<sup>th</sup> March, 1946, the **Cabinet Mission** came to Delhi under the leadership of **Pethick-Lawrence**. Its other members were - **Stafford Cripps** (Chairman, Board of Trade), and **A.V. Alexander** (Minister of the Navy). (UP GIC, 2010)
- The Muslim League accepted the Cabinet Mission Plan on 6<sup>th</sup> June, 1946 and the Congress on 24<sup>th</sup> June, 1946.
- After the acceptance of Cabinet Mission by the Congress and the Muslim League, elections were held in July, 1946 to form the Constituent Assembly, in which the Congress secured 208 seats including 4 Sikh members. The Muslim League won 73 seats.
- The Muslim League celebrated '**Direct Action Day**' on 16<sup>th</sup> August, 1946. (UPPCS, 2007, 2008)
- On 2<sup>nd</sup> September 1946, Jawaharlal Nehru formed the Interim Government. (UPPCS, 2006, 2016)
- **Mountbatten Plan** of partition of India was published on 3<sup>rd</sup> June, 1947. (MPPCS, 2014)
- Mountbatten plan was accepted by the Congress Working Committee (CWC) on 3<sup>rd</sup> June, 1947.
- The Muslim League accepted the Mountbatten plan with an overwhelming majority on 10<sup>th</sup> June, 1947.
- The Indian Freedom Bill was introduced in the British Parliament on 4<sup>th</sup> July 1947, passed by the House of Commons on 15<sup>th</sup> July 1947 and the House of Lords on 16<sup>th</sup> July 1947. It was **signed by the British Emperor on 18<sup>th</sup> July 1947**.
- According to this Bill, the country will be divided into two Dominions, India and Pakistan and will be given complete independence and sovereignty.
- Pakistan was established on 14<sup>th</sup> August, 1947 and Indian Dominion was established on 15<sup>th</sup> August, 1947.
- The Emperor of England was George VI during India's Independence and was the first head of the Commonwealth countries. (JPSC, 2016)
- During India's Independence, the Prime Minister of Britain was **Clement Attlee**. Attlee belongs to the Labour Party. (Chattisgarh PCS, 2008)
- Notably Congress President was J.B. Kriplani, during India's Independence. (UPPCS, 2015)

## 15. Important Movements and Events related to the History of Indian Independence

| Movements and Events       | Year                           | Related Subjects / Persons                           |
|----------------------------|--------------------------------|------------------------------------------------------|
| Banga - Bhang Movement     | 1905                           | Against the partition of Bengal                      |
| Partition of Congress      | 1907                           | Split into Moderates and Extremists                  |
| Lucknow Pact               | December, 1916                 | Agreement between Congress and the Muslim League     |
| Montague Declaration       | 20 <sup>th</sup> August, 1917  | Declaration of Secretary of India, Lord Montague     |
| Rowlatt Act                | March, 1919                    | Black Act (No Dalil, No Vakil, No Appeal)            |
| Jallianwala Bagh Massacre  | 13 <sup>th</sup> April, 1919   | Massacre by General Dyer (Amritsar)                  |
| Khilafat Movement          | 1919                           | Shaukat Ali, Mohammad Ali                            |
| Congress Session at Nagpur | December, 1920                 | Proposal of Non-Cooperation Movement has been passed |
| Non-Cooperation Movement   | 1 <sup>st</sup> August, 1920   | Mahatma Gandhi (Tilak died on the same day)          |
| Chauri-Chaura Incident     | 4 <sup>th</sup> February, 1922 | Gorakhpur (Uttar Pradesh)                            |
| Formation of Swaraj Party  | January, 1923                  | Motilal Nehru and Chittaranjan Das                   |



|                                        |                                                                   |                                                                                                          |
|----------------------------------------|-------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| Appointment of Simon Commission        | November, 1927                                                    | A seven-member commission headed by John Simon                                                           |
| Simon Commission's visit to India      | 3 <sup>rd</sup> February, 1928                                    | Lala Lajpat Rai suffered severe injuries in a lathi charge during protests and later died.               |
| Nehru Report                           | August, 1928                                                      | Pt. Motilal Nehru, President                                                                             |
| Bardoli Satyagraha (IAS, 2003)         | October, 1928                                                     | Agitation under the leadership of Sardar Patel against the hike in rent of farmers of Gujarat            |
| Central Legislative Assembly Bomb Case | 8 <sup>th</sup> April, 1929                                       | Bombs thrown by Bhagat Singh and Batukeshwar Dutt in the Legislative Assembly                            |
| Congress Session at Lahore             | December, 1929                                                    | Passed the resolution on Poorna Swaraj                                                                   |
| Independence Day                       | 26 <sup>th</sup> January, 1930                                    | Announcement made to celebrate 26 <sup>th</sup> January as the Independence Day                          |
| Dandi March                            | 12 <sup>th</sup> March-5 <sup>th</sup> April, 1930                | Mahatma Gandhi violated the 'Salt Law' to travel from Sabarmati Ashram to Dandi                          |
| Civil Disobedience Movement            | 6 <sup>th</sup> April, 1930                                       | Civil Disobedience Movement begins                                                                       |
| First Round Table Conference           | 12 <sup>th</sup> November, 1930 to 19 <sup>th</sup> January, 1931 | Held in London under the chairmanship of the Prime Minister MacDonald                                    |
| Gandhi- Irwin Pact                     | 5 <sup>th</sup> March, 1931                                       | Announced to postpone the Civil Disobedience Movement concluded between Mahatma Gandhi and Viceroy Irwin |
| Second Round Table Conference          | 7 <sup>th</sup> September, 1931 to 1 <sup>st</sup> Dec., 1931     | Gandhiji participated in this conference                                                                 |
| Communal Award                         | 16 <sup>th</sup> Aug., 1932                                       | Providing separate representation to Dalits too, by McDonold                                             |
| Poona Pact                             | 24 <sup>th</sup> September, 1932                                  | Agreement between Gandhiji and Dr. Ambedkar                                                              |
| Third Round Table Conference           | 17 <sup>th</sup> November, 1932                                   | Congress did not participate in the conference                                                           |
| Formation of Congress Socialist Party  | 1934                                                              | Jaiprakash Narayan, Meenu Masani and M.S Joshi                                                           |
| Mukti Diwas                            | 22 <sup>nd</sup> December, 1939                                   | Celebrated by the Muslim League after the resignation of Congress cabinet                                |
| Formation of Forward Block             | May, 1939                                                         | Subhash Chandra Bose                                                                                     |
| Demand for Pakistan                    | 22 <sup>nd</sup> -24 <sup>th</sup> March, 1940                    | Lahore Conference of the Muslim League                                                                   |
| August Offer                           | 8 <sup>th</sup> August, 1940                                      | Viceroy Linlithgow                                                                                       |
| Cripps Mission                         | March, 1942                                                       | Stafford Cripps                                                                                          |
| Quit India Movement                    | 9 <sup>th</sup> Aug., 1942                                        | Mahatma Gandhi                                                                                           |
| Shimla Conference                      | 1945                                                              | All Political Party Meeting                                                                              |
| Naval Rebellion                        | 18 <sup>th</sup> -23 February, 1946                               | Mumbai (by HMIS Talwar soldiers)                                                                         |
| Announcement of Prime Minister Attlee  | 20 <sup>th</sup> February, 1946                                   | Assurance to declare India's Independence                                                                |
| Arrival of Cabinet Mission             | 24 <sup>th</sup> March, 1946                                      | Pethik Lawrence, Sir Stafford Cripps and A. V. Alexander                                                 |
| Direct Action Day                      | 16 <sup>th</sup> August, 1946                                     | By the Muslim League                                                                                     |
| Establishment of Interim Government    | 2 <sup>nd</sup> September, 1946                                   | Nehru became the Vice-President of the Executive Council                                                 |
| Mountbatten Plan                       | 3 <sup>rd</sup> June, 1947                                        | Plan of partition of India                                                                               |
| The Attainment of Freedom              | 15 <sup>th</sup> Aug., 1947                                       | The Indian Independence Act                                                                              |
| Establishment of Indian Republic       | 26 <sup>th</sup> January, 1950                                    | Dr. Rajendra Prasad (First President)                                                                    |
| Bhoodan Movement                       | 1951                                                              | Started by Vinoba Bhave                                                                                  |

## 16. Governor - Generals / Viceroy of India

| Governors of Bengal / Governor -General                                                                                                                             | Tenure                                          | Work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Robert Clive (Governor)                                                                                                                                          | 1758-1760<br>(1765-1767)<br><b>(BPSC, 2020)</b> | (i) Treaty of Allahabad (1765) with Nawab Shujaud-daulah of Awadh and Mughal Emperor Shah Alam (ii) Dual Government in Bengal (iii) White Rebellion (iv) Restrictions on taking gifts by Company's employees (v) Establishment of Society for Trade                                                                                                                                                                                                                                                                                  |
| 2. Warren Hastings (Governor)<br>Warren Hastings (First Governor-General of Bengal)                                                                                 | 1772-1774<br>1774-85                            | (i) End of Dual Government in Bengal (1772) (ii) First Anglo - Maratha War (1775-82) (iii) Second Anglo - Mysore War (1780-84) (iv) The Supreme Court of Judicature at Fort William, Calcutta, founded in 1774 by the Regulating Act of 1773 (v) Nand Kumar (Brahmin) hanged on wrong charges (1775) (vi) Pitts India Act (1784) (vii) Five year Land Settlement replacing the traditional zamindars with the highest bidding revenue speculators (viii) Treaty of Banaras (1773) (ix) Establishment of Government Mint in Calcutta. |
| 3. Lord Cornwallis Cornwallis twice held the post. First Tenure - 1786-1793. For the second time, he came to India in 1805, but died before he could took the post. | 1786-1793                                       | (i) Third Anglo-Mysore War (ii) Establishment of 4 Provincial Courts in Calcutta, Murshidabad, Dhaka and Patna (iii) Introduction of Permanent Land Settlement System in Bengal (1793) (iv) Father of Indian Civil Service (v) Separation of Revenue Administration and Civil Jurisdiction (vi) Cornwallis Code, 1793 (vii) Establishment of Revenue Board (viii) Mausoleum at Ghazipur (U.P.)                                                                                                                                       |
| 4. Sir John Shore                                                                                                                                                   | 1793-1798                                       | (i) Battle between the Nizams and Marathas (1795) of Khanda (ii) Passed the Charter Act of 1793. (iii) The policy of non-interference (laissez-faire) towards the native states.                                                                                                                                                                                                                                                                                                                                                     |
| 5. Lord Wellesley                                                                                                                                                   | 1798-1805                                       | (i) Implemented Subsidiary Alliance System (ii) Fourth Anglo-Mysore War (1799) (iii) Second Anglo-Maratha War (1803-05) (iv) Establishment of Fort William College in Calcutta (v) Treaty of Bassein with Bajirao in 1802 (vi) Princely States annexed in British Empire by Subsidiary Alliance (a) Hyderabad - 1798 (b) Mysore - 1799 (c) Tanjore - 1799 (d) Awadh- 1801 (e) Maratha- 1802 (f) Bhonsle - 1803                                                                                                                       |
| 6. Sir George Barlow                                                                                                                                                | 1805-1807                                       | Sepoy Mutiny in Vellore                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 7. Lord Minto I                                                                                                                                                     | 1807-1813                                       | The famous 'Treaty of Amritsar' (1809) with Maharaja Ranjit Singh                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 8. Lord Hastings                                                                                                                                                    | 1813-1823                                       | (i) First Anglo-Nepal War (1814-16) (ii) Third Anglo-Maratha War (1817-18) (iii) Suppression of Pindaris (1817-18)                                                                                                                                                                                                                                                                                                                                                                                                                   |
| John Adams (Acting)                                                                                                                                                 | January-August 1823                             | (iv) Tenancy Act implemented in Bengal (1822)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 9 . Lord Amherst                                                                                                                                                    | 1823-1828                                       | (i) First Anglo - Burma War (1824-26) (ii) Treaty of Yandaboo between the British and the Burma (iii) Revolt in the military cantonment of Barrackpore (1824)                                                                                                                                                                                                                                                                                                                                                                        |
| Governors-General of India                                                                                                                                          |                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 1. Lord William Bentinck                                                                                                                                            | June (1834-1835)                                | (i) Abolition of Sati Practice (1829) (ii) Suppression of Thuggee Practice (1830) (iii) Banned female infanticide (iv) Charter Act of 1833 (v) Establishment of Medical College in Calcutta (1835) (vi) Government Declaration to end discriminatory policy in services (vii) First Governor-General of India (viii) English became the official language of Indian administration (1835) (ix) Agra became new Presidency (x) Anglo-Oriental Education Disputes (xi) Appointment of Commissioners of circuit and revenue             |

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| <p>📌 <b>Note :</b> On 4 March, 1828 Lord William Bentinck was appointed as Governor General of Bengal. He was appointed Governor General of India on 16th June, 1834.</p> |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 2. Charles Metcalfe                                                                                                                                                       | 1835-1836 | (i) Removed the ban on newspapers (ii) Liberator of the Indian Press                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 3. Lord Auckland                                                                                                                                                          | 1836-1842 | (i) First Anglo-Afghan War (1838-42) (ii) Tri-party treaty between the Company, Maharaja Ranjit Singh and Shah Shuja (iii) Repair of Grand Trunk Road from Calcutta to Delhi                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 4. Lord Ellenborough                                                                                                                                                      | 1842-1844 | (i) Sindh merged into British State (ii) Abolition of Slavery (1843) (iii) First Anglo-Afghan War ended                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 5. Lord Hardinge                                                                                                                                                          | 1844-1848 | (i) First Anglo-Sikh War (1845-46) (ii) Occupation of Lahore by the British                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 6. Lord Dalhousie                                                                                                                                                         | 1848-1856 | (i) Second Anglo-Sikh War (1848-49) (ii) Mergence of Punjab into the British State (1849) (iii) Second Anglo-Burmese War (1853) (iv) Introduced 'Doctrine of Lapse' (v) Abolition of the title of <b>Nawab</b> of Karnataka and <b>Raja</b> of Tanjore (vi) Berar annexation on charges of taking more debts. (vii) Construction of the first Railway line [1853 ( <b>BPSC, 2008</b> )] (viii) Sir Charles <b>Wood's Despatch</b> on Education (1854) (ix) The beginning of the first electric wire (1852) (x) Postal system (1853) (xi) Santhal Rebellion (xii) Annexation of Awadh on charge of misrule [1856 ( <b>UPPCS, 1994</b> )] (xiii) State merged with Doctrine of Lapse Principle (a) Satara – 1848 ( <b>UPPCS, 2016</b> ) (b) Jaitpur, Sambhalpur – 1849 (c) Baghat – 1850 ( <b>JPCS, 2016</b> ) (d) Udaipur - 1852 (e) Jhansi – 1854 (f) Nagpur – 1854 (g) Awadh – 1856 (xiv) Establishment of Public Works Department and Public Service Department |

| Viceroy of India                   |                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------------|------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Lord Canning (Governor-General) | 1856-1858<br><br>1 <sup>st</sup> Nov., 1858-21 <sup>st</sup> March, 1862, first Viceroy) | (i) Revolt of 1857 (ii) Widow Remarriage Act of 1856 ( <b>UP Lower, 2002, 2003</b> ) (iii) Act of 1858 (iv) Establishment of Universities in Bombay, Madras and Calcutta (v) Indian Council Act 1861 (vi) Establishment of a High Court in Calcutta, Bombay and Madras under the High Court of India Act, 1861 (vii) Indian Penal Code (1860) (viii) Civil Penal Procedure Code (1861) (ix) Last Governor-General appointed by East India Company |
| 2. Lord Elgin                      | 1862-1863                                                                                | Suppression of Wahabi Movement                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 3. Robert Napier                   | 21 <sup>st</sup> November, 1863<br>2 <sup>nd</sup> December, 1863                        | —                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 4. William Denison                 | 2 <sup>nd</sup> December 1863-<br>12 <sup>th</sup> January 1864                          | Acting Viceroy                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 5. Sir John Lawrence               | 1864-1869                                                                                | (i) Famous non-interference policy in the context of Afghanistan (Ring Fence Policy) (ii) Terrible famines in Orissa in 1866 and Rajputana and Bundelkhand in 1868-69 (iii) Construction of railways and canals in large numbers (iv) Established first marine communication system with Europe.                                                                                                                                                  |
| 6. Lord Mayo                       | 1869-1872                                                                                | (i) Decentralization of Finance in India (ii) Establishment of Mayo College at Ajmer (iii) Murdered by an Afghan at Port Blair during his tenure. (iv) Census for the first time in India in 1872. ( <b>UPPCS, 2000</b> )                                                                                                                                                                                                                         |
| 7. Lord Northbrook                 | 1872-1876                                                                                | (i) Kuka Movement in Punjab (1872) (ii) Famine in Bengal (1873)                                                                                                                                                                                                                                                                                                                                                                                   |

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|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8. Lord Lytton                                                                                                                                                                                                           | 1876-1880 | (i) Formation of a Famine Commission under the chairmanship of Richard Strachey (1878) (ii) Conducting a Grand Durbar in Delhi (1877) (iii) Queen Victoria's title of 'Kaiser-i-Hind' (1877) (iv) Vernacular Press Act ( <b>UPPCS, 2007</b> ) and Indian Arms Act (1878) (v) Maximum age in appearing civil services exam lowered from 21 to 19. (vi) Second Anglo-Afghan War (1878-80)                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|  <b>Note :</b> Lord Lytton used to write literature under the name of 'Owen Meredith'.                                                  |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 9. Lord Ripon                                                                                                                                                                                                            | 1880-1884 | (i) First Factory Act (1881) (ii) Appointment of Hunter Commission (for primary education) (1882) (iii) Ilbert Bill Controversy (1883-84) (iv) Starting of local self-government [1882 ( <b>UPPCS, 2015</b> )] (v) Establishment of Census system (vi) First systematic census in 1881 (except Kashmir) (vii) Decision of systematic census after every 10 years (regular)                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|  <b>Note :</b> Lord Ripon was called the 'Saviour of India' by Florence Nightingale.                                                    |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 10. Lord Dufferin                                                                                                                                                                                                        | 1884-1888 | (i) Establishment of Indian National Congress (1885) (ii) Third Anglo-Burmese War (1885) (iii) Bengal Farmers Act passed (1885)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 11. Lord Lansdowne                                                                                                                                                                                                       | 1888-1894 | (i) Manipur Rebellion (1891) (ii) Determination of the Border Line (Durand Line) between India and Afghanistan (1893) (iii) Passed Indian Council Act, 1892 (iv) Declaration of 'Ganapati Festival' by Tilak (1893) (v) Second Factory Act (1891)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 12. Lord Elgin II                                                                                                                                                                                                        | 1894-1899 | (i) Terrible famine in North India in 1896-97 (ii) Formation of Famine Commission in the name of 'Lyard Commission' (iii) Declaration of Shivaji Festival by Tilak (1895) (iv) Two British officers killed in Poona by Chapekar Brothers (1897)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|  <b>Note :</b> Elgin II said that "India has won on the strength of the sword and it will be protected on the strength of the sword." |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 13. Lord Curzon                                                                                                                                                                                                          | 1899-1905 | (i) Appointment of Agricultural Inspector-General in 1901 to look after the agricultural work. (ii) Formation of new province namely North-West Frontier Province (iii) A delegation led by Younghusband went to Lhasa, Tibet (1904) (iv) Indian Universities Act (1904) (v) Formation of Indian Public Service Board (1905) (vi) Appointment of Police Commission under Sir Andrew Frazer (vii) Establishment of University Commission under the chairmanship of Sir Thomas Raleigh (1902) (viii) Famine Commission constituted under the chairmanship of Sir Antony MacDonnell (1900) (ix) [Ancient Monuments Preservation Act 1904 ( <b>UPPCS, 2005</b> )] (x) Partition of Bengal (1905) (xi) Formation of Irrigation Commission ( <b>Chairman Colin Scott Moncrieff</b> ) (1901) (xii) Constitution of Railway Board (1905) |
| 14. Lord Minto II                                                                                                                                                                                                        | 1905-1910 | (i) Formation of the Muslim League (in Dacca) (1906) (ii) Anglo-Russian Friendship (1907) (iii) Execution of Khudiram Bose (iv) 6 years imprisonment of Tilak (1908) (v) [Indian Council Act or Morley - Minto Reforms Act passed (1909) ( <b>UPPCS, 1994</b> )] (vi) S.P. Sinha appointed to Viceroy's executive (1909) (vii) Congress divided in Surat Session (1907)                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 15. Lord Hardinge II                                                                                                                                                                                                     | 1910-1916 | (i) The arrival of King George V of Britain to India (December 12, 1911) (ii) Annulment of the partition of Bengal in Delhi (1911) (iii) Declare the shift of capital of India from Calcutta to Delhi (1911) (iv) Delhi again became the capital (1912) (v) Balmukund sentenced to death for throwing a bomb at Hardinge at the time of his entry in Delhi (December, 1912)                                                                                                                                                                                                                                                                                                                                                                                                                                                      |



|                     |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     |           | (vi) The beginning of the First World War (August, 1914) (vii) Gandhiji returned to India from South Africa (1915) (viii) Death of Gokhale and Feroze Shah Mehta (1915) (ix) Lord Hardinge was appointed as the Chancellor of Banaras Hindu University (1916) (x) Hindu Mahasabha was founded in 1915.                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 16. Lord Chelmsford | 1916-1921 | (i) Establishment of the Home Rule League by Tilak and Annie Besant (1916) (Tilak in April, Besant in September) (ii) Declaration of the establishment of Banaras Hindu University (1916) (iii) Gandhiji's Champaran Satyagraha (1917) (iv) Rowlatt Act (April, 1919) (v) First session of the Indian Trade Union Congress (1920) (vi) Khilafat Movement (vii) The Non-Cooperation Movement by Gandhiji (1 <sup>st</sup> August, 1920) (viii) Sir S.P. Sinha, first Indian Governor of Bihar (ix) [Jallianwala Bagh Massacre (13 <sup>th</sup> April, 1919) (UPPCS, 1993)] (x) Montague - Chelmsford Reform Act (1919) (xi) Third Afghan War                                                                                                                |
| 17. Lord Reading    | 1921-1926 | (i) Visit of Prince of Wales to India (November 1921) (ii) Moplah Rebellion (Malabar Coast, Kerala) (iii) Formation of Communist Party of India by M.N. Rai (1920) (Tashkent) (iv) [Chauri-Chaura incident (4 <sup>th</sup> February, 1922) (UP Lower, 2002)] (v) Non-Cooperation Movement ended (12 <sup>th</sup> February, 1922) (vi) Kakori train conspiracy (9 <sup>th</sup> August, 1925) (vii) All India Communist Party formed in Kanpur (1924)                                                                                                                                                                                                                                                                                                      |
| 18. Lord Irwin      | 1926-1931 | (i) Appointment of Simon Commission (1927) (ii) Opposition of Simon Commission on its arrival in India (1928) (iii) Bomb thrown at Assembly Hall of Delhi by Bhagat Singh, Batukeshwar Dutt (8 <sup>th</sup> April 1929) (iv) Congress Declaration of 'Poona Swaraj' at Lahore Session (December 31 <sup>st</sup> , 1929) (v) Historical Dandi March (12 <sup>th</sup> March to 5 <sup>th</sup> April, 1930) (vi) First Round Table Conference in London (November, 1930) (vii) Gandhi - Irwin Pact (5 <sup>th</sup> March, 1931), The Meerut conspiracy trial.<br>(BPSC, 2011)                                                                                                                                                                             |
| 19. Lord Willington | 1931-1936 | (i) Gandhiji participated as the representative of Congress in the Second Round Table Conference (7 <sup>th</sup> September to 1 <sup>st</sup> December 1931) (ii) Declaration of Communal Award (16 <sup>th</sup> August 1932) (iii) Pact between Mahatma Gandhi and B.R. Ambedkar (24 <sup>th</sup> September, 1932) (iv) Civil Disobedience Movement restarted by Gandhiji (v) Third Round Table Conference organized (17 <sup>th</sup> November, 1932 to 24 <sup>th</sup> December, 1932) (vi) Civil Disobedience Movement was withdrawn by Congress (April, 1934) (vii) Government of India Act (August, 1935)                                                                                                                                         |
| 20. Lord Linlithgow | 1936-1943 | (i) Elections were held in eleven provinces for the first time with eight states-(Assam, Orissa, North-West Frontier Province, Bihar, Bombay, Central Province, Madras, United Provinces) Establishment of new governments by Congress (Absolute majority in 5 provinces of Congress) (ii) Subhash Chandra Bose was reelected President in the Tripuri Congress Session despite the opposition of Mahatma Gandhi. (iii) 'Establishment of Forward Block' by Subhash Chandra Bose (iv) Declaration of 'August Offer' by Viceroy (8 <sup>th</sup> August, 1940) (v) Individual Civil Disobedience Movement (started on 17 <sup>th</sup> October, 1940) (vi) Quit India movement was started (vii) Karachi Session of the Muslim League 'Divide & Quit' slogan |

|                      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 21. Lord Wavell      | 1943-1947 | (i) Wavell met Congress and the Muslim League's representatives in Shimla (June - July, 1945) (ii) Navy revolted in Bombay (iii) Arrival of Cabinet Mission in India (iv) Declaration of Cabinet Mission Proposal (16 May, 1946) (v) 'Direct Action Day' was observed by the Muslim League (16 <sup>th</sup> August, 1946) (vi) Election for the Constituent Assembly (July, 1946) (vii) Interim Government formed led by leadership of Jawaharlal Nehru (September, 1946) (viii) [First meeting of the Constituent Assembly (9 <sup>th</sup> , December, 1946) ( <b>UPPCS, 2009</b> )] (ix) The British Prime Minister, Attlee announced the Independence of India by June 1948 (20 <sup>th</sup> February, 1947) |
| 22. Lord Mountbatten | 1947-1948 | (i) Radcliff Commission was constituted (ii) According to the 'Third June Plan', the Declaration of Partition of India (3 <sup>rd</sup> June, 1947) (iii) The Bill of Indian Independence was introduced in the British Parliament, July (1947) and accepted by the Emperor on 18 <sup>th</sup> July. (iv) India became independent (15 <sup>th</sup> August, 1947).                                                                                                                                                                                                                                                                                                                                               |

### Exam Oriented Facts

- Lal Bahadur Shastri is known as the man of peace.
- **Gopal Krishna Gokhale** is called the diamond of India.
- The famous Hing Laj Mata Temple is located in India's neighbouring country Pakistan.
- **Vedika, Chhatra** and harmika are related to the structure of the Stupa, while Vimana is not related to the **Stupa**.
- Narayan Guru advocated the ideology of **Oru Jaati, Oru Matam, Oru Manushyanu**, (one caste, one religion, one God for mankind).

- Elphinstone was the Governor of Bombay province, India during **1819-27**.
- Sometime before the Maurya Empire period, about 2400 years ago, emperors in China began building the Great.
- The first Indian cotton mill was established at Fort Gloucester, Calcutta in **1818 AD. by Henry Gauger**.
- The Mongols, led by Genghis Khan, invaded Transoxiana in north-eastern Iran in 1219. (**SSC MTS, 2023**)
- Shikhana element in North. Indian temple architecture refers to the superstructure or tower over the sanctum sanctorum and pillared mandapas. (**SSC, 2023**)

## 17. History from 1947 to 1964 : Consolidation of Princely States

- At the time of Independence, there were 565 princely states in the Indian region, where either Nawab or Raja was ruling.
  - On the 15<sup>th</sup> of June, 1947, the All-India Congress accepted the British Plan for the Partition of India in New Delhi.
  - On **15<sup>th</sup> June, 1947**, the All India Congress Committee announced that 'It cannot accept the right of any Princely State of India to declare independence and remain separate from India'.
  - The Government of India established a separate department called Princely States Department in June 1947, the responsibility of which was assigned to Sardar Vallabhbhai Patel.
  - Integration of princely states was done by two processes.
- (1) To merge smaller princely states into any area or neighbouring provinces was administered by the Central Government.
- (a) Under this, the eastern princely states merged into either the provinces of Orissa or Madhya Pradesh.
- (b) The princely states of Deccan and Gujarat merged into Bombay province.
- (2) A large administrative union was formed by combining some princely states.
- (i) United States of Kathiawar (Saurashtra)
  - (ii) United States of Matsya
  - (iii) United States of Rajasthan
  - (iv) United States of Vindhya Pradesh
  - (v) Gwalior, Indore and the United States of Malwa
  - (vi) Formation of Patiala and East Punjab States Union (PEPSU).
- ### Junagadh Princely States
- The princely state of Junagadh declared to join Pakistan, while most of the princely states' people were Hindus, who wanted to stay in India.
  - In February 1948, the state of Junagadh was incorporated into the Union of India by **holding a referendum**.
- ### The Princely States of Hyderabad
- Hyderabad was the largest princely state of India.
  - The ruler of Hyderabad was a Muslim, but most of the people of the state were Hindus.

- The Government of India started **military operations** in Hyderabad on 13<sup>th</sup> September, 1948.
- Major General EL. Edroos, a military commander of the princely state of Hyderabad surrendered to the commander of the Indian Army, Major General JN Choudhuri.
- Thus, Hyderabad was merged into the Indian Union.
- The Government of India named this secret military operation '**Operation Polo**'. (UP UDA/LDA, 2013)

### The Princely States of Kashmir

- The King or ruler in the princely state of Kashmir was a Hindu, but the majority of the people were Muslims.
- On 20<sup>th</sup> October, 1947, the North-West Frontier province tribals and many Pakistani's attacked Kashmir.
- Fearing this situation, on 24<sup>th</sup> October 1947, **Raja Harisingh** demanded military assistance from the Government of India to protect his kingdom from the invaders and prayed to annex Kashmir to the Union of India.
- On 26<sup>th</sup> October, 1947, Raja Hari Singh signed the Instrument of Accession.
- On 31<sup>st</sup> October 1951, the Constituent Assembly of the state of Jammu and Kashmir came into existence.
- On 15<sup>th</sup> February, 1954, the merger of Jammu and Kashmir into the Union of India was ratified by the Constituent Assembly.
- On 19<sup>th</sup> August, 1952, under **Article 370**, Sadr-e-Riyasat (President) Karan Singh and Wazir-i- Azam (Prime Minister) Sheikh Abdullah were nominated.
- On **17<sup>th</sup> November, 1956**, a separate constitution for the state was passed by the Constituent Assembly.
- On **26<sup>th</sup> January 1957**, the new Constitution of Jammu and Kashmir came into force.
- The term of Sadr-e Riyasat (President) and Wazir-i-Azam (Prime Minister) was abolished by the Sixth Constitutional Amendment Act, 1965, in 1965.
- On **5<sup>th</sup> August 2019**, the President of India in the exercise of the powers entitled under clause (1) **Article 370** of the Constitution had issued the Constitution (Application to Jammu and Kashmir) Order, 2019. Through this, the Government of India modified Article 370 itself (not revoked it).

✎ **Note :** At the time of Independence, **Chandranagar** (Calcutta) **Pondicherry**, **Karaikal**, **Mahe** were in possession of France, later, they were handed over to India in 1954.

- Goa, Daman and Diu were under the Portuguese at the time of independence, were merged into India in 1961.

### Shimla Agreement

- The **Simla Agreement** was signed between India and Pakistan on **2<sup>nd</sup> July, 1972**.

- According to this agreement that the basic issues and causes of conflict which have bedevilled the relations between the two countries for the last 25 years shall be resolved by peaceful means.
- Both sides will always have respect for each other's territorial integrity, universality and political freedom.

### Other Important Points

- In India, the first general election was held in 1952.
- Nagaland became the sixteenth state of India in the year 1962.
- Panchayati Raj was first established in **1959**, in **Nagaur**, Rajasthan.

## 18. Other Major Historical Facts

- The **Tashkent Agreement** was signed on 10<sup>th</sup> January, 1966 between Indian Prime Minister Lal Bahadur Shastri and President of Pakistan, Ayub Khan.
- Bangladesh was created on 16<sup>th</sup> December, 1971. (MPPCS, 2014)
- The **Shimla Agreement** was signed between Zulfikar Ali Bhutto and Mrs. Indira Gandhi on 2<sup>nd</sup> July, 1972.
- **Panchsheel Agreement** was signed between India and China on 29<sup>th</sup> April, 1954.
- On 20<sup>th</sup> October, 1962 China invaded India.
- **Bandung Conference** was held in April, 1955 in Bandung City, Indonesia. The conference was organized by India, Burma, and Indonesia jointly.
- From 1<sup>st</sup> to 6<sup>th</sup> September 1961, the Non-Aligned Movement was formed with the cooperation of India's Prime Minister **Jawaharlal Nehru**, President of Egypt, **Colonel Nasser** and President of Yugoslavia, **Marshal Tito etc.**
- The first Non-Aligned Summit was held in Belgrade in September, 1961.

## D

## World History

### 1. Renaissance

- Renaissance means '**Rebirth**'.
- The Renaissance was the intensification of the cosmic tendencies of Western European thought, literature and art during the fourteenth, fifteenth and sixteenth centuries.
- The basic mantra of the Renaissance was - Worldliness or Cosmicity which is related to this world, not the supernatural world.
- Renaissance started in Italy. The city of Florence was the largest centre of the Renaissance.
- The strong reason for the Renaissance was the rise of trade. This led to the rise of cities and their importance began to grow.

- **“If I had control, I would throw all Aristotle’s texts into the fire, because one wastes time and ignorance increases due to the rise of false ideas.”** - Roger Bacon
- The credit of inventing paper is given to China, but Italy was the world’s Führer in making the best paper initially.
- The essential basis of the Renaissance was humanism, in which humans, rather than God, were given the main focus.
- Petrarch, a resident of Italy, is considered the founder of ‘Humanism’.

### Literature of the Renaissance Period

- The best expression of the cosmic spirit of the Renaissance period is in literature.
- In the field of literature in Italy, residents of Florence **Dante**, **Petrarch** and **Boccaccio**, are the pioneers.
- Dante (1265-1321) has been called the ‘**Forerunner of the Renaissance**’ and the ‘first person of the Renaissance’.
- Dante’s work is ‘**Divine Comedy**’ in which there is a lot of discussion about Christian stories and theology.
- Dante, in his political book ‘**De Monarchia**’ argues for the unification of Italy under the leadership of the Holy Roman Empire.
- Story collection called ‘Decameron’ is of Boccaccio, which describes dirty romance.
- Machiavelli’s famous work ‘**The Prince**’.
- Sir Thomas More composed ‘**Utopia**’.
- Martin Luther translated the Bible into the German Language.
- Erasmus is called the **Prince of Humanists**.
- He wrote the book ‘**Praise of Folly**’ in a satire style.
- Erasmus was the first thinker to call Jesus a historical figure.
- During the reign of Elizabeth (1558-1603) in the field of literature ‘Nest of Singing Birds’ was composed.
- In the field of Spanish Renaissance literature, the names of Cervantes and Lope de Vega is profound.
- **Cervantes** is composed by Don Quixote.
- Shakespeare’s most famous work is **Romeo and Juliet**.

### Renaissance and Art

- The Renaissance of Italy took place mainly in the field of art, painting, crafts and architecture which progressed greatly.
- **Leonardo da Vinci**, **Michelangelo**, **Raphael**, and **Titian** are famous painters.
- In addition, being painter and sculptor, Leonardo da Vinci was also a scientist, mathematician, engineer, composer and philosopher.
- **Last Supper**, **Monalisa**, **Virgin of Rocks** are famous paintings by Leonardo da Vinci.
- In the Renaissance period ‘Giotto’ is considered as the father of painting.

- Michelangelo was an amazing sculptor and painter. His most famous picture was - **The Last Judgment** and **The Fall of Man**.

- **Sistine Madonna** is counted as the most famous painting of the world due to its liveliness and beauty which was painted by Raphael.

### Science of Renaissance Period

- Although the emergence of science took place in the **17<sup>th</sup> and 18<sup>th</sup>** centuries but it was initiated in the Renaissance period.
- Copernicus refuted the geocentric theory of Ptolemy, rendering the Sun-centered theory.
- According to **Copernicus**, the Earth is not at the centre of the universe, but it is at the centre of the Solar System and like other planets, the Earth revolves around the Sun.
- **The Law of Gravitation was proposed by Newton**.
- The promoter of the Reformation Movement was Martin Luther (1483–1546), who was born in an ordinary peasant family in Germany.
- John Wycliffe is called the ‘**Morning Star**’ of the Reformation movement.
- America was named after the name of Italian **Amerigo Vespucci**.
- Magellan I travelled the whole world by sea.

## 2. American Revolution or Freedom Struggle

- America’s freedom struggle lasted between 1763 and 1783.
- According to the **Treaty of Paris** in September 1783, Britain recognized the Independence of America.
- According to this treaty, Britain accepted the independence of 13 English colonies of North America.
- The immediate reason for the American freedom struggle was the tea policy of the British Prime Minister, Lord North.
- On 16<sup>th</sup> December, 1773, there was an incident of the ‘**Boston Tea Party**’ whose hero was Samuel Adams.
- America’s freedom struggle started with the Boston Tea Party incident.
- The slogan of American independence was – **No Taxation Without Representation**.
- George Washington was the hero of the American freedom struggle. Later, he became the first President of the US.  
(UK UDA/LDA, 2007)
- America attained complete independence on **4<sup>th</sup> July, 1776**.
- The Constitution of America came into force in 1788.
- Red Indians were native to America.
- The **first written Constitution** in the world came into force in America.
- A civil war in America began on 12<sup>th</sup> April, 1861, against the southern states supporting slavery and the northern states opposing it.



- Slavery was abolished in America on 1<sup>st</sup> January, 1863 by **Abraham Lincoln**.
- The American Civil War ended on 26<sup>th</sup> May, 1865.
- The first English settlement established in America was named **Jamestown**.

### 3. French Revolution

- Napoleon Bonaparte said- **"Without Rousseau, the French Revolution would not have taken place"**. Louis XVI would have saved himself if he had controlled writing".
- Many reasons for the French Revolution were the unbalanced economy, social class - impermanence, exploitation of peasants, weakness of autocratic monarchy, a rebellious attitude of intellectuals, etc.
- The French Revolution took place in 1789 during the reign of Louis XVI.
- Louis XIV (1643-1715) said - "I am the kingdom and my words are the law".
- Louis XVI reigned between 1774 and 1792.
- The judiciary of France was called **Parlama**.
- The immediate cause of the French Revolution was to call a meeting of the Estates-General.
- The session of the Estates General was inaugurated on 5<sup>th</sup> May, 1789 by Louis XVI.
- Political prisoners were freed on 14<sup>th</sup> July 1789, escaping the Bastille prison in France.
- Versailles was made the capital of France and mirror palaces were built by Louis XIV here.
- Rousseau, Montesquieu and Voltaire had significant contributions in the French Revolution.
- Voltaire's statement was - "A lion's rule is better than a hundred rats.
- Rousseau's work is **'Social Contract'**, while Montesquieu's work is **'The Spirit of Laws'**.
- Napoleon was born on 15<sup>th</sup> August, 1769 in an ordinary family on the island of Corsica.
- He claimed himself to be the 'Son of Revolution'.
- He was appointed as the General of the French Army on **15<sup>th</sup> October, 1795**.
- Napoleon was proclaimed himself the Emperor of France in 1804.
- On **21<sup>st</sup> October, 1805**, Trafalgar War broke out between England and Napoleon.
- The Bank of France was founded in 1800 by Napoleon.
- The Battle of Waterloo took place on **18<sup>th</sup> June, 1815** between the Allied army and Napoleon, in which Napoleon was taken captive.
- Napoleon died in May, **1821** and was cremated on the island of St. Helena.
- He originated the 'continental system'.

### 4. Unification of Italy

- "We work for humanity by working according to the real principles of our country. Our country is the action point of the lever we use for the betterment of the common man" **Joseph Mazzini**.
- Joseph Mazzini is considered the **"father of the Unification of Italy."**
- He was born in Genoa, Italy.
- **He said - 'First you are a man, then a citizen of a country or something.**
- **He founded 'Young Italy' in 1831.**
- 'If the revolution is to be brought in the society, then give the leadership of the revolution to the young men'- **Mazzini**.
- Austria was the main barrier to the unification of Italy.
- Integration of Italy was accomplished by **Mazzini's** idealistic Christian activities, from **Garibaldi's** adventurism to Kabur's well-planned diplomatic experiment.
- Garibaldi is called the sword of unification of Italy.
- The unification of Italy began with the joining of Lombardy and Sardinia.
- Garibaldi organized a contingent of armed youth who came to be known as the **Red Shirts**.
- The first war of unification of Italy was fought in 1848, in which the people of Naples, Sicily and Rome were participated, which was called the **National War**.
- The birth of Italy is considered to be in 1860, but its integration was completed in 1871 by count Kavar.

### 5. Unification of Germany

- Bismarck strongly believed that "great contemporary questions can be resolved not by speeches and majority but by **'blood and iron'**."
- He was born on 1<sup>st</sup> April, 1815 in Altmark Prussia.
- Bismarck was Prime Minister of the ruler of Prussia William I.
- Germany was unified by Bismarck.
- He assumed the title of Chancellor of Prussia in 1871.
- King of Prussia believed in the unification of Germany under the leadership of **William I**. But its most staunch opponent was Austria.
- Austria surrendered to Prussia in 1866.
- The 'Friedrich List' is considered the **Father of Germany's Economic Nationalism**.
- Under the Prague Treaty of 23<sup>rd</sup> August, 1866, Schleswig and Holstein joined the administration.
- The Battle of the Sedans was fought on 1<sup>st</sup> September, 1870 between Prussia and France.
- The Treaty of Frankfurt was signed between Prussia and **France in 1871**.

- Bismarck used France's defeat to unify Germany.
- On 18<sup>th</sup> January, 1871, King William I of Prussia was declared the emperor of Germany in the Palace of Versailles.
- A unified Germany emerged on the map of Europe.

## 6. Russian Revolution

- In Russia, one group was called **Bolshevik** or Majority Party and the other faction was the **Menshevik** or minority group.
- The leader of the Bolshevik faction was **Lenin**.
- Lenin was a deeply committed revolutionary. He had intellectualism, vigour, indomitable power and great ability to set the summer policy of revolution.
- In 1898, the Russian Marxists established the **Social Democratic Party**.
- The term 'Socialism' was first used by **Robert Owen** of Wales.
- **Karl Marx** a German is considered the founder of Scientific Socialism.
- '**Das Kapital**' and '**Communist Manifesto**' are books of Kark Marx.
- On 8<sup>th</sup> March, 1917, the first explosion of the revolution took place in Russia. On the same day, poor peasants and labourers marched on the streets of Petrograd.
- **St. Simon** is considered the **Father of French Communism**.
- The ruler of Russia was called **the Czar**. This system of monarchy ended in March 1917.
- **"If not today, tomorrow or not tomorrow, day after tomorrow, the building of European imperialism is going to collapse" – Lenin**
- Karl Marx's slogan was- "**Workers of the world, unite**".
- 'Czar Nicholas II' was the last Czar of Russia who was killed in a bombing.
- In March 1919, the Bolshevik Party was renamed as **Communist Party**.
- War Minister, Trotsky is credited with organizing the **Red Army**.
- In April 1917, Lenin published a revolutionary plan in Russia, known as the '**April Theses**'.
- He said 'One Step Forward, Two Steps Back'.
- He died in the year 1924.
- Stalin is considered the **Creator of Modern Russia**.
- He accused Trotsky of treason and anti-communism and removed him from the party.
- **Stalin said- "Right now we are 50 or 100 years behind the developed countries. We have to finish this distance within ten years. Either we will achieve it or we will be crushed."**

## 7. Industrial Revolution

- The beginning of the Industrial Revolution is believed to be from 1750 AD to 1850.
- The Industrial Revolution started in England.
- The basic intention of 'Industrial Revolution' is- 'Changes in the Production System.
- A man named Brindley built the canal from Manchester to Worsley.
- The author of the book 'The Wealth of Nations' is **Adam Smith**.
- Graham Bell invented the telephone in 1876.
- The safety coating was invented by **Humphry Davy**.
- The term **industrial revolution** was first used by the French socialist leader **Blancci** in 1837.
- In 1829, George Stephenson began the era of rail transport by driving a train between Liverpool to Manchester at a speed of sixteen miles per hour with his own engine.
- A Civil War, also called the Great rebellion (1642-1651) broke out in England in 1642 during the reign of Charles I. This civil war lasted for 9 years.
- King James II had to lose the throne due to the glorious revolution (1688).
- It is also called the '**Bloodless Revolution**' because in this revolution, not a single drop of blood of a person from any side came out and it was only by demonstration and conversation that the revolution became successful.
- This revolution occurred when Emperor James II challenged the supremacy of the Parliament.
- War of the Roses took place in England.
- There was a **100 year war between England and France**.
- After the glorious revolution, the divine rights of the king were invalidated and the era of constitutional monarchy flourished in England.

## 8. World War-I

- The series of secret treaties in Europe was the fundamental cause of **World War-I**.
- Bismarck, the Chancellor of the German Empire initiated the 'secret treaties'.
- World War-I broke out on 28<sup>th</sup> July, 1914.
- The assassination of the **Crown Prince of Austria Archduke Franz Ferdinand proved to be the immediate cause of the First World War**.
- In First World War, the world was divided into two camps - **Allied and Central Powers**.
- Allied nations were England, Italy, Russia, America, France, Japan.
- Among the Central Nations - **Germany, Turkey, Hungary and Austria**, etc. were the countries, led by Germany.

- Germany attacked France and Russia on 1<sup>st</sup> August, 1914 and 3<sup>rd</sup> August, 1914 respectively.
- America joined World War I on 6<sup>th</sup> April, 1917. The then President of the United States was **Woodrow Wilson**.
- Italy joined the Allied powers in April 1915.
- Britain joined World War I on 4<sup>th</sup> August, 1914, because of the German army's entrance into Belgium.
- **World War I lasted for more than 4 years.**
- World War I ended on **11<sup>th</sup> November, 1918.**
- After World War I, the Treaty of Versailles was signed with Germany on **28<sup>th</sup> June, 1919.**
- The Paris Peace Conference began in January 1919, with US President Woodrow Wilson, UK Prime Minister Lloyd George and French Prime Minister **George Clemenceau** taking the lead.
- The real results of the First World War were - the development of liberalism and democracy and the establishment of the League of Nations.
- The first council meeting of the league of nations was held on 16<sup>th</sup> of January, 1920, and the first meeting of the Assembly of the League took place on 15<sup>th</sup> November, 1920.

## 9. Nationalism and in Germany, Nazism

- Before 1870, Germany was a country of disciplined, persistent, hardworking people of **Nordic Tutan species** divided into many small states, princely states and territories.
- Napoleon Bonaparte was a major contributor to the rise of German nationalism, he organized 200 German states into the **Rhine Union** of 39 states.
- The Union Parliament of the Rhine Union was located in Frankfurt.
- Hitler was born in Austria on 20<sup>th</sup> April, 1889.
- Nazi Party rose in Germany under Hitler's leadership.
- The Nazi Party was founded in Munich in 1919 by **Anton Drexler**. In 1920, Hitler named it the **National Socialist German Workers Party**.
- In 1924, after a failed attempt to control the state of Bavaria, the Nazi Party was temporarily banned and Hitler was jailed.
- In March 1933, the German Parliament **Reichstag** passed the Enabling Act, giving Hitler government the power to issue mandates without Parliament's permission.
- In July 1933, the government ordered that only the Nazi Party would remain in Germany.
- After the death of President Hindenburg on 2<sup>nd</sup> August, 1934, Hitler assumed the title of **Führer** (Supreme Leader) along with Chancellor.
- **'Mein Kampf'** is an autobiography of Adolf Hitler.
- Nazism rose in Germany under the leadership of Adolf Hitler in the third decade of the twentieth century and the establishment of the **Third Reich** was the logical culmination of all German history and philosophy.
- Hitler became Chancellor of Germany in January 1933, and contemporary to the President Hindenburg.
- Austria was the first victim of Hitler's expansionist policy.
- **Hitler said "There should be no hesitation in lying if the lie that uttered is effective".**
- Hitler committed suicide on **30<sup>th</sup> April, 1945.**
- The symbol of Hitler's Nazi Party was **Swastika**.

## 10. Rise of Fascism in Italy

- After World War I, there was widespread dissatisfaction in Italy. The Paris Conference did not accept Italy's claims that Italy considered justified.
- Benito Mussolini was born in 1883 in Italy.
- Initially, he was of leftist ideology and an active worker of the Italian Communist Party.
- His party was named National Fascist Party. It was established in Milan in 1919.
- He launched a newspaper called 'La Lotta Di Classe' (class struggle). Later, he went on to support war and nationalism (today we are residents of Italy only). Fascism began with the slogan 'Italy Always' (Viva l'Italia!).
- **In Italy, the Fasces members are called 'fascists' and its doctrines are called Fascism.**
- The word **Fascies** is derived from the Latin Word 'Faseis', meaning Gatta or Bundle.
- 'Fascies in' the ancient Roman Empire was called **the sceptre**, an axe-like weapon made by tying several sticks of banquet or elm which the officers carried.
- Fascies was made a symbol of the Fascist Party in 1919.
- Mussolini taught his team members to wear uniforms, tie arms, parade and carry flags.
- The shirt worn by the men at this party was black So, these people became famous as **Black Shirts**.
- Mussolini was also known as **Il Duce (The Leader)**.
- The Fascist Grand Council was established by Mussolini in 1923 and he became its permanent President.
- Ethiopia was invaded by Mussolini in 1935.
- The incident of the formation of his cabinet is known as his invasion on Rome.
- He was hanged along with his wife on 28<sup>th</sup> April, 1945.

## 11. Japanese Imperialism

- Military service was made mandatory in Japan in 1873.
- **China** became the first victim of **imperialism of Japan**.

- Russia was defeated by Japan in 1905. The war concluded with the **Treaty of Portsmouth**.
- The United Nations sent the 'Lytton Commission' to Manchuria.
- Manchuria was invaded by Japan in 1931.
- Japan relinquished the membership of the United Nations in March, 1933.
- Atomic bombs were used by the US on Hiroshima (Little Boy) on 6<sup>th</sup> August, 1945 and Nagasaki (Fat man) on 9<sup>th</sup> August, 1945.
- Forced by this horrific massacre, Japan had to accept the unconditional surrender and on 2<sup>nd</sup> September, 1945 signed the MoU.

## 12. World War II

- The possibility of **World War II** had occurred since the time of the peace conference of 1919, when the victorious nations made a humiliating treaty of Versailles with Germany.
- The immediate cause of World War II was the German invasion on Poland on **1<sup>st</sup> September, 1939**.
- According to **Cyril Pfalz**, World War II was originally a **vengeful war**.
- The French commander, Marshal French, in 1919 said that **"the Treaty of Versailles is not a peace treaty, but only a cease-fire treaty for twenty years"**.
- The western states promised that if Germany invaded Poland, they will send their soldiers. Hence, France and Britain declared war against Germany.
- On 3<sup>rd</sup> September, 1938, Britain declared war against Germany, a few hours later France did the same.
- On 22<sup>nd</sup> June, 1941, the Germans invaded the Soviet Union under **Operation Barbarossa**.
- On 8<sup>th</sup> December, 1941, America (Operation Fritz) in World War II.
- Germany invaded Russia on **22<sup>nd</sup> June, 1941**, alleging breach of the agreement reached with Russia on **23<sup>rd</sup> August, 1939**.
- Italy participated in World War II on behalf of Germany on **10<sup>th</sup> June, 1940**.
- The President of the United States at the time of World War II was **Franklin D. Roosevelt** while the Prime Minister of Britain was **Winston Churchill**.
- In 1936, the civil war started in Spain. Spain was the first victim of Italy and Germany jointly.
- During the Second World War, the British Government assumed Indians to give Dominion State Status in reform for war aid against the slogan 'Asia for Asians' of Japan.
- World War II was fought for 6 years.
- It ended on **2<sup>nd</sup> September, 1945**.

- At San Francisco Conference on **24<sup>th</sup> October, 1945**, the Allies established the United Nations, a successful attempt to prevent war after World War-II.

## 13. Turkiye

- In World War-I, Turkiye supported Germany. Therefore, post-war victorious allies imposed a **'Treaty of Sevres'** on Turkiye and ended its empire.
- The creator of modern Turkiye, **Mustafa Kemal Pasha** was a staunch opponent of imperialism and a strong supporter of nationalism and modernity.
- He proposed six principles-republicanism, nationalism, judicial system, economy, secularism and revolutionism to modernize Turkiye.
- He was called **Ataturk (Father of the Nation) of Turkiye**.
- The **Treaty of Lausanne** between Turkiye and the Allies was concluded in 1923. It was the last treaty of the First World War.
- The Khilafat was abolished on **3<sup>rd</sup> March, 1924**.
- The Republic of Turkey was declared on **29<sup>th</sup> October, 1923**. On **20<sup>th</sup> April 1924**, a new constitution was announced in Turkey.
- Mustafa Kemal Pasha abolished the rights of the Caliphs.
- Muslims of India (Agha Khan and Amir Ali) reported against it and wrote a letter to Kemal Pasha but he did not worry about these people and described them as the flunky of British imperialism.
- Kemal Pasha banned the previously prevalent face cap and burqa and encouraged European dress pants, coat and tie.
- Mustafa Kemal Pasha founded the 'Republican People's Party'.
- He died in 1938.
- He ended the **Purdah System** and the Polygonal marriage, instead of arranging education for women.

## 14. Miscellaneous Facts

- China was known as the **'Patient of Asia'**.
- Turkiye was called the **'Patient of Europe'**.
- The hero of the Chinese revolution in 1911 was Sun Yat-Sen.
- An organization called **'Tung Meng Hui'** was founded by **Sun Yat-Sen**.
- **Sun Yat-Sen** is called the Father of China. He proposed three principles - nationalism, democratism and social justice.
- Mao Tse-Tung (Mao Zedong) was the first President of the Chinese Communist Republic.
- Portuguese started geographical discoveries in 15<sup>th</sup> century. Prince Henry initiated in this direction that he was known as Henry the Navigator.





# Geography



## Topics of the Unit

### A. World Geography

- Cosmos ● Solar System ● Bodies of Solar System ● Other Bodies of Solar System ● World's Top Geographical Discoveries ● Internal Structure of the Earth ● Lithosphere ● Endogenic Process ● The Earthquake ● Rocks ● Continents and Major Peninsulas ● Atmosphere ● Temperature ● Local Winds and their Different Names ● Hydrosphere

### B. Geography of India

- General Introduction ● Neighbouring Countries of India ● The Physical Characteristics of India ● Drainage System ● Major Lakes and Waterfalls in India ● Climate of India ● Soil of India ● Agriculture in India ● Irrigation and Multipurpose Projects in India ● Mineral Resources in India ● Transportation in India ● Classification of Roads in India ● Associated Organizations ● Rail Transport in India ● Industries of India ● Major Wildlife Sanctuaries in India ● Tribes in India ● India and Antarctica ● The Census of India

- The study of Geography is about more than just memorising places on a map. It is about the complexity of our world, appreciating the diversity of cultures across the continents.
- Ocean, rivers, mountains, terrestrial and celestial bodies, and other parts of nature and space, constitute the universe and are studied as the subject matter of geography.
- The Term 'Geography' was coined by the Greek scholar **Eratosthenes**, who combined two Greek words 'Geo' (The Earth) and 'Graphien' (to describe).
- Eratosthenes is considered the “**Father of the Systematic Geography**”.
- The Systematic approach in geography was introduced by **Alexander Von Humboldt**, a German geographer (1769-1859) while the regional geography approach was developed by another German geographer and a contemporary of Humboldt, **Karl Ritter** (1779-1859).
- The main divisions within human geography include urban geography, economic geography, cultural geography, political geography, social geography, and population geography.
- **Hecataeus**, the renowned historiographer of Greece, is the **father of geography**.
- **Alexander von Humboldt** is the founder of systematic modern geography.

## A

## World Geography

### 1. Cosmos

- Everything we can touch, feel, sense, measure or detect is the cosmos. It includes things of nature, such as planets, stars, galaxies, dust clouds, light and even time which are regarded as part of **the cosmos**.
- Astronomy is the scientific study of **celestial objects** (such as stars, planets, comets and galaxies) and phenomena that originate outside **the Earth's** atmosphere.
- **Claudius Ptolemy**, the Greek astronomer, pioneered a systematic study of the universe.
- **Ptolemy** argued that the Earth is at the centre of the universe and the Sun and other planets **revolve around** it.
- **Nicolaus Copernicus** first expressed that the Sun, not the Earth is at the centre of the universe.
- **Copernicus** is considered the **father of Modern Astronomy**.
- **Johannes Kepler** propounded three **laws** that govern the **motion of planets** around the sun, which are known as Kepler's laws of planetary motion.  
There are mainly three principles of the origin of the universe.  

|                              |                           |
|------------------------------|---------------------------|
| 1. Big-Bang Theory           | (UPPCS, 2016; BPSC, 2022; |
| 2. Steady-State Theory       | SSC MTS, 2021 CAPE, 2016; |
| 3. Pulsating Universe Theory | CPO, 2020; UPPCS, 2016)   |

### Big-Bang Theory :

- The **most valid theory of the origin of the universe** is the Big-Bang Theory. (RAS/RTS, 2007)
- This theory was **formulated in 1927 by Georges Lemaitre** (1894–1966 AD) and later **explained by Robert Wagner in 1967**. (67<sup>th</sup> BPSC, 2022)
- According to this theory, all the substances responsible for the origin of the universe were initially in the conglomerate form with high temperature and density. Due to excessive concentration, this mass exploded resulting in the splintering of substances and creating many cosmic bodies in the process since then the universe has been expanding continuously.
- Scientists supporting this theory, believe the Big-Bang occurred 13.7 or 13.8 billion years ago.

### Steady-State Theory:

- Steady-State Theory is the second primary theory of the origin of the universe. According to this theory, the universe did not originate from an explosion. The universe has no beginning or end, though this theory includes expandability while maintaining a constant average density, as new stars and galaxies form continuously while old ones correspondingly disappear. Propounders of this theory are **Fred Hoyle, Hermann Bondi and Thomas Gold**.

### Pulsating Universe Theory:

- According to this theory, our universe keeps expanding and shrinking at intervals of millions of years. The propounder of this theory is **Dr Allan Sandage**. According to him, there was a sharp explosion 12 billion years ago and the universe has been expanding since then. After 29 billion years', this expansion will stop and the universe will start to shrink.

### Exam Oriented Facts

- Otto Schmidt a Russian scientist revised the Nebular Hypothesis, and proposed his 'Inter-stellar dust hypothesis' in 1943 to explain the complex problems of the origin and characteristics of the solar system and the earth.
- The most outstanding characteristic feature of this hypothesis is that the earth and solar system have taken to have been formed from gas and dust particles.

## 2. Solar System

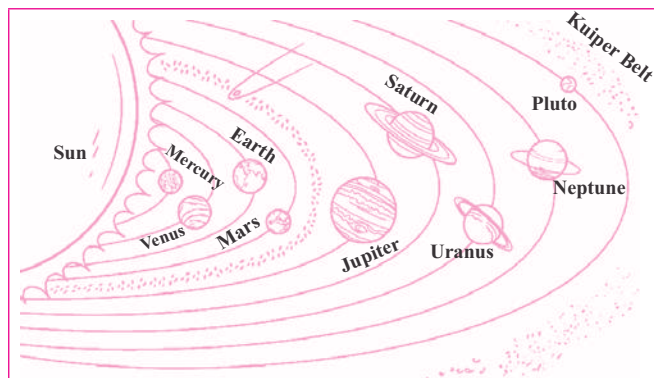
- The solar system consists of the sun and stars revolving around it.
- The solar system evolved about 9.1 billion years after the Big-Bang, that is, approximately 4.6 billion years ago.
- It is called the galaxy or the milky way in which our solar system is located. (BPSC, 2022; UPPCS, 2001)
- The distance travelled in 1 year at a speed of  $3 \times 10^8$  m/s in a vacuum by light is called **Light Year**. (UK PSC, 2006)

- Light Year is a unit that measures the astronomical distance. (MPPCS, 1994)
- Parsec is also a distance-measuring **unit approximately** equal to 3.26156 light-years.
- An astronomical unit is the distance between the sun and the Earth.
- The Indian astronomer **Varahamihira** in the **6<sup>th</sup> century AD** first revealed that the **moon revolves** around the Earth.
- Earlier, there were I Planets in the solar system. Their distance in ascending order from the sun are as follows -  
Mercury (57.9 million km.)  
Venus (108.2 million km.)  
Earth (149.6 million km.)  
Mars (228 million km.)  
Jupiter (778.5 million km.)  
Saturn (1433 million km.)  
Uranus (2872 million km.)  
Neptune (4495 million km.)

**Source - Jet Propulsion Laboratory**

✎ **Note :** In August, 2006 the 26<sup>th</sup> General Assembly of International Astronomical Union was held in Prague, (Czech Republic). The assembly excluded Pluto from the list of planets and reclassified it as a Dwarf Planet.

- Solar system can also have more than one star. These are called Binary star system.
- Our solar system orbits the centre of milky way galaxy at about 828,000 km/hr. Our solar system takes about 230 million years to complete one orbit around the galactic centre.

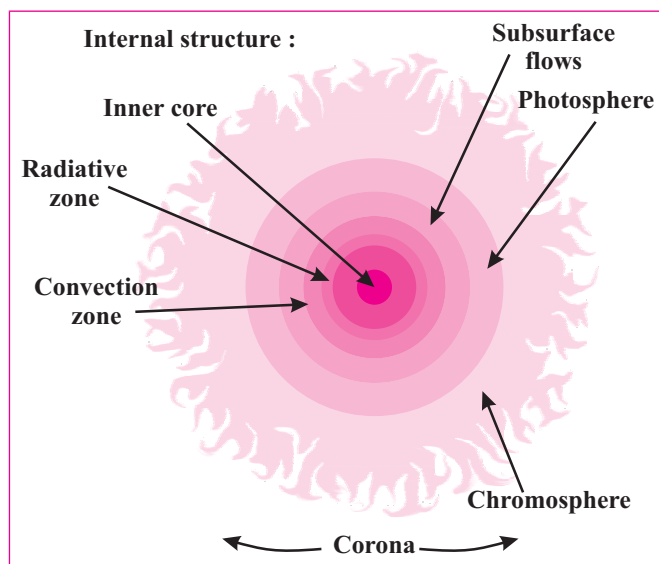


### The Sun

- The sun has an atmosphere. The lower region of the solar atmosphere is called the Chromosphere. The uppermost portion of sun's atmosphere is called Corona. (UPPCS, 2001)
- Sun is at the centre of the solar system. (BPSC, 1995; MPPCS, 2016)
- Sun is a Yellow dwarf star, with a hot ball of glowing gas. It is the source of all energy of the solar system.
- The cloud of gases create stars, so the sun is a gaseous sphere. In terms of atomic number, the sun consists of

approximately 91.2% hydrogen and 8.7% helium, while in terms of mass it has 70% hydrogen and 27.1% helium.

- The temperature of the core of the sun is  $1.5 \times 10^7^\circ\text{C}$  or 15 million  $^\circ\text{C}$  while its outer surface temperature is  $5500^\circ\text{C}$  –  $6000^\circ\text{C}$ . (IAS 1994, IAS, 1998)
- There are three main layers in the sun's interior : the Core, the radiative zone and the Convective zone.
- The boundary between the Sun's interior and the Solar atmosphere is called the Photosphere.
- The diameter of the sun is **109.2 times** the diameter of the Earth. (MPPCS, 2014)
- The age of the Sun is **4.6 billion years**.
- The Sun is about **1.3 million times** larger than the Earth.
- Earth receives only two billionth part of the thermal radiation of the sun.
- The sunlight takes about **8 minutes 19 seconds (499 seconds)** to reach the Earth. (38<sup>th</sup> BPSC - 1991; MPPCS, 1996; UPPCS, 2005; BPSC, 2019)
- Nuclear fusion is the source of all sun's energy. (UPPCS, 2006, 2001, 1996)



### Bodies of Solar System

#### The Planets :

- The word Planet is Greek and means 'wanderer'. Planet is the Celestial Body which does not have light or heat of its own.
- A Planet should possess the following qualities :
  - It should orbit around the sun.
  - It should not be a satellite of any planet.
  - Due to its own mass and self-gravity, it should have a spherical shape and any other celestial body should not cross in its orbit. (UPPCS, 1992)
- The Planets are classified in order of their distance from the Sun and based on their characteristics. They are :
  1. The inner planets or terrestrial planets or rocky planets. Mercury, Venus, Earth and Mars are called inner or terrestrial planets.

2. The outer Planets or gaseous planets or giant planets- Jupiter, Saturn, Uranus and Neptune are called outer or gaseous planets. (IAS, 1998)

- There are **8 planets** in the solar system. (UPPCS, 1992)
- The order of the planets **based on the distance** from the sun is - Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.
- The **planet closest to the sun is Mercury and the farthest planet is Neptune**.
- The descending order of planets **based on size** is- Jupiter, Saturn, Uranus, Neptune, Earth, Venus, Mars and Mercury.
- The descending order of planets based on mass is- Jupiter, Saturn, Neptune, Uranus, Earth, Venus, Mars and Mercury.
- The **most giant planet is Jupiter** and the **most minor is Mercury**. (UPPCS, 2004, 2016; IAS, 1998)
- The direction of rotation of Venus and Uranus is **east to west** (clockwise) while for all other planets it is from **west to east** (anti-clockwise).
- **Solar eclipse** occurs when the **moon comes between the sun and the Earth** so that the **sun's light does not** reach the Earth **during the eclipse**. (UPPCS, 1991, 1990; MPPCS, 1993; RAS/RTS, 2000, 1999)

- A solar eclipse occurs only on **New Moon Day** or **Amavasya**.

#### The Mercury:

- The magnetic field is found in the Mercury. (IAS, 1997)
- It completes the **circling of the sun in the shortest time** (in 88 Earth days). (UPPCS, 2002)
- The average distance from the Sun to Mercury is roughly 58 million km. (41<sup>st</sup> BPSC, 1996)
- The temperature of Mercury is the **highest** in comparison to other planets. (UPPCS, 2003, SSC MTS, 2016)
- Its temperature in the day-time is  $430^\circ\text{C}$  and at night it drops to the level of  $-180^\circ\text{C}$ , which makes the days extremely hot and the night is snowy.
- It is the **nearest to the sun** and the **most minor planet**. (UPPCS, 2004, BPSC, 1996)
- Mercury has **no satellite**. (UPPCS, 2016)

✎ **Note :** Satellites are those celestial bodies that revolve around their planets or the Sun or any other big celestial body.

#### The Venus :

- Venus is the **brightest planet**. (W.B. PCS, 2008, 210)
- Venus has the warmest surface temperature of all the planets due to how strongly the atmosphere of the gas carbon dioxide traps heat.
- It completes the orbit of the sun in approximately 225 earth days.
- Venus is the **hottest** and **nearest planet to Earth**. (41<sup>st</sup> BPSC, 1996; UPPCS, 1991, 1993, 1997, 2012)
- Venus is called the Morning Star or Evening Star.

(UP Lower, 2010)

- Venus is also called the **sister of the Earth** because it is almost identical to the Earth in density and size.

(UPPCS, 2007)

- The atmosphere of Venus mainly consists of carbon dioxide.
- There is **no satellite** of Venus.
- The sun light takes 6 minutes to travel from the Sun to Venus.

#### The Earth:

- Earth is the only planet in the solar system that provides sustenance or life on it.
- Earth is the third planet from the sun and the fifth largest in the solar system.
- Due to the presence of water on Earth, it is also called '**Blue Planet**'.
- Earth's only satellite is the Moon.
- The earth's axis is inclined at an angle of  $66\frac{1}{2}^\circ$  to the orbital plane.
- Earth is tilted on its axis at  $23\frac{1}{2}^\circ$ .

[UPPCS 2016; IAS, (Pre), 2005; MPPCS, 1990]

- **Weather changes** on the Earth occur due to **its axis tilt and rotatory motion**.
- The Earth completes one orbital revolution in 23 hours 56 minutes and 4 seconds. This motion is called **rotatory motion or daily motion**.
- The movement of the Earth on its axis is called **spin or rotation** due to which **day and night occurs**.
- It takes **365 days 6 hours, 9 minutes and 9.51 seconds** or **365.25 days** for the Earth to complete **one revolution of the sun**.
- The time taken by the Earth in a revolution of the Sun is called the **solar year**. Each solar year is increased by about 6 hours from the calendar year which is included in the calendar every fourth year as a **leap year**.
- The Earth revolves around the Sun at a **velocity of 29.8 km/second**.
- The Earth is **nearest** to the sun on January 4, and it is called **Perihelion**.
- The Earth is at the **farthest** from the Sun on July 4 and it is called **Aphelion**.
- The star closest to the Earth after the Sun is **Proxima Centauri**.
- The Earth's magnetic field Varies from Place to Place.
- On **21<sup>st</sup> March** and **23<sup>rd</sup> September**, the day and night are **equal in both hemispheres of the Earth**.
- The **longest day in the northern hemisphere** of the Earth falls on **21/22 June** while the **longest day in the southern hemisphere falls on 22<sup>nd</sup> December**.

(UK PCS, 2002; MPPCS, 1992; UPPCS, 1994)

#### The Mars:

- Mars is known as the **Red Planet**. It appears red due to the presence of reddish Iron Oxide in it.
- The axial tilt of Mars is  $25^\circ 12'$  relative to its orbital Plane.
- Mars has two satellites, namely **Phobos** and **Deimos**.
- Its axis is tilted and days are similar to the Earth. So similar change of the season is observed on Earth and Mars.
- Carbon dioxide (95.1%), Nitrogen (2.59%), Argon (1.94%), Oxygen (0.16%) and water are found in Mars' atmosphere.
- The presence of frozen water indicates life on Mars.
- '**Nix Olympia**', a volcanic mountain found on Mars and known as the Olympus Mons, is approx three times larger than **Mount Everest**.
- It is the largest volcanic mountain in the solar system.
- It takes 24.7 hours for Mars to make one revolution on its axis.
- It completes the orbit of the sun in approximately 687 earth days.

(UPPCS, 1990)

#### The Jupiter :

- Jupiter is the **most giant planet** in the solar system.
- **Jupiter** is the **fastest spinning** planet in our solar system **rotating** on average once in just under **10 hours**.
- Notably, Great Red Spot, a gigantic storm twice as big as Earth, the spot was first observed 300 years ago – and may have been churning long before that.
- It completes one revolution of the sun in about 11.86 years.
- **Ganymede** is the largest and most massive moon in the solar system.
- Jupiter is also called the **Miniature Solar System**.
- As of July, 2024, 95 satellites of Jupiter has been discovered.
- Among these, the 4 largest satellites of Jupiter are IO, Europa, Ganymede and Callisto. These four are also known as Galilean Moon.
- Jupiter has the shortest day in the solar system. One day on Jupiter takes only about 10 hours (the time it takes for Jupiter to rotate or spin around once), and Jupiter makes a complete orbit around the Sun (a year in Jovian time) in about 12 Earth years (4,333 Earth days).

(MPPCS, 1996, 1990, BPSC, 1996; UPPCS, 1990)

#### The Saturn :

- Saturn is the **second-largest planet** in the solar system.
- **Seven rings** are found around Saturn.
- There are **146 natural satellites** of Saturn.
- **Titan**, the largest satellite of Saturn is also the second-largest satellite of the solar system.
- The satellite called **Phoebe orbits Saturn in the opposite direction**.

(UPPCS, 1990)

(IAS, 2009)

(UP UDA/LDA, 2006)



- The average density of the Saturn is less than water. It means that when Saturn is placed into water, it will float.
- Saturn takes approximately 29.456 years to complete a revolution around the Sun. (44<sup>th</sup> BPSC, 2000)

#### The Uranus :

- The planet Uranus was discovered by **William Herschel in 1781 AD.**
- Uranus is the **third largest planet** in the solar system.
- Uranus takes 84.07 Earth years to complete a revolution around the sun. (44<sup>th</sup> BPSC, 2000)
- Uranus rotates from east to west on its axis while other planets rotate from west to east.

✎ **Note :** Uranus is one of only two planets that rotate from east to west. Only Venus and Uranus rotate like this.

- **Sunrise** occurs in the **west** and **sunset** in the **east** on Uranus.
- Due to its greater tilt (97.8°), the planet Uranus appears to be lying on its sides.
- **Titania** is the largest satellite of Uranus.
- The number of **satellites** of Uranus is **27**.
- Uranus holds the record for the coldest temperature ever measured in the Solar System: a very chilly -224. (MPPCS-2014)

#### The Neptune:

- Neptune is **farthest from the Sun.**
- It takes about 165 Earth years to complete a revolution around the sun.
- It was **discovered** by the German astronomer **Johann Galle** in 1846.
- A cloud of super-cool methane is capped around Neptune.
- It appears bright blue.
- It has a total of **14 satellites.** (MPPCS, 1994)
- Its largest satellite is **Triton.**

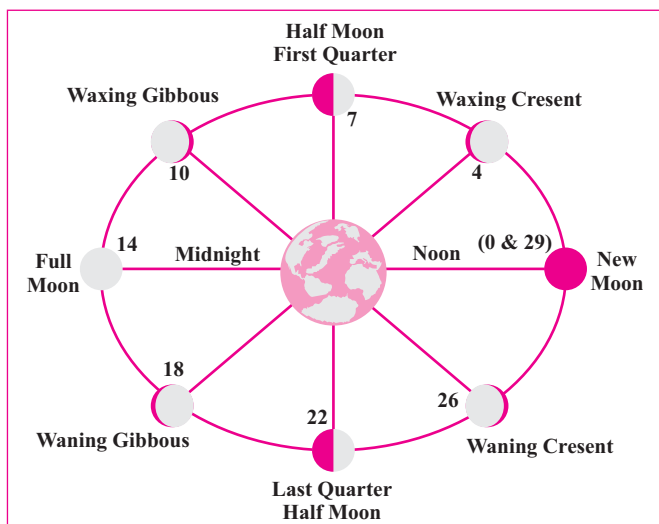
#### Dwarf Planets:

- The number of dwarf planets is **5.**
- **Criteria for being a dwarf planet-** It should be like the moon, huge and spherical in size, and revolve around the sun and its orbit does not fall in the way of the neighbouring planet.
- On August 24, 2006, Pluto was removed from the planet category and placed in the dwarf planet's category for not meeting the planetary criteria at the **International Astronomical Union (IAU)** conference in Prague, Czech Republic. (MPPCS, 2012; BPSC, 2018)
- Pluto was **discovered** in the **year 1930** by **Clyde William Tombaugh.** (CAPF 2015; CPO, 2018)
- The orbit of Pluto does fall in the way of the planet Neptune.
- The number of Pluto's satellites is **5.**

- Pluto takes 247.7 Earth years to complete a revolution around the sun.
- **Ceres, Haumea, Makemake** and **Eris** are also dwarf planets.

#### The Moon:

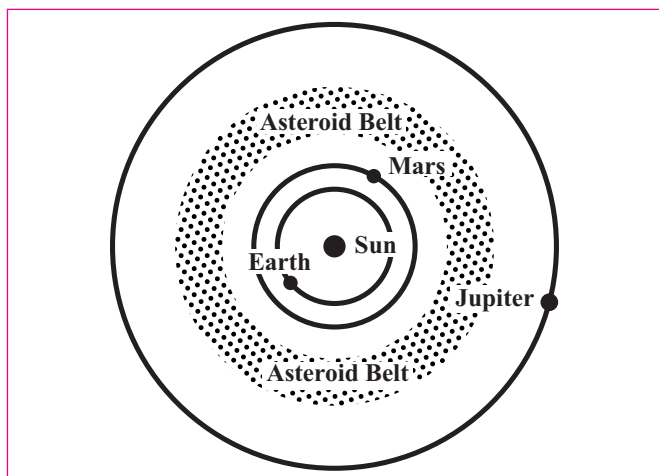
- The **only satellite of Earth is the Moon.** (IAS, 2005; UK Lower Sub, 2004)
- It **completes the orbit of the Earth** in about **27 days 7 hours 43 minutes** and in that time it also completes a rotation on its axis.
- Only 59% of the Moon's is visible from the Earth.
- The plane of the Moon's orbit is inclined at a mean angle of 5.145° to the plane of Earth's orbit around the sun.
- The moon is tilted 6.68° on its axis (orbital plane).
- The minimum distance from the **Earth to the Moon is 363300 kilometres** the **maximum is 405500 kilometres** while the **average distance is 3,84,400 kilometres.**
- It takes 29 days, 12 hours, 44 minutes and 3 seconds (29.53059 days) for the Moon to return to the same point on the celestial sphere with respect to the sun (due to the movement of the Earth around the Sun).
- The time taken by the Moon to revolve around the sun from one full moon to another full moon is called a **Lunar Month or Synodic Month.**
- When the moon is closest to the Earth, that condition is called **super moon** or **full perigee moon.**
- When two full moon falls in a calendar month, the second full moon is called a **blue moon.** (UPPCS, 2007, 2009)
- Humans (Neil Armstrong and Edwin Aldrin) first stepped on the moon on **20 July 1969.** (MPPCS, 1995)
- The Sea of Tranquility is located at Moon. Apollo 11 landed here.
- When the Earth comes between the Sun and the Moon, it is called a **Lunar Eclipse.** (MPPCS, 1994, 1992, Uttarakhand Lower, Sub, 2010)
- "Supermoon" is described as a full Moon within at least 90 percent of perigee. Supermoons only happen three to four times a year, and always appear consecutively.
- At its closest point, the full moon can appear up to 14 percent bigger and 30 percent brighter than the faintest Moon of the year, which occurs when it's farthest from Earth in its orbit.
- The area of the dark spot on the Moon is called the **Sea of Tranquility.**
- The Lunar Eclipse always occurs on the Full Moon day. (MPPCS, 1994)
- A "blood moon" happens when Earth's moon is in a total lunar eclipse. While it has no special astronomical significance, the view in the sky is striking as the usually whitish moon becomes red or ruddy brown.



## Other Bodies of Solar System

### The Asteroids :

- Most of the asteroids are **located between Jupiter and Mars.** (IAS, 1997, 2011; UPPCS, 2008; IAS, 1998)
- Asteroids revolve around the sun. (IAS, 1998; UPPCS, 1998)
- Asteroids were formed as a result of Big-Bang.
- A huge crater is formed on the surface of the Earth when the asteroids hit it.



### Comets:

- Comets are bodies of the solar system that are made of small fragments of **stone dust, ice and gas.**
- Comets also revolve around the sun like planets.
- Comets are visible only when they are moving towards the Sun because only then the rays of the Sun make their gases glow.
- Comets have **tails always in the opposite direction to the Sun.**
- **Coma** is the top part of a comet. It is a gaseous coating generally made of ice and comet dust around the comet's nucleus.
- The **comet** is also called the **tail star.** (MPPCS, 1997)

### Meteors:

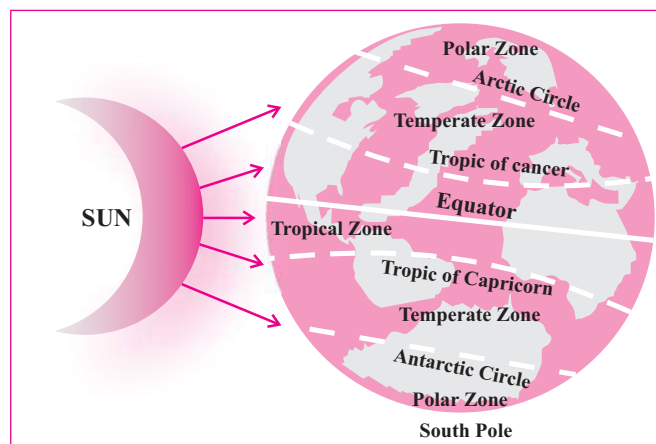
- Meteoroids are cosmic particles **moving in the universe at a rapid pace.** (IAS, 1995)
- Meteors are dust particles of asteroids or comets.
- Meteors begin to glow due to atmospheric friction when they enter the atmosphere.
- Some fragments of meteor do not burn to perfection and fall on the earth in the form of stones called **Meteorites.**
- Meteor is also called **meteorite** or a **falling star.**
- **Lonar Lake** of Maharashtra is the result of a meteor hitting the Earth. Notably, this lake was declared as Ramsar site in 2020.

### Black Hole:

- **S. Chandrasekhar** propounded the Black Hole Theory. (BPSC, 2001, 2003; UPPCS, 2005, 1996)
- A black hole is an astronomical field in space that does not allow any radiation to come out due to very high density (its intense gravitational field). (UPPCS, 2001, 2003; IAS, 2000)

### Earth:

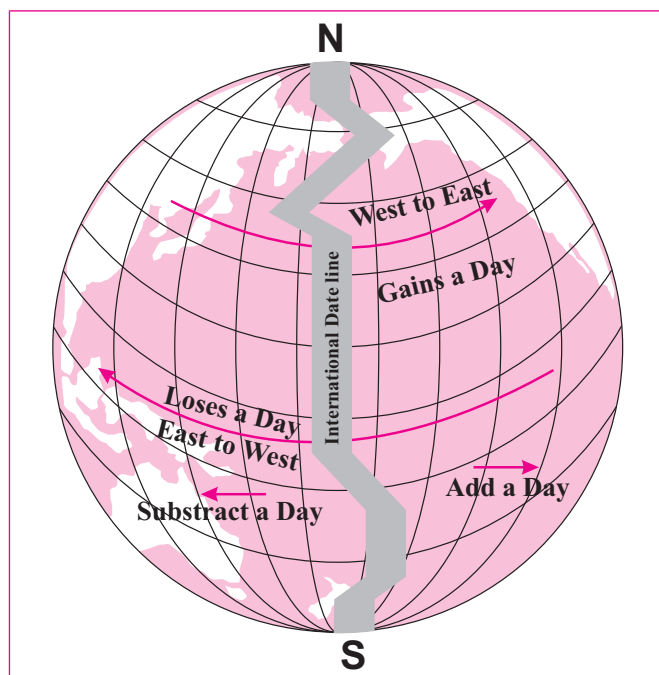
- In the **Carboniferous Era**, the entire part of the Earth existed as a large continent called **Pangea.**
- The entire water body was called **Panthalassa.**
- Pangea split into two parts in the **Triassic Era** about 200 million years ago.
- The northern part was called **Laurasia** and the southern part was called **Gondwana Land.**
- Present North America and Eurasia were parts of Laurasia while South America, Africa, India and Australia, etc. were parts of the Gondwana Land.



- **Latitude:** Latitude is the angular distance of a place north or south from the equator on the globe.
- **Equator:** The latitude of zero degrees on the globe of the Earth is called the **Equator.** (IAS, 2001)
- The northern part of the Equator is called the **Northern Hemisphere** and the southern part is called the **Southern Hemisphere.** (MPPCS, 1997)
- The equator passes through Sao Tome and Principe, Gabon, Republic of Congo, Democratic Republic of Congo,

Uganda, Kenya, Somalia, Maldives, Indonesia, Kiribati, Ecuador, Colombia and Brazil.

- The latitude lines are assumed to be drawn at an interval of every  $1^\circ$  north and south of the equator.
- Each degree of latitude is approximately **69 miles (111 kilometres)** apart.
- **Longitude** : The imaginary lines joining the North Pole with the South Pole are called **longitude lines**.  
(UPPCS, 2011)
- All longitudinal lines are equal in length.
- The zero degrees ( $0^\circ$ ) line of longitude that passes through the Royal Observatory in Greenwich, England is the **Greenwich Meridian**.  
(UPPCS, 2005)
- It's also called the **Prime Meridian**.
- The Prime Meridian line passes through the United Kingdom, France, Spain, Algeria, Mali, Burkina Faso, Togo, Ghana and Antarctica (Southern Hemisphere).
- Just opposite to the Greenwich ( $0^\circ$  longitude) line,  $180^\circ$  longitude line is known as the **International Date Line**.
- The International Date Line passes through the middle of the Pacific Ocean and is the imaginary line that separates two consecutive calendar days.
- The standard time is determined internationally from the Greenwich line itself.
- There is usually a difference of **4 minutes at 1-degree longitude**.



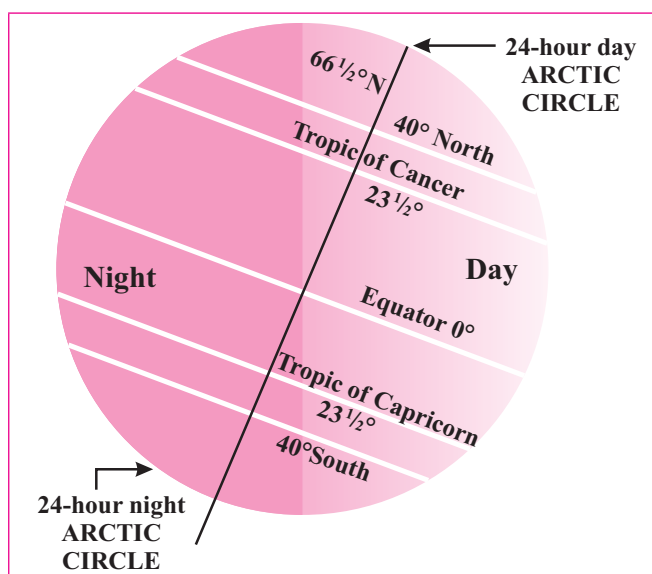
- The Equator and Greenwich lines meet at the **Gulf of Guinea**, west of the Continent of Africa.
- **Tropic of Cancer**:  $23.5^\circ$  latitude on the north side of the equator is called the **Tropic of Cancer**.
- Tropic of Cancer passes through **Hawaii Island (USA), Mexico, Bahamas, Mali, Western Sahara, Mauritania,**

**Niger, Algeria, Libya, Saudi Arab, Egypt, UAE, India, Bangladesh, Myanmar, China, Oman and Taiwan.**

- **Tropic of Capricorn** : It is an imaginary line of latitude at  $23.5^\circ$  South to the Equator around the Earth.
- It passes through Argentina, Brazil, Chile, Paraguay, Namibia, Botswana, South Africa, Mozambique, Madagascar, French Polynesia, Tonga and Australia.  
(UP Lower Sub, 1997; UPPCS, 2003)
- **Zero latitude and Zero longitude lines intersect each other in the Atlantic Ocean.**
- The Equator, the Tropic of Cancer and the Tropic of Capricorn, all three lines pass through the Continent of Africa.
- Solstice, either of the two times in the year when the Sun's apparent path is farthest north or South from the Earth's Equator.
- June 20/21 is the longest day of the year in the Northern Hemisphere at the time of **Summer Solstice**. (IAS, 2022)
- December 21/22 is the shortest day of the year in the Northern Hemisphere at the time of **Winter Solstice**.

(MPPCS, 1990)

- In contrast, the shortest day in the Southern Hemisphere would be on 20/21 June and the longest day on 21/22 December.  
(MPPCS, 2015)
- Each hemisphere of the Earth is divided into different zones based on temperature.
- The  $23.5^\circ$  northern and  $23.5^\circ$  southern parts of the equator are called the **Tropical Zone**.
- The region from  $23.5^\circ$  North to  $66.5^\circ$  and South in both hemispheres is called **Temperate Zone**.
- The region from  $66.5^\circ$  North to  $90^\circ$  South and in both hemispheres is called a **Frigid Zone/ Polar Zone**.
- The temperature in the polar zone is very low as a result, it always remains covered with snow.



### Equinoxes :

- Equinoxes occur when the earth reaches the points in its orbits where the equatorial and the orbital planes intersect, causing the sun to appear directly overhead at the equator.
- On 21<sup>st</sup> march, the Sun is directly overhead at the equator. Throughout the world, on this day all the places experience almost equal hours of day and night. This position of the Sun is called spring equinox.
- On 23<sup>rd</sup> September, the Sun is directly overhead on the equator and it is called autumn equinox.

### Solstices :

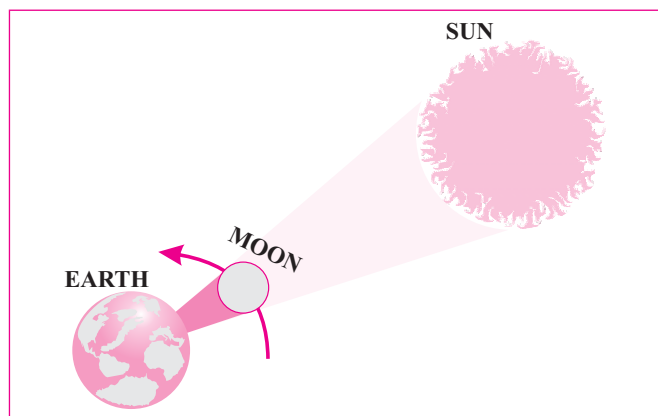
- The rays of the Sun fall vertically at the tropic of cancer ( $23\frac{1}{2}^{\circ}\text{N}$ ).
- When the sun's rays fall vertically on the Tropic of Capricorn, is known as winter solstice (22 December).

### Eclipses :

- An eclipse is a complete or partial obscuration of light from a celestial body which passes through the shadow of another celestial body.
- The eclipses are of two types.

#### (A) Solar Eclipse :

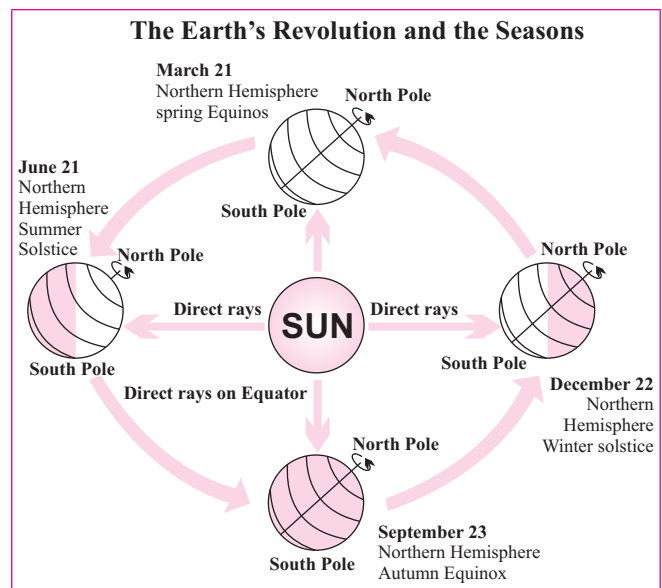
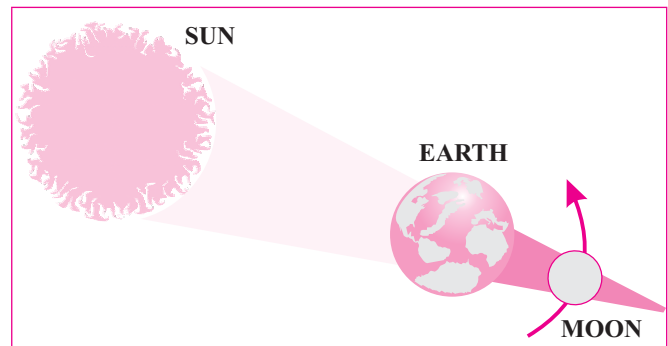
- It occurs on New Moon days, when the moon is between the Sun and the Earth.
- A **partial solar eclipse** happens when the moon partially covers the disc of the sun.
- An **annular solar eclipse** occurs when the moon passes centrally across the solar disc. During a **total solar eclipse**, the moon's shadow is short enough to cover the whole sun.
- The outer regions still glow and look as bright as a ring. Such a phenomenon is called a **diamond Ring**.



#### (B) Lunar Eclipse:

- It occurs on a Full Moon position when the earth is between the Sun and the Moon.
- A **partial lunar eclipse** can be observed when only a part of the moon's surface is obscured by earth's umbra.
- **Penumbral Lunar eclipse** happens when the moon travels through the faint penumbral portion of the earth's shadow.

- A **total lunar eclipse** occurs when the earth umbra obscures the entire the moon's surface.



### Difference Between Rotation and Revolution

| Rotation                                                                                                                        | Revolution                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| It defines spinning of the earth from west to east on its axis.                                                                 | It defines movement of earth around the Sun in its elliptical orbit.                                                  |
| It takes 24 hours to complete a rotation.                                                                                       | It takes $365\frac{1}{4}$ days to complete a revolution.                                                              |
| It is known as the daily or diurnal movement.                                                                                   | It is known as annual movement of the earth.                                                                          |
| Rotation causes days and nights to alternate, tides, deflection of winds and ocean currents and also gives the earth its shape. | Revolution Results varying lengths of day and night, changes in the altitude of the midday sun and change of seasons. |

### World's Top Geographical Discoveries

- In 1492 AD, Columbus, a resident of Spain, discovered the Caribbean islands, Central America and South America.
- The claim for the discovery of North America or the present United States is disputed. Some people claim

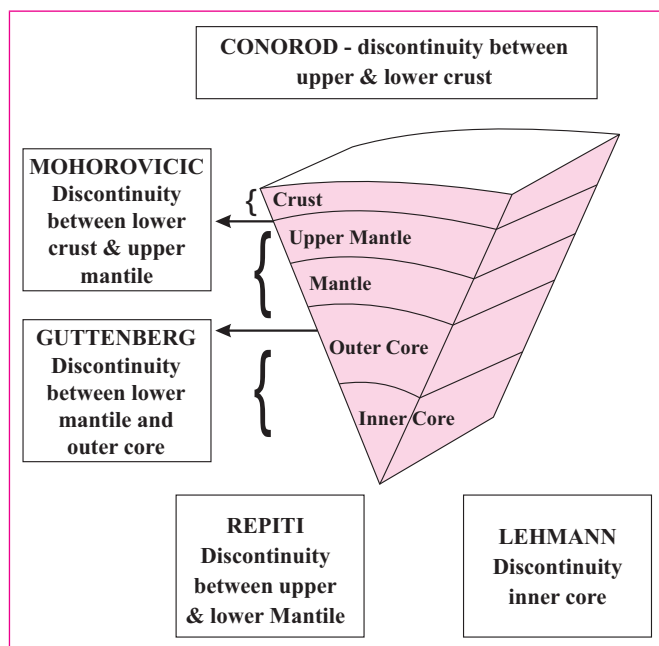


that European traveller Leif Eriksson (approx. 986 AD) discovered America while some support the belief that Chinese Admiral Zheng (1421 AD) was the first to reach and find America.

- In the United States, Columbus is largely considered to have discovered America and Columbus Day is celebrated there on the second Monday of every October.
- John Cabot discovered Newfoundland (1497 AD).
- Vasco da Gama (Portugal) came to India (1498 AD) via the Cape of Good Hope.
- Nicolaus Copernicus wrote a manuscript named "Little Commentary" in which he placed the Sun rather than the Earth at the Centre of the Universe.
- In 1610, Galileo saw for the first time in human history that the Moon orbits Jupiter.
- Johannes Kepler (Germany) propounded the law of Planetary Motion in 1609.
- The Hawaiian Islands were discovered (1778 AD) by **Captain James Cook**.
- The North Pole was discovered (1909 AD) by **Robert Peary (America)**.
- The first expedition to reach the South Pole (in 1911) was led by the Norwegian explorer **Roald Amundsen**.

### 3. Internal Structure of the Earth

- The earth's interior is made up of three concentric layers - **(i) Crust, (ii) Mantle, (iii) Core**.
- The crust is a silicate solid, the mantle is viscous molten rock, the outer core is a viscous liquid, and the inner core is dense solid.



#### (i) Crust :

- The crust is the outermost, substantial and brittle part of the earth.
- Oceanic crust is thinner as compared to the continental crust.
- The mean thickness of the oceanic crust varies in the range 5-30 kms whereas that of the continental is around 50-70 kms.
- The crust mainly consists of Silica (Si) and Aluminium (Al), thus it is known as "**SiAl**" layer.
- The mean density of the materials in the crust is about 2.7 g/cm<sup>3</sup>.
- Whereas the average density of earth is about 5.51 g/cm<sup>3</sup>.

#### (ii) Mantle:

- The Mantle forms about 83 percent of the earth's volume and holds approximately 67% of the earth's mass. It extends from Moho's discontinuity to a depth of 2900 km.
- The density of upper Mantle varies between 2.9 - 3.3 g/cm<sup>3</sup>. The lower Mantle extends beyond the asthenosphere. The density ranges from 3.3 - 5.7 g/cm<sup>3</sup> in the lower mantle.
- The Mantle is approximately solid bulk of Earth's interior.
- Mantle comprises 45% oxygen, 23% magnesium and 21% silicon. The silicate rocks in the mantle are rich in iron and magnesium relative to overlying crust.
- The Mantle mainly comprises of Silica (Si) and Magnesium (Ma). Hence, it is called "**SiMa**" layer.
- Mantle is partially molten between 100 to 250 km depth. This zone is said to be asthenosphere, also known as Mohr discontinuity, a simplification of Mohorovicic, the name of the seismologist who discovered it.
- In the 1930s, Arthur Holmes presented the Convectional Current Theory. It talked about how convection currents might be present in the mantle section. The mantle's thermal fluctuations are caused by radioactive materials, which create these currents.

#### (iii) Core :

- The core (inner core and the outer) core accounts for just about 16 percent of the Earth's volume but 33% of the Earth's mass.

#### Outer Core :

- The Outer core, surrounding the inner core, lies between 2900 km. and 5100 km. below the earth's surface.
- The outer core is comprised of iron mixed with nickel (NiFe).
- The Nature of the outer core is liquid due to not enough pressure.
- According to dynamo theory convection in the outer core, combined with the Coriolis Effect gives rise to Earth's magnetic field.

### Inner Core :

- The inner core is solid and extends from the center of the earth to 5100 km. below the earth's surface.
- It is generally believed to be composed primarily of iron (80%) and some nickel (NiFe).
- Because it consists of Nickel (Ni) and Iron (Fe). Hence, it is called "**NiFe**" layer.
- Thus, Earth's structure can also be explained as **SiAl**, **SiMa** and **NiFe**.
- The **average density** of the Earth is **5.5 gram/cm<sup>3</sup>** and the equatorial radius is about **6378 km**.
- Moving down the Earth's crust towards the core, temperature increases by 1°C after every 32 mtrs.
- The crust is the outermost layer of Earth and forms about 0.5-1.0 percent of earth's volume and less than 1 percent of Earth's Mass.
  1. The continental crust can be thicker than 70 km. in the areas of major mountain systems. It is as much as 70-100 kms. thick in Himalayan region.
  2. The temperature of the crust increases in depth reaching values typically in the range from about 200°C to 400°C at the boundary with the underlying mantle.
- The temperature increases by as much as 30°C for every kilometer in the upper part of crust.
- The outer covering of the crust is sedimentary material and below that lie crystalline, igneous, and meta morphic rocks which are acidic in nature. The lower layer of the crust consists of Basaltic and ultra basic rocks.
- The continental crust is composed of lighter Sodium Potassium Aluminium silicate rocks (Felsic), like granite.
- The oceanic crust, on the other hand, is composed of dense (mafic) iron magnesium silicate igneous rocks, like Basalt.

| Element        | % By Weight |
|----------------|-------------|
| Oxygen (O)     | 46.6        |
| Silicon (Si)   | 27.7        |
| Aluminium (Al) | 8.1         |
| Iron (Fe)      | 5.0         |
| Calcium (Ca)   | 3.6         |
| Sodium (Na)    | 2.8         |
| Potassium (K)  | 2.6         |
| Magnesium (Mg) | 1.5         |

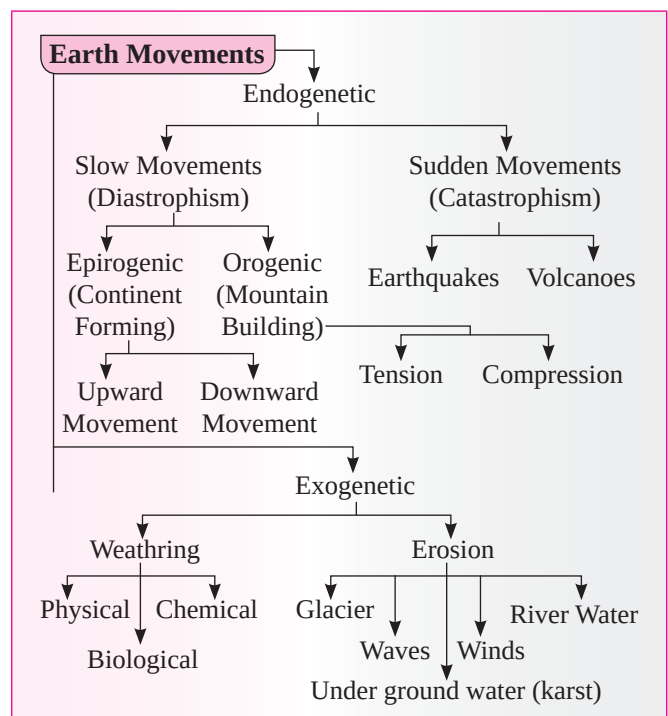
### Seismic Discontinuities :

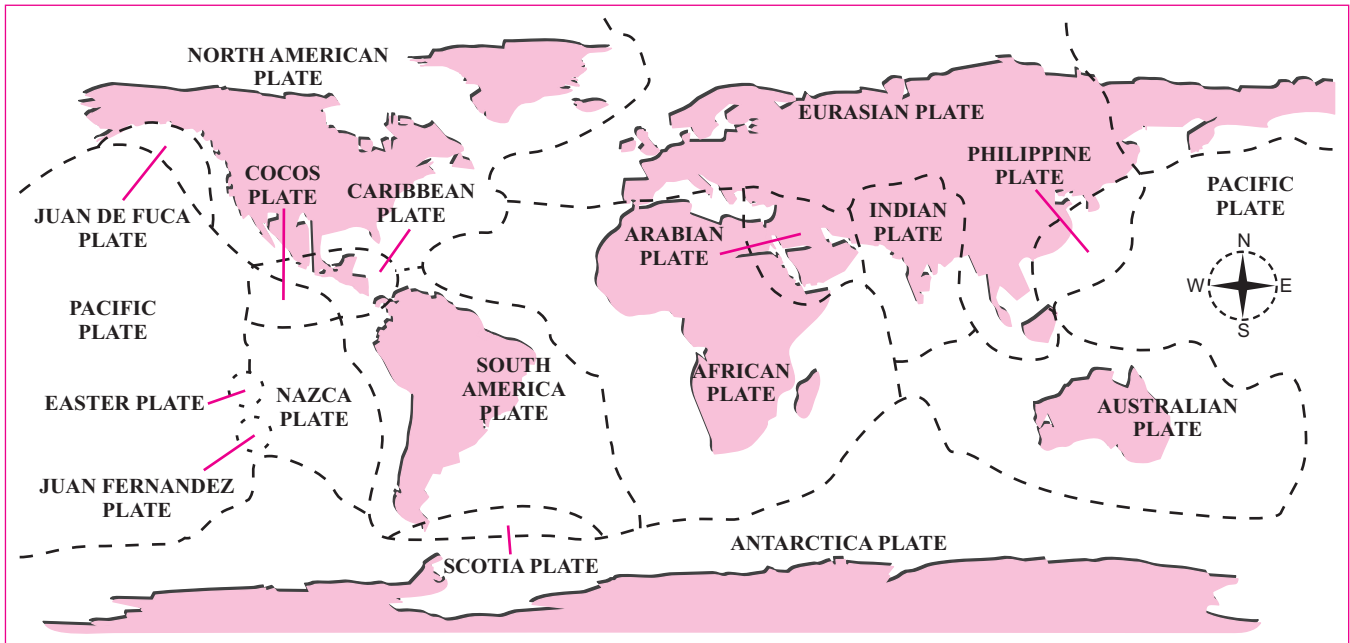
- Seismic discontinuities are the areas in the Earth where there is abnormal behaviour or the seismic waves due to the change in physical and Chemical properties.

- **Mohorovic Discontinuity** - It separates (Moho the crust from mantle.
- **Asthenosphere** - It is highly viscous mechanically weak and ductile part of mantle.
- **Repiti Discontinuity** - It separates lower mantle and upper mantle.
- **Guten berg discontinuity** - It lies Between the mantle and outer core.
- **Lehman Discontinuity** - It lies between the outer core and inner core.
- The outer surface of the Earth can be divided into the following parts: **Lithosphere**, **Hydrosphere** and **Biosphere**.

## 4. Lithosphere

- The rigid, rocky outer layer consisting of the crust and the outermost solid layer of the upper mantle form **Lithosphere**.
- The 'Lithosphere' is derived from the Greek words '**lithos**' meaning rocky and '**spharia**' meaning sphere.
- The term '**Lithosphere**' was introduced by '**Joseph Barrell**', an American Geologist.
- The **maximum altitude** of the lithosphere is 8,848 m (8848.86m) (**Mount Everest**) and the **maximum depth is approximately 11,033 m (Mariana Trench)**.
- About 70.9% of the Earth's surface is covered by water and the remaining 29.1% part is land.
- **Water** is found in about **61%** of the Earth's Northern Hemisphere area and about **81%** in the Southern Hemisphere area.





### Endogenic Process

#### Plate Boundaries :

- Lithosphere plates are sometimes called as **crustal plates** or **tectonic plates**.
- Earth's lithosphere is divided into a series of major and minor mobile plates.
- Eurasian Plate, Indo-Australian Plate, South American Plate, Pacific Plate, African Plate and antarctic Plates are the major plates.

#### Divergent Plate Boundary :

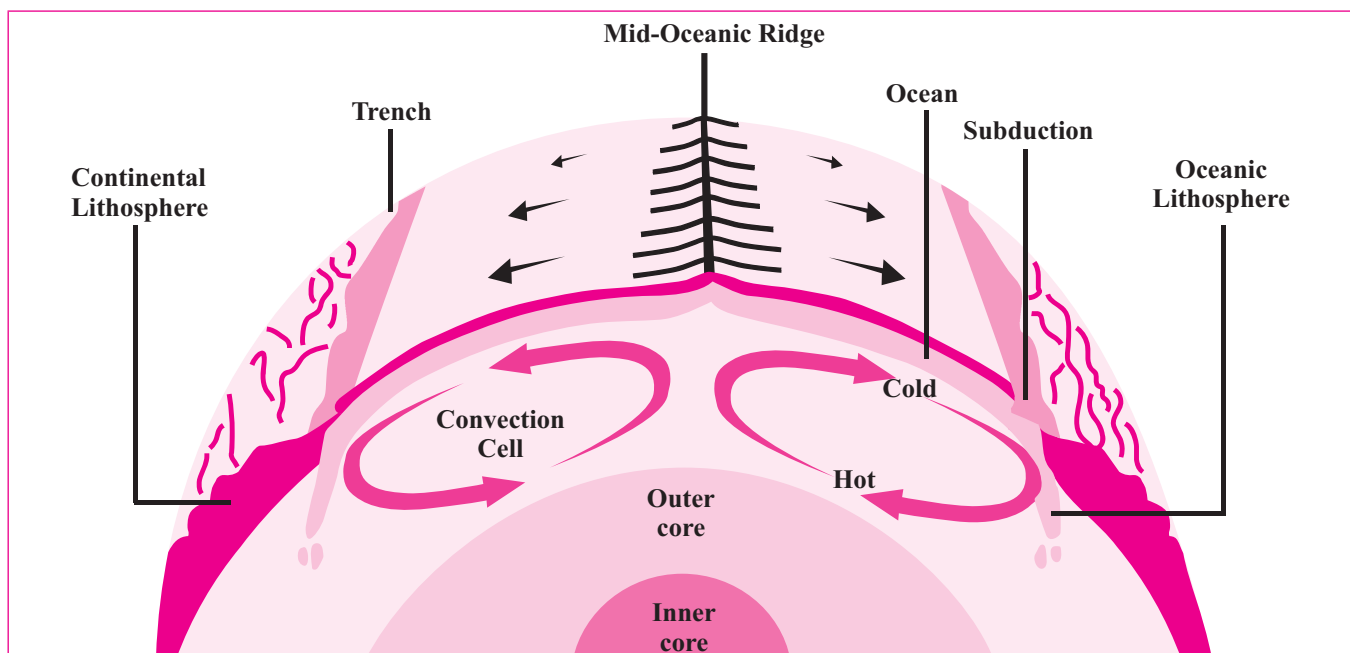
- It is the margin where two plates move are moving away from one another.
- Narrow oceans represent young divergent boundaries and

wide oceans have implications for old ocean basins.

- The Divergent Plate Boundary is also called Constructive plate boundary or accreting plate margin.
- Examples of Divergent Plate boundaries are **Oceanic ridges** and **Rift Valley**.

#### Convergent Plate Boundary :

- It is the margin where two plates collide with one another.
- Examples of Convergent Plate Boundaries are **Trenches** and **Fold mountains**.
- **Subduction zone** - A subduction zone is a Boundary where one plate sinks under other plate. It was first identified by 'Kiyo Wadati' and 'Benioff.'
- The zone marking the Boudary of the two colliding plates is known as Suture line.



- Subduction zones are the most seismically active areas on the earth.

#### Transform Plate Boundary :

- Transform Plate Boundary is the margin where two plates move side by side.
- The lithosphere is neither destroyed nor created by the Transform Plate Boundary. Hence it is called as conservative or '**Passive plate Boundary**'.

#### Convection Cell :

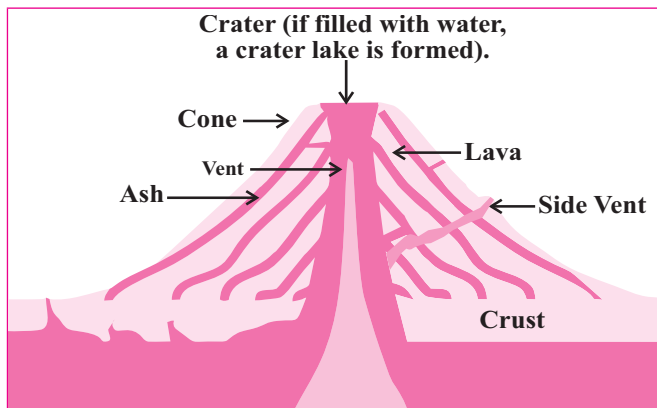
- Convection cell is the circulation of the molten material caused by the heat derived from the core.
- When the molten materials (magma) circulate in different directions, they Push or Pull in the different directions. Thus the Plates move towards each other, away from one another and side by side.
- The Plate movements cause the formation of fold, fault, earthquake and volcano the occur.

#### Internal Forces :

- The Internal Forces are also called the tectonic forces.
- They are caused by convection cell and Plate movement.
- **Fold** - A fold is geologic structure that is formed by layers. Significantly, the plane that marks the center of the fold is called the Axial plane.

#### Parts of a Fold :

- Up thrown Part of a fold is called '**anticline**.' Down thrown part of a fold is called '**Syncline**'. The side of the fold is called '**Limb**'. The top of the fold is called '**Crest**'.

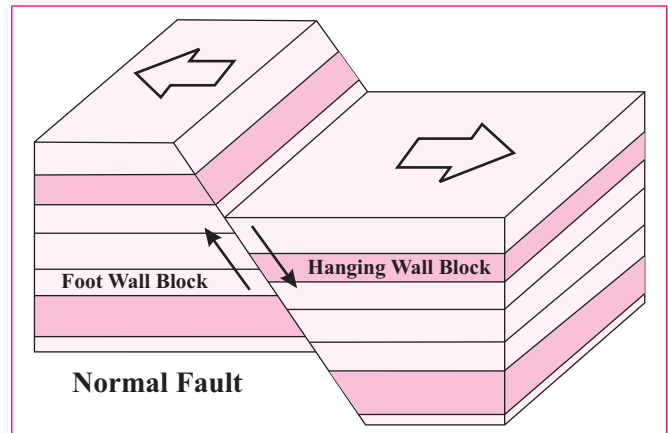


- Types of a Fold depend on the nature of the rock.
- When compressional force is equal from both sides, the limb angle is equal on both sides. Such as fold is called '**Symmetrical fold**'.
- When compressional force is more from one end, one limb is steeper than the other. Such as fold is called Asymmetrical fold.
- '**Isoclinal folds**' are symmetrical and aligned in a parallel fashion.
- When one limb of the fold is pushed over the other limb of the fold, it is called '**over turned fold**'.
- When one side of the fold is pushed so much that it lies positioned over the other such a fold is called '**recumbent fold**'.

- **Fault** - A Fault is a break in Earth's crust where blocks of rock crust slide past each other.

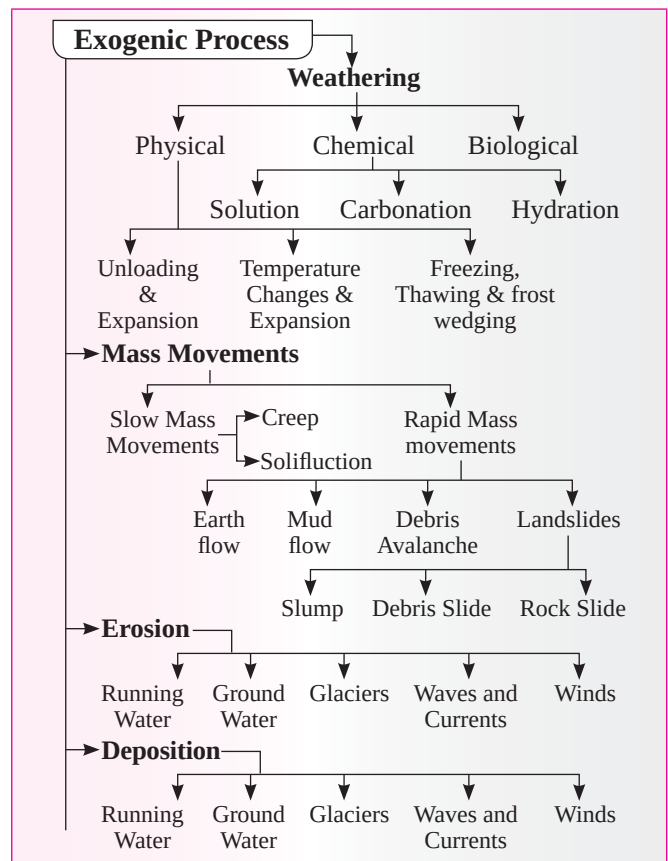
#### Types of Fault :

- **Normal Fault** - Vertical displacement of crust is called a normal fault.
- The normal fault is caused by tensional force where plates diverge.
- Examples of Normal Fault are **Graben** and **Horst**.
- **Reverse Fault** - A reverse Fault is a horizontal displacement of the crust. It is caused by compressional forces along convergent plate boundaries.



#### Exogenic Process :

- The process which occur on earth's surface due to the influence of external forces are called as 'exogenic Process'.





- (A) **Weathering** - It is the process of disintegration and decomposition of rocks. There are three types of weathering.
- '**Physical Weathering**' is the disintegration of rocks mainly induced by elements of weather.
  - '**Thermal Weathering**' is the disintegration of rocks under the extreme temperature condition.
  - '**Chemical Weathering**' is the decomposition of rocks due to chemical effects.
  - '**Biological Weathering**' is the alteration of rock by action of Plants, animals and man.
- (B) **Mass Wasting** - Mass wasting is the movement of large masses of rocks, soil and down ward by the pull of gravity.

### Volcanoes

- A volcano is a vent in the crust of the Earth or a planet or satellite, through which molten rocks, hot rock fragments and hot gases gush out of the surface. (UK PSC, 2016)
  - Gases forcing their way out of Earth's surface following volcanic eruption contain a high quantity of water vapours (H<sub>2</sub>O). (Jharkhand PCS, 2013)
  - At the time of volcanic eruption, the fluid embedded in Earth's surface is called **Magma**. (UPPCS, 2015, 2017)
  - When magma hits the ground, it is called **Lava**.
  - At the time of the eruption of the volcano, water vapours from the holes and crevices sometimes rise to a considerable height and are known as **Geysers**.
  - **Old Faithful** is a major geyser located in Yellowstone Park, United States of America. (MPPCS, 2019, 2021)
  - The water vapours that come out in the last phase of the volcano eruption are called **Fumaroles**.
  - A fumarole rich in sulfur gases is called a **Solfatara**.
  - **Valley of Ten Thousand Smokes** (filled with myriad fumaroles) is a volcanic region in **Mount Katmai** southern Alaska in the U.S.
  - **Ojos del Salado** is an active and the **highest active volcano in the world** at 6,893 m in the Andes mountain range on Argentina–Chile Border. (MPPCS, 1997)
  - The highest peak in the Andes, the **Mt. Aconcagua** (6,962 metres) is **the world's highest extinct volcano** that was active about 9.5 million years ago.
  - Based on the nature of the eruption of lava, the volcano is divided into three types.
- (i) **Active Volcano :**
- The active volcano erupts frequently.
  - **Kilauea** on the Hawaiian Islands of America is the most active volcano in the world. (UPPCS, 2006, 2009)

- The world's largest volcano in terms of size, **Mauna Loa** is located on the south-central part of the Island of Hawaii, U.S. (UPPCS, 2004; 2014)
- **Shield volcanoes** are constructed primarily of thin lava flows that cover large areas. Examples of shield volcanoes are Kilauea and Mauna Loa. (UPPCS, 2014, 2005)
- The dominant lavas of Hawaii, from the eruption of which result the structures typical of Hawaiian volcanoes, are the olivine basalts and basalts, and the closely related picrite-basalts and basaltic andesites.
- **Mount Etna** and **Stromboli in Italy**, **Colima in Mexico**, **Cotopaxi in Ecuador**, **Barren Island volcano in Andaman Nicobar**, **Mount Erebus in Antarctica**, are some important among the active volcanoes in the world.
- **Stromboli volcano** located in Lipari Island north of Sicily in the Mediterranean Sea is called the **lighthouse of the Mediterranean Sea**. Presently, **Vesuvius Volcano** of Italy is an active volcano. Earlier, it was in the category of a dormant volcano. (IAS, 2005; BPSC, 2022)

#### (ii) **Dormant Volcano-**

- A dormant volcano is not currently active or erupting, but geologists think that it is potentially active.
- **Mt. St. Helen's of USA** is famous dormant volcano in the world.

#### (iii) **Extinct Volcanoes:**

- Extinct volcanoes are those that once erupted in earlier times, but are now inactive.
- Among the extinct volcanoes, **Koh-i-Sultan** of Pakistan, **Damavand** in Iran, **Popa** in Myanmar, **Kulal and Kilimanjaro** in Africa, **Chimborazo** in Ecuador, are prominent. (MPPCS, 2011, 2009; 44<sup>th</sup> BPSC, 2000)
- Due to the presence of a large number of active volcanoes in coastal parts of the Pacific Ocean, the region is called the **Pacific Ring of Fire**.
- The **most active volcanoes** are located on the coasts of the **continents of America and Asia**.

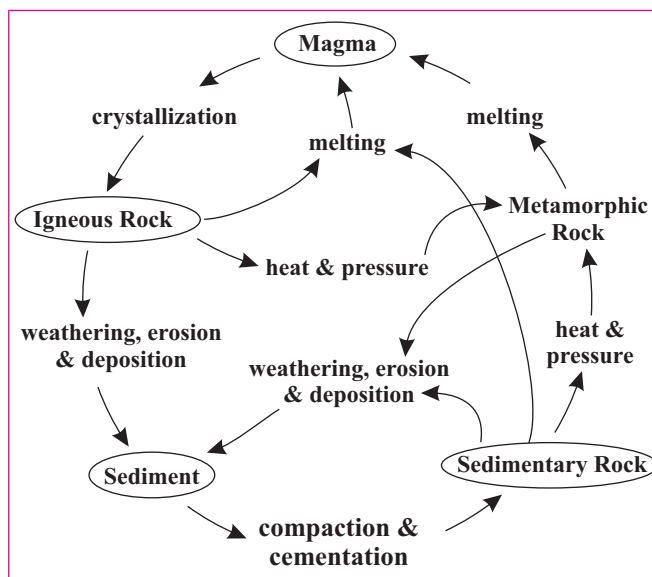
### The Earthquake

- An earthquake is an intense shaking of the Earth's surface caused by movements in its outermost layer.
- **Seismology** is a scientific discipline that deals with the study of earthquakes and the propagation of seismic waves within the Earth.
- Earthquakes produce three types of seismic waves- **primary, secondary** and **surface**. (SSC MTS, 2009)
- The fastest seismic waves are called **primary waves**, or **P waves**.

- These waves are the **first to arrive** at the **surface when an earthquake** occurs. These waves are similar to sound waves. (W.B. PCS, 2009, 2011)
- Primary waves (P-waves) can travel through **solids, liquids, and gases**. (Kerala PCS, 2005, 2007)
- As they pass through a material, the particles of the material are slightly pushed together and pulled apart (longitudinal waves).
- Secondary waves are also called **S waves**. (CDS 2009)
- When secondary waves pass through a material, the material's particles are shaken up and down or from side to side (transverse waves). (CDS, 2011)
- Secondary waves can travel through rocks (solids) but unlike primary waves, they **cannot pass through liquids or gases**.
- **Surface waves**, also known as long waves or **L-waves**, are seismic waves that move along Earth's surface, not through its interior.
- The first kind of surface wave is called **Love wave** also known as **Q waves**, named after **A.E.H. Love**, a British mathematician who worked out the mathematical model for this wave in 1911. These are surface seismic waves that cause horizontal shifting of the Earth during an Earthquake.
- The other kind of surface wave is the **Rayleigh wave**, named after John William Strutt, **Lord Rayleigh**, who mathematically predicted the existence of this wave in 1885. These waves roll along the ground just like a tide runs across a lake or an ocean. Because these roll, they move the ground in every direction following the direction of the movement. Most of the shaking and damage from an Earthquake is caused by this wave.
- It is the surface waves that are almost entirely responsible for the damage and destruction associated with earthquakes.
- The place where an earthquake originates is called **Focus**. It is the point inside the Earth where the rocks break off and pressure is generated.
- All three types of waves P, S and L emerge from the focus of the earthquake.
- An area between 105° and 145° from the earthquake epicentre (where no earthquake waves are recorded) is the **Shadow Zone** for the P waves and the entire zone beyond 105° which does not receive S-waves is the Shadow zone of S-waves. (Chattisgarh PCS, 2020)
- The place where an earthquake originates initially on the surface of the Earth, **just above the focus**, is called the **epicentre** of the earthquake. (UP RO/ARO, 2017)
- **P waves reach the epicentre first**. (UP RO/ARO, 2017)
- A **Tsunami** is a series of enormous ocean waves caused by earthquakes, underwater landslides, volcanic eruptions or asteroids.
- Tsunami is a Japanese word. (UK PSC, 2005)
- Earthquake waves are measured by an instrument named **Seismograph**. (UK Lower Sub, 2010; UPPCS, 2017)
- The **Richter Scale** measures **magnitude** while **Mercalli Scale** and **Rossi Forel Scale** are used to measure the intensity of earthquakes.
- The **Ring of Fire** also referred to as the **Circum-Pacific Belt**, is a path along the Pacific Ocean characterized by **active volcanoes** and **frequent earthquakes**.
- Around 90% of earthquakes are experienced in the Pacific Ocean region.
- Dhajji-Dewari system of construction is earthquake resistant, and is located in Jammu and Kashmir, India.

## Rocks

- Hard materials found on the outer layer of the Earth are called **rocks**.
- Quartz and Feldspar are minerals that we can find prominently in the earth's crust. More than 60% of the earth's crust consists of Feldspars. (IAS, 2001)
- Based on origin, the rocks are divided into three parts -
  - Igneous Rocks**
  - Sedimentary Rocks**
  - Metamorphic Rocks** (MPPCS, 1993)



- **Igneous Rocks**- Igneous rocks are formed by the **solidification of magma and lava**. (40<sup>th</sup> BPSC, 1995)
- Igneous rocks are also known as **Primary Rocks**.
- Examples of Igneous rocks are **basalt, granite, pegmatite, diorite and gabbro**. (UK PCS, 2006)

- Igneous rocks are rigid and do not contain any fossils.
- Igneous rocks consist of magnetic iron, nickel, copper, lead, zinc, chromite, manganese, gold and platinum.

(40<sup>th</sup> BPSC, 1995)

**(ii) Sedimentary Rocks-** These are formed as layers of sediments caused by erosion of rocks.

- The sedimentary rocks are flaky.
- Sandstone, conglomerate, silt, loess, coal and loess are examples of sedimentary rocks. (MPPCS, 1993)
- Fossils of flora and fauna are found in sedimentary rocks.
- Iron ore, phosphate, coal and cement forming rocks are found in them.
- Mineral oil is also found in sedimentary rocks.

**(iii) Metamorphic Rocks-** Because of chemical reactions, temperatures, pressures, sedimentary rocks undergo change transforming themselves into metamorphic rocks.

- Examples of metamorphic rocks are Slate, Schist, Quartzite, Marble, Phyllite and Gneiss.
- There are three kinds of rock: igneous, sedimentary, and metamorphic. Igneous rocks form when molten rock (magma or lava) cools and solidifies. Sedimentary rocks originate when particles settle out of water or air, or by precipitation of minerals from water. They accumulate in layers.
- Transformation of various basic rocks takes the following forms :

| Transformation of the Rocks |                   |
|-----------------------------|-------------------|
| Basic Sedimentary Rocks     | Metamorphic Rocks |
| Sand stone                  | Quartzite         |
| Lime stone                  | Marble            |
| Shale                       | Slate             |
| Slate                       | Phyllite          |
| Coal                        | Diamond           |

### Various Topographies

- Various types of topographies have been created on the surface caused by the **endogenous** and **exogenous forces** of the Earth.
- Based on structure, topography is mainly divided into mountains, plateaus and plains.

#### (A) Mountains:

- Mountain is a landform that rises prominently above its surroundings, exhibiting steep slopes, a relatively confined summit area, considerable local reliefs.

- Mountains are of four types based on structure-

#### (i) Block Mountains

- Block Mountains are those formed as a result of faulting caused by **tensile** and **compressive forces** generated by endogenic forces.
- The strain causes cracks or crevices due to which some parts get elevated while some parts of the surface sink.
- The **elevated part** of the mountain is called the **Block Mountain** and the **sunk portion** (lowland region) in the middle is called the **Rift Valley**.
- The Vosges Mountains (France), Black Forest (Germany) and Salt Range (Pakistan) are the prime examples of Block Mountains.

➤ **Note :** The **Sierra Nevada** Mountains of California (USA) are the **most extensive Block Mountains** in the world.

- The **Jordan River Valley** is the **longest rift valley** in the world extending from the basin of the Red Sea to the Zambezi River (approx. 4800 km).

#### (ii) Residual Mountain

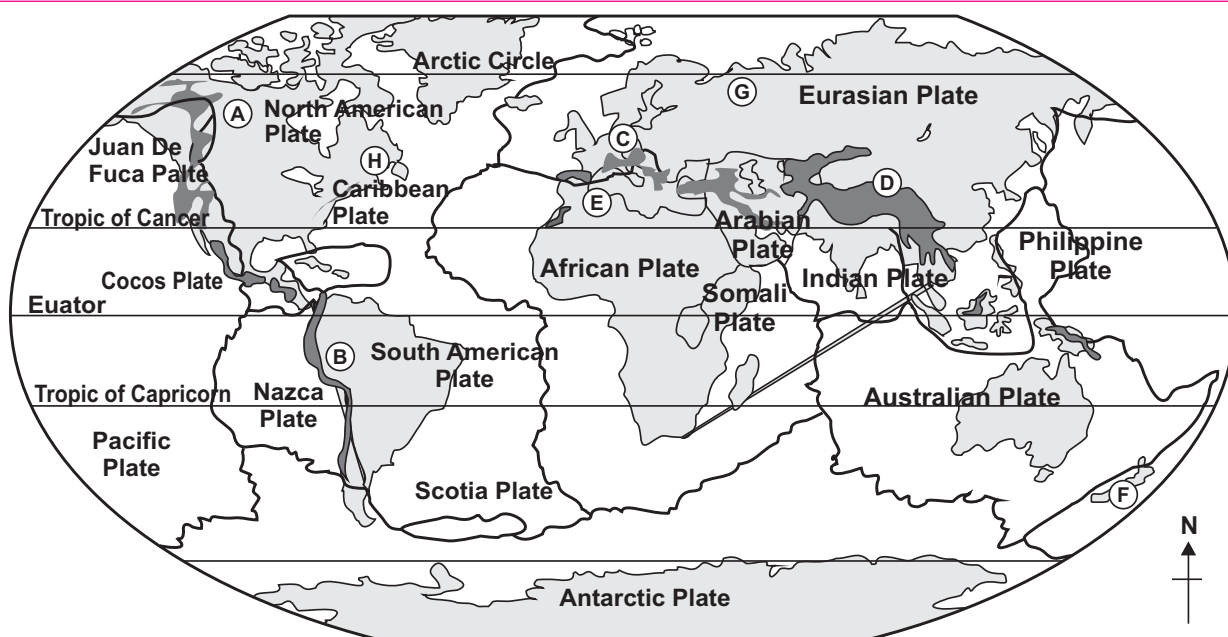
- Residual mountains are those which have been formed by the erosion of hard rock caused by wind, rain, frost and running water.
- Vindhya, Nilgiri, Parasnath, Rajmahal Hills of India and the Sierras of Central Spain and Mesas of USA are some examples of Residual Mountains.

#### (iii) Accumulated Mountain

- The mountains formed out of the accumulation of **volcanic materials, pebbles, stones, sands and clays** are called Volcanic Mountains or Mountains of Accumulation.
- **Sand dunes or hills of sand** that are shaped by winds as they blow across deserts are examples of Mountains of Accumulation.

#### (iv) Fold Mountain

- Fold mountains are created where two or more of **Earth's tectonic plates are pushed together**.
- Fold mountains are also known as **wave-like mountain**.
- Numerous anticlinal and synclinal folds are found in the fold mountains.
- The distributional pattern of fold mountains across the globe shows that they are generally found along the margins of the continents either in north-south or east-west direction.
- The **Himalayas in India, the Urals in Russia, the Rockies in North America** and the **Andes in South America** are examples of fold mountains.



A. Rocky Mountains

B. Andes Mountains

C. Alps

D. Himalayas

E. Atlas Mountains

F. Southern Alps

G. Ural Mountains

H. Appalachian Mountains

- The **Aravalli Range**, an eroded stub of ancient mountains, is the **oldest range of fold mountains in India**.
- **Guru Shikhar**, a peak in Mount Abu in Rajasthan, is the highest point of the Aravalli range.
- Aravalli range is also an example of residual mountains.
- The structure of the fold mountain is based on the plate tectonic theory which was propounded by **McKenzie, Parker and Morgan** in 1967.
- The seafloor spreading hypothesis is related to geophysicist Harry H. Hess.
- The Himalayas consist of parts of the Tethys Sea.
- Based on plate tectonic theory, it is believed that today where the Himalayan mountains are located; there was once a vast Tethys Sea. Northward displacement of the southern plateau pushed the base of the **Tethys Sea** which resulted in the formation of the Himalayas.
- The **world's longest above-water mountain range is the Andes**, about 7200 km long.

(MPPCS, 2012; UK PCS, 2006; 41<sup>st</sup> BPSC, 2006)

- **Drakensberg mountain range** is the **highest mountain range in Southern Africa**, with peaks that rise up to 3,482 metres.
- The **Pyrenees mountains** form the natural land border between **Spain and France**.
- **Mount McKinley** (also known as Denali) is the highest mountain in the **North American** continent.

- The **Black Mountains** and the **White Mountains** are located in the **United States of America**.
- The Great Himalayas mountain range is the world's highest mountain range and home to the planet's highest Mountain peaks with **Mount Everest** being the **highest peak in the world**.
- **British Columbia** is called the **Sea of Mountains**.

(UPPCS, 2015)

### Major Mountain Ranges of the World

| Name                            | Location           | Highest Point       |
|---------------------------------|--------------------|---------------------|
| 1. Cordillera de Los Andes      | South-West America | Aconcagua           |
| 2. Rocky Mountain Range         | North-West         | Mount Albert        |
| 3. Himalaya-Karakoram-Hindukush | South-Central Asia | Mount Everest       |
| 4. Great Dividing Range         | East Australia     | Kosciuszko          |
| 5. Trans Antarctica Mountains   | Antarctica         | Vinson Massif       |
| 6. Tien Shan                    | South Central Asia | Pik Pobedy          |
| 7. Altai Mountains              | Central Asia       | Belukha             |
| 8. Ural Mountain Range          | Central Russia     | Narodnaya           |
| 9. Kamchatka Range              | East Russia        | Klyuchevskaya Sopka |



|                                 |                    |                         |
|---------------------------------|--------------------|-------------------------|
| 10. Atlas Mountain              | North-West Africa  | Toubkal                 |
| 11. Verkhoyansk Range           | East Russia        | Mus-Khaya               |
| 12. Western Ghats               | Western India      | Anamudi                 |
| 13. Sierra Madre Oriental       | Mexico             | Potosi                  |
| 14. Zagros Mountain Range       | Iran               | Dena (Qash-Mastan)      |
| 15. Elburz                      | Iran               | Damavand                |
| 16. Scandinavian Range          | Western Norway     | Galdhopiggen            |
| 17. Drakensberg                 | South Africa       | Thabana Ntlenyana       |
| 18. Caucasus                    | Russia Elbrus      |                         |
| 19. Alaska Range                | USA (South Peak)   | Mount McKinley (Denali) |
| 20. Cascade Range               | USA-Canada         | Mount Rainier           |
| 21. Apennine                    | Italy              | Corno Grande            |
| 22. Appalachian                 | Eastern USA-Canada | Mount Mitchell          |
| 23. Alps                        | Central Europe     | Mont Blanc              |
| 24. Sierra Madre del Sur Mexico | Cerro Nube         |                         |

## B. Plateaus

- A plateau is that part of the land which is more or less flat and level and stays at an elevated level. It often comes with its steep slopes or vertical cliffs on one or more sides.
- Their height generally varies between 300 to 500 metres.
- The **Plateau of Pamir** is called the **roof of the world**.
- The **Plateau of Patagonia** (South America) is called the **reservoir of minerals**. (RAS/RTS, 2010)
- Different categories of plateau are as follows - Piedmont Plateau, Inter-mountain Plateau, Domed Plateau, Coastal Plateau, Continental Plateau, Glacial Plateau, Fluvial Plateau, Aeolian Plateau and Volcanic Plateau.
- The flatness of the mountains or the elevation in the middle of the plain is called **Mountainous Plateau** or **Piedmont Plateau**.
- The Piedmont Plateau of the United States and the Patagonia Plateau of South America are prime examples of the mountainous plateau.
- The plateau formed in the mountain ranges is called the **Inter-Montane Plateau**.
- The Bolivian and the Peruvian plateaus are prime examples of the inter-mountain plateau.
- The fold plateaus are formed by folding action on the terrain.
- **Chotanagpur and Ramgarh** plateau in India and the Ozark plateau in the United States are prime examples of the **domed plateau**.
- The plateau situated on the coastal part of the sea is called the **coastal plateau**.

- Infinite deposits of lavas raise the level of the surface causing coastal plateau to be formed.
- The coastal plateau is also known as **shield**. (MPPCS, 1996)
- The Canadian Shield, Brazilian Shield, Siberian Shield, Baltic or Fenno Scandian Shield are the prime examples of the coastal plateau.
- A Glacial plateau is formed by the erosion process undergoing extensive glacial mountains.
- The Prussian Plateau in Germany is the prime example of the glacial plateau.
- The fluvial plateau is formed both by the sedimentary action caused due to deposits by the river and the vertical movement of Earth.
- The Vindhya Plateau and the Shillong Plateau in India and the Shan Plateau in Myanmar are examples of fluvial Plateau.
- The Potawar Plateau in Pakistan and the Loess Plateau in China are prime examples of Aeolian Plateau.
- The Volcanic Plateau is formed due to the eruption of the volcanoes.
- Volcanic Plateaus are found in New Zealand, South Africa, Northern and Southern Argentina, Brazil, Western United States, France and Siberia.
- The Columbian Plateau of the United States is an example of a volcanic plateau.

## Plains:

- Plains are broad, nearly level stretches of land that have no significant changes in the level of elevation. Plains are generally at a lower level than the land around them.
- Plains are of two types: the **erosional plain** and the **depositional plain**.
- (i) **Erosional Plains**- Erosional plains are formed on the Earth's surface caused by denudation by water run-off, rivers, winds and glaciers wear out the rugged surface and smoothen them.
- The following are the types of erosional plains-
- (a) **Loess Plains**- Loess plains are formed by the deposits of soil and sand, etc. brought by the winds.
- (b) **Desert Plains**- The plains where sand accumulates in large quantities are desert plains and are developed by wind action.
- (c) **Glacial Plains**- These are formed by the movement of ice from highlands to low lands.
- (d) **Karst Plains**- The Karst plains are formed by dissolution of water with limestone in rocky regions.
- (e) **Penplains**- A penplain (almost a plain) is a low-relief plain which is formed as a result of erosional cycle.
- (ii) **Depositional Plains**- The depositional plain is an erosional plain that is formed by the deposits brought by rivers, winds, glaciers and waves.

- The depositional plain is also known as **alluvial plain** and **delta plain**.
- The Ganges-Sutlej, Mississippi and the Hwang Ho Plains are examples of depositional plains.

### External Factors that bring changes on the surface and the consequent topography

| Factors         | Erosional Landforms                                                                                                                        | Depositional Landforms                                                                                             |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| 1. River        | V-shaped valley, gorge, canyon, waterfall, River estuary/Meander, River terrace.                                                           | Delta, alluvial fan, alluvial cone, floodplains, natural embankments.                                              |
| 2. Ground Water | Doline, Polje, Uvala, lapies, Ponores, natural bridge, Blindvalley, Karst/solution valley, sinking creek.                                  | Stalactite, Stalagmite, Cave pillar, Dripstone, Globulite, Helictite, heligmites, drapes or curtains, flow stones. |
| 3. Sea Water    | Coastal clips, grooves, coastal caves, cisterns, natural chimney or vault holes natural arches, stacks, arched altars, miniature cisterns. | Pulin / Beach, Tombolo, Spit, Coastal barrier, Barrier island, Ringed barrier.                                     |
| 4. Glacier      | Cirque, Tarn, U-shaped valley, Horn, Arete, Fjord, Roche, Terminus.                                                                        | Drumlin, Kame, Esker, Kettle, Moraine.                                                                             |
| 5. Wind         | Deflation hollows, Piedmonts mushroom rock, Yardang, Zeugen, Dreikanter, Stone Lattice, Wind Bridges.                                      | Loess, dunes, Barchans, Bajada, Sand dunes.                                                                        |

#### Grasslands:

- Grasslands are found in the region extending from the equator to the poles.
- The grasslands are divided into two categories based on the nature of the grass :

##### (i) Tropical Grasslands

- The equatorial region between north and south latitudes at 10 to 25 degrees has extensions of tropical grasslands.
- These grasslands are called **Savannah** in Africa, **Llanos** in Venezuela and Colombia, **Campos** in Brazil, Paraguay, Argentina and Uruguay, **Parkland** in North America and **Selvas** in the Amazon Basin. (UPPCS, 2012, 2018, 1993, 2011)
- Tropical rainforests, located in Amazon Basica, is called selvas. (MPPCS, 1997)

##### (ii) Temperate grasslands

- Temperate grasslands are found in central regions between latitudes at 30 to 45 degrees **North and South**.
- Due to the high terrestrial expansion in the Northern Hemisphere, the expansion of these plains is found somewhere up to 50° North latitude.

- These grasslands are called the **Prairie** in the United States and Canada, the **Pampas** in Argentina, Uruguay and Brazil, **Veld** in South Africa, **Steppes** in Eurasia and the **Downs** in Australia. (UPPCS, 2002, 2012)

### 5. Continents and Major Peninsulas

- Seven continents together constitute the Earth.
- These are- 1. Asia, 2. Europe, 3. North America, 4. South America, 5. Africa, 6. Australia and 7. Antarctica.

#### Asian Continent

- The word Asia is derived from the Hebrew word 'Asu'.
- The meaning of Asia is '**Rising Sun**'.
- The Asian continent is known as '**The Mainland of All Religions**'.
- Asia is the largest continent in the world. (UPPCS, 1992, 2017)

- It has approximately **29.9 per cent of the Earth's land area**.
- It is also the world's most populous continent residing in it with roughly 60 per cent of the total population.
- Its area is **44568,500 square kilometres**.
- Three major latitudinal circles (Equator, Cancer and Arctic) pass through it.
- Asia makes up the eastern part of the Eurasian supercontinent; Europe occupies the western part.
- The border between the two continents is unclear and debatable. However, most geographers define Asia's western border following the line that runs along the Ural Mountains, the Caucasus Mountains, and the Caspian sea and the Black Sea.
- The Arctic borders Asia in the North, the Pacific in the East and the Indian Ocean in the South.
- The **Red Sea and the Suez Canal** separate Asia and Africa.
- The **Bering Strait** separate Asia and North America.
- **Gondwana Land** (Peninsular India) and **Angara Land** (Russia and China) of the ancient era, are located in Asia.
- The **Arabian peninsula**, **Deccan peninsula** and **Indo-China peninsula** are the three significant peninsulas in Asia.
- Russia is the biggest country in Asia in terms of area.
- Maldives is the smallest country in Asia in terms of area.
- According to UNO, India is the biggest country in Asia and the world in terms of population. Earlier, China had this status. (UPPCS, 2015 Mains)
- The **largest peninsula** in the world is the **Arabian peninsula**.
- The **world's highest plateau** in Asia is the **Tibetan Plateau** (average elevation 4500 m).
- The **Tibetan Plateau (25 lakh sq km)** in Central Asia is the **most extensive in the world**.

- **Singapore** is the **most densely populated country in the world** (**World Population Prospects Report, 2022**).
  - **Java** is the **most densely populated island in Asia**.
  - A landlocked country is surrounded by land and does not have an opening to ocean or sea. There are currently 45 landlocked countries in the world.
  - **Landlocked countries of Asia** are- Nepal, Bhutan, Mongolia, Laos, Armenia, Azerbaijan, Kyrgyzstan, Turkmenistan, Afghanistan, Kazakhstan, Tajikistan and Uzbekistan.
  - **Kazakhstan** is the **largest landlocked country in Asia**.
  - Laos is the only landlocked country in south-east Asia.
  - The average depth of the **Dead Sea** in Asia is **120 metres**. It is the **deepest lake in the world**.
  - The **world's deepest oceanic trench** with a depth of 11033 mtrs, the **Mariana trench**, is located in Asia, near the Philippines Island.
  - The Asian part of Russia is called Siberia where **Lake Baikal** is located.
  - The **longest river in Asia** is the **Yangtze**.
  - Bangladesh has around 700 rivers and tributaries, which cover a total length of over 24000 km.
  - The **Baikal Lake** in Asia is the **world's oldest and deepest** (depth 1620 m) **lake**.
  - The **Caspian Sea** (374000 square kilometres) is the world's largest lake (the inland water body) located in Asia.
- 🔍 **Note :** The Caspian Sea is a landlocked body of water between Europe and Asia. Baikal Lake is the largest lake in Asia after the Caspian Sea.
- In Ladakh and Tibet, **Pangong Lake** is situated at the height of almost 4,350m, is the **world's highest salt water lake**.
  - In Asia, 90% of the rainfall comes from summer monsoon.
  - India's Mawsynram in Meghalaya has the highest average rainfall per year which is the highest in the world.
  - **Aden** (Yemen) in Asia is the **driest place on the Earth**.
  - In Asia, the **Qinghai-Tibet (Lhasa) Rail Track of China** is the **highest (height 5072 m) railway track in the world**.
  - Indian Railway is building the world's highest railway line at a height of 5,360 meters above **sea level**, the 465 km Bilaspur - Kullu Manali - Leh broad-gauge line.
  - Rivers Mekong, Irrawaddy, Salween, Indus, Brahmaputra and Ganges, etc. flow into the Indian Ocean.
  - Syr Darya-Amu Darya flows into the **Aral Sea** and forms Aral Sea Basin.
  - Yenisei, Lena and the Ob are the main rivers of Asia flowing into the **Arctic Ocean**.
  - The **Mekong River** is called the **Danube and the Ganges of Southeast Asia**.
  - China is the **world's top** fishing nation.
  - **India** has the **highest number of post offices in the world**.
  - The major rivers of Asia flowing into the Pacific Ocean are **Huang Ho, Yangtze** (Chang River) and the **Mekong**.
  - The plains of Asia's rivers are known as the **Cradle of Civilization**.
  - The countries with the Mediterranean **climate** in Asia are Turkey, Israel, Jordan, Cyprus and Lebanon.
  - **China** is the largest **producer** of tobacco, wheat, rice and tea in the world (FAO 2022).
  - **Thailand** is the **world's most natural rubber producing country** (FAO 2022).
  - India is the largest sugarcane **producing country** in Asia (FAO : 2022).
  - The most arable land in **Asia is in India**.
  - According to the International Sericulture Commission, **China** was the **largest producer of silk in the world** in 2022(P) followed by **India**.
  - **China** is the **world's largest shipbuilder** in terms of gross tonnage. (UNCTAD 2022)
  - The **Nagasaki City** in **Japan** is located on the **island of Kyushu**.
  - The **Trans Siberian Railroad** from **St. Petersburg (Leningrad) to Vladivostok** is the **largest** (9332 km) **rail route in Asia**. (NCERT, 2023-24)
  - **Japan's Seikan Rail Tunnel Length (53.85km)** is **Asia's longest and deepest rail tunnel** in the world.
  - The **longest platform in the world** is in Gorakhpur (UP) in India.
  - **China** is the **largest tin producing** country in Asia. (International Tin Association).
  - The **Suez Canal connects the Red Sea and the Mediterranean Sea**.
  - **Verkhoyansk** in Siberia is **Asia's coldest (- 67.8°C)** place.
  - **Mitribah, Kuwait** is the hottest place in Asia (**WMO - 21 July, 2016**).
  - The **Bering Strait** is located in the **middle of Alaska** and the **Kamchatka Peninsula**.
  - The strait connecting the Arctic Ocean and the Pacific Ocean is the **Bering Strait**.
  - The Bering Strait is located parallel to the International Date Line.
  - Myanmar is **famous for its beautiful Buddhist temples**.
  - Laos - Thailand - Myanmar are known as the **Golden Triangle**.
  - Pakistan has the highest number of canals in the world under irrigation.
  - Russia and Turkey are two countries each of whom shares two continents, Asia and Europe.

- **Bhutan** is known as the **Land of Thunderbolt**.
- **Myanmar** is called the **country of the Golden Pagoda**.
- **Japan** is called the **country of sunrise**.
- **China** is called the **world's rice bowl**.
- **Lebanon** is called **Switzerland of the East** or the **Middle East**.

| Currency and Capital of Major Countries or Regions of the Continent of Asia. |                   |                                                      |
|------------------------------------------------------------------------------|-------------------|------------------------------------------------------|
| Country                                                                      | Currency          | Capital                                              |
| 1. Singapore                                                                 | Dollar            | Singapore                                            |
| 2. Hong Kong                                                                 | Dollar            | Victoria                                             |
| 3. Brunei                                                                    | Dollar            | Bandar Seri Begawan                                  |
| 4. Guam                                                                      | Dollar            | Hagatna                                              |
| 5. Taiwan                                                                    | Dollar            | Taipei                                               |
| 6. Syria                                                                     | Pound             | Damascus                                             |
| 7. Cyprus                                                                    | Euro              | Nicosia                                              |
| 8. Iraq                                                                      | Iraqi Dinar       | Baghdad                                              |
| 9. Kuwait                                                                    | Kuwaiti Dinar     | Kuwait City                                          |
| 10. Jordan                                                                   | Jordanian Dinar   | Amman                                                |
| 11. Bahrain                                                                  | Bahraini Dinar    | Manama                                               |
| 12. Oman                                                                     | Omani Riyal       | Muscat                                               |
| 13. Qatar                                                                    | Qatari Riyal      | Doha                                                 |
| 14. Cambodia                                                                 | Combodian Riel    | Phnom Penh                                           |
| 15. Yemen                                                                    | Yemeni Rial       | Sana'a                                               |
| 16. Saudi Arabia                                                             | Saudi Riyal       | Riyadh                                               |
| 17. India                                                                    | Indian Rupee      | New Delhi                                            |
| 18. Nepal                                                                    | Nepali Rupee      | Kathmandu                                            |
| 19. Pakistan                                                                 | Pakistani Rupee   | Islamabad                                            |
| 20. Sri Lanka                                                                | Sri Lankan Rupee  | Colombo (Sri Jayawardenepura as legislative capital) |
| 21. Maldives                                                                 | Maldivian Rufiyaa | Male                                                 |
| 22. Indonesia                                                                | Indonesian Rupiah | Jakarta                                              |
| 23. North Korea                                                              | North Korean Won  | Pyongyang                                            |
| 24. South Korea                                                              | South Korean Won  | Seoul                                                |
| 25. Kyrgyzstan                                                               | Kyrgyzstani Som   | Bishkek                                              |
| 26. Uzbekistan                                                               | Uzbekistani Som   | Tashkent                                             |
| 27. Israel                                                                   | New Shekel        | Jerusalem                                            |
| 28. Afghanistan                                                              | Afghani           | Kabul                                                |
| 29. Kazakhstan                                                               | Tenge             | Nur-Sultan                                           |
| 30. China                                                                    | Yuan              | Beijing                                              |
| 31. Japan                                                                    | Yen               | Tokyo                                                |
| 32. Turkiye                                                                  | Lira              | Ankara                                               |

|                  |          |              |
|------------------|----------|--------------|
| 33. Turkmenistan | Manat    | Ashgabat     |
| 34. Tajikistan   | Somoni   | Dushanbe     |
| 35. Bangladesh   | Taka     | Dhaka        |
| 36. Bhutan       | Ngultrum | Thimphu      |
| 37. Myanmar      | Kyat     | Naypyidaw    |
| 38. Malaysia     | Ringgit  | Kuala Lumpur |
| 39. Mongolia     | Togrog   | Ulaanbaatar  |
| 40. Laos         | Lao kip  | Vientiane    |
| 41. Vietnam      | Dong     | Hanoi        |
| 42. UAE          | Dirham   | Abu Dhabi    |
| 43. Macau        | Pataca   | Macau        |
| 44. Philippines  | Peso     | Manila       |

| Currencies and Capitals of Major Countries of Oceania |          |              |
|-------------------------------------------------------|----------|--------------|
| Country                                               | Currency | Capital      |
| 1. Fiji                                               | Dollar   | Suva         |
| 2. New Zealand                                        | Dollar   | Wellington   |
| 3. Nauru                                              | Dollar   | Yaren        |
| 4. Australia                                          | Dollar   | Canberra     |
| 5. Tuvalu                                             | Dollar   | Funafuti     |
| 6. Micronesia                                         | Dollar   | Palikir      |
| 7. Solomon Islands                                    | Dollar   | Honiara      |
| 8. Marshall Islands                                   | Dollar   | Majuro       |
| 9. Kiribati                                           | Dollar   | Tarawa       |
| 10. Palau                                             | Dollar   | Ngerulmud    |
| 11. Tonga                                             | Pa'anga  | Nuku'alofa   |
| 12. Vanuatu                                           | Vatu     | Port Vila    |
| 13. Papua New Guinea                                  | Kina     | Port Moresby |
| 14. Samoa                                             | Tala     | Apia         |

#### European Continent :

- Europe is the sixth among the seven continents in terms of area.
- The total area of this continent is about **9948000** (6.68% of the world's area) sq. km.
- The **Caucasus** and the **Ural Mountains** separate Asia and the Europe.
- Europe is surrounded by the **Mediterranean Sea**, the **Black Sea** in the south, the **Arctic Sea** in the north and the **Atlantic Ocean** in the west.
- Europe is the **most urbanised continent** in the world.
- There are **49 countries** in Europe. **Traditionally** there are 44 countries in Europe because some of the countries are spread in both Europe and Asia. e.g. Azerbaijan, Russia.



- Europe is known as a **peninsula among peninsulas**.
- **Scandinavia, Iberian, Balkans and Apennine** are among the **largest peninsulas in Europe**.
- The British Isles and Iceland are the largest among the islands in Europe.
- Europe is smaller than all other continents except Australia in terms of area.
- **Paris**, the capital of France, is located on the banks of the **Seine river**.
- **Paris** is also known as the **city of fashion**.
- **Paris** is considered a **beautiful city in the world**.
- Northern Ireland and the Irish Republic are known as Emerald Islands, because of the abundance of grass here.
- **London** is the **largest city in Europe**.
- The largest museum in the world is the **British Museum (London)**.
- **London** is located on the banks of the **River Thames**.
- The **longest river in Europe** is the **Volga** (3645 km).
- The **Volga** and **Ural** rivers **flow** into the **Caspian Sea**.
- The Danube (2888 Km) is the most important river in Europe.
- It flows through Germany, Hungary, Croatia, Serbia, Moldova, Slovakia, Bulgaria, Romania, Austria and Ukraine.
- The capitals falling on the banks of the Danube are **Vienna (Austria), Bratislava (Slovakia), Belgrade (Serbia) and Budapest (Hungary)**.
- The Danube falls into the **Black Sea** near the Ukraine border.
- Alps (France) and the Caucasus are prominent among the new fold mountains in Europe.
- **Elbrus** (5633 m) is the **highest mountain peak in Europe**.
- **Mount Blanc** (France) is the **highest peak in the Alps Mountains**.
- Mount Blanc is located on the **border of France and Italy**.
- The Seine River (France) **falls** into the **English Channel (Le Havre)**.
- **Po River** is known as the **Ganges of Italy**.
- **Venice (Italy)** is known as the **Queen of the Adriatic**.
- **Etna** and **Stromboli** in **Italy** are **active volcanoes**.
- **Vesuvius** is an **active volcano** located in Naples, **Italy**. Earlier, it was a **dormant volcano**.
- **Rome** is known as the **Eternal City**.
- Ukraine shares the border with seven other countries: Poland, Slovakia, Hungary, Romania, Moldova, Russia, and Belarus.
- **Ukraine** is called the **world's granary or breadbasket**.
- The **Rhine River** waterway is Europe's busiest interstate waterway.
- **Finland** is called the **country of lakes**.(UPPCS, Mains 2012)
- Denmark is the largest centre of dairy products in the world.
- **Copenhagen**, the capital of Denmark, is known as the **key to the Baltic Sea**.
- The Harz Mountains and the Black Forest are the rift mountains of Europe.
- The Oriental rail route from Paris in France to Constantinople in Turkiye is the most crucial in Europe.
- The lowest natural depression of Europe is the Caspian Sea.
- In Europe, Russia is the largest country in the world in terms of area.
- **Norway** is called the **country of the midnight sun**.  
(UPPCS Pre, 1990)
- The world's champagne wine is produced on large scale in France.
- **France** is called the **Country of the Peasants and the Queen of the Seas**.
- Italy is called as India of Europe.
- The landlocked countries in Europe are Hungary, Austria, Switzerland, Czech Republic, Slovakia, Luxemburg, Serbia, Andorra, Macedonia, Moldova, San Marino, Belarus, Liechtenstein and Kosovo.
- Belgium, Netherlands and Luxembourg are countries included in the Benelux Nations.
- The European Union (EU) has 27 member countries.
- Geothermal energy is the primary source of power in Iceland.
- The temperate grasslands of Europe are also called Pustaz in Hungary and Steppe in Ukraine.
- The combined territory of **Europe** and **Asia** is called Eurasia.
- Great Saint Bernard Pass connects the route between Italy and Switzerland.
- Brenner Pass connects route between Italy and Austria.
- London first opened an underground railway in 1863, which is now the world's fourth longest underground railway.
- **Antwerp (Belgium)** is the world's largest diamond trading centre.
- The countries belonging to the Caucasus State are Russia, Azerbaijan, Georgia and Armenia.
- The port of the five seas is called Moscow (Caspian Sea, Black Sea, Baltic Sea, White Sea and Ladoga Lake).
- Eastern Europe is called Green Europe or farmer's Europe.
- The primary food crop in Europe is wheat.
- Hungary is called the storehouse of wheat.
- Beetroot is the major source of sugar in Europe.
- Almost 70% of the **world's beetroot** is produced in Europe.
- **France** is called **mini Europe** in terms of climate and land.

- Norway is known as the country of the **fjords coasts** and **France as the wine yard**.
- The **English Channel** separates the **United Kingdom** and **France**.
- **Switzerland** is called the **Playground of Europe**.
- The largest expanse of the Alps mountain is in Switzerland.
- The Gulf Stream is called the **Warm Blanket of Europe**.
- The international border between Poland and Germany is called Hindenburg Line.
- The international border between **Germany** and **France** is called the **Maginot Line**.
- The channel tunnel connecting **France** and the **United Kingdom** passes through the **Dover Strait**.
- The **International Seed Reserve** is located in the Svalbard Island of Norway.
- France is the only self-reliant country in Europe regarding food grain production.
- **England**, **Wales** and **Scotland** are collectively called **Great Britain**.
- The **United Kingdom** includes **Great Britain** and **Northern Ireland**.
- A beach built along the coast of the North Sea in the Netherlands is called Dykes.
- The Meseta plateau is shared by Spain and Portugal.
- Madrid, capital of Spain, is located on the Meseta Plateau.
- **Portugal** and **Spain** together form the **Iberian Peninsula**.
- Land reclaimed from the sea in Netherlands by building embankment in the Netherlands is called **Polder**.

### Currencies and the Capitals of Major Countries of Europe

| Country         | Currency      | Capital    |
|-----------------|---------------|------------|
| Luxembourg      | Euro          | Luxembourg |
| Belgium         | Euro          | Brussels   |
| France          | Euro          | Paris      |
| Switzerland     | Franc         | Bern       |
| Ireland         | Euro          | Dublin     |
| Malta           | Euro          | Valletta   |
| United Kingdom  | Pound         | London     |
| Latvia          | Euro          | Riga       |
| Russia          | Ruble         | Moscow     |
| Armenia         | Armenian Dram | Yerevan    |
| Belarus         | Ruble         | Minsk      |
| North Macedonia | Denar         | Skopje     |
| Serbia          | Dinar         | Belgrade   |

|                    |             |                     |
|--------------------|-------------|---------------------|
| Slovenia           | Euro        | Ljubljana           |
| Bosnia-Herzegovina | Convertible | Sarajevo Mark (BAM) |
| Croatia            | Kuna        | Zagreb              |
| Denmark            | Krone       | Copenhagen          |
| Norway             | Krone       | Oslo                |
| Sweden             | Krona       | Stockholm           |
| Iceland            | Krona       | Reykjavik           |
| San Marino         | Euro        | San Marino          |
| Italy              | Euro        | Rome                |
| Spain              | Euro        | Madrid              |
| Portugal           | Euro        | Lisbon              |
| Germany            | Euro        | Berlin              |
| Greece             | Euro        | Athens              |
| Lithuania          | Euro        | Vilnius             |
| Finland            | Euro        | Helsinki            |
| Netherlands        | Euro        | Amsterdam           |
| Austria            | Euro        | Vienna              |
| Bulgaria           | Lev         | Sofia               |
| Poland             | Zloty       | Warsaw              |
| Hungary            | Forint      | Budapest            |
| Ukraine            | Hryvnia     | Kiev                |
| Czech Republic     | Koruna      | Prague              |
| Romania            | Leu         | Bucharest           |
| Azerbaijan         | Manat       | Baku                |
| Georgia            | Lari        | Tbilisi             |
| Albania            | Lek         | Tirana              |
| Slovak Republic    | Euro        | Bratislava          |

- Livre was a unit of currency in France, discontinued in 1794. From 1781 to 1794, the livre served as France's money unit.

### North American Continent

- In terms of size, North America is the third largest continent (area **24,473,000 Sq. km**) of the world.
- **Greenland** is the largest island in North America.
- North America comprises **16.44%** of the world's territorial area.
- The earliest landmass of **North America** is the Canadian (Laurentian) shield.
- There are a total of **23 countries in North America**.
- **100 degrees west** longitude passes through the middle of North America.

- America (1507 AD) is named after Amerigo, the Italian explorer who travelled after Christopher Columbus.
- Amerigo called it 'New World'.
- Red Indian, Eskimo and Inuit are natives of North America.
- **Mount Denali (Mount McKinley)** (height 6190 meters) in Alaska is the **highest mountain peak in North America**.
- The cyclone which occurs in the Gulf of Mexico is called **Hurricane** and **Tornado**.
- **Akron**, the world's largest synthetic rubber and tyre manufacturing centre is located in the United States.
- **Detroit** is the major centre of automobiles in the United States.
- **Montreal** (Canada) is famous in the world for its paper industry.
- Canada ranks first in **newsprint** production in the world (FAO: 2022).
- Canada is the third largest uranium producer from mines in the world.
- **Hudson Bay** (Canada) is the **largest Bay in the world**.
- The **city of Uranium** is located on the shores of **Lake Athabasca, Canada**.
- The Sullivan mine in British Columbia (Canada) is the world's largest lead and zinc mine.
- The United States is the world's largest maize producing country (FAO: 2022).
- **Winnipeg (Canada)** is a world-famous city also known as the **wheat market**.
- The world-famous corn market is located in the city of **St. Louis**, United States.
- The city of **Arizona** in the United States is famous for copper production.
- **Silicon Valley** (San Francisco) is famous for the software and computer industry.
- The United States is the world's largest producer of soybean.
- **Cuba** is called the **sugar bowl** of the world being the major producer of sugarcane.
- Jamaica is famous for banana production.
- **Coca-Cola** was invented in the **city of Atlanta (Georgia, U.S.)**.
- **New York** is called the **City of Cities**.
- Mexico coast is the most ideal place for coffee cultivation.
- **Butte Mine**, the largest copper mine in the world, is located in the State of Montana, United States.
- Mexico is the **largest silver producing** country in the world.
- **Wood Buffalo National Park** is located in Canada.
- The world's largest railway station (based on the number of platforms) **Grand Central Terminal** is located in New York City, USA.
- The **Great Salt Lake** in the State of Utah, United States is the largest saltwater lake in the western hemisphere.
- There are 5 largest natural lakes in North America - **Superior, Huron, Michigan, Erie and Ontario**.
- Superior Lake is the **largest of the world's freshwater lakes** by surface area and by volume it is third, next to Baikal and Tanganyika Lake.
- **Niagara Falls** is located on the border of Canada and the United States.
- Philadelphia is famous as **Quaker City**.
- The Great Lakes St. Lawrence River waterway is the longest inland deep-draft navigation system in the world.
- The **Mexico** and **Colorado plateaus** are the two inter-mountain plateaus in North America.
- **San Diego** is also known as the **City of Evergreen Spring Season**.
- **Los Angeles** (California) is noted for the **film industry**.
- The major mountain ranges of Rocky mountain are Cascade, Sierra Nevada, Coast Range and the Sierra Madre.
- The world's first park is Yellow Stone Park, located in the United States.
- **Ontario** is the world's largest gold mine located in Canada.
- The Homestake Mine is a famous gold mine in the United States.
- Mesabi Mine is the famous iron ore mine in the United States.
- Panama and Colon are the two ports located on the Panama Canal.
- The hills located in the United States are Blue Hill, Black Hill and Green Hill.
- **Quebec in Canada** is called a **Country within the Country**.
- Mexico City is **the largest city in North America** by population.
- The Death Valley of Southern California is a rift or graben valley.
- Its temperature varies from 55°-57°C in summer.

#### Currencies and Capitals of North America and Caribbean Countries

| Country                          | Currency | Capital    |
|----------------------------------|----------|------------|
| Canada                           | Dollar   | Ottawa     |
| Saint Vincent and the Grenadines | Dollar   | Kingstown  |
| Bermuda                          | Dollar   | Hamilton   |
| Bahamas                          | Dollar   | Nassau     |
| Jamaica                          | Dollar   | Kingston   |
| Barbados                         | Dollar   | Bridgetown |

|                     |         |                |
|---------------------|---------|----------------|
| Belize              | Dollar  | Belmopan       |
| Grenada             | Dollar  | Saint George   |
| Cuba                | Peso    | Havana         |
| Dominion Republic   | Peso    | Santo Domingo  |
| Mexico              | Peso    | Mexico City    |
| Costa Rica          | Colon   | San Jose       |
| El Salvadore        | Dollar  | San Salvador   |
| Guatemala           | Quetzal | Guatemala City |
| Nicaragua           | Cardoba | Managua        |
| Honduras            | Lempira | Tegucigalpa    |
| Antigua and Bermuda | Dollar  | St. John's     |
| Panama              | Balboa  | Panama City    |
| Haiti               | Gourde  | Port-au-Prince |
| USA                 | Dollar  | Washington, DC |

### South American Continent

- South America (area 1,78,19,000 square km) is the fourth largest continent in the world.
- The shape of this continent is **triangular**.
- **Cape Horn** is the **southernmost part** of South America.
- The **Strait of Magellan** separates Tierra del Fuego Island and the mainland of South America.
- South America lies in the middle of the Atlantic and the Pacific Ocean.
- The **Tropic of Capricorn** passes through the middle of this continent.
- The **Panama Canal** connects the Atlantic and the Pacific Ocean.
- **South America, Central America, Western Islands and Mexico** are collectively called **Latin America**.
- The countries of South America, Colombia, Brazil and **Ecuador** are located on the **Equator**.
- **Uruguay** is the **most urbanized country** in South America.
- Except for **Chile** and **Ecuador**, all other South American countries share the border with Brazil.
- Quito (Ecuador) is the second highest capital city in the world after La Paz (Bolivia) and also the city which is closest to the equator.
- Ecuador is the most densely populated country in this continent.
- The **world's highest waterfall** is **Salto Angel Falls** (979 m.). It is located in South America. (**Source- World Waterfall Database**)
- The **world's highest navigable Lake Titicaca** (height **3810 m**) is located on the **Peru-Bolivia border**.
- The **Amazon River** is the **world's largest river** in terms of drainage basin.

- The **Amazon River** is also the **largest river in** South America.
- The Amazon River is called the **World's Widest and largest river by water volume**.
- The Amazon is the world's largest and best known tropical rainforest.
- The world's **highest active volcano, Ojos del Salado (6893 m) (Chile)**, falls on the Argentina Chile border.
- South American rainforests are locally known as '**Selvas**'.
- Temperate grasslands of South America are called Pampas.
- They extended mainly to Argentina and Uruguay.
- **Valsa** is the lightest timber in the world found in the forests of the Amazon basin.
- **Toucan** is a bird found in the Amazon basin.
- The world's largest predator bird **Condor** is found in South America.
- The **Rheas** are flightless birds that have their origin in South America.
- South America is called the **continent of birds**.
- The rubber tree is found in Brazil.
- The **Heart of Argentina** is called **Pampas**.
- The nutrient-rich grass called **Alpha-Alpha** is found in the Pampas.
- **Puma** and **Jaguar** are hunter animals of South America.
- **Llama**, a pack animal is found in the higher reaches of the Andes mountains.
- **Guanaco** is a type of wild Llama found in the Patagonia plateau.
- The Crescent belt of wheat is located in Argentina.
- Argentina is one of the biggest producers of sunflower seeds in world.
- Brazil ranks Seventh in the world in the production of cocoa (beans) (FAO: 2022).
- Brazil is the largest (in population and area) country in South America.
- Brazil is the world's largest producer of coffee. (FAO, 2022)
- Brazilian coffee plantations are called Fazenda.
- Globally as well as continentally, Brazil is the top producer of soybean (FAO : 2022).
- Brazil and Sao Paulo are called World's coffee pot and market respectively.
- Brazil is the largest maize producing country in South America while third in the world (FAO : 2022).
- Sao Paulo is called the 'world's coffee market' while Brazil is called the 'world's coffee pot'.
- **Santos Port** is the port of South America for exporting coffee to the world.
- The **world's highest capital city is La Paz** (the capital of Bolivia).



- **Rio-de-Janeiro** (Brazil) is the **largest city in South America**.
- The plateaus of Brazil and Patagonia are located in Guyana and South America respectively.
- The **world's longest mountain range is the Andes** (about 7200 km).
- Aconcagua (6960 m) is the **highest mountain peak of the Andes mountain range**.
- The forests of the eastern slopes of the Andes mountains are called **Montana**.
- Brazil is the largest producer of manganese in South America.
- **Amapa mine** in Brazil is famous for large manganese mines.
- Brazil's major iron ore mining centre is at **Itabira**.
- Brazil is the largest crude petroleum-producing country in South America.
- The tropical Savanna grasslands of Venezuela are called **Llanos**.
- Chile is the **largest copper producing country** in South America.
- Chuquicamata, in Chile and known for its copper mines, is called the **world's copper capital**.
- The **world's driest place Arica** (outside the polar region) is located in north Chile.
- In Argentina, breeder cattle are called **Gauchos** and a large private plot used for cattle raising is called **Estancia**.
- Nitrate reserves are located in the **Atacama desert**.
- The **Chaco plain** is Argentina's main cotton-producing area.
- Argentina is one of the world's largest meat exporting countries.
- The **Patagonia desert** is the temperate desert of South America.
- The largest landlocked country in South America is **Bolivia**.
- **Bolivia** and **Paraguay** are two **landlocked countries** in South America.
- Central Chile receives winter rainfall (Mediterranean climate) in winter.
- Phosphorus rich **guano** is manure derived from sea birds inhabiting the western coastal areas of South America.
- The natural site of **Olive Ridley** turtle is Galapagos Island (Ecuador).

#### Currencies and Capitals of Major Countries of South America

| Country  | Currency | Capital     |
|----------|----------|-------------|
| Guyana   | Dollar   | George Town |
| Colombia | Peso     | Bogota      |

|           |           |              |
|-----------|-----------|--------------|
| Chile     | Peso      | Santiago     |
| Uruguay   | Peso      | Montevideo   |
| Suriname  | Dollar    | Paramaribo   |
| Peru      | Nuevo Sol | Lima         |
| Brazil    | Real      | Brasília     |
| Bolivia   | Boliviano | La Paz       |
| Paraguay  | Guarani   | Asuncion     |
| Ecuador   | Dollar    | Quito        |
| Argentina | Peso      | Buenos Aires |
| Venezuela | Bolivar   | Caracas      |

#### African Continent:

- The African continent is called the **future continent**.
- It is the second-largest continent in the world in terms of area. (Area, 30,065,000 Sq. km.)
- **Negrito** are natives of this continent.
- **The Atlantic Ocean** lies to the west of Africa while to its east, lies the **Indian Ocean**.
- The **Gibraltar Strait** separates the African continent (Morocco) from the European continent (Spain).
- The largest lake in the continent is **Lake Victoria**.
- The **Equator** passes through Lake Victoria.
- **Africa is the only continent through which all three latitudinal lines - the Equator, Tropic of Cancer and Tropic of Capricorn, passes.**
- The origin of the world's longest **river Nile** is **Lake Victoria**.
- The Nile flows into the Mediterranean Sea.
- The **Aswan Dam** is built on the Nile.
- The **Victoria Falls** is located on the Zambezi river.
- World's largest tropical lake and the largest lake in the African Great Lakes region · Shared by Kenya, Uganda, and Tanzania.
- **Stanley Falls** is located on the Lualaba, a tributary of Congo river.
- The **Kariba Dam** is built on the Zambezi river on the borders of Zambia and Zimbabwe.
- Most of the hydropower in Africa is produced by the Kariba Dam.
- The Niger River in Africa is called the **river of palm oil**.
- **Cairo** is the largest city on the banks of the Nile.
- **Chad Lake** is located in the Sahara Desert.
- The primitive tribes of Africa are the Pygmy (Congo Basin), **Bushman** (Kalahari Desert) and Bedouin (Sahara Desert).
- The Tuareg tribe which serves as a guide for foreign tourists is found in the Sahara desert.

- Both Egyptian farmers and the agricultural labourers are known as **Fellah**.
- Nigeria is called the country of palm oil.
- Johannesburg (South Africa) is known as the **City of Gold**.
- The **Limpopo river** crosses the **Tropic of Capricorn twice**.
- Congo is the **only river that crosses the equator twice**.
- The temperate grasslands of Africa are called **Veld**.
- The tropical grasslands of Africa are called **Savanna**.
- Jute is produced in Africa from a plant called **sisal**.
- Egypt is the major palm producing country in Africa.
- The Transvaal region in Africa is famous for **zebra** and **giraffe** animals.
- A bird called **Ostrich** is found in the **Kalahari desert**.
- **Nigeria** is the **largest Cassava producing country** in the world (FAO : 2022).
- **Ivory Coast** is the **largest cocoa beans producing country** in the world (FAO : 2022).
- Morocco and Kenya are the largest producers of olive and tea respectively in their continent (FAO : 2022).
- Kenya ranks third in the world in tea production while Morocco ranks fourth in olive production (FAO : 2022).
- The largest Sorghum producing country in Africa is Nigeria (FAO : 2022).
- The **Suez Canal**, connecting the Red Sea to the **Mediterranean Sea** is located in **Egypt**.
- **Port Said Harbor** is located at the northern end of the **Suez Canal** and **Port Suez Harbor** at the southern end.
- The Coastal plain in Mozambique is the largest in Africa.
- The **Cape-Cairo rail route** from Cape Town (South Africa) to Cairo (Egypt) is the **longest in Africa**.
- The **world's largest diamond mine** is located in **Kimberley, South Africa**.
- **Kimberley** is also known as the city of diamonds.
- **Bloemfontein** is the judicial capital of South Africa.
- **Sahara Desert** (93 lakh square kilometres), the world's largest desert, is located in Africa.
- **Chad Lake** is located in the Sahara Desert.
- The **Kalahari Desert** is located in Africa.
- The **Plateau of Abyssinia** is in Africa.
- **Tafilalt Desert** (approx. 65000 hectares) is in Morocco.
- 52.52% of the world's Chromium is produced in South Africa (WMP : 2017-21).
- The **River Zaire** is also called **Congo** in its lower course.
- The **junction of the continent of Asia and Europe** is called the country of Egypt.
- According to the World Bank's WDI data, Egypt in Africa is the most urbanized country in the continent.
- **Africa** has the highest population growth in the world.
- Nigeria is the most populous country in Africa.
- The Democratic Republic of Congo is called the country of forests.
- Ghana is also known as the **Gold Coast**.
- Kenya is known the **Big Safari Center**.
- Malawi is called as the **Switzerland of the African Continent**.
- The African continent is called '**Dark Continent**'.
- Somali peninsula in the northeast of the continent is popularly known as the Horn of Africa. Horn of Africa comprises- Somalia, Ethiopia, Eretria and Djibouti.
- Africa straddles the equator which passes through 8 countries: **Uganda, Republic of Congo, Somalia, Congo, Saotome, Principe, Kenya and Gabon**.
- Coffee is cultivated on the eastern slopes of Kilimanjaro by the **Chaga tribe**.
- **South Sudan** is the latest nation of Africa which came into existence on 9<sup>th</sup> July, 2011.
- The capital of southern Sudan is Juba.
- **South Sudan** is the **193<sup>rd</sup> member of the United Nations**.

✎ **Note :** In March 2022, Tanzania got it's first female president.

#### Currencies and Capitals of Major Countries of Africa

| Country                  | Currency | Capital      |
|--------------------------|----------|--------------|
| Madagascar Malagasy      | Ariary   | Antananarivo |
| Guinea                   | Franc    | Conakry      |
| Cote d'Ivoire            | Franc    | Yamoussoukro |
| Comoros                  | Franc    | Moroni       |
| Burkina Faso             | Franc    | Ouagadougou  |
| Togo                     | Franc    | Lome         |
| Niger                    | Franc    | Niamey       |
| Central African Republic | Franc    | Bangui       |
| Burundi                  | Franc    | Gitega       |
| Cameroon                 | Franc    | Yaounde      |
| Djibouti                 | Franc    | Djibouti     |
| Rwanda                   | Franc    | Kigali       |
| Congo                    | Franc    | Brazzaville  |
| Senegal                  | Franc    | Dakar        |
| Benin                    | Franc    | Porto-Novo   |
| Gabon                    | Franc    | Libreville   |
| Chad                     | Franc    | N'Djamena    |

|                              |           |                      |
|------------------------------|-----------|----------------------|
| Liberia                      | Dollar    | Monrovia             |
| Mali                         | Franc     | Bamako               |
| Kenya                        | Shilling  | Nairobi              |
| Somalia                      | Shilling  | Mogadishu            |
| Tanzania                     | Shilling  | Dodoma               |
| Algeria                      | Dinar     | Algiers              |
| Tunisia                      | Dinar     | Tunis                |
| Egypt                        | Pound     | Cairo                |
| Sudan                        | Pound     | Khartoum             |
| Mauritius                    | Rupee     | Port Louis           |
| Seychelles                   | Rupee     | Victoria             |
| Sao Tome and Principe        | Dobra     | Sao Tome             |
| Angola                       | Kwanza    | Luanda               |
| Ghana                        | Cedi      | Accra                |
| Malawi                       | Kwacha    | Lilongwe             |
| Ethiopia                     | Birr      | Addis Ababa          |
| Morocco                      | Dirham    | Rabat                |
| Democratic Republic of Congo | Franc     | Kinshasa             |
| Nigeria                      | Naira     | Abuja                |
| South Africa                 | Rand      | Pretoria / Cape Town |
| Uganda                       | Shilling  | Kampala              |
| Gambia                       | Dalasi    | Banjul               |
| Lesotho                      | Loti      | Maseru               |
| Mauritania                   | Ouguiya   | Nouakchott           |
| Eritrea                      | Nakfa     | Asmara               |
| Sierra Leone                 | Leone     | Freetown             |
| Eswatini (Swaziland)         | Lilangeni | Mbabane              |

#### Australia Continent:

- The Continent of Australia is also known as the **Island continent**.
- Australia is the **smallest continent** by area in the southern hemisphere.
- It is the least populous continent.
- The Tropic of Capricorn passes through the middle of the continent.
- The continent of Australia is also called **The Land of Golden Fleece**.
- **Abel Tasman** (1642 AD) and **Captain Cook** (1770 AD) discovered Tasmania and Australia respectively.
- Nauru is the smallest country in Australia (Oceania).
- The Torres Strait is located between the Melanesian island of **New Guinea** and Australia.

- The **Bass Strait** is located between the islands of Australia and Tasmania.
- **Aborigines** are natives of Australia.

#### States of The Continent of Australia and Their Capitals

| State              | Capital   |
|--------------------|-----------|
| Western Australia  | Perth     |
| North Australia    | Darwin    |
| Southern Australia | Adelaide  |
| Queensland         | Brisbane  |
| New South Wales    | Sydney    |
| Victoria           | Melbourne |
| Canberra*          | Canberra  |
| Tasmania           | Hobart    |

#### \*Union Territory

- **Kosciuszko** (elevation 2228 m) is the highest mountain peak in the continent of Australia.
- The largest lake in Australia is '**Lake Eyre**'.
- The **Great Dividing Range** is the main mountain range of Australia.
- Australia's most prominent agricultural region is the **Murray Darling Valley**.
- The fertile land of the Murray Darling valley is called **Riverina**.
- The Murray Darling River System is Australia's largest river system.
- Victoria and New South Wales are the major wheat-growing regions of Australia.
- The city of Darwin (Northern Province) is called the **Gateway of Australia**.
- Australia is the major producer of world-famous merino wool.
- **Jackaroos** are said to be labourers working in sheep farming centres in Australia.
- Wheat is Australia's principal food crop.
- Artesian Wells are found in the intermediate lowlands of Australia.
- Water from the artesian well continues to precipitate above itself.
- Water emerges naturally from the basin through cracks in the rock encasing the water, into springs, lakes, creeks and rivers, creating a permanent water source even during dry season. These wells are called the Great Artesian Basin.
- The Great Barrier Reef is located on the northeastern coast of the State of Queensland.

- The temperate tropical grasslands of **Victoria** and **Tasmania** are called **Downs**.
  - The Carpentaria Plains are located in northern Australia.
  - **Sydney** is the oldest and largest city in Australia.
  - Australia is the largest bauxite producing country in the world (WMP : 2017-21).
  - Australia ranks third among the world's zinc ore producing countries (IMY: 2021).
  - Australia has the world's largest lead reserves of lead ore (IMYB: 2021).
  - **Broken Hill** is famous for the production of lead, zinc and silver.
  - **Kalgoorlie** and **Coolgardie** are the world's renowned gold mines in Australia.
  - The **Trans-Continental Railroad** connecting **Sydney** to **Perth** is Australia's longest railroad.
  - **Gibson, Simpson, Great, Sandy, and Great Victoria** are deserts of Australia.
  - The continent of Australia is also known as the **Continent of Thirsty Lands** and the **Land of Kangaroos**.
  - Australia and New Zealand are also known as **Unknowable countries**.
  - **New Zealand** is located in the south-east of Australia.
  - New Zealand is called **Britain of the South**.
  - The **South Island** is the largest in New Zealand.
  - Huka Falls - a set of waterfalls is located on the Waikato River in New Zealand.
  - **Kiwi** is the national bird of New Zealand.
  - Birds called **Kookaburra** and **Emu** are found in New Zealand.
  - Kookaburra is also called **Laughing Jackass**.
  - **Cook Strait** separates the north and the south Islands of New Zealand.
  - The mountain range of New Zealand is known as the **Southern Alps**.
  - Mount Cook (3724 m) is the highest peak in New Zealand.
  - New Zealand's longest **river Waikato** flows through the North Island.
  - **Maori** are natives of New Zealand.
  - The Maori name of **Mt. Cook peak** is **Aorangi**.
  - Platypus is a bizarre four-legged creature of Australia that lays eggs.
  - The **Lyrebird** of Australia mimics different kinds of sounds including those of animals and birds.
  - The Islands Group, located in the westernmost part of the Pacific Ocean, is called **Melanesia**.
  - Melanesia is located in the east of Australia, between Australia and Indonesia, in the Pacific Ocean.
  - The islands included in Melanesia are Irian Jaya (Indonesia), Papua New Guinea, Solomon Islands, Vanuatu, New Caledonia and Fiji.
  - Vanuatu, a group of about **82 Volcanic Islands**, is also known as **New Hebrides**.
  - Micronesia includes four islands groups-**Caroline, Marshall, Mariana and Gilbert**.
  - The main islands of Polynesia are **Tonga, Samoa, Hawaii, Tuvalu and Cook**, etc.
  - **Canberra**, the capital of Australia is situated on the banks of the **Molonglo River**.
  - The **Murray Darling River System** is Australia's largest river system.
- The Continent of Antarctica:**
- **Antarctica** is a part of the ancient Gondwana Land.
  - Antarctica is the **fifth-largest continent in the world in terms of area**.
  - The continent of Antarctica is located in the Southern Hemisphere.
  - The British navigator **James Cook** discovered the continent of Antarctica but could not reach its mainland.
  - **Fabian Gottlieb von Belling Shausen** discovered the mainland of Antarctica.
  - The continent of Antarctica is called the **White Continent**, as 98% of its area is always covered with snow.
  - It is the coldest continent in the world.
  - It is known as the **largest cold desert in the world** due to snowfall as precipitation.
  - The continent of Antarctica is surrounded by the Pacific Ocean, the Indian Ocean and the Atlantic Ocean.
  - **Roald Amundsen** of Norway was the first to reach (1911 AD) the South Pole.
  - The Antarctica continent is called a **Continent Dedicated to Science**.
  - The shape of the Antarctica continent changes in summer and winter, due to which it is also called a **Dynamic or Active Continent**.
  - The **Queen Maud Mountain** Range divides the continent of Antarctica into two equal parts.
  - The highest mountain peak of the continent of Antarctica is **Vinson Massif (4897 m)**.
  - The world's largest **glacier Lambert** is located on the continent of Antarctica.
  - The **krill fish** of Antarctica lives in the school.
  - The main flora of Antarctica is **Mosses and Lichens**.
  - In Antarctica, there is **6 month of day** during South Solstice and **6 month of night** during North Solstice.
  - The world's lowest annual temperature is found in the **Pole of Cold** in Antarctica.
  - Vostock in Antarctica recorded the world's lowest temperature (-89.2 ° C).
  - The **Rock Sea** is located in Antarctica Continent.





### Area-wise Temperature and Precipitation Data

| Area                        | Highest Temperature                                                     | Lowest Temperature                 | Highest Rainfall                                                          | Lower Rainfall                        |
|-----------------------------|-------------------------------------------------------------------------|------------------------------------|---------------------------------------------------------------------------|---------------------------------------|
| Asia                        | Mitribah, Kuwait (53.9°C ± 0.1°C)                                       | Verkhoyansk, Russia (−67.8°C)      | Mawsynram, India (11872) (highest in world)                               | Aden, Yemen (45.7)                    |
| Africa                      | Kebili, Tunisia (55°C)                                                  | Ifrane, Morocco (−23.9°C)          | Debundscha, Cameroon (10287)                                              | Wadi Halfa, Sudan (Less than 2.54 mm) |
| North America               | Furnance Creek Ranch, Death Valley, USA (56.7°C) (highest in the world) | Snag, Yukon, Canada (−63°C)        | Henderson Lake, British Columbia, Canada (7000)                           | Batagues, Mexico (30.5)               |
| South America               | Rivadavia, Argentina (48.9°C)                                           | Sarmiento, Argentina (−32.8°C)     | Quibdo, Colombia (8990)                                                   | Arica, Chile (0.76) (Lowest in World) |
| Europe                      | Ethence Unan (48°C)                                                     | Ust'Schugor, Russia (−58.1°C)      | Crkvice, Montenegro (4593)                                                | Astrakhan, Russia (162.6)             |
| Antarctica                  | Esperanza Research Station (Mainland of Argentina) (18.3°C)             | Vostok (−89.2°C) (Lowest in World) | Eastern and Western Coast of Antarctica (>800 mm above water equilibrium) | Amundsen-Scott South Pole Station (2) |
| South-Western Pacific Ocean | Odpadatta, Australia (50.7°C)                                           | Ranfurly, New Zealand (−25.6°C)    | Mt. Waialeale, Hawaii, USA (11640)                                        | Truganina, Australia (102.9)          |

\* Average annual figures for highest and lowest precipitation are in mm.

\* The most precipitation in Australia occurs in the Blandander Kerr in Queensland province.

| World's Major Mountain Peaks and Their Elevations |                     |
|---------------------------------------------------|---------------------|
| Mountain Peaks                                    | Height ( in meters) |
| 1. Mount Everest (Nepal)                          | 8848.86             |
| 2. Kanchenjunga (Nepal-India)                     | 8598                |
| 3. Lhotse Nepal                                   | 8516                |
| 4. Makalu (Nepal-China)                           | 8481                |
| 5. Dhaulagiri (Nepal)                             | 8172                |
| 6. Annapurna (Nepal)                              | 8078                |
| 7. K-2 [Godwin Austin (India)]                    | 8611                |
| 8. Nanga Parbat (India)                           | 8126                |
| 9. Nanda Devi (India)                             | 7817                |
| 10. Kamet (India-China)                           | 7756                |
| 11. Gasherbrum (Pakistan)                         | 8068                |
| 12. Rakaposhi (Pakistan)                          | 7788                |
| 13. Tirich Mir                                    | 7708                |
| 14. Gosainthan (Shishapangma) (China)             | 8014                |
| 15. Namcha Barwa (China)                          | 7756                |

| Geographical Surnames of Major Countries of The World |                                                                   |
|-------------------------------------------------------|-------------------------------------------------------------------|
| Country                                               | Surname                                                           |
| 1. Australia                                          | Land of the Golden Fleece, Land of Kangaroos, Land of Golden Wool |
| 2. Ireland                                            | Emerald Island                                                    |
| 3. Africa                                             | Blind Continent (RAS/RTS, 1997)                                   |
| 4. Oxford (England)                                   | City of Dreaming Spires                                           |
| 5. Aberdeen (Scotland)                                | Granite City                                                      |
| 6. Atlantic Ocean                                     | Herring Pound                                                     |
| 7. Osaka (Japan)                                      | Manchester of the East                                            |
| 8. Kerala (India)                                     | India's Spices Garden                                             |
| 9. Kent (England)                                     | Garden of England                                                 |
| 10. Canada                                            | Lily Country                                                      |
| 11. Kochi (India)                                     | Queen of the Arabian Sea, Venice of the East                      |
| 12. Korea                                             | Hermit Kingdom, Land of Morning Calm                              |
| 13. Quito (Ecuador)                                   | City of Constant Flowing Waterfalls                               |
| 14. Cuba                                              | Pearl of the Antilles, the world's Sugar Bowl                     |

|                                   |                                                                                                                                   |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| 15. Pamir Plateau                 | Roof of the World(RAS/RTS, 1997)                                                                                                  |
| 16. Prairies of North             | Never Never Land                                                                                                                  |
| 17. Laos                          | Country of Thousand Elephants                                                                                                     |
| 18. Thailand                      | Country of White Elephants                                                                                                        |
| 19. Switzerland                   | Playground of Europe                                                                                                              |
| 20. Bhutan                        | Land of Thunderbolt                                                                                                               |
| 21. Japan                         | The Country of Sunrise                                                                                                            |
| 22. Egypt                         | Gift of the Nile                                                                                                                  |
| 23. Venice (Italy)                | Queen of the Adriatic                                                                                                             |
| 24. New York                      | Empire City, City of Skyscrapers                                                                                                  |
| 25. Gibraltar                     | Gateway of the Mediterranean                                                                                                      |
| 26. Jerusalem                     | Holy Land                                                                                                                         |
| 27. Finland                       | Country of Thousand Lakes                                                                                                         |
| 28. Norway                        | The Country of Midnight Sun                                                                                                       |
| 29. Rome (Italy)                  | Eternal City (Holy City) Blood Color Woman, City of Pope, City of Seven Hills, Em press of the Ancient World, Babylon of the West |
| 30. Hwang Ho River (Yellow River) | China's Sorrow                                                                                                                    |
| 31. Chicago                       | Windy City / Garden City                                                                                                          |
| 32. Singapore                     | Pearl of the Orient                                                                                                               |
| 33. Philadelphia                  | Quaker City                                                                                                                       |
| 34. Japan                         | Great Britain of the East, Country of Tender Flower                                                                               |
| 35. Stockholm                     | Venice of the World                                                                                                               |
| 36. Sri Lanka                     | Pearl of the East, Pearl of Indian Ocean                                                                                          |
| 37. Guinea Coast                  | Whiteman's Grave                                                                                                                  |
| 38. Netherlands                   | The Land of Windmills                                                                                                             |
| 39. Thailand                      | Paris of Asia                                                                                                                     |
| 40. Strait of Gibraltar           | Pillars of Hercules                                                                                                               |
| 41. Zanzibar (Tanzania)           | Island of Fabrics                                                                                                                 |
| 42. Natal (South Africa)          | Garden Province of South Africa                                                                                                   |
| 43. Belgium                       | Cockpit of Europe                                                                                                                 |
| 44. Scotland                      | Land of Cakes                                                                                                                     |
| 45. New Zealand                   | Britain of South                                                                                                                  |
| 46. Myanmar                       | Country of Golden Pagoda                                                                                                          |
| 47. San Francisco                 | City of Golden Gate                                                                                                               |
| 48. Mumbai                        | City of Seven Islands                                                                                                             |
| 49. Prairies of North             | World Bread Basket, USA                                                                                                           |

|                                 |                                     |
|---------------------------------|-------------------------------------|
| 50. Lhasa (Tibet)               | Forbidden City                      |
| 51. Tristan da Cunha            | The Uninhabited Island of the World |
| 52. Bengaluru                   | The Garden City of India            |
| 53. The Strait of Bab-at Mandeb | The Entrance of Tears               |
| 54. Balkan                      | The Powder Keg of Europe            |
| 55. Bahrain                     | The Island of Pearl                 |
| 56. Norway                      | The Country of Sunset               |
| 57. Belgrade                    | White City                          |
| 58. Vienna                      | City of Monuments                   |
| 59. Paris (France)              | Paradise of the World               |

### Important Facts Related to the Continents

| Continent              | Largest Country( In area)            |
|------------------------|--------------------------------------|
| 1. Asia                | Russia (39 <sup>th</sup> BPSC, 1994) |
| 2. Africa              | Algeria                              |
| 3. North America       | Canada                               |
| 4. South America       | Brazil                               |
| 5. Australia           | Australia                            |
| 6. Europe              | Russia                               |
| Smallest Country       | Continent                            |
| 1. Nauru               | Australia & Oceania                  |
| 2. Maldives            | Asia                                 |
| 3. St. Kitts and Nevis | North America                        |
| 4. Vatican City        | Europe                               |
| 5. Suriname            | South America                        |
| 6. Seychelles          | Africa                               |
| Continent              | Highest Peak                         |
| 1. Asia                | Mt. Everest                          |
| 2. Africa              | Mt. Kilimanjaro                      |
| 3. Europe              | Mt. Elbrus                           |
| 4. South America       | Mt. Aconcagua                        |
| 5. Australia           | Mt. Kosciuszko                       |
| 6. Antarctica          | Vinson Massif                        |
| 7. North America       | Mount Mc Kinley (Denali)             |
| Longest River          | Continent                            |
| 1. Amazon              | South America                        |
| 2. Volga               | Europe                               |
| 3. Yangtze             | Asia                                 |
| 4. Missouri            | North America                        |
| 5. Murray              | Australia                            |
| 6. Onyx                | Antarctica                           |

| Deepest Point     | Continent     |
|-------------------|---------------|
| 1. Eyre Lake      | Australia     |
| 2. Dead Sea       | Asia          |
| 3. Assal Lake     | Africa        |
| 4. Caspian Sea    | Europe        |
| 5. Death Valley   | North America |
| 6. Denman Glacier | Antarctica    |

### Major Vegetation Zones of The World and Its Associated Floras

| Vegetation Zone                                        | Vegetation  |
|--------------------------------------------------------|-------------|
| 1. Vegetation of Tundra and Cold Countries             | Cryophytes  |
| 2. Vegetation of Tropical Desert Zones                 | Xerophytes  |
| 3. Grass and Vegetation with Tropical Climate          | Tropophytes |
| 4. Vegetation of Temperate Zones                       | Mesophytes  |
| 5. Vegetation Growing in Hard Rocks                    | Lithophytes |
| 6. Vegetation of Marshy and Equatorial Warm Humid Zone | Hygrophytes |
| 7. Vegetation found in high Salty Regions              | Halophytes  |
| 8. Vegetation of Water-logged Areas                    | Hydrophytes |

### Major Tribes of The World and related Countries

| Country/Region                       | Tribes         |
|--------------------------------------|----------------|
| 1. Arabian (UPPCS, 2009, 2016)       | Bedouin/ Bedu  |
| 2. Congo Basin                       | Pygmies        |
| 3. North America                     | Red Indian     |
| 4. Kalahari Desert (Botswana)        | Bushman        |
| 5. Greenland and Canada              | Eskimos        |
| 6. North America                     | Yukon          |
| 7. Japan                             | Ainu           |
| 8. East Africa (Kenya) (UPPCS, 2009) | Masai          |
| 9. Brazil                            | Boro           |
| 10. New Guinea                       | Papuans        |
| 11. Malaysia                         | Semang         |
| 12. New Zealand                      | Maori          |
| 13. Siberia                          | Yukaghir       |
| 14. Central Asia (UPPCS, 2016)       | Kirgiz/Kyrgyz  |
| 15. Central Africa                   | Negro          |
| 16. Sri Lanka                        | Vedda          |
| 17. South Africa                     | Zulu           |
| 18. Siberia                          | Tatar / Tartar |
| 19. Southern Africa                  | Inkatha        |

- In 2020, as the first Indigenous woman to hold ministership, **Nania Mahuto** was appointed as Foreign Affairs Minister of New Zealand.

### Prominent Places of The World

|                               |                                                           |
|-------------------------------|-----------------------------------------------------------|
| 1. Jerusalem (Israel)         | Al Aqsa, Wailing Wall, Temple Mount                       |
| 2. Moscow                     | Kremlin, Red Square                                       |
| 3. Sydney                     | Opera House                                               |
| 4. Yangon (Myanmar)           | Shwedagon Pagoda                                          |
| 5. Lhasa (Tibet)              | Potala                                                    |
| 6. Washington DC (USA)        | Pentagon, White House                                     |
| 7. London (England)           | 10-Downing Street, Buckingham Palace, Billings Gate       |
| 8. Jakarta (Indonesia)        | Mardeka Palace                                            |
| 9. Egypt                      | Pyramids, Sphinx                                          |
| 10. Mecca (Saudi Arab)        | Kaaba                                                     |
| 11. New York                  | Statue of Liberty, Empire State Building, Broadway Street |
| 12. Paris (France)            | Eiffel Tower, Louvre                                      |
| 13. Rome (Italy)              | Colosseum                                                 |
| 14. Berlin (Germany)          | Brown Sauce, Brandenburg Gate                             |
| 15. Nanjing (China)           | Porcelain (Tower)                                         |
| 16. Pisa (Italy)              | Leaning Tower                                             |
| 17. Constantinople (Istanbul) | St. Sophia                                                |
| 18. Arizona (USA)             | Grand Canyon                                              |

### Major Tribes and Their Habitats

1. YURT- Temporary houses are built from the skins of animals by Kirghiz, Kalmuk and Kazakhs.
2. TIPI-Houses are made by Red Indians.
3. KRAAL-Houses are built by Masai, Kafirs and Zulu by the grass.
4. IGLOO-Houses are built by Eskimos by ice.
5. IZBA-Human made triangular houses constructed in Northern Russia.

### Major Industrial Cities of The World and Their Industries

| City      | Industry                             |
|-----------|--------------------------------------|
| 1. Osaka  | Iron & Steel, Engineering Industries |
| 2. Nagoya | Cotton Textiles, Ship-building       |
| 3. Havana | Cigar                                |
| 4. Dhaka  | Carpet Industry, Muslim              |

|                             |                             |
|-----------------------------|-----------------------------|
| 5. Kobe                     | Iron & Steel                |
| 6. Wellington               | Dairy Industry              |
| 7. Belfast (Ireland)        | Ship-building               |
| 8. Aachen (Germany)         | Iron & Steel                |
| 9. Los Angeles              | Entertainment, Petroleum    |
| 10. Lyons ( France)         | Silk Industry               |
| 11. Venice                  | Glass Industry              |
| 12. Birmingham              | Iron & Steel                |
| 13. Milan (Italy)           | Silk Textiles Industry      |
| 14. Plymouth (USA)          | Ship-building               |
| 15. Detroit                 | Automobiles                 |
| 16. Munich                  | Lens Making                 |
| 17. Chelyabinsk (Russia)    | Iron & Steel, Machine Tools |
| 18. Kansas                  | Meat Industry               |
| 19. Multan                  | Clay Pottery                |
| 20. Seattle                 | Aircraft Construction       |
| 21. Vladivostok             | Ship-building               |
| 22. Glasgow                 | Ship-building, Iron & Steel |
| 23. Kiev                    | Engineering Industry        |
| 24. Pittsburg               | Iron & Steel                |
| 25. Philadelphia            | Locomotive                  |
| 26. Manchester              | Cotton Textile Industry     |
| 27. Hollywood (Los Angeles) | Film Industry               |

### Major Islands of The World and Their Locations

| Name                          | Area (in Sq. Km) | Location                 |
|-------------------------------|------------------|--------------------------|
| 1. Greenland                  | 2166086          | Arctic Ocean             |
| 2. Baffin Island              | 507451 (Canada)  | North Arctic Ocean       |
| 3. United Kingdom             | 242514           | North Atlantic Ocean     |
| 4. Iceland                    | 103000           | North Atlantic Ocean     |
| 5. Ireland                    | 70273            | North Atlantic Ocean     |
| 6. New Guinea                 | 785753           | South West Pacific Ocean |
| 7. Luzon Island               | 109965           | West Pacific Ocean       |
| 8. Honshu (Japan)             | 22,7963          | North-West Pacific Ocean |
| 9. South Island (New Zealand) | 150,416          | South-West Pacific Ocean |



|                                |        |                          |
|--------------------------------|--------|--------------------------|
| 10. North Island (New Zealand) | 114154 | South-West Pacific Ocean |
| 11. Tasmania                   | 68401  | South-West Pacific Ocean |
| 12. Borneo                     | 751929 | South-West Pacific Ocean |
| 13. Madagascar                 | 587713 | Indian Ocean             |
| 14. Sumatra (Indonesia)        | 472784 | Indian Ocean             |
| 15. Sulawesi (Indonesia)       | 180681 | Western Pacific Ocean    |
| 16. Java Island (Indonesia)    | 139000 | Indian Ocean             |
| 17. Sri Lanka                  | 65610  | Indian Ocean             |
| 18. Victoria Island (Canada)   | 217291 | Arctic Sea               |
| 19. Ellesmere Island (Canada)  | 196236 | Arctic Sea               |
| 20. Cuba                       | 110860 | Caribbean Sea            |

### Major Deserts of The World and Their Areas

| Desert                 | Expansion Area                                                                               | Area (in sq. km) |
|------------------------|----------------------------------------------------------------------------------------------|------------------|
| 1. Sahara              | Chad, Mali, Niger, Sudan, Egypt Western Sahara, Morocco, Libya, Algeria, Tunisia, Mauritania | 92,00,000        |
| 2. Australian          | Great Victoria, Great Sandy, Gibson, Simpson and Sturt Stony Deserts                         | 13,71,000        |
| 3. Arabian             | Saudi Arab, Yemen, Jordan, Iraq, Kuwait, Oman, Qatar, UAE, Bahrain                           | 23,30,000        |
| 4. Gobi                | Mongolia and China                                                                           | 12,95,000        |
| 5. Kalahari            | Botswana (Africa)                                                                            | 9, 00,000        |
| 6. Taklamakan          | Xinjiang (China)                                                                             | 3, 20, 000       |
| 7. Sonoran             | USA and Mexico                                                                               | 3, 10,800        |
| 8. Namib               | Namibia                                                                                      | 8, 06,000        |
| 9. Karakum             | Turkmenistan                                                                                 | 3, 50,000        |
| 10. Thar               | North-West India and Pakistan                                                                | 2, 00,000        |
| 11. Atacama            | Northern Chile                                                                               | 128,000          |
| 12. Kyzylkum           | Uzbekistan and Kazakhstan                                                                    | 3, 00,000        |
| 13. Dasht-e Lut        | Eastern Iran                                                                                 | 22,780           |
| 14. Desierto de Secura | North- West Peru                                                                             | 188735           |
| 15. Patagonia          | Argentina                                                                                    | 6, 73,000        |
| 16. Mojave Desert      | South California                                                                             | 77248            |

### Changed Names of Countries and Cities of the World

| Present Name         | Old Name                      |
|----------------------|-------------------------------|
| 1. Varanasi          | Banares or Kashi              |
| 2. Prayagraj         | Allahabad                     |
| 3. Iran              | Persia                        |
| 4. Iraq              | Mesopotamia                   |
| 5. Istanbul          | Constantinople, Kostantiniyye |
| 6. Republic of Congo | Zaire                         |
| 7. Madagascar        | Malagasy                      |
| 8. Myanmar           | Burma                         |
| 9. Malawi            | Nyasaland                     |
| 10. Lesotho          | Basutoland                    |
| 11. Suriname         | Dutch Guyana                  |
| 12. Hawaiian Islands | Sandwich Island               |
| 13. Japan            | Nippon                        |
| 14. Ho Chi Minh City | Saigon                        |
| 15. Netherlands      | Holland                       |
| 16. Harare           | Salisbury                     |
| 17. Kinshasa         | Leopoldville                  |
| 18. Thailand         | Siam                          |
| 19. Ethiopia         | Abyssinia                     |
| 20. Java             | Swarnadvipa & Yavadvipa       |
| 21. Patna            | Pataliputra                   |
| 22. Botswana         | Bechuanaland                  |
| 23. Chennai          | Madras                        |
| 24. Cambodia         | Kampuchea, Khmer              |
| 25. Djibouti         | French Somaliland             |
| 26. Bangladesh       | East Pakistan                 |
| 27. Malaysia         | Malaya                        |
| 28. Zambia           | Northern Rhodesia             |
| 29. Zimbabwe         | Southern Rhodesia             |
| 30. Taiwan           | Formosa                       |
| 31. Ghana            | Gold Coast                    |
| 32. Kozhikode        | Calicut                       |
| 33. St. Petersburg   | Leningrad                     |
| 34. Benin            | Dahomey                       |
| 35. Belize           | British Honduras              |
| 36. Nur-Sultan       | Astana                        |
| 37. Swaziland        | Eswatini                      |
| 38. Sri Lanka        | Ceylon                        |
| 39. Burkina Faso     | Upper Volta                   |

| Major Manufacturing Industries of the World |                                            |
|---------------------------------------------|--------------------------------------------|
| Industry                                    | Country                                    |
| 1. Silk Textiles Industry                   | China, India, Japan, Russia, France        |
| 2. Cotton Textiles Industry                 | China, India, UK, Russia                   |
| 3. Woollen Textiles Industry                | USA, Britain, Japan                        |
| 4. Iron Steel Industry                      | Japan, USA, Russia, Ukraine                |
| 5. Aircraft Manufacturing Industry          | France, UK, Russia, USA                    |
| 6. Automotive Industry                      | Japan, USA, Russia, Italy, France, Germany |
| 7. Shipbuilding Industry                    | USA, Sweden, Japan, Germany, China         |
| 8. Potash Fertilizer Industry               | USA, Germany                               |
| 9. Phosphate Fertilizer Industry            | Australia, USA                             |
| 10. Nitrogen Fertilizer Industry            | Japan, India, USA                          |

| Landlocked Countries of the World                                                                                                                                                                    |                                                                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Continents                                                                                                                                                                                           | Landlocked Countries                                                                                                                                               |
| 1. Africa (16)                                                                                                                                                                                       | Mali, Malawi, Chad, Burundi, Lesotho, Botswana, Niger, Swaziland, Zimbabwe, Rwanda, Uganda, Zambia, Burkina Faso, South Sudan, Ethiopia, Central African Republic. |
| 2. Asia (12)                                                                                                                                                                                         | Bhutan, Nepal, Laos, Mongolia, Azerbaijan, Armenia, Afghanistan, Tajikistan, Kazakhstan, Kyrgyzstan, Turkmenistan, Uzbekistan                                      |
| 3. South America (2)                                                                                                                                                                                 | Paraguay, Bolivia.                                                                                                                                                 |
| 4. Europe (15)                                                                                                                                                                                       | Andorra, Austria, Serbia, Hungary, Moldova, Macedonia, Lichtenstein, Belarus, Slovakia, Switzerland, Luxembourg, Czech Republic, Vatican City, San Marino, Kosovo. |
| <p>🔍 <b>Note :</b> Kazakhstan, located in Asia, is the largest landlocked country in the world.</p> <p>🔍 <b>Note :</b> World's two doubly landlocked countries are Uzbekistan and Liechtenstein.</p> |                                                                                                                                                                    |

| World-famous Landmarks and Countries |                  |
|--------------------------------------|------------------|
| Famous Landmarks                     | Country/Place    |
| 1. Statue of Liberty                 | New York (USA)   |
| 2. Disney Land                       | California (USA) |
| 3. White Sands                       | USA              |
| 4. Billings Gate                     | London (England) |
| 5. Cannes                            | France           |
| 6. Elysee Palace                     | France           |

|                    |                 |
|--------------------|-----------------|
| 7. Red Square      | Russia          |
| 8. Auroville       | India           |
| 9. Statue of Unity | Gujarat (India) |

| Major Plateaus of the World and their Locations |                                                          |
|-------------------------------------------------|----------------------------------------------------------|
| Names of the Plateau                            | Location                                                 |
| 1. Columbia Plateau                             | USA                                                      |
| 2. Deccan Plateau                               | South India                                              |
| 3. Madagascar Plateau                           | Madagascar Central Highland Plateau                      |
| 4. Iranian Plateau                              | Iran (Asia Minor Plateau)                                |
| 5. Tibetan Plateau                              | North of Himalayas and to the South of QinLing Mountains |
| 6. Mexico Plateau                               | Mexico                                                   |
| 7. Brazilian Plateau                            | Middle Eastern Part of South America                     |
| 8. Greenland Plateau                            | North Atlantic Ocean                                     |
| 9. Colorado Plateau                             | Arizona and the Plateau of the State of Utah, USA        |
| 10. Australia Plateau                           | Western Part of Australia                                |
| 11. Meseta Plateau                              | Iberian Peninsula of Spain                               |
| 12. Plateau of Mongolia                         | Republic of Mongolia                                     |
| 13. Plateau of Alaska                           | Alaska, Canada (Yukon Plateau)                           |
| 14. Plateau of Great Basin                      | In between Columbia and Colorado Rivers                  |
| 15. Plateau of Bolivia                          | Andes Mountains Region of Bolivia                        |
| 16. Chiapass Plateau                            | South Mexico                                             |
| 17. Indo-China Plateau                          | Eastern Peninsula of Southern Asia                       |
| 18. Plateau of Abyssinia                        | Ethiopia and Somalia (East Africa)                       |
| 19. Arabian Plateau                             | Southwest Asia                                           |
| 20. Plate of Anatolia Su                        | Turkiye                                                  |

## 6. Atmosphere

- The atmosphere is the expansion of air that surrounds the Earth.
- The atmosphere is a mixture of various gases.

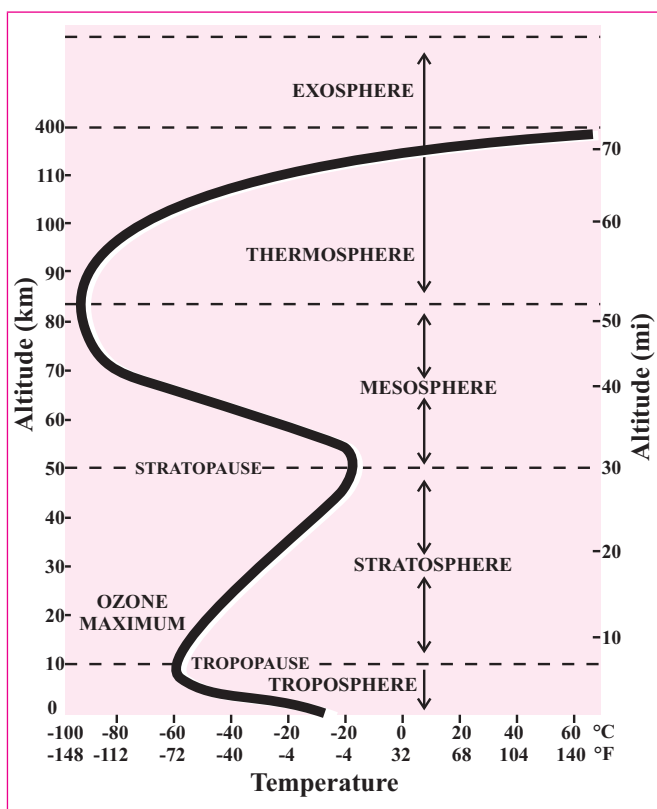
| Gases in the Atmosphere           |             |
|-----------------------------------|-------------|
| Gas                               | Mass (in %) |
| Nitrogen (N <sub>2</sub> )        | 78.08%      |
| Oxygen (O <sub>2</sub> )          | 20.95%      |
| Argon (Ar)                        | 0.93%       |
| Carbon dioxide (CO <sub>2</sub> ) | 0.04 %      |
| Neon (Ne)                         | 0.002 %     |

|                            |           |
|----------------------------|-----------|
| Krypton (Kr)               | 0.0001%   |
| Helium (He)                | 0.000 5%  |
| Hydrogen (H <sub>2</sub> ) | 0.000055% |
| Xenon (Xe)                 | 0.000009% |
| <b>Source – NASA</b>       |           |

- **Carbon dioxide** is being the heaviest gas, found in the lower layer of the atmosphere.
- Carbon dioxide and water vapours are primarily permeable to the sun's rays and inaccessible to the rays reflected from the earth.
- Carbon dioxide is responsible for the greenhouse effect on the Earth.
- In a little amount, Ozone gas is found in the atmosphere at high altitudes.
- Ozone gas is found in the lower part of the stratosphere at an altitude of **15 to 35 kilometres** above the Earth's surface.
- Ozone gas absorbs some amount of **ultraviolet rays** coming from the Sun.
- **Water Vapours, Ozone, Oxygen and Carbon dioxide**, etc. absorb solar heat and solar radiation.
- Water vapours and Carbon dioxide maintain the Earth's temperature.
- The sky appears blue due to the scattering of light from dust particles.

#### Atmospheric Structure:

- The atmosphere is divided into five parts: Troposphere, Stratosphere, Mesospheres, Ionosphere and Exosphere.



#### A. Troposphere

- The lowermost layer of the atmosphere is the **troposphere**.
- According to NASA, the height of the troposphere is 8-15 km, while its average height is considered 12 km.
- **Leon Teisserenc de Bort** named this layer.
- The height of the Troposphere increases in summer and decreases in winter.
- There is a decrease of 6.5 °C in temperature per kilometre elevation in Troposphere. This fall in temperature is called a **lapse rate**.
- Various atmospheric **phenomena like hail**, fog, frost, thunderstorms, rain and **thunder**, etc. are generated by Troposphere.
- The **jet stream flows in troposphere**.
- **Convection currents are found in troposphere**.
- The troposphere is **also called Convective Region**.
- The upper boundary of troposphere is called **Tropopause**.

#### B. Stratosphere

- The average expansion of stratosphere in the atmosphere ranges **from 12 to 50 km** above the Earth's surface.
- The stratosphere is thicker at the poles than at the equator and that is why the Antarctic stratosphere is thinner than the Arctic because the stratospheric wind system in the southern hemisphere is not sufficient in transporting Ozone towards the south pole.
- Initially, the temperature on the stratosphere remains constant but there is a sudden increase in temperature at an altitude of 20 kms.
- The stratosphere is extremely dry.
- An extremely dry stratosphere results in weather-related events like scant rainfall. Therefore, it is ideal for flying aircraft.
- Cirrus clouds are sometimes found in stratosphere and are known as the **Mother of Pearl Clouds**.
- The upper limit of stratosphere is called the **stratopause**.
- The ozonosphere is a part of stratosphere.
- The ozonosphere extends from 15 to 35 kilometres above the Earth's level.

✎ **Note :** The Dobson unit is used to measure the thickness of the ozone layer.

- Ozone gas is present in the ozonosphere. It absorbs ultraviolet rays emitted from the Sun.
- The ozonosphere is also known as the **Protective Shield of the Earth**.

#### C. Mesosphere

- The mesosphere extends upto a **height of 50-80 km** above the Earth.

- The top of the mesosphere is the coldest area of the Earth's atmosphere because temperature may locally decrease to as low as 100 K (-173°C).
- Noctilucent clouds appear above the **poles in mid-summer**.
- Mesosphere is the region where '**Noctilucent clouds**' are formed through the ice crystals which are created by fine dust particles from meteors.
- There is a drop in temperature with the increasing height in Mesosphere.
- The upper boundary of the mesosphere is called **mesopause**.

#### D. Ionosphere

- The ionosphere extends upto an altitude of **80–640 km** above the earth.
- There is an **excess of electrically charged particles** in ionosphere. These are called **ions**.
- Temperature increases with height in the ionosphere.
- The ionosphere is divided into the following layers- **D-layer, E-layer, F-layer, G-layer**
- In D-layer, **low-frequency radio waves**, i.e. long-wavelength waves, are reflected.
- The E-layer is also called the **Kennelly Heaviside layer**.
- The E-layer **reflects high-frequency radio waves and sends them to Earth**.
- The F-layer is also known as the **Appleton Layer**.
- The F-layer also **reflects the mid and high-frequency radio waves**, having short wavelength.
- The G-layer **reflects waves of all frequencies**.
- Mobile, radio, television and radar, etc. operate through long frequency in the D-layer of the ionosphere.
- Communication satellites are installed in the ionospheres.
- The fundamental phenomena of ionosphere are the **aurora australis** (south polar light) and **aurora borealis** (north polar light).
- **Aurora is a cosmic shining light**.
- The aurora is formed by electron waves emitting from the sun's surface.
- Auroras usually appear at midnight.

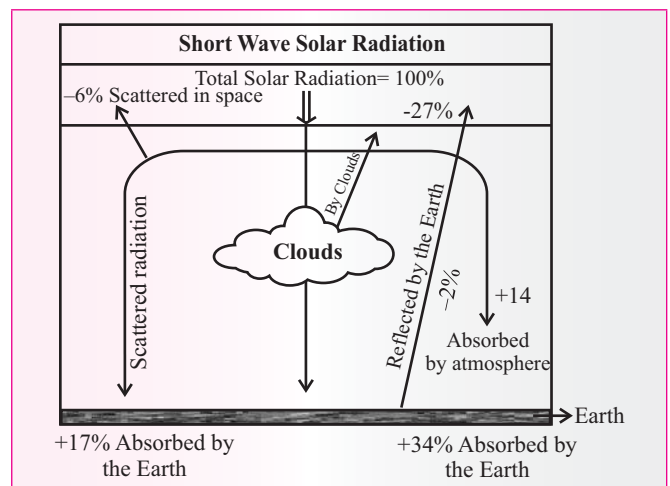
#### F. Exosphere

- The **topmost layer of the atmosphere** above ionosphere is called **exosphere**.
- The exosphere is the outermost layer of the earth's atmosphere. It starts at an **altitude at about 640 kms**.
- The exosphere has **no upper boundary**.
- The exosphere is dominated by electrically charged particles, temperature gradually increase through the layer.
- The exosphere has gases like hydrogen and Helium but in a trace amount.
- There is an absence of air to breathe in ionosphere.

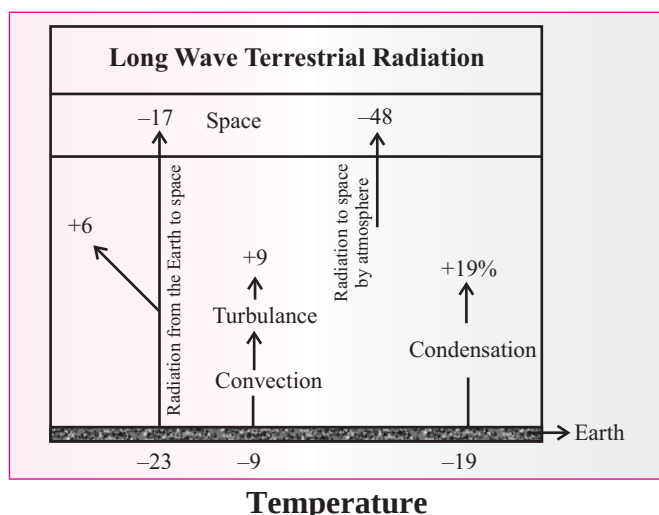
| Atmospheric Structure |                                         |                                                                                |                                                                                                                 |
|-----------------------|-----------------------------------------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Layer                 | Height                                  | Temperature                                                                    | Specific Facts                                                                                                  |
| Troposphere           | 15 km (8 km at poles)                   | Decreases with increasing height                                               | atmospheric phenomena such as thunder-storms, etc.                                                              |
| Stratosphere          | 15 to 50 km (Thickness at pole highest) | In the beginning temperature remains constant, grows when goes up above 20 km. | Ozone gas is found from 15 to 35 km.                                                                            |
| Mesosphere            | 50-80 km                                | Decreases in temperature with increasing height.                               | Upper limit is called Mesopause.                                                                                |
| Ionosphere            | 80-640 km                               | Rise in temperature with increasing height.                                    | Communication satellites are placed in ionosphere, events like aurora australis and aurora borealis occur here. |
| Exosphere             | above 640kms                            | —                                                                              | —                                                                                                               |

#### Insolation

- The solar **radiation** that reaches the earth is called **insolation**.
- Only **51 per cent** of the heat emitted from the sun reaches the top surface of the Earth.
- Only about **2 per cent** of the insolation is reflected from the ground.
- The atmosphere absorbs only **14 per cent** of the solar radiation.
- **Albedo** is the ratio between the amount of insolation the surface receives and the amount of insolation reflected from the same surface.
- Approximately **27 per cent** part of the total solar radiation reflected to space from the top of clouds.







- The Earth receives heat from the sun by radiation.
- Direct heating of a substance by the transmission of heat waves is called **radiation**. Radiation does not require any physical **medium**.
- The Earth receives heat from the sun in **the form** of short waves radiation.
- Heat reflected from the earth's **surface** is called **terrestrial radiation**.
- Terrestrial radiation is in the form of long waves.
- The radiation coming from the sun is short wave radiation that crosses the atmosphere and reaches the earth.
- Radiation from the Earth's surface is in the form of long-wave radiation which heats the lower layers of the atmosphere.
- The atmosphere gets warmer due to the terrestrial radiation from the Earth than the solar radiation received from the sun.
- The imaginary line joining places of equal temperature is called **isotherm**.
- Isothermal lines are drawn parallel to latitudes in the **east-west direction**.
- The isotherms automatically turn due to the temperature variation on land and water.
- The differences in temperature in the Southern Hemisphere is less frequent due to the greater presence of water body.
- The lack of water body area and high temperature disparity is found in the Northern Hemisphere.
- The distance between isotherms estimates the temperature gradient (temperature change rate).
- When the isotherms are apart from one another, the **heat gradient is low**.
- The heat gradient is higher when the isotherms are close to one another.
- In polar regions, due to extremely low temperature, the isotherms are found with low values.
- In tropical regions, high values of the isotherms are found when the temperature is high.

- In January and July, the northern hemisphere receives minimum and maximum temperature respectively in most of the world.
- The difference between the minimum and the maximum temperature is called the **temperature difference**.
- The difference between the maximum and the minimum temperature on a day at a particular place is called **daily temperature difference**.
- The difference in the mean temperature of the hottest and the coldest months of a particular place is called **annual temperature difference**.
- The difference between the average temperature of a particular place and the average temperature of its latitude is called a **thermal anomaly**.

#### Atmospheric Pressure :

- A **barometer** measures air pressure.
- **Bar** is the unit of atmospheric pressure.
- One bar is equal to  $10^5 \text{ N/m}^2$ .
- Standard sea-level pressure equals 760 mm (76 cm) of mercury.
- Isobars are lines that connect points of equal pressure, generated from mean sea-level pressure.
- The difference in pressure between any two places is called **pressure gradient**.
- The pressure gradient is low when the isobar lines are away from each other.
- The pressure gradient is higher if the isobars are close to each other.

#### Horizontal and Latitudinal Distribution

- There are a total of 7 pressure belts on the globe. These 7 air pressure belts include- **Polar High Pressure, Sub-polar Low Pressure, Subtropical High Pressure and Equatorial Low Pressure**.

##### 1. Polar High Pressure

- The polar high pressure is extended around the poles between  $80^\circ$ - $90^\circ$  in both the Northern and the Southern Hemisphere.
- The cold (heavy) air on reaching poles subsides, which then creates a high-pressure belt at the surface of the Earth.

##### 2. Sub-polar Low Pressure

- The extension of the sub-polar low-pressure belt is found between  $60^\circ$  and  $65^\circ$  latitude in both hemispheres.
- Despite low temperature throughout the year in this belt, it gets low air pressure. In fact, due to the rotational motion of the earth, the air is transferred in these latitudes resulting in kinetic low air pressure.

##### 3. Subtropical High-Pressure Belt

- The subtropical high-pressure belts lie between latitudes  **$30^\circ$  to  $35^\circ$  in the northern and southern hemispheres**. This belt is also called the **horse latitudes**.

#### 4. Equatorial low

- Equatorial low air pressure belts are generally found **between 5° north and 5° south latitude of the equator** but this equatorial low pressure belt moves due to the movement of the sun in the northern and the southern hemispheres.
- This region gets the vertical rays of the sun throughout the year which leads to the expansion of the air.
- The surface winds do not flow in the equatorial low-pressure zone.
- The air becomes light and moves up because of the high temperature in this pressure belt, causing **convection currents**.
- The equatorial low-pressure belt is called **doldrums** or the **zone of calm**.

#### Wind

- The wind is the air that moves from high-pressure areas to low-pressure areas.
- The vertical or nearly vertical movement of the air is referred to as **air current**.
- Due to the **rotation of the Earth on its axis** and **axis being tilted**, the **winds change their direction**.
- The **gradient of air pressure** determines the wind speed.
- The **higher the gradient of air pressure** at two places, the **faster the air moves**.
- When the **gradient of air pressure between two places is low**, the **speed of the wind is slow**.
- The deflection of winds from their original direction is due to the rotation of the Earth is called **Coriolis Force**.
- Due to the effect of Coriolis Force, the wind is deflected towards the right in the northern hemisphere and to the left in the southern hemisphere.
- The effect of the Coriolis Force at the **Equator is zero**.
- The effect of the Coriolis Force at the **poles is maximum**.
- The **wind direction change due to the Coriolis effect, pressure gradient force, ground friction and centripetal force**.

#### Types of Winds :

- **Winds are of three types** - planetary winds, seasonal winds, local winds.

#### 1. Planetary winds

- planetary winds constantly blow throughout the year in a particular direction.

- The **trade winds** (easterlies), **westerlies** and **polar winds** are the **permanent winds**.

#### A. The Trade Winds

- These are extremely steady winds blowing from the sub-tropical high-pressure areas (30°N and S) towards the equatorial low-pressure belt.

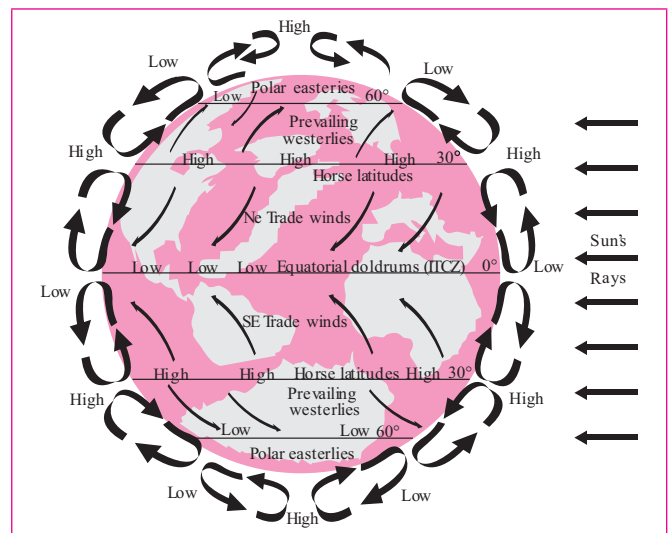
- They flow as the north-eastern trade in the northern hemisphere and the south-eastern trade in the southern hemisphere. Trade winds from both the hemispheres meet at the Equator and they rise and cause a heavy rainfall due to convergence.

#### B. Westerlies wind

- In the northern and the southern hemispheres, the permanent air blowing from the subtropical high-pressure tropics to the sub-polar low pressure tropics is called **westerlies**.
- The **west sides** of the continents (45° to 65°) receive rain due to **westerlies**.
- Westerlies between the latitudes of 40° to 65° are best developed in the Southern Hemisphere due to the absence of surface barriers.
- The sailors have named winds that are blowing between 40° and 60° in southern hemisphere as the **roaring forties**, **furious fifties** and **shrieking sixties**.

#### C. Polar Winds

- The winds that flow from polar high-pressure belts to sub-polar low-pressure belts are called **polar winds**.
- **Polar winds have a low water vapour holding capacity**.
- The westerlies in the sub-polar low-pressure tropics collide with the polar winds to form polar air fronts that produce the extra-tropical or temperate cyclone.



#### 2. Seasonal Winds

- These winds change their direction in different seasons.

- Land and sea breezes and monsoon winds are examples of seasonal winds.

#### a. Land and Sea Breezes

During the day, the land gets warmer than the sea, which is relatively cold; therefore, zone of low pressure is developed on the land and high pressure above the sea; hence the air flows from sea to land which is called a **sea breeze**.

#### b. Monsoon Winds:

- All those winds which change according to the seasons are called **monsoon winds**.

- Monsoon winds move from the sea to the land in summer and from the land to the sea in winter.

#### 3. Local Winds

- Local winds are produced due to regional variability in temperature and pressure conditions.
- Local winds are confined to the lower layers of the troposphere.

#### i. Chinook

- Chinook is the warm, dry wind, descending from the **eastern slopes of the Rocky Mountains**, primarily in winter.
- The Chinook wind flows from the **eastern slope of Rocky Mountains from Colorado (USA) in the south to British Columbia (Canada) in the north**.
- Chinook wind melts snow for much of the winter keeping the pastures open for animals.

#### ii. Sirocco

- It is a hot, dry and sandy wind **flowing from the Sahara desert in the north through the Mediterranean Sea**.
- It crosses the Mediterranean Sea and enters Italy and Spain.
- Sirocco wind has different names at different places, such as **Gibli in Libya, Khamasin in Egypt**, etc.
- These winds pass through the Mediterranean Sea, retain moisture and occasionally rain in southern Italy called **blood rain**.

#### iii. Foehn

- Foehn is a warm and dry wind that flows through the **northern slope of the Alps mountains**.
- Dryness and heat of Foehn cause the ice to melt, leading to the **development of pastures**.
- Under the influence of Foehn, the weather becomes pleasant and the **grape crop ripens quickly**.
- Foehn has the most significant effect in **Switzerland**.

#### iv. Samun

- Samun wind has the same characteristics as Foehn. It moves across **Kurdistan in Iran and Iraq**.

#### v. Shamal

- Shamal is the **dry and sandy** wind in the **desert region of Iraq, Iran and Arabia**.

#### vi. Black Roller

- Black Roller is the **hot and dry sandy wind** blowing

through north-west or south-west region in the **Great Plains** of the USA.

#### vii. Simoom

- Simoom is a warm, dry and dusty wind of the Arabian desert.

#### viii. Yoma

- Yoma is a warm and dry wind blowing in Japan.

#### ix. Harmattan

- Harmattan is a wind blowing **from the east** and the **northeast towards the west in the Sahara desert**.
- Harmattan is also known as **Doctor wind** because it makes the weather healthier by bringing dryness in the humid and warm air of the west coast of Africa.

#### x. Norwester

- Norwester is a **hot** and **dry** wind descending from high mountains in northern New Zealand.

#### xi. Karaburan

- Karaburan (Black storm) is the **hot and dusty** wind of Central Asia – Tarim Basin, Mongolia.

#### xii. Blizzard

- **Blizzard is a snow-laden wind** of Canada, the USA and Siberian region.

#### xiii. Koimband

- Koimband is a **hot** and **dry wind blowing in Java**.
- Koimband is **harmful to tobacco crops**.

#### xiv. Papagayo

- Papagayo is a **cold** and **dry** wind blowing from the northeast of the coast of Mexico.

#### x. Gregale

- Gregale is a strong and cold wind that blows from the northeast in the western and central Mediterranean region, mainly in winter.
- The Local wind blows over a limited area.
- Local winds are found in **hot** and **cold**.



## Local Winds and their Different Names

| Major Local Cold Winds        |                             |
|-------------------------------|-----------------------------|
| Wind                          | Place                       |
| 1. Northern                   | USA                         |
| 2. Norte                      | USA                         |
| 3. Williwaw                   | Alaska                      |
| 4. Pampero                    | Argentina, Uruguay          |
| 5. Papagayo                   | Mexico                      |
| 6. Purga                      | Tundra Region               |
| 7. Bise                       | Eastern France, Switzerland |
| 8. Mistral                    | Spain & France              |
| 9. Buran                      | Russia                      |
| 10. Bora                      | Adriatic Coast              |
| 11. Cape Doctor (Table Block) | South African Republican    |
| 12. Haboob                    | Sudan                       |
| 13. Seistan                   | Eastern Iran                |
| 14. Tramontane                | Central Europe              |
| 15. Levanter                  | Spain                       |

| Major Local Hot Winds      |                                 |
|----------------------------|---------------------------------|
| Wind                       | Place                           |
| 1. Sirocco                 | Sahara Desert, Italy            |
| 2. Harmattan (Doctor Wind) | Guinea Coast                    |
| 3. Chinook                 | Rocky Mountains (USA)           |
| 4. Foehn                   | Alps Mountains (Switzerland)    |
| 5. Brickfielder            | Australia                       |
| 6. Simoom                  | Arabian Desert                  |
| 7. Black Roller            | Plains of North America         |
| 8. Ghibli / Gibli          | Libya                           |
| 9. Khamsin                 | Egypt                           |
| 10. Leste                  | Madeira and Canary Islands      |
| 11. Chili                  | Tunisia                         |
| 12. Koimbang               | Java (Indonesia)                |
| 13. Shamal                 | Iraq                            |
| 14. Norwester              | New Zealand                     |
| 15. Santa Ana              | Southern California             |
| 16. Samun                  | Iran                            |
| 17. Loo                    | Northern India                  |
| 18. Ayala                  | France                          |
| 19. Garmsil                | South-east Iran                 |
| 20. Solano                 | South-east Spain                |
| 21. Poniente               | North-Eastern Mediterranean Sea |
| 22. Berg                   | South Africa                    |
| 23. Baguio                 | Philippines                     |
| 24. Sukhove                | Russia & Kazakhstan             |
| 25. Haboob                 | Sudan                           |

## Jet Streams :

- Jet streams are relatively narrow bands of **strong winds in the upper levels of the atmosphere.**
- The winds blow from west to east in jet streams but the flow often shifts to the north and the south.
- Jet streams follow the boundaries between hot and cold air.
- Propagation of the jet streams is between 20° latitudes in both the hemispheres at an altitude ranging from 7.5 to 14 km between poles.
- Jet streams generally have a speed of **150 to 200 km per hour.**
- Jet streams become stronger during winter and their velocity is twice as much as in summer.
- The difference in temperature resulting in air pressure fluctuations on the surface of the earth is the prime cause of developing Jet streams.
- It is related to the difference in temperature from the Equator towards the poles and the high pressure on the poles and the lower pressure in the troposphere above it.
- Jet streams play an important role in balancing the temperature variation on the earth.
- Tropical monsoonal rainfall is affected by Jet streams.
- Jet streams produce **storms, rainfall, atmospheric disturbances, cyclones and anti-cyclones.**

## Air Masses

- Air masses are the largest part of the atmosphere where humidity and temperature show a uniform pattern of physical characteristics across multiple layers horizontally.
- Air masses play an essential role in the study of weather and climate.

## Fronts

- The boundary zones of convergence separating two air masses are called **fronts.**
- Along a **warm front**, a warm air mass slides over a cold air mass.
- A front in which cold air is replacing warm air at the surface is called a **cold front.**

## Humidity

- Humidity is the amount of water vapour in the air.
- **Absolute humidity** is the ratio of the mass of water vapour and the mass of dry air in a particular volume of air at a specific temperature.
- The absolute humidity as measured is a unit of a given grams of water vapour per cubic meter of the air.
- The total mass of water vapour present in a certain mass of air is called **specific humidity.**
- Specific humidity is expressed in **grams/kilogram** unit.
- Relative humidity is the ratio of the amount of water vapour actually present in the air to the greatest amount possible at the same temperature. The formula to measure relative humidity is-



$$\text{Relative Humidity} = \frac{\text{Specific Humidity}}{\text{Absolute Humidity}} \times 100$$

- Relative humidity is expressed in percentage.
- The temperature of the air and the amount of water vapour depends on relative humidity.
- Relative humidity decreases when the air temperature increases.
- Relative humidity increases when air temperature decreases.
- Approximately 45% relative humidity in the air is most comfortable for humans.
- The relative humidity of saturated air is 100%.

#### **Dew Point :**

- Dew point is the temperature at which water is converted from its gaseous state to a liquid or solid state.

#### **Condensation :**

- The change of water vapour into the liquid is known as **condensation**.
- The condensation depends on the relative humidity of the air and the fall in the temperature.

#### **Dew:**

- When the air temperature is below the dew point, the water vapour in the air condenses and accumulates on the surface in the form of small drops of water which is called **dew**.

#### **Frost :**

- The frost occurs when the dew point is below freezing point and the excess water vapour freezes into ice particles.

#### **Fog :**

- A cloud of smoke formed near the lower surface of the atmosphere due to dust particles and concentrated water particles is called **fog**.
- Fog is formed when the air temperature is below the dew point. The visibility during fog is less than a kilometre.

#### **Mist :**

- Mist is a smaller form of fog.
- The mist contains more moisture than fog.
- Mist is less dense and quicker to dissipate.
- Visibility in the mist is more than 1 kilometre and less than 2 kilometres.

#### **Clouds :**

- Clouds are formed primarily as a result of condensation of water vapour in the atmosphere into a large collection of very tiny droplets of water or ice crystals.
- Clouds float due to low density in the atmosphere.
- Clouds are of different kinds based on shape, vertical expansion and height from the ground. They are as follows-

#### **(i) Cirrus Clouds :**

- These clouds are found at the highest altitude. They are formed by small ice particles and because of this they appear silky. When the rays of the sun pass through them, they become white. Cirrus clouds appear in the sky before the arrival of cyclones.

#### **(ii) Cirrostratus Clouds:**

- They are mainly found at an altitude of more than 18000 feet. On their arrival, a halo is formed around the sun and the moon, anticipating the cyclone.

#### **(iii) Cirrocumulus Clouds:** These clouds are found in white and small circular forms.

#### **(iv) Altostratus Clouds:** Altostratus clouds are mid-level, grey or blue-grey clouds having a fibrous or uniform appearance that usually covers the whole sky. They cause extensive and continuous rain.

#### **(v) Altocumulus Clouds:** It is a medium-level cloud found at low altitudes similar to cirrocumulus clouds. They have wavy layers of globular form. High globular groups of altocumulus clouds are sometimes called **sheep clouds or woolpack clouds**.

#### **(vi) Stratocumulus clouds:** They are whitish, found in round patches between the height of 2600 m to 3000 m.

#### **(vii) Stratus Clouds:** Stratus clouds are low and uniformly grey in colour and can cover most or all the sky. Stratus clouds can look like fog that never reach the ground.

#### **(viii) Nimbostratus Clouds:** They are found much closer to the ground. They are dark, grey, featureless layers of cloud, thick enough to block out the sun and produce persistent rain.

#### **(ix) Cumulus Clouds:** Cumulus clouds are puffy clouds that sometimes look like pieces of floating cotton. The base of each cloud is often flat and may be only 1000 meters (3300 feet) above the ground. The top of the cloud has a shape of rounded towers.

#### **(x) Cumulonimbus Clouds:** Cumulonimbus clouds are extremely wide and deep. This is the only type of cloud that can produce hail, thunder and lightning. The base of the cloud is often flat.

#### **➤ Rainfall:**

- The water vapour condenses into clouds and converts into drops of water and heavy droplets on the earth are called **rain**.
- Rainfall has been classified into three main types based on the origin – convectional rainfall, orographic (relief) rainfall and cyclonic rainfall.

#### **1. Convectional Rainfall:**

- Convection currents are created by the rise of hot winds above the surface of the earth. After reaching a higher altitude, the convection currents become fully saturated and form the black cumulus clouds which cause excessive rainfall known as **convectional rainfall**.

#### **2. Orographic Rainfall:**

- It occurs when hot and humid air rises along the slope of a mountain. It cools down due to the adiabatic process and becomes saturated, as a result of which it condenses and causes rainfall.

- Most of the rainfall in the world is in the form of orographic rain.

### 3. Cyclonic or Frontal Rainfall:

- Rain occurring due to cyclones is called **cyclonic** or **frontal rainfall**.
- Cyclonic rainfall is caused due to Western disturbance, Nor'westers, and mango showers.
- The place of origin of western disturbances active in northwest India during the winter season is the Mediterranean Sea, particularly the eastern Mediterranean region.

#### Cyclones :

- A cyclone is a large scale air mass that rotates around a strong centre of low atmospheric pressure.
- In the northern hemisphere, the cyclone moves anti-clockwise, and in the Southern Hemisphere, it moves clockwise.
- There are two types of cyclones: (i) temperate and (ii) tropical.

🔍 **Note :** A cyclone helps in getting rain.

#### Anticyclone:

- In an anticyclone, the air system is opposite to the cyclone. There is high pressure in the centre and low pressure in the outer area.

🔍 **Note :** In the opposite direction of a cyclone, an anticyclone is produced.

- In the northern hemisphere, the anticyclone moves clockwise, while in the southern hemisphere, it moves anti-clockwise.

🔍 **Note :** The weather in the cyclone is clear and the winds are mild.

#### Tornados:

- A **tornado** is a short-lived and catastrophic tropical cyclone.
- It has a funnel shape and originates mainly in the United States.

#### Hurricanes:

- Hurricanes are massive storm systems that form over warm ocean waters and move toward land.
- Hurricanes originate in the Atlantic basin which includes the Atlantic Ocean, Caribbean Sea, the Gulf of Mexico, the Eastern North Pacific Ocean, and, less frequently, the Central North Pacific Ocean.

#### Typhoon:

- The typhoon is a cyclone rising from the Pacific Ocean, mainly affecting the China Sea, the Philippines Islands and the Southern Japan region.

## 7. Hydrosphere

- The hydrosphere covers about 70.9% of the entire Earth.
- 80.9% of the Southern Hemisphere and 60.7% of the Northern Hemisphere are surrounded by oceans.

- The saline water of the oceans is 97% of the total water present on Earth, while clean water or soft water is only remaining 3%.
- The oceans constitute the largest component of the hydrosphere and have no fixed boundary.
- The oceanic crust mainly consists of silica and magnesium; it is therefore called sima (si-silica and ma-magnesium)
- **The Pacific Ocean is the largest in the world.**
- Salinity and high average temperatures are two important characteristics of ocean water.
- Hypsographic fathoms the depth of the oceans and the altitude of the landmass.
- The average depth of the oceans is 12100 feet (3688 meters).
- Ocean water has an average temperature of about 27 degrees celsius.
- The Atlantic Ocean records a relatively higher annual range of temperature than the Pacific Ocean due to morphological variation.
- The temperature difference is more in the northern hemisphere than in the southern hemisphere.
- The salinity of ocean water is expressed in its ratio per thousand.
- The average salinity of seawater is 35 per thousand (‰).
- The line connecting ocean waters of equal salinity is called **Isohaline**.
- Southern latitude between 10° to 30° and northern latitude between 20° to 40° northern latitude have the highest salinity.
- The highest salinity in the world is found in Assal Lake (348‰) Djibouti and Van Lake Turkiye (330‰).
- The third place in the world as regards the highest salinity (238‰) is the Dead Sea.

### Oceans and Trenches

| Position                            | Trench      | Depth (in meters) |
|-------------------------------------|-------------|-------------------|
| 1. Pacific Ocean                    | Mariana     | 11033             |
| 2. Pacific Ocean                    | Mindanao    | 10540             |
| 3. Pacific Ocean                    | Tonga       | 10882             |
| 4. Atlantic Ocean (Western Islands) | Puerto Rico | 8385              |
| 5. Eastern Indian Ocean             | Sunda       | 8152              |
| 6. Southern Atlantic Ocean          | Romanche    | 7631              |

- Mariana Trench is also known as **Challenger Trench**.
- It is located in the Pacific Ocean near Guam Island.
- Its depth is **11033 meters**.
- The **Great Barrier Reef** is the world's largest coral reef. It is located near Queensland, Australia.

- The shallowest part of submerged uplift water is called **Shoal**.
- The principal divisions (in descending order of area) are the: Pacific Ocean, Atlantic Ocean, Indian Ocean, Southern (Antarctic) Ocean, and Arctic Ocean.

### Pacific Ocean :

- The area of the Pacific Ocean is 168.7 million square kms.
- It covers around 46% of the Earth's water surface.
- It has a triangular shape. The Pacific Ocean stretches from the shores of Antarctica to the Bering Strait over 135° of latitude.
- The prominent feature of the Pacific Ocean is the coral reefs.
- North and South America lie to the east of the Pacific Ocean while Asia and Australia to the west and Antarctica to the south.
- The main seas of the Pacific Ocean are the East China Sea, the Yellow Sea, the Sea of Japan, the Bering Sea and the Okhotsk Sea.
- Most of the coastline is in the western part of the Pacific Ocean.
- The Gulf of California is located in the eastern part of the Pacific Ocean.

### Major Countries of The World With Large Coastlines

| Country          | Length of Coastline |
|------------------|---------------------|
| 1. Canada        | 202080 km           |
| 2. Indonesia     | 54716 km            |
| 3. Greenland     | 44087 km            |
| 4. Russia        | 37653 km            |
| 5. Philippines   | 36289 km            |
| 6. Japan         | 29751 km            |
| 7. Australia     | 25760 km            |
| 8. Norway        | 25148 km            |
| 9. United States | 19924 km            |
| 10. New Zealand  | 15134 km            |

### Major Countries of The World With Large Water Areas

|                  |              |
|------------------|--------------|
| 1. Canada        | 891163 sq km |
| 2. Russia        | 720500 sq km |
| 3. United States | 685924 sq km |
| 4. India         | 314070 sq km |
| 5. China         | 270550 sq km |
| 6. Iran          | 116600 sq km |

### Atlantic Ocean :

- The Atlantic Ocean has an area of 85.1 million square km.
- The area of the Atlantic Ocean is 23.5% of the area of global ocean.
- The shape of the Atlantic Ocean is similar to the English letter 'S'.
- Europe and Africa are located on the east coast of the Atlantic Ocean while North America and South America are on the west.
- The North Sea, the Baltic Sea, the Hudson Bay and Greenland are located to the north of the Atlantic Ocean while it faces Antarctica in the south.
- The Central Atlantic Ridge is an important feature of the Atlantic Ocean.
- The Mid-Atlantic Ridge extends from Iceland in the north to Bouvet Island in the south.
- Mid-Atlantic ridge has a length of about 16000 kilometres and a height of 3000 mtrs. above sea-level.
- Mid-Atlantic ridge is a submerged ridge.
- Many peaks of the Mid-Atlantic Ridge have risen above the water and look like islands.
- The main islands of Mid-Atlantic Ridge are **Cape Verde Island** and **Pico Island**.
- The peak of the St. Paul Archipelago, located near the Equator, is the smallest of the Mid-Atlantic ridges.
- St. Helena, Gough, Bouvet Island, Tristan da Cunha and Ascension Island are the major volcanic islands of the southern Atlantic Ocean.
- The **Bermuda Atoll** is located in the North Atlantic Ocean.
- The highest width of the Atlantic Ocean is near the latitude of 55 degrees north.
- The Atlantic Ocean separates into two parts near the Equator.
- The Northern Atlantic ridge is known as **Dolphin Rise** and the Southern part is named as **Challenger Rise**.
- The Gulf of Mexico, the Gulf of Hudson, the Bay of Baffin, the Baltic Sea, the North Sea, and the Caribbean Sea are all located in the Atlantic Ocean.

### Indian Ocean:

- The area of the Indian Ocean is 70.5 million square km.
- The Indian Ocean is a semi-ocean.
- On all its sides, east, west, north and south it has the continents of Australia, Africa, Asia and the Antarctica located respectively.
- The Indian Ocean has the Atlantic Ocean on one side and the Pacific Ocean on the other.
- The northern boundary of the Indian Ocean is the Tropic of Cancer.

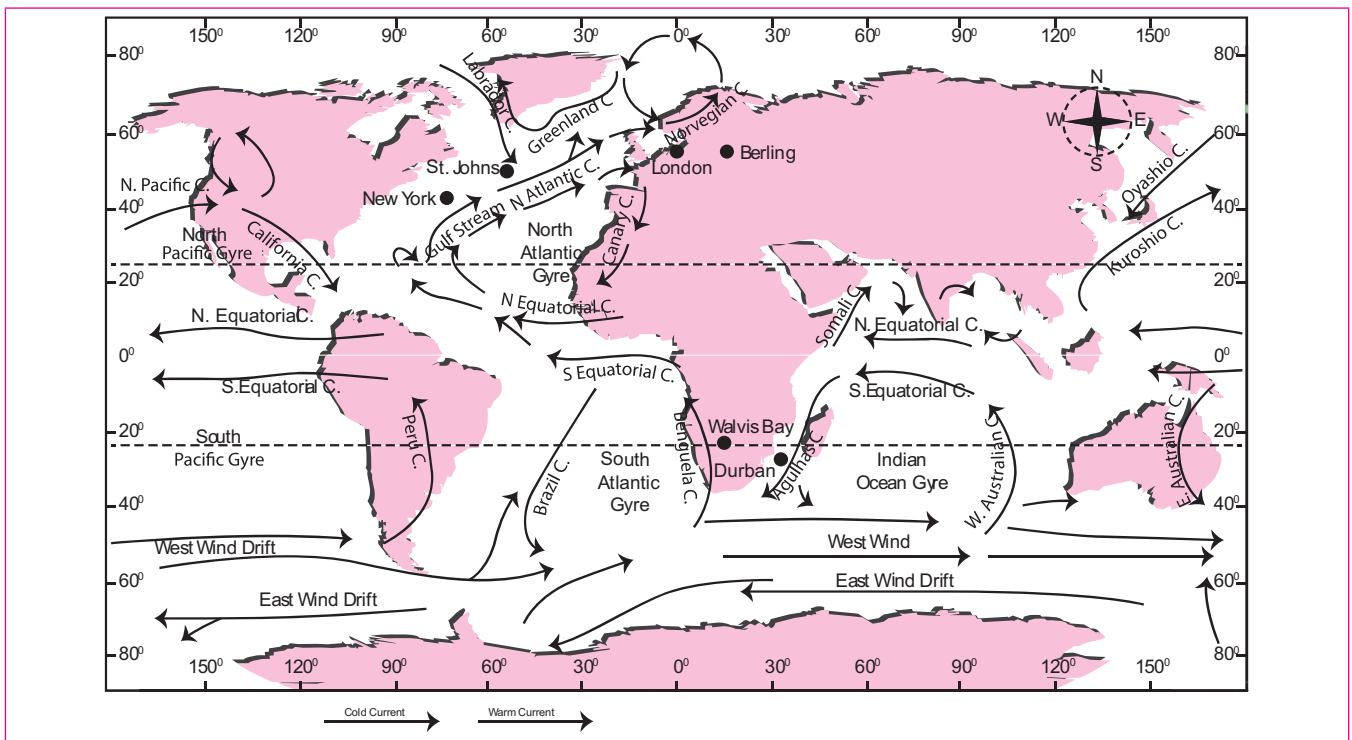
- The islands of Reunion and Mauritius are volcanic islands of the Indian Ocean.
- Madagascar is the largest island in the Indian Ocean.
- Diago Garcia is an island in the Indian Ocean.
- 90° East Ridge is located in the Indian Ocean.

#### Exam Oriented Facts

- The Arctic ocean basin is the smallest ocean basin. It includes the waters north of the North American and Eurasian continents.
- The Arctic Ocean covers an area of 5.427 Million square miles and the structure of basin is circular.
- The continental slope connects the continental shelf and the ocean basins.
- A continental shelf typically extends from the coast to depths of 100–200 metres (330–660 feet). It is gently inclined seaward at an average slope of about 0.1°.
- A continental shelf is the edge of a continent that lies under the ocean. Continents are the seven main divisions of land on Earth. A continental shelf extends from the coastline of a continent to a drop-off point called the shelf break.

#### Ocean currents :

- The flow of a large amount of ocean water in a particular direction is called **ocean currents**.
- Ocean currents consist of hot and cold streams.
- The flow of hot water is from the lower latitudes of the tropics to the high temperate and sub-polar regions.
- Warm currents often flow from the Equator to the Pole.
- The cold water flows from higher latitudes to lower latitudes.
- Cold streams often flow from the poles towards the sub-polar regions.
- Due to the influence of **Coriolis Force**, ocean currents turn to their right in the Northern Hemisphere and to their left in the Southern Hemisphere.
- The direction of the flow of water currents in the northern part of the Indian Ocean changes with the direction of monsoon winds.
- The Gulf streams and the Labrador streams intersect near New Foundland.
- An important marine fishing site in the North Atlantic Ocean is located on **Grand Bank New Foundland**.
- The grass called Plankton is found at the junction of the hot and cold streams.
- The combination of hot Kuroshio streams and cold Oyashio streams creates a thick, foggy environment in Japan.
- The Sargasso Sea is a tranquil water zone between the Gulf Streams, the Canary and the North Equatorial streams in the North Atlantic Ocean.
- The rootless grass is found in the Sargasso Sea because of this it was named **Sargasso**.
- The sailors of Spain first saw the Sargasso Sea.
- The Atlantic Ocean has the highest salinity (37‰) in the Sargasso Sea.
- The Sargasso Sea is known as the **ocean desert**.





### Warm Currents of the Pacific Ocean

|    |                            |
|----|----------------------------|
| 1. | Kuroshio Current           |
| 2. | Alaska Current             |
| 3. | Tsushima Current           |
| 4. | El Nino Current            |
| 5. | North Equatorial Current   |
| 6. | South Equatorial Current   |
| 7. | North Pacific Current      |
| 8. | East Australian Current    |
| 9. | Counter Equatorial Current |

### Cold Currents of the Pacific Ocean

|    |                                 |
|----|---------------------------------|
| 1. | Humboldt or Peruvian Current    |
| 2. | California Current              |
| 3. | Antarctica Current              |
| 4. | Kurile Current/ Oyashio Current |
| 5. | Okhotsk Current                 |

### Warm Currents of the Atlantic Ocean

|    |                                     |
|----|-------------------------------------|
| 1. | Gulf Streams                        |
| 2. | Brazil Current                      |
| 3. | Florida Current                     |
| 4. | Irminger Current                    |
| 5. | Northern Equatorial Current         |
| 6. | Southern Equatorial Current         |
| 7. | Equatorial Counter (Guinea) Current |

### Cold Streams of the Atlantic Ocean

|    |                        |
|----|------------------------|
| 1. | Canary Current         |
| 2. | Benguela Current       |
| 3. | Labrador Current       |
| 4. | Falkland Current       |
| 5. | East Greenland Current |
| 6. | Antarctica Current     |

### Permanent and Hot Currents of The Indian Ocean

|    |                             |
|----|-----------------------------|
| 1. | Mozambique Current          |
| 2. | Agulhas Current             |
| 3. | Southern Equatorial Current |

### Permanent and Cold Currents of the Indian Ocean

|    |                         |
|----|-------------------------|
| 1. | West wind drift         |
| 2. | West Australian Current |

- The summer monsoon stream is hot and unstable in the Indian Ocean and the winter monsoon stream is cold and unstable.

### Tide and Ebb:

- Tide and ebb is the process of rise and fall of ocean water due to the gravitational force of the Sun and the Moon.
- The 'tide' is the process of rising above seawater.
- Ebb is the receding or outgoing tide.
- The Moon is much closer to the Earth; therefore, its tide generating power is twice as much as that of the Sun.
- The moon, the Sun and the Earth are in one line on a full moon and new moon due to which high tides are generated on earth on this day.
- On the seventh or the eighth day of both the full moon phase and the new moon phase, the moon and the Sun, form a right angle with the centre of the earth, causing a low tidal situation on the earth.
- Tides come twice a day at any place, one of which is due to the gravitational force of the moon and the other due to the centrifugal force of the earth.
- Southampton, on the southern coast of England, receives four tides every day.
- The tides come twice each from the North Sea and the English Channel.
- The lowest and highest annual temperatures are recorded in February and August respectively.
- The average daily warming of the ocean surface is negligible (i.e, about 1° C).

### Oceans of The World and Trenches

| Ocean                                   | Trench                |
|-----------------------------------------|-----------------------|
| 1. Pacific Ocean (168.7 million sq. km) | Mariana Trench        |
| 2. Atlantic Ocean (85.1 million sq. km) | Puerto Rico Trench    |
| 3. Indian Ocean (70.5 million sq. km)   | Sunda Trench          |
| 4. Arctic Ocean (15.5 million sq. km)   | Eurasian Basin        |
| 5. Antarctic Ocean                      | South Sandwich Trench |

### Major Canals and the Countries of The World

| Canal            | Country | Location in between               |
|------------------|---------|-----------------------------------|
| 1. Suez Canal    | Egypt   | Red Sea and the Mediterranean Sea |
| 2. Panama Canal  | Panama  | Pacific Ocean and Atlantic Ocean  |
| 3. Welland Canal | Canada  | Erie and Ontario                  |
| 4. Erie Canal    | USA     | Hudson river and Erie Lake        |
| 5. Soo Canal     | USA     | Lake Superior and Huron Lake      |

|                      |             |                               |
|----------------------|-------------|-------------------------------|
| 6. New Water Way     | Netherlands | North Sea and Rotterdam       |
| 7. Kiel Canal        | Germany     | Baltic Sea and the North Sea  |
| 8. North Sea Canal   | Netherlands | Amsterdam and the North Sea   |
| 9. Gota Canal        | Sweden      | Gutenberg and the Stockholm   |
| 10. Manchester Canal | UK          | Liverpool and Manchester      |
| 11. Volga Don Canal  | Russia      | Stalingrad and Rostov         |
| 12. Albert Canal     | Belgium     | Antwerp and Liege             |
| 13. K.P. Canal       | India       | Tamil Nadu and Andhra Pradesh |

### World's Major Rivers, The Place of Origin and Drainage

| River                   | Length | (Km) Origin                                    | Drainage                   |
|-------------------------|--------|------------------------------------------------|----------------------------|
| 1. Nile                 | 6650   | Victoria Lake                                  | Mediterranean Sea          |
| 2. Amazon               | 6436   | Laggo Wilfero                                  | Atlantic Ocean             |
| 3. Yangtze              | 6300   | Tibet's Plateau                                | East China Sea             |
| 4. Mississippi Missouri | 6275   | Lake Itasca                                    | Gulf of Mexico.            |
| 5. Ob Irtysh            | 5410   | Altai Mountains                                | Gulf of Ob                 |
| 6. Huang Ho             | 5464   | Kunlun Mountains                               | Gulf of Chihli.            |
| 7. Yenisei - Angara     | 5539   | Large and small Yenisei confluence             | Kara Sea                   |
| 8. Congo Ocean          | 4700   | North-East Zambia Highlands                    | Atlantic                   |
| 9. Amur                 | 4444   | Shilka and Argun rivers                        | Sakhalin Gulf, Okhotsk Sea |
| 10. Lena                | 4400   | Baikal Mountains (Russia)                      | Laptev Sea                 |
| 11. MacKenzie*          | 4241   | Great Slave Lake                               | Beaufort Sea               |
| 12. Niger               | 4184   | Guinea (Africa)                                | Gulf of Guinea             |
| 13. Mekong              | 4909   | Tibet Plateau                                  | South China Sea            |
| 14. Volga               | 3645   | Valdai Plateau (Russia)                        | Caspian Sea                |
| 15. St. Lawrence        | 3058   | Lake Ontario                                   | Bay of St. Lawrence        |
| 16. Brahmaputra         | 2900   | Near Mansarovar Lake                           | Bay of Bengal              |
| 17. Indus               | 2880   | Near Mansarovar Lake                           | Arabian Sea                |
| 18. Danube              | 2888   | Black Forest (Germany)                         | Black Sea                  |
| 19. Euphrates           | 3000   | From the confluence of Karasu and Murat rivers | Shatt al-Arab              |
| 20. Darling             | 1545   | Great Dividing Range Australia                 | Murray River               |
| 21. Murray              | 2508   | Australian Alps                                | South Sea                  |
| 22. Paraguay            | 2695   | Mato Grosso (Brazil)                           | Parana River               |

|               |      |                                  |                    |
|---------------|------|----------------------------------|--------------------|
| 23. Ural      | 2428 | Southern Ural Mountains (Russia) | Caspian Sea        |
| 24. Ganga     | 2525 | Gomukh Gangotri Glacier          | Bay of Bengal      |
| 25. Amu-Darya | 2620 | Pamir Plateau                    | Aral Sea           |
| 26. Salween   | 2400 | Tibet Plateau                    | Andaman Sea        |
| 27. Arkansas  | 2348 | Rocky Mountains                  | Mississippi River  |
| 28. Colorado  | 2333 | Rocky Mountains                  | Gulf of California |
| 29. Dnieper   | 2287 | Valdai Hills (Russia)            | Black Sea (Russia) |
| 30. Ohio      | 2102 | Allegheny River Pennsylvania     | Mississippi River  |
| 31. Irrawaddy | 2809 | Mali and Nmai Rivers             | Andaman Sea        |
| 32. Orange    | 2200 | Drakensburg Mountains            | Atlantic Ocean     |
| 33. Orinoco   | 2410 | Sierra Parima Mountains          | Atlantic Ocean     |
| 34. Columbia  | 2250 | Rocky Mountains                  | Pacific Ocean      |
| 35. Don       | 1870 | Tula (Russia)                    | Azov Sea           |
| 36. Tigris    | 1850 | Taurus Mountains (Turkiye)       | Euphrates          |

📌 **Note :** After confluence of Tigris and Euphrates river, it is called Shatt al- Arab.

\* Length 1738 Km without headstream, 4245 Km with headstream

### Major Straits of the World and Related Seas

| Strait               | Related Sea                                   | Separates to             |
|----------------------|-----------------------------------------------|--------------------------|
| 1. Palk Arabian Sea  | Bay of Bengal and Sri Lanka                   | India and                |
| 2. Malacca of Bengal | Java Sea and Bay Sumatra                      | Malaya and               |
| 3. Bering (USA)      | Arctic Sea and Bering Sea                     | Russia and Alaska        |
| 4. Florida (USA)     | Atlantic Ocean & Gulf of Mexico               | Quba & Florida           |
| 5. Dover North Sea   | Atlantic Ocean &                              | France & UK              |
| 6. Gibraltar         | Atlantic Ocean and Mediterranean Sea (Europe) | Morocco (Africa) & Spain |

### Major Straits of The World

| Strait          | Geographical location | Connects                             |
|-----------------|-----------------------|--------------------------------------|
| 1. Dover        | France-England        | North Sea and English Channel        |
| 2. Davis Baffin | Canada-Greenland      | Atlantic Ocean and Bay               |
| 3. Denmark      | Greenland-Iceland     | Greenland Sea and North Atlantic Sea |
| 4. Palk Strait  | Sri Lanka-India       | Bay of Bengal and Gulf of Mannar     |

|                                                                                                                                                                                                                                                                                                                            |                                             |                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|---------------------------------------|
| 5. Malacca                                                                                                                                                                                                                                                                                                                 | Malaysia-Indonesia                          | South China Sea and Andaman Sea       |
| 6. Hudson                                                                                                                                                                                                                                                                                                                  | Canada                                      | Atlantic Ocean and Hudson Bay         |
| 7. Bering                                                                                                                                                                                                                                                                                                                  | Russia-Alaska                               | Chukchi Sea and Bering Sea            |
| 8. Luzon                                                                                                                                                                                                                                                                                                                   | Taiwan-Luzon Island (Philippines)           | Philippines Sea and South China Sea   |
| 9. Magellan                                                                                                                                                                                                                                                                                                                | Chile                                       | Atlantic Ocean and Pacific Ocean      |
| 10. Gibraltar                                                                                                                                                                                                                                                                                                              | Morocco-Spain                               | Atlantic Ocean and Mediterranean Sea  |
| 11. Korea                                                                                                                                                                                                                                                                                                                  | South Korea-Japan                           | East China Sea and Sea of Japan       |
| 12. Torres                                                                                                                                                                                                                                                                                                                 | Australia-New Guinea                        | Bay of Papua and Arafura Sea          |
| 13. Florida                                                                                                                                                                                                                                                                                                                | Cuba-USA                                    | Atlantic Ocean and Gulf of Mexico     |
| 14. Bab-Al-Mandab                                                                                                                                                                                                                                                                                                          | Djibouti-Yemen                              | Arabian Sea and Red Sea               |
| 15. Dardanelles                                                                                                                                                                                                                                                                                                            | Turkiye                                     | Aegean Sea and Sea of Marmara         |
| 16. Bass                                                                                                                                                                                                                                                                                                                   | Australia                                   | South Sea and Tasman Sea              |
| 17. Tsushima Korea                                                                                                                                                                                                                                                                                                         | Japan and South Korea                       | East China Sea and Sea of Japan       |
| 18. Bosphorus                                                                                                                                                                                                                                                                                                              | Turkiye                                     | Black Sea and Sea of Marmara          |
| 19. Cook                                                                                                                                                                                                                                                                                                                   | New Zealand (Northern and Southern Islands) | Tasman Sea & Southern Pacific Ocean   |
| 20. Tsugaru                                                                                                                                                                                                                                                                                                                | Japan                                       | Pacific Ocean and Sea of Japan        |
| 21. Sunda                                                                                                                                                                                                                                                                                                                  | Indonesia                                   | Indian Ocean and Java Sea             |
| 22. Belle Isle                                                                                                                                                                                                                                                                                                             | Canada                                      | Atlantic Ocean & Gulf of St. Lawrence |
| 23. Tatar                                                                                                                                                                                                                                                                                                                  | Russia                                      | Sea of Japan and Okhotsk Sea          |
| 24. Yucatan                                                                                                                                                                                                                                                                                                                | Mexico-Cuba                                 | Caribbean Sea and Gulf of Mexico      |
| 25. North Channel                                                                                                                                                                                                                                                                                                          | England-Ireland                             | Atlantic Ocean & Irish Sea            |
| 26. Otranto                                                                                                                                                                                                                                                                                                                | Albania-Italy                               | Ionian Sea and Adriatic Sea           |
| 27. Foveaux                                                                                                                                                                                                                                                                                                                | New Zealand                                 | Pacific Ocean and Tasman Sea          |
| 28. Makassar                                                                                                                                                                                                                                                                                                               | Indonesia                                   | Celebes Sea and Java Sea              |
| 29. Hudson                                                                                                                                                                                                                                                                                                                 | Canada                                      | Hudson Bay and Atlantic Ocean         |
| 30. Hormuz straight                                                                                                                                                                                                                                                                                                        | Iran-Oman                                   | Gulf of Oman and Gulf of Persia       |
| <p>✎ <b>Note-</b> The Torres, Bosphorus, Gibraltar, Bering and Bab-Al-Mandeb straits divide the continents.</p> <p>✎ <b>Note-</b> Rail tunnels connecting the land areas have been built through the Dover and Tsugaru Straits.</p> <p>✎ <b>Note-</b> The Gibraltar Strait is called the Key to the Mediterranean Sea.</p> |                                             |                                       |

| Major Cities of the World Located on the Banks of Rivers |                                 |
|----------------------------------------------------------|---------------------------------|
| City                                                     | River                           |
| 1. Chicago (America)                                     | Chicago                         |
| 2. Berlin (Germany)                                      | Spree                           |
| 3. Ottawa (Canada)                                       | Ottawa                          |
| 4. Quebec City (Canada)                                  | St. Lawrence                    |
| 5. Montreal (Canada)                                     | St. Lawrence                    |
| 6. Aswan (Egypt)                                         | Nile                            |
| 7. Khartoum (Sudan)                                      | Nile                            |
| 8. Cairo (Egypt)                                         | Nile                            |
| 9. New York                                              | Hudson                          |
| 10. Saint-Luis (America)                                 | Mississippi                     |
| 11. Washington DC                                        | Potomac                         |
| 12. Warsaw (Poland)                                      | Vistula                         |
| 13. Rome (Italy)                                         | Tiber                           |
| 14. London (England)                                     | Thames                          |
| 15. Paris (France)                                       | Seine                           |
| 16. Moscow (Russia)                                      | Moskva                          |
| 17. Belgrade (Yugoslavia)                                | Danube                          |
| 18. Budapest (Hungary)                                   | Danube                          |
| 19. Madrid (Spain)                                       | Manzanares                      |
| 20. Lisbon (Portugal)                                    | Tagus                           |
| 21. Dublin (Ireland)                                     | Liffey                          |
| 22. Prague (Czech Republic)                              | Vitava                          |
| 23. Bonn (Germany)                                       | Rhine                           |
| 24. Ankara (Turkiye)                                     | Ankara                          |
| 25. Dundee (Scotland)                                    | Tay                             |
| 26. Liverpool (England)                                  | Mersey                          |
| 27. Cologne (Germany)                                    | Rhine                           |
| 28. Hamburg (Germany)                                    | Elbe                            |
| 29. Baghdad (Iraq)                                       | Tigris                          |
| 30. Bristol (England)                                    | Avon                            |
| 31. Kiev (Ukraine)                                       | Dnieper                         |
| 32. Leningrad (Russia)                                   | Neva                            |
| 33. Perth (Australia)                                    | Swan                            |
| 34. Vienna (Austria)                                     | Danube                          |
| 35. Tokyo (Japan)                                        | Sumida                          |
| 36. Shanghai (China)                                     | Yangtze Kiang and Huangpu River |
| 37. Caracas (Venezuela)                                  | Rio Guaire                      |
| 38. Dresden (Germany)                                    | Elbe                            |
| 39. Lahore (Pakistan)                                    | Ravi                            |
| 40. Karachi (Pakistan)                                   | Indus                           |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| 41. Volgograd / Stalingrad                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Volga (Russia) |
| 42. Rangoon (Myanmar)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Irrawaddy      |
| 43. Chittagong (Bangladesh)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Karnaphuli     |
| 44. Basra (Iraq)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Shatt-al-Arab  |
| <p>🦋 <b>Note :</b> The Hoover Dam is located on the bank of the Colorado river.</p> <p>🦋 <b>Note :</b> Delta of Hwang-ho River is an example of the abandoned delta.</p> <p>🦋 <b>Note :</b> The Missouri Mississippi river forms the birdsfoot delta.</p> <p>🦋 <b>Note :</b> Kariba Dam and Victoria Falls are situated on the Zambezi River.</p> <p>🦋 <b>Note :</b> The river that passes through the Equator twice is Congo (Zaire).</p> <p>🦋 <b>Note :</b> Limpopo River (South Africa) crosses the Tropic of Capricorn twice.</p> <p>🦋 <b>Note :</b> The Mahi river (India) crosses the Tropic of Cancer twice.</p> <p>🦋 <b>Note :</b> The Amur River forms the boundary between Russia and China.</p> |                |

### Major Lakes of the World and their Respective Countries

| Name                | Area (in sq km) | Related Country                                     |
|---------------------|-----------------|-----------------------------------------------------|
| 1. Caspian Sea      | 374000          | Kazakhstan, Turkmenistan, Russia, Iran & Azerbaijan |
| 2. Superior Lake    | 82100           | Canada & USA                                        |
| 3. Huron Lake       | 59600           | Canada & USA                                        |
| 4. Erie             | 25655           | Canada & USA                                        |
| 5. Ontario Lake     | 19009           | Canada & USA                                        |
| 6. Michigan Lake    | 57750           | USA                                                 |
| 7. Great Slave Lake | 28568           | Canada                                              |
| 8. Lake Winnipeg    | 24387           | Canada                                              |
| 9. Lake Athabasca   | 7935            | Canada                                              |
| 10. Reindeer Lake   | 6650            | Canada                                              |
| 11. Lake Baikal     | 31500           | Russia                                              |
| 12. Ladoga Lake     | 18130           | Russia                                              |
| 13. Onega Lake      | 9720            | Russia                                              |
| 14. Lake Balkhas    | 22000           | Kazakhstan                                          |
| 15. Issyk Kul Lake  | 6236            | Kyrgyzstan                                          |
| 16. Rudolf /        | 6500            | Kenya, Ethiopia Turkana Lake                        |
| 17. Lake Victoria   | 62940           | Kenya Uganda and Tanzania                           |
| 18. Aral Sea        | 17158           | Uzbekistan and Kazakhstan                           |
| 19. Lake Tanganyika | 32000           | Burundi, Zambia, Congo and Tanzania                 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |       |                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------------------------------|
| 20. Malawi Lake                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 29604 | Tanzania, Mozambique and Malawi  |
| 21. Lake Titicaca                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 8300  | Bolivia & Peru                   |
| 22. Nicaragua Lake                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 8150  | Nicaragua                        |
| 23. Chad Lake                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1600  | Niger, Nigeria Cameroon and Chad |
| 24. Eyre Lake                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 9690  | Australia                        |
| <p>🦋 <b>Note :</b> The Aswan Dam and Nassir Lake are built on the Nile River.</p> <p>🦋 <b>Note :</b> The deepest lake in the world is Lake Baikal (1620 m) of Russia.</p> <p>🦋 <b>Note :</b> Tanganyika Lake (of Africa) (1470 m) is the second deepest lake in the world.</p> <p>🦋 <b>Note :</b> Tanganyika (660 km) is the world's longest freshwater lake.</p> <p>🦋 <b>Note :</b> The Caspian Sea is the largest lake (saltwater) in the world.</p> <p>🦋 <b>Note :</b> Lake Superior is the largest freshwater lake in the world in surface area and the third largest by volume.</p> <p>🦋 <b>Note :</b> Lake Victoria constitutes the international boundary between Uganda and Tanzania.</p> |       |                                  |

### Major Waterfalls of the World and their Respective Countries

| Waterfall                                                                                                                                                                | Height (metre) | Country                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------------------------------|
| 1. Salto Angel                                                                                                                                                           | 979            | Venezuela                      |
| 2. Kukenan                                                                                                                                                               | 674            | Venezuela                      |
| 3. Mardalsfossen                                                                                                                                                         | 645            | Norway                         |
| 4. Yosemite                                                                                                                                                              | 739            | California, USA                |
| 5. Della                                                                                                                                                                 | 440            | British Columbia (Canada)      |
| 6. Gavarnie                                                                                                                                                              | 422            | France                         |
| 7. Victoria                                                                                                                                                              | 105            | On Zambia and Zimbabwe Border  |
| 8. Sutherland                                                                                                                                                            | 580            | New Zealand                    |
| 9. Ribbon                                                                                                                                                                | 491            | California, USA                |
| 10. Jog (Garsoppa)                                                                                                                                                       | 253            | India                          |
| 11. Niagara                                                                                                                                                              | 55-57          | On the order of USA and Canada |
| 12. Tagela                                                                                                                                                               | 948            | South Africa                   |
| 13. Reichenbach Fall                                                                                                                                                     | —              | Switzerland                    |
| 14. Wollomombi                                                                                                                                                           | —              | Australia                      |
| <p>🦋 <b>Note :</b> The Niagara fall is located on the St. Lawrence River.</p> <p>🦋 <b>Note :</b> 'Jog fall' (Mahatma Gandhi fall) is located on the Sharavati River.</p> |                |                                |



### 1. General Introduction

- The mainland of India extends from 8° 4' North latitude to 37° 6' North latitude and from 68° 7' East longitude to 97° 25' East longitude in the northeastern hemisphere.
- The total geographical area of India is spread over 32,87,263 square kilometres. (UPPCS, 2006)
- According to the 2011 census, there were **6,40,932 villages** in India. (BPSC, 1994)
- The territory of India is spread over **2.4%** of the landmass and is home to **17.5%** of the world's population. (UPPCS, 2006, 2022)
- It is the **seventh-largest country by area** and **second-largest country by population**. (Jharkhand PCS, 2016)
- India lies across both **tropical** and **subtropical** regions.
- The whole territory of India lies in areas with a monsoon climate. (MPPCS, 2010)
- The Tropic of Cancer passes through India.
- It passes through 8 states- **Gujarat, Rajasthan, Madhya Pradesh, Chhattisgarh, Jharkhand, West Bengal, Tripura and Mizoram**. (IAS, 2010; RAS, 2010; UPPCS, 1990, 2017; MPPCS, 2014; UK PSC, 2010; Jharkhand PCS, 2011; UPRO, 2016; UP GIC, 2010; UPPCS, 1999)
- The Easternmost state in India is **Arunachal Pradesh**, the westernmost state is **Gujarat**, the northernmost state is **Himachal Pradesh** and the southernmost is **Tamil Nadu** since 31<sup>st</sup> of October, 2019.
- Ladakh is in the northernmost part and the Andaman and Nicobar Islands southernmost part among the Union Territories of the country.
- The southernmost point of India is **Indira Point** (Great Nicobar Island), and the southernmost point on the mainland is **Kanya Kumari**, Tamil Nadu. (UP Lower Sub, 2002; UK PCS, 2003; UPPCS, 1990)
- The former name of Indira Point was **Pygmalion Point**.
- The northernmost point of India is **Indira Col** (Ladakh) near Siachen Glacier.
- The far eastern point of India is called **Kibithu** and it is located in Arunachal Pradesh.
- The far western point of India is known as **Guhar Moti** (Gujarat). (MPPCS, 2008)
- The Indian territory measures **2933 km** from East to West and **3214 km** from North to South.
- The length of India's terrestrial range is **15106.7 km**, and the length of the mainland coastline is **5422.6 km**. (UPRO/ARO, 2016)
- The total coastline length of the country, including the islands, is **7516.6 km**.

- The state with the longest coastline in India is **Gujarat** (1214.70 km), while the Union Territory with the longest coastline is the **Andaman Nicobar Islands** (1962 km). The coastline of **Goa** (among States) is the shortest in length (101 km).
- Nine States of India viz. **Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Odisha** and **West Bengal** have coastal borders.
- Due to the vast longitudinal distance, there is a difference of **2 hours** in local time between the farthest points in the east and west regions of India.
- The Standard Meridian of India or Indian Standard Time (IST) is calculated on the basis of **82° 30'** east longitude.
- The **82°30'** east-longitude passes through **Prayagraj, Mirzapur**, etc.
- The standard meridian of Indian Standard Time passes through **Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Odisha, Andhra Pradesh**.
- The standard time of India is five and a half **hours** ahead of Greenwich Mean Time (GMT).

### 2. Neighbouring Countries of India

- India's neighbour's are Pakistan, Afghanistan, China, Nepal, Bhutan, Myanmar, Bangladesh, Maldives and Sri Lanka.
- The number of neighbouring countries sharing borders with India is seven.
- A total of 16 States and two Union Territories of India share their territorial boundaries with neighbouring countries.
- The boundaries of India are both natural and artificial.
- In artificial boundaries, some limitations have been imposed.
- The imposed border is the boundary that is determined by third power interest and thrust upon neighbours sharing a border.
- India shares its land borders with Pakistan and Afghanistan in the northwest.
- India's territorial border meets **China and Nepal in the north, Afghanistan and Pakistan in the west, Bangladesh and Myanmar in the east and Bhutan in the northeast**.
- India shares its longest international territorial border with **Bangladesh**. Its length is **4096.7 km**, while the shortest international territorial border (106.0 km) shares with **Afghanistan**.
- The States/Union Territories that share its borders with Pakistan are **Punjab, Rajasthan, Gujarat, Jammu and Kashmir and Ladakh**. (Since 31<sup>st</sup> of October, 2019)
- The states that share their borders with **Bhutan** are **West Bengal, Sikkim, Arunachal Pradesh, and Assam**. (MPPCS, 2012)

- **Ladakh**, the Union Territory shares its border with Afghanistan.
- The border sharing states with China are **Himachal Pradesh, Uttarakhand, Sikkim** and **Arunachal Pradesh**.
- **Ladakh**, the Union Territory shares its border with China. (Since 31<sup>st</sup> October 2019).
- The states that share their borders with Bangladesh are- **Mizoram, Tripura, Assam, Meghalaya** and **West Bengal**. (IAS, 2006; UPSC, 2003)
- Tripura is surrounded by Bangladesh on three sides.
- The states that share their borders with Myanmar are **Arunachal Pradesh, Nagaland, Manipur** and **Mizoram**. (IAS, 2006)
- **Arunachal Pradesh** is the longest border-sharing state with Myanmar.
- The states that share their borders with Nepal are **Uttarakhand, Uttar Pradesh, Bihar, West Bengal** and **Sikkim**.
- **Sri Lanka** is the closest country to India across the sea, which is separated from the Indian mainland, Tamil Nadu by the Palk Strait.
- Sikkim shares its border with three countries **Nepal, Bhutan** and **China**.
- Pakistan is separated from India by the **Radcliffe Line**.
- China is separated from India by the **Mac Mahon line**.
- Afghanistan is separated from Pakistan by the **Durand Line**.

### 3. The Physical Characteristics of India

- According to its physical characteristics, India is divided mainly into **four parts**.
  - (A) Northern Mountain Regions
  - (B) Peninsular Plateaus
  - (C) The Great Plains
  - (D) Island Regions and Coastal Plains (RAS, 1996)
- In India, high mountain ranges account for 10.6%, hills 18.5%, plateaus 27.7% and plains 43.2% of its total land area. (UPPCS, 2006)

#### A. Northern Mountain Region :

- The formation of the Himalayan mountains is believed to be due to the rise of debris of the Tethys Sea, while the geologists believe that the Himalayas were formed by **plate tectonics**.
- The Himalayan mountain range and Tibetan plateau formed as a result of the collision between the Indian Plate and Eurasian Plate which began 50 million years ago and continues to this day.
- The Himalayas protect us from the cold blizzard winds that are generated by the continental winter high pressure system of north-eastern and central Asia.

- Because the Indian Plate is moving northward as well as anticlockwise hence around 64 million years ago the present when the Oceanic part of Indian plate converged with the continental plate of the **Eurasian Plate**. It led to the oceanic continental convergence Forming the **Trans Himalayas** on the Eurasian continental Boundaries.
- Around 55 million years ago the present as this convergence turned into continental - continental convergence. It led to the rise of greater himalayayas just south of Trans Himalayas which continued till 24 million years before present.
- Himalayan region still rising as Young fold Mountains.
- The oldest formation is - Trans Himalaya > Greater Himalaya > Middle Himalaya > Outer Himalaya.
  - (i) The North South division of the Himalayas
- The Himalayan ranges can be divided into four parallel mountain regions –
  - (i) Trans Himalaya (Territory of Tibet)
  - (ii) Great or Inner Himalayas
  - (iii) Lesser Himalayas or Middle Himalayas
  - (iv) Outer / Sub Himalayas (Shivalik) (UK PCS, 2016)

#### (I) Trans-Himalaya :

- All categories of the Himalayas have risen at different periods of the Tertiary Period.
- The **Karakoram, Ladakh** and **Zaskar** Ranges of the mountain fall under the Trans-Himalayan Region. (SSC MTS, 2021)
- The highest peak of Karakoram is called **K2 or Godwin Austin** (8611 m) which is the highest peak in India.
- The Karakoram Range is also called the **backbone** of **Upper Asia**. (CGPSC, 2022, 2019, 2016)
- The **Indo-Tsangpo Shuture-Zone** separates the Trans-Himalayas from the Greater Himalayas.

#### (II) Great Himalaya :

- The Great Himalaya or Himadri is the **highest range of the Himalayas**.
- The Great or Inner Himalayas or Himadri is the northernmost range and is also known as 'Himadri'.
- **Mount Everest** (8848 m) is officially the world's highest peak. (Bihar PCS, 2001; JKPSC, 2011)
- China and Nepal jointly announced the new height of Mt. Everest which is 8,848.86 meters in the Himalayan range, located in Nepal.
- The Mount Everest is called the **Sagarmatha** in Nepal.
- **Kanchenjunga** (8598 m), **Nanga Parbat**, **Nanda Devi**, **Kamet** and **Namcha Barwa** are important peaks of the Greater Himalayas.
- The **Main Central Thrust** separates the Great Himalayas from the Middle Himalayas.

#### (III) Middle (Lesser) Himalaya :

- The Middle Himalaya is a Lesser Himachal Range, consisting of **Pirpanjal, Mahabharata, Mussoorie, Dhauladhar** and **Nag Tibba Ranges**.

- Pirpanjal (Kashmir) is the longest chain of the Middle Himalayas.
- Atal Tunnel (also known as Rohtang Tunnel) is a highway tunnel built under the Rohtang Pass in the eastern Pir Panjal range of the Himalayas. (UPPCS, 2007, UPRO/ARO, 2016)
- The valleys of **Lahaul Spiti, Kashmir Valley, Kullu** and **Kangra**, join the great and Middle Himalayas.
- There is **alpine pasture** located at the central Himalayas called Marg (Gulmarg, Sonmarg) in Kashmir valley and Bugyals or Pyar in Uttarakhand.
- **Mussoorie, Shimla, Kullu, Manali** and **Darjeeling**, are in the central Himalayas.
- The **Main Boundary Fault** separates the miniature Himalayas from the Shivalik.

#### (IV) Outer Himalayas :

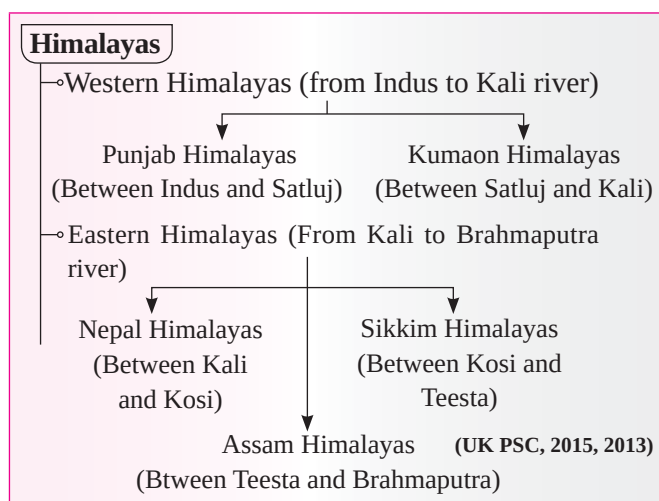
- Outer Himalayas are also called Shivalik or Lower Himalayas.
- It is the latest part of the Himalayas.
- There are many valleys between the lesser Himalayas and the Shivalik.
- The valleys are called Doon in the west and Duar or Dooars in the east, Like Dehradun, Haridwar. (43<sup>th</sup> BPSC, 1999)
- The lower part of the Shivalik is called the **Terai**. The Terai is a swampy and forest area.

#### Regional Division of the Himalayas

| Territorial Part | Extension Between                           | Length |
|------------------|---------------------------------------------|--------|
| Punjab Himalaya  | Indus and Sutlej Rivers                     | 560 km |
| Kumaon Himalaya  | Sutlej and Kali Rivers                      | 320 km |
| Nepal Himalaya   | Kali and Teesta Rivers                      | 800 km |
| Assam Himalaya   | Teesta and Brahmaputra Rivers (UPPCS, 2009) | 720 km |

✎ **Note :** The Punjab State is divided into three regions : Majha, Doaba and Malwa.

(ii) The West-East division of Himalayas



#### ➤ Differences Between Eastern and western Himalayas

| Western Himalayas                                                                                                                                   | Eastern Himalayas                                                                                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. From Indus river to Kali river                                                                                                                   | 1. From Kali river to Brahmaputra river                                                                                                                  |
| 2. Lower and Gradual slope hence the higher peaks in this part are farther from plains and number of ranges line between the plains and high peak.  | 2. Higher and steep sudden slope that is why two of highest peaks of Himalayas mt. Everest (in Nepal) and Kanchenjunga are not very far from the plains. |
| 3. Located on higher latitude, therefore colder. As a result, the snow line in the western Himalayas is at lower altitude than in Eastern Himalaya. | 3. Located on lower latitude, therefore warmer. Therefore snow line is at higher altitude.                                                               |
| 4. Peaks : Nanga Parvat, Nanda devi Badrinath.                                                                                                      | 4. Peaks : mt. Everest, Makalu, Annapurna, Dhaulagiri.                                                                                                   |

#### ➤ Fault lines in Himalayas :

**Himalayan Frontal Fault :** It is major thrust Fault at the front of Himalayas, Separating the Indian Subcontinent from the Eurasian Plate.

**Main Boundary thrust :** It is significant fault in the Himalayas, marking the Boundary between the lesser Himalayas and sub Himalayas.

**Main Central Thrust :** This Fault separates the Lesser Himalayas from the Greater Himalayas and is responsible for upliftment of the Greater Himalayas.

#### B. Peninsular Plateaus :

- This is the oldest and first region to be formed. It was formed in the Pre-cambrian period.
- The peninsular plateau has been formed by old **crystalline**, **igneous** and **metamorphic** rocks.
- The peninsular plateau is mainly composed of two parts - the **Central Highlands** and the **Deccan Plateau**.
- Different types of rock regions in the Peninsula.
  - (i) Archean region
    - It is the oldest rock region.
    - No Biotic sources such as carbon rich and calcium rich minerals.
    - Regions - Bengal Bundelkhand and Nilgiri.
    - Metallic minerals and Uranium mines.
  - (ii) Dharwar Region
    - Also developed Biotic minerals. Regions- Bellari, Aravali, Balaghat, Rewa and Chhota Nagpur metallic and Uranium.

- (iii) Cudappa region.  
Regions - Krishna Valley, Nallamalla hills, Jodhpur region (west of Aravalis).  
Metallic Minerals and limestones, Sand stones, Shale etc.
- (iv) Vindhya Rock regions  
Along Vindhyan Mountains. Limestone, slate and precious stones.  
Regions - Extends from Chittorgarh in Rajasthan to Sasaram in Bihar.
- (v) Gondvana Rocks (Upper and Middle Carboniferous)  
Regions - 4 river valleys : starting from Damodar, Mahanadi, Godavari and Krishna.
- The Aravalli Hills extend up to **Gujarat, Rajasthan, Haryana and Delhi.** (UK RO/ARO, 2014)
- It was built during the **Precambrian Period.**
- **Aravalli** is one of the **oldest** mountain range in the world. (MPPCS, 1993; RAS/RTS, 2003; UPPCS, 2017)
- The highest peak of the Aravalli hill is **Guru Shikhar** (1722 m), located on **Mount Abu** in Aravalli.
- The **Banas River** originates from the Khamnor Hills, the eastern part of Aravalli.
- The **Luni** river originates from the western slopes of Aravalli.
- The Luni River disappears in the **Rann of Kutch.**
- The plateau of Malwa is located in the State of **Madhya Pradesh** and **Chhattisgarh.**
- The **Chambal** and **Betwa** Rivers originate from the **Malwa Plateau.**
- **Vindhya Mountain** range separates North India from South India.
- The **Maikal Plateau** is located in Chhattisgarh.
- The Son river originates near Amarkantak region at Sonbachawar Gaurela-Pendra-Marwahi district of Chattisgarh.
- The **Narmada** River originates from the western part of the **Maikal Plateau.**
- The Chota Nagpur plateau is known as the '**Ruhr of India**' for its abundant mineral resources.
- Parasnath Hills are a range of hills located in Giridih district of Jharkhand.
- The highest peak is 1350 metres. It is one of the most important pilgrimage centre for Jains.
- The Chota Nagpur Plateau is the most important region of India in terms of mineral deposits.
- Japfu Peak is the second highest peak in Nagaland and stands 3048 metres above sea level. It is about 15 kms south of Kohima.
- The **Satpura Range** is a range of hills in Madhya Pradesh and Maharashtra and Gujrat, Chhattisgarh.
- **Dhupgarh** is the highest peak (1350 m) of Satpura which is situated on the Mahadev Hills.
- The **Tapti River** originates from the southern part of Satpura.
- The Western Ghats extend approximately 1500 km from Gujrat to Tamil Nadu parallel to the Arab sea coast. The length of the river is found from the mouth of the Tapti river in the north to Kanyakumari in the south.
- The origin of the **river Narmada** is in the northern part of Satpura.
- The Western Ghats are also called **Sahyadri.**
- Due to altitude, the temperatures in the hills of Western Ghats remain below 25°C.
- The 16° North latitude line (based on structural features) divides the Sahyadri into two parts, the Northern Sahyadri and the Southern Sahyadri.
- The highest peaks of Northern Sahyadri and Southern Sahyadri are **Kalsubai** (1646 m) and **Kudremukh** (1892 m) respectively.
- The Deccan Plateau is located across **Madhya Pradesh** and **Maharashtra.**
- The Deccan Plateau is formed by volcanic basalt rocks.
- The **eastern part** of the Deccan plateau is called **Vidarbha.**
- **Black soil** is found in the Deccan plateau.
- The Cave of **Ajanta** is located in **Aurangabad** district in Maharashtra.
- **Balaghat, Harishchandra** and **Satmala** ranges are located in Maharashtra.
- **Dharwad** plateau is located in **Karnataka.**
- The hills of **Baba Budan** and the **Brahmagiri** are in the western part of the **Dharwad Plateau.**
- The Nilgiri hills are spread across **Tamil Nadu, Kerala** and **Karnataka.**
- The highest peak of Nilgiri is **Doddabetta** (2637 m).
- Doddabetta is the second highest peak in South India.
- The **Anaimalai range** is located on the border of Kerala and Tamil Nadu.
- **Anamudi** (2,695 m) is the highest peak of South India on the Anaimalai Hills.
- In Meghalaya, the Khasi, Garo, and Jaintia hills are located.
- The Mizo Hills, located in the southeastern Mizoram state, were formerly called Lushai Hills.
- The Kangchenjunga Himal is located in eastern Nepal and Sikkim, India. Kangchenjunga is the highest peak in India, and the easternmost of the peaks higher than 8,000m (26,247 ft).
- The Anaimalai or Anamala Hills, also known as the Elephant mountains, are the range of mountains that form the southern portion of the Western Ghats.



- It spans the border of Tamil Nadu and Kerala in southern India. Anai Peak (8,842 feet [2,695 metres]) lies at the extreme southwestern end of the range and is the highest peak in southern India.
- Shevaroy Hills are located in Tamil Nadu.
- Dhinodhar Hills are located near Nani Aral village, in Gujarat.
- The name Kuduremukha literally means “horse-faced” in Kannada and refers to a particular picturesque view of a side of the mountain that resembles a horse’s face.
- Mahadeo Hills are sandstone hills, located in the northern part of the Satpura Range, in southern Madhya Pradesh state, central India.
- Western Ghats are locally known by different names such as Sahyadri in Maharashtra, Nilgiri hills in Karnataka and Tamil Nadu, Anaimalai hills and Cardamom hills in Kerala.
- Kamet is the second-highest mountain in the Garhwal region of Uttarakhand, after Nanda Devi.
- If one goes from Rajasthan in the west to Orissa in the east, the correct order of Peninsulas one will come across is- Marwar Plateau, Malwa Plateau, Chhattisgarh Plateau and Chhota Nagpur Plateau.
- Mahendragiri is the highest peak in the Eastern Ghats of India.

### C. The Great Plains of North India :

- The Great Plain of North India is also known as the **Indus-Ganges** and **Brahmaputra Plains**.
- The vast plains of north India are divided into four parts based on the typical terrestrial regions - the Bhabar, the Bhangar, the Khadar and the Terai.

#### (i) The Bhabar :

- The Bhabar region extends from the river Indus (west) to the river Teesta (east) at the **foothills of the Shivalik**.
- **Pebbles, stones** are abundant in the Bhabar region.
- **Porosity** is a unique feature of the Bhabar.
- Due to porosity, the streams disappear once they reach the Bhabar region.

#### (ii) The Bhangar :

- The Bhangar is the **higher region** of the plains where floodwaters do not reach usually.
- The Bhangar plain consists of **old alluvial soil** which is rich in pebbles and sand.
- The Bhangar is called Bhur in the local language.

#### (iii) The Khadar :

- The Khadar region is formed by new alluvial soil brought by **flooding of rivers** in the Khadar region every year.
- The Khadar region is also known as an **alluvial region** or **flood plain**.
- The Ganges and Brahmaputra rivers form the **Khadar region** (delta).

(MPPCS, 2014)

#### (iv) The Terai :

- Humidity is very high in the terai region because Terai plains are marshy.
- The underground rivers of the Bhabar belt **re-emerge** in this belt.
- The Terai region consists of **dense forests**.
- There are biodiversity reserves in the terai region.

### D. Island Region :

- **Andaman & Nicobar** and **Lakshadweep** are the two islands of India.
- In the Andaman and Nicobar archipelago, there are **572** islands out of which **550 islands** are in Andaman island group and 22 islands are in the Nicobar archipelago.
- **Saddle Peak** is the **highest peak (732 m)** of the Andaman and Nicobar archipelago.
- The largest port of the Andaman archipelago is **Port Blair** (South Andaman).
- The Lakshadweep, archipelago is located in the **Arabian Sea**.
- **The Lakshadweep** is a group of **36 Islands**.
- Only 11 islands of Lakshadweep are inhabited.
- The largest island of Lakshadweep is **Andrott / Androth Island**.
- **Pamban Island** is located in the Gulf of Mannar.
- There are two famous volcanic islands in India called **Narcondam** and **Barren**.
- Narcondam Island is a **dormant volcano**.
- Barren Island is an **active volcano**.
- The 8-degree channel separates **Maldives** and **Minicoy**.
- The 9-degree channel is located between **Lakshadweep** and **Minicoy**.
- The 10-degree channel separates the **Little Andaman** from the **Car Nicobar**.

### E. Sea Coastal Plains :

- In the east and west of peninsular platen, two narrow coastal plains are found which are called Eastern coastal and western coastal plains respectively.
- These coastal plains are originated in Eocene period due to submergence of terrestrial Blocks of Arabian sea and Bay of Bengal regions.
- The western coastal plain is narrower than Eastern coastal plains.
- These coastal plains have been formed by erosion and direct deposition by ocean waves and by deposition of sediments Brought by plateau rivers.
- The Eastern and Western Coastal Plains are separated by Nagercoli and Kanyakumari ridges, of Tamilnadu.

#### (1) Eastern Coastal Plains

- This plain is situated Between Eastern Ghat and Bau of Bengal. It extends from the mouth of Ganges in the north to Kanyakumari in south.

- It is mainly made up of recent and tertiary alluvium.
  - Eastern Coastal Plains are wider than the western coastal plains. The main reason in for this is the formation of delta By rivers like Krishna, Godavari and Kaveri.
  - 'A part from the mouth of the Ganges and Gulf of Mannar, the submerged coast of Bay of Bengal is narrower than that of Arabian Sea'.
  - Their width is more than that of Maharashtra and Gujarat Coasts.
- Coastal Plain is divided into three minor geological units.
1. Plains of Utkal (Odisha)
  2. Plains of Kakinada (Andhra)
  3. Plains of Coromandel (Tamil Nadu)
- The eastern coast of India, the coastal region from Kanya Kumari to the Krishna Delta is known as the **Coromandel Coast**.
  - The Krishna Delta to the North Coast is called the Northern Circars.
  - Paradeep (Odisha), Haldia (West Bengal), Visakhapatnam (Andhra Pradesh), Chennai, V.O. Chidambaram (Tuticorin) and Kamarajar (Ennore) (Tamil Nadu) are the major **ports** on the **eastern coast of India**.
  - Gopalpur port is a deep sea port of Gopalpur near Brahmapur city in Ganjam district Odisha, India.
  - Pulicat (Andhra Pradesh, Tamil Nadu), Chilika (Odisha) and Kolleru (Andhra Pradesh) are the main lagoons on the **eastern coast of India**.

#### (2) Western coastal Plains :

- Deendayal (Kandla, Gujarat), Mumbai (Maharashtra), New Mangaluru (Goa), New Mangaluru (Karnataka), Cochin (Kerala) and Nhava Sheva (Maharashtra) are the major ports on the **western coast of India**.
- On the western coast of India, the coastal region from Gujarat to Goa is known as the **Konkan**, the coastal area from Goa to Mangaluru in Karnataka is known as **Canara (Kanara)** and the coastal region from Mangaluru to Kanya Kumari is known as **Malabar Coast**.
- The lagoons found on the Malabar Coast are called "Kayals" in local language.

#### Exam Oriented Fact

- The Himalayas shield the subcontinent from the northern winds by acting as a wall of mountains. Thus, the tropical climate of Northern India is made possible by these mountains. The Himalayas thus serve as an effective climatic divide.
- The Northern Plains are densely populated because the plains are formed by deposits of alluvial soils.
- Rohtang pass connects the link between Kullu valley with the Lahaul and Spiti valleys of Himachal Pradesh.

## 4. Drainage System

- The flow of water through well-defined channels is known as '**drainage**' and such channels network is called a '**drainage system**'.
- A river drains the water collected from a specific area, which is called its '**catchment area**'.
- An area drained by a river and its tributaries is called a **drainage basin**.
- The boundary line separating one drainage basin from the other is known as the **watershed**.
- The catchments of large rivers are called **river basins** while those of small rivulets and rills are often referred to as **watersheds**. There is, however, a slight difference between a river basin and a watershed. Watersheds are small in area while the basins cover larger areas.
- The **drainage pattern of an area is the outcome of** the geological time period, nature and structure of rocks, topography, slope, amount of water flowing and the periodicity of the flow.

**Drainage Pattern** : A geometric arrangement of streams in a region; determined by slope, differing rock resistance to weathering erosion, climate, hydrological variability and structural controls of the landscape known as drainage pattern.

**The following are the major drainage pattern –**

- Dendritic
- Radial
- Centripetal
- Trellis

- A drainage pattern which looks like tree branches with lots of twigs is known as **Dendritic drainage pattern**. For example, the rivers of the northern plain.
- **Radial drainage patterns** form when rivers originate from a hill and flow in all directions. For example, the rivers originating from the Amarkantak.
- **The Centripetal drainage pattern** is formed when rivers discharge their waters from all directions into a lake or a depression. For example, Loktak lake in Manipur.
- **Trellis drainage pattern** is formed when the primary tributaries of main rivers flow parallel to each other and secondary tributaries join them at right angles. For example, rivers in the upper part of the Himalayan region.

#### Evolution of Himalayan Drainage System :

- There was a mighty river called Shiwalik or **Indo Brahma** that traversed the entire longitudinal extent of the Himalayas from Assam to Punjab and onwards to Sind, and finally discharged into the Gulf of Sind near lower Punjab during the Miocene period some million years ago.
- The remarkable continuity of the Shiwalik and its lacustrine origin and alluvial deposits consisting of sands, silt, clay,

boulders and conglomerates support this viewpoint. Himalayan rivers later got dismembered into three major systems.

- This dismembered was probably due to the Pleistocene upheaval in the western Himalayas, including the uplift of the Potwar Plateau (Delhi Ridge), which acted as the water divide between the Indus and Ganga drainage systems.
- Likewise, the down-thrusting of the Malda gap (Garo-Rajmahal Gap) area between the Rajmahal hills and the Meghalaya plateau during the mid-Pleistocene period, diverted the Ganga and the Brahmaputra systems to flow towards the Bay of Bengal.

#### Evolution of Peninsular Drainage

- Geologists believe that the **Sahyadri-Aravali axis** was the main water divide in the past.
- According to one hypothesis, the existing peninsula is the remaining half of a bigger landmass.
- The Western Ghats were located in the middle of this landmass.
- So one drainage was towards east flowing into Bay of Bengal and the other towards west draining into Arabian Sea.
- The western part of the Peninsula cracked and submerged in the Arabian Sea during the early **Tertiary period (coinciding with the formation of Himalayas)**.
- During the collision of the Indian plate, the Peninsular block was subjected to subsidence in few regions creating a series of **rifts (trough, faults)**.
- **The following table illustrates the significant differences between the Himalayan and the Peninsular Rivers system.**

| Characteristics  | Himalayan River                                                                                                                                     | Peninsular River                                                                 |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| Place of origin  | Himalayan mountains (covered with glaciers).                                                                                                        | Peninsular plateau and central highland.                                         |
| Nature of flow   | Perennial; receive water from glaciers and rainfall.                                                                                                | Seasonal; dependent on monsoon rainfall.                                         |
| Type of drainage | Antecedent and consequent leading to dendritic pattern in plains.                                                                                   | Superimposed rejuvenated resulting in trellis, radial, and rectangular patterns. |
| Nature of river  | Long course, flowing through the rugged mountains experiencing headward erosion and river capturing; In plains, meandering and shifting off course. | Smaller, fixed course with well adjusted valleys.                                |

|                  |                                                         |                                                                            |
|------------------|---------------------------------------------------------|----------------------------------------------------------------------------|
| Catchment area   | Very large basin.                                       | Relatively smaller basin.                                                  |
| Age of the river | Young and youthful, active and deepening in the valleys | Old rivers with graded profile, and have almost reached their base levels. |

- Based on drainage and aquatic characteristics, the rivers of India are divided into two categories - (A) Himalayan Rivers and (B) Peninsular Rivers.

#### (A) The Himalayan Rivers :

- The Ganges, the Indus and the Brahmaputra are the Himalayan Rivers. [UDA (Pre), 2013]
- The source of the Indus river is the **Bokhar-Chu Glacier**. It is located near Mansarovar lake, situated in the Great Himalayas.
- The Indus river enters Indian territory through union territory Ladakh.
- The tributaries of the Indus river are the Jhelum, the Chenab, the Ravi, the Beas and the Sutlej.
- The largest tributary of the Indus river is the **Chenab**.
- Indus Water Agreement was signed in 1960 to share Indus river water between **India and Pakistan**.
- Based on the 1960 Indus Water Treaty, India can use only 20% of the entire water of the Indus river.
- The Chenab is called **Chandrabhaga** in Himachal Pradesh.
- The Sutlej originates from the **Rakshastal** near the Mansarovar Lake, south of Mount Kailash in Tibet.
- **Bhakra Nangal Dam** is built on the Sutlej River.
- The Ganges originates from the **Gangotri glacier** near Gomukh in Uttarkashi district of Uttarakhand.
- The Ganges at the point of origin is called the **Bhagirathi**. (UK PCS, 2006)

- Mandakini river meets Alaknanda at **Rudraprayag**.
- Alaknanda meets Bhagirathi at **Devprayag**.
- The Ganges gets its name after Devprayag.
- The Ganges enters the plains near Haridwar.
- Ganga is called the **Padma** in Bangladesh. (UK PCS, 2005)
- Before falling into the Bay of Bengal, Ganga forms a delta called Sunderban. (UPPCS, 2016, 2010)

| Place of Confluence | Rivers                                     |
|---------------------|--------------------------------------------|
| Vishnu Prayag       | Dhaulti Ganga meets Alaknanda              |
| Nand Prayag         | mandakini meets Alaknanda                  |
| Karn Prayag         | Pindar meets Alaknanda                     |
| Rudra Prayag        | Kali ganga or Mandakini meets Alaknanda    |
| Dev Prayag          | Bhagirathi meets Alaknanda and Forms Ganga |

- The Brahmaputra river is known as the **Yarlung Tsangpo** in China (Tibet). (MPPCS, 2014)
  - This river originates at the **Angsi glacier in western Tibet**.
  - The Brahmaputra river is called **Tsangpo in China (Tibet)** and **Jamuna in Bangladesh**. (UDA, 2013)
  - The Tributaries of Brahmaputra river are, Dibang, Lohit Subansiri, Kameng, Manas, Sankosh and Teesta etc.
  - The Lohit river originates from Zayul Chu mountain glacier of eastern Tibet. It flows in Assam and Arunachal Pradesh.
  - Dibang originates from Mishmi hills of Tibet.
  - Subansiri is the largest Tributary of Brahmaputra.
  - Dhansiri originates from Laisang mountain peak of Nagaland.
  - Turning south near Namcha Barwa, the Brahmaputra enters Arunachal Pradesh with its changed name **Dihang**.
  - **Majuli Island**, the largest river island, is located on the Brahmaputra **river in Assam**. (UDA, 2016)
  - The Kosi River is called the "**Sorrow of Bihar**".
  - The Ghaggar River of Haryana is an example of **inland drainage**.
- (B) Peninsular Rivers :**
- The gradient slope of the peninsular rivers is shallow.
  - The Mahanadi, the Godavari, the Krishna and the Kaveri rivers **flow eastward**. (UPPCS, 2020)
  - The Narmada and the Tapi (Tapi) rivers **flow westward**.
  - Both rivers form **estuaries**. (MPPCS, 2014, 2016)
  - The Narmada and the Tapi are the major rivers in India that flow through rift valleys. (IAS, 2013)
  - The River Tapi flows from the East to the West and is second largest inter-state rivers, spread across the areas of Maharashtra, Madhya Pradesh and Gujarat. (MPPCS, 2014)
  - The Narmada originates at the Amarkantak peak of Maikal Mountain. (UPPCS, 2012, 2005)
  - It is the largest river in peninsular India and falls into the Arabian Sea. (BPSC, 2000; UPPCS, 2010)
  - Jabalpur city of Madhya Pradesh is situated on the banks of the Narmada River.
  - **Dhuandhar** and **Bhedaghat** falls are located on the Narmada River in Jabalpur district.
  - The Godavari river originates from (Trimbakeshwar) **Nasik** district in Maharashtra.
  - The Godavari is the largest river in peninsular India.
  - The Godavari is called the **Vridha Ganges (Dakshin Ganga, Source-NCERT)**.
  - There is a dispute among Tamil Nadu, Karnataka, Kerala and Puducherry over the sharing of Kaveri river water.
  - The Chambal River originates near **Mhow in Madhya Pradesh**.
  - Chambal is the only river in Rajasthan that flows throughout the year.
  - The famous **Chulia Fall** is located on this river. It forms the **deep ravine (Chambal Ravine)**.
  - Gandhi Sagar (Madhya Pradesh), Rana Pratap Sagar and Jawahar Sagar (Rajasthan) are dams Located on the **Chambal River**.
  - Mahakaleshwar Temple in Ujjain is located on the banks of the Shipra river. Kumbha Mela is organized here at the interval of 12 years.
  - **Kumbh Mela** is also organized at **Prayagraj**, at the confluence of Ganges and Yamuna and the invisible Saraswati.
  - The basin consisting of Brahmani river (Flowing in the east) extends over states of Odisha, Jharkhand and Chhattisgarh having an area of 39053 Sq.km.
  - The Periyar 244 km. in length is the longest river of Kerala and drains an area of 5,398 sq km.
  - Narmada, Tapi, Mahanadi, Krishna, Kaveri and Godavari are the major basins of peninsular India.
  - Eskers are ridges made of sands and gravels, deposited by glacial meltwater flowing through tunnels within and underneath glaciers, or through meltwater channels on top of glaciers. (UKPSC, 2012, MPPCS 2003, RO/ARO 2017)
  - Shimsha River originates in the southern part of the Devarayanadurga hill in the Tumkur District of Karnataka and flows for about 221 km (137 mi) before joining the River Cauvery at Karnataka State.
  - Subansiri River, a major tributary of the Brahmaputra River in the northeastern part of India, has been analyzed in detail for various studies. (SSC MTS, 2009, 2012)
  - The Ghaghara originates in the glaciers of Mapchachungo. After collecting the waters of its tributaries – Tila, Seti and Beri, it comes out of the mountain, cutting a deep gorge at Shishapani.
  - The Gautami, a tributary of River Godavari, passes along Yanam enclave of Union territory of Puducherry and empties itself into sea at Point Godavery.
  - Manjira, Purna, Pravara, Penganga, Wardha, Pranhita etc are tributaries of Godavari.
  - River Ravi one of the five rivers of Indus system is 720 km long, out of which 320 km is in India, of which 158 km lies within Himachal Pradesh and 162 km within Punjab. It is a perennial river that flows in a north-westerly direction.
  - The Ravi River forms the biggest sub-micro region of Chamba district. It flows along the Indo–Pak border for 80 km before entering Pakistan and joining the Chenab River.
  - On the right bank 4 tributaries namely, the Vaki, the Gomai, the Arunavati and the Aner join the Tapi. (CAPF, 2015, 2017)
  - On the left bank, 10 important tributaries namely the Nesu, the Arunavati, the Buray, the Panjhra, the Bori, the Girna,



the Vaghur, the Purna, the Mona and the Sipna drain into the main channel.

- Bharathapuzha, Pamba and Periyar flow in Kerala.
- The Pennar river originates from Kolar in Karnataka and joins the Bay of Bengal in Andhra Pradesh.
- Jabalpur, formerly Jubbulpore, is a city situated on the banks of Narmada River in the state of Madhya Pradesh, India.
- Chambal, Ken and Betwa are rivers of Malwa plateau.
- Also termed as Escher, Eskers are sand and gravel ridges formed by glacial meltwater flowing through tunnels within and beneath glaciers or meltwater channels on top of glaciers.
- The principal tributaries joining the Ganga river from right are the Yamuna and the Son.
- A meander is when water flows in a curvy, bendy path, like a snake. As a river makes its way through a relatively flat area, it often develops bends as it erodes its way through the path of least resistance.
- The Tawa River is a tributary of the Narmada River of Central India.
- Tons, Giri, Hindon Chambal, Banas, Kali Sindh, Parbati, Sind, Betwa, Dashan and Ken are tributaries of Yamuna river.
- The Indus basin extends over China (Tibet), India, Afghanistan and Pakistan draining an area of 11,65,500 Sq.km. In India, the basin spreads over states of Jammu & Kashmir, Himachal Pradesh, Punjab, Rajasthan, Haryana and Union Territory of Chandigarh having an area of 3,21,289 Sq.km which is nearly 9.8% of the total geographical area.
- The length of Indus River in India is 1114 km.
- Watershed is a land area that channels rainfall and snowmelt to creeks, streams, and rivers, and eventually to outflow points such as reservoirs, bays, and the ocean.
- The Luni drains an area of 32879 sq.km. in Rajasthan state only. The catchment area of the basin upto Chittalwana is 32661 sq.km.
- The Godavari is India's second longest river after the Ganga river and is called Lifelines of South India.
- Krishna river originates at a waterfall near **Mahabaleshwar** in the Western Ghats.
- It falls into the Bay of Bengal through Maharashtra, Telangana, Karnataka and Andhra Pradesh.
- Koyna, Ghataprabha, Malaprabha, Bhima, Tungabhadra, etc. are the tributaries of Krishna river.
- The Kaveri River is also known as the **Ganges of South India**.
- The presence of the **Sivasamudram Waterfall** and the presence of Srirangapatnam and Sivasamudram islands raise the importance of the Kaveri.

- Nagarjuna Sagar dam is located, on the Krishna River in Andhra Pradesh and Telangana and Nizam Sagar Dam on the Manjira river in Telangana.
- The peninsular rivers from north to south are- Mahanadi, Godavari, Krishna, Pennar, Kaveri and Vaigai in that order.
- In descending order, the lengthwise peninsular rivers are- Godavari, Krishna, Narmada, Mahanadi, Kaveri and Tapi in that order.
- Rajasthan has the smallest river system.
- The River Cauvery (Kaveri) originates at Talakaveri in Coorg District of Karnataka in Brahmagiri Range of hills in the Western ghats at an elevation of 1341 m. (above MSL).

### Some Important River and Their Tributaries

| Name of river | Sources                        | Important Tributaries                                                                                     |
|---------------|--------------------------------|-----------------------------------------------------------------------------------------------------------|
| Godavari      | Trimbak Plateau Near Nashik    | Manjira, Penganga, Wardha, Wainganga, Indravati, Sabari, Pranhita                                         |
| Krishna       | Mahabaleshwar in Maharashtra   | Koyna, Ghat prabha, Malaprabha, bhima, Tungbhadara, Musi, Muneru                                          |
| Kaveri        | Tall Kaveri in Western Ghats   | Herangi, Hemavati, Lakpavani, Shimsha, Arkavati, Lakshmanatirtha, Kabani, Suvarnavati, Bhavani, Amaravati |
| Narmada       | Amarkantak Plateau             | Hiran, Orsang, Barna, Kolar, Burhner, Banjar, Shar Shakhra, Tawa, Kundi<br>(IAS, 2013; MPPCS, 2014)       |
| Tapi          | Multai in Betul district of MP | Purna, Girna, Panjhra, Ganjal                                                                             |
| Subarnarekha  | Chhota Nagpur Plateau          | Kharkai, Kanchi, Dumra, Harmu Nadi.                                                                       |

| Rivers in India |                                                                           |                            |                                       |
|-----------------|---------------------------------------------------------------------------|----------------------------|---------------------------------------|
| Rivers          | Origin                                                                    | Length                     | Confluence/ Estuary                   |
| Indus           | From a glacier near Bokhar Chu near Kailash Mountain in Tibet             | 2880 km (1114 km in India) | The Arabian Sea (UPPCS, 2014)         |
| Chenab          | Near Bada Lacha Pass Lahaul District (Himachal Pradesh)                   | 1180 km                    | Sutlej River (H.P. PCS, 2014)         |
| Ravi            | Near Rohtang Pass in Kangra District                                      | 725 km                     | Chenab River (Near Sarai Sindh)       |
| Jhelum          | From Verinag (Jammu and Kashmir) waterfall situated on Pirpanjal Mountain | 724 km                     | Chenab River (near Jhang in Pakistan) |

|                      |                                                                                        |                            |                                                      |
|----------------------|----------------------------------------------------------------------------------------|----------------------------|------------------------------------------------------|
| Beas                 | At an altitude of 4000 m from Beas Pond near Rohtang Pass                              | 470 km                     | Sutlej River (Kapurthala) near Harike                |
| Sutlej               | From the Rakshastal located near Kailash Mountain (Height 4555m above sea-level)       | 1500 km (1050 km in India) | Indus River <b>(H.P. PSC, 2008, 10)</b>              |
| Ganges               | Gomukh glacier near Gangotri (at an altitude of more than 3900 meters above sea-level) | 2525km                     | The Bay of Bengal <b>(SSC MTS, 2008)</b>             |
| Ramganga             | From Dudha Toli Range located in Garhwal near Nainital                                 | 596 km                     | River Ganges (near Kannauj)                          |
| Sharda (Kali Sarayu) | Milam Glacier of Kumaon Himalaya Ghaghara                                              | 596 km                     | River Ghaghara near Bahram Ghat                      |
| Gandak               | Nepal                                                                                  | 425 km                     | River Ganges (Sonpur near Patna)                     |
| Kosi                 | North of Gosainathan Peak                                                              | 730 km                     | River Ganges <b>(BPSC, 2001, 03)</b>                 |
| Yamuna               | Lies in the western side of Banderpooch Yamunotri Glacier                              | 1376 km                    | River Ganges (at Prayagraj)                          |
| Chambal              | Near Mhow in Malwa Plateau, Madhya Pradesh (600 m above sea-level)                     | 965 km                     | Yamuna River (Etawah)                                |
| Betwa                | Vindhyaachal Mountain in Raisen District of Madhya Pradesh                             | 590 km                     | River Yamuna (Hamirpur)                              |
| Son                  | Amarkantak Hills                                                                       | 881 km                     | River Ganges (Patna)                                 |
| Brahmaputra          | Angsi Glacier near Lake Mansarovar in Tibet                                            | 2900 km (916 km in India)  | (River Padma) The Bay of Bengal                      |
| Narmada              | From Amarkantak Plateau located in Vindhyaachal Mountain Ranges                        | 1312 km                    | The Gulf of Khambhat <b>(IAS, 2013; MPPCS, 2014)</b> |
| Tapti                | From Multai in Betul district (M.P.)                                                   | 724 km                     | The Gulf of Khambhat near Surat                      |
| Mahi                 | Dhar district (Madhya Pradesh) in the Vindhya Mountain Region                          | 583 km                     | The Gulf of Khambhat                                 |
| Luni                 | Ajmer (Rajasthan) Western Aravalli Mountains                                           | 511 km                     | Rann of Kutch                                        |

|              |                                                                                                               |         |                                                   |
|--------------|---------------------------------------------------------------------------------------------------------------|---------|---------------------------------------------------|
| Mahanadi     | Near Sihawa in Dhamtari District of Chhattisgarh                                                              | 851 km  | The Bay of Bengal (near Cuttack)                  |
| Shipra       | Kakri Bardi Hills (Indore)                                                                                    | 210 km  | Chambal River                                     |
| Sabarmati    | Aravalli Mountains (Udaipur)                                                                                  | 371 km  | The Bay of Khambhat                               |
| Banas        | Khamnor Hills Aravalli Mountains (Rajsamand District Rajasthan)                                               | 512 km  | Chambal <b>(IAS, 1998; UPPSC, 2008)</b>           |
| Krishna      | From the Western Ghats near Mahabaleshwar (Maharashtra)                                                       | 1400 km | The Bay of Bengal <b>(IAS, 1996; UPPCS, 2011)</b> |
| Kaveri       | Brahmagiri Hills (in the Coorg District of Karnataka)                                                         | 800 km  | The Bay of Bengal                                 |
| Godavari     | Trimbakeshwar of Nasik (Maharashtra)                                                                          | 1465 km | The Bay of Bengal                                 |
| Tunga-bhadra | Tunga and nearby origin of Bhadra river at Kadur, from Gangamoola Peak of Western Ghat Mountains in Karnataka | 531 km  | Krishna River                                     |
| Pennar       | From Chenna Kesava Hills (Karnataka) of Nandi Range                                                           | 597 km  | The Bay of Bengal                                 |
| Periyar      | From the forest area of Sivagiri Peak of Sundaramala                                                          | 244 km  | The Arabian Sea                                   |
| Hooghly      | It is a tributary of river Ganges which separates from Ganges and flows south from Dhulia (West Bengal)       | 260 km  | The Bay of Bengal                                 |

### Major Cities and River Banks

| City                                       | River                      |
|--------------------------------------------|----------------------------|
| Delhi                                      | Yamuna                     |
| Agra                                       | Yamuna                     |
| Bareilly                                   | Ramganga                   |
| Mathura                                    | Yamuna                     |
| Kanpur <b>(44<sup>th</sup> BPSC, 2000)</b> | Ganges <b>(BPSC, 2011)</b> |
| Prayagraj                                  | Ganges-Yamuna confluence   |
| Varanasi                                   | Ganges                     |
| Kannauj                                    | Ganges                     |
| Lucknow                                    | Gomti <b>(UPGIC, 2010)</b> |

|                                     |                          |
|-------------------------------------|--------------------------|
| Ayodhya                             | Sarayu                   |
| Jaunpur                             | Gomti                    |
| Badrinath                           | Alaknanda                |
| Firozpur                            | Sutlej                   |
| Kolkata                             | Hooghly                  |
| Dibrugarh                           | Brahmaputra              |
| Kota (UP RO/ARO, 2016; UPPCS, 2009) | Chambal                  |
| Ujjain                              | Shipra [IAS (Pre), 2007] |
| Jabalpur                            | Narmada                  |
| Guwahati                            | Brahmaputra              |
| Pandharpur                          | Bhima                    |
| Ahmedabad                           | Sabarmati                |
| Jamshedpur                          | Subarnarekha             |
| Hyderabad (UP RO/ARO, 2016)         | Musi                     |
| Surat (UPPCS, 2019)                 | Tapti (Tapi)             |
| Srinagar                            | Jhelum                   |
| Kurnool                             | Tungabhadra              |
| Cuttack                             | Mahanadi                 |
| Nasik (UP RO/ARO, 2016)             | Godavari                 |
| Srirangapatnam                      | Kaveri                   |
| Tiruchirappalli                     | Kaveri                   |
| Orchha                              | Betwa                    |
| Ludhiana                            | Sutlej (UK PSC, 2002)    |
| Vijayawada                          | Krishna                  |

### Geographical Surnames of Regions of India

|                               |                |
|-------------------------------|----------------|
| 1. City of Rallies            | New Delhi      |
| 2. Paddy Bowl                 | Chhattisgarh   |
| 3. City of Clouds             | Meghalaya      |
| 4. City of Gardens            | Kapurthala     |
| 5. Paradise of Fruit Orchards | Sikkim         |
| 6. City of Space              | Bengaluru      |
| 7. City of Joy                | Kolkata        |
| 8. Soya City                  | Madhya Pradesh |
| 9. Salt City                  | Gujarat        |
| 10. Golden City               | Amritsar       |
| 11. Queen of Chhota Nagpur    | Netarhat       |
| 12. Queen of Deccan           | Pune           |
| 13. City of Mountains         | Dungarpur      |
| 14. Earth's Paradise          | Srinagar       |
| 15. City of Temples and Ghats | Varanasi       |

### Surnames of Important Cities in India

| Surname                       | Place                    |
|-------------------------------|--------------------------|
| 1. Abode of God               | Prayagraj                |
| 2. City of Golden Temple      | Amritsar                 |
| 3. City of Temples and Ghats  | Varanasi                 |
| 4. Queen of Arabian Sea       | Kochi                    |
| 5. Venice of East             | Kochi                    |
| 6. City of Festivals          | Madurai                  |
| 7. Gem of Karnataka           | Mysore                   |
| 8. Pink City                  | Jaipur                   |
| 9. Paris of East              | Jaipur                   |
| 10. Paris of India            | Jaipur                   |
| 11. Switzerland of India      | Kashmir                  |
| 12. Mini Switzerland of India | Khajjiar                 |
| 13. Scotland of East          | Shillong                 |
| 14. Kashmir of South          | Kerala                   |
| 15. Rajasthan Pride           | Chittorgarh              |
| 16. Gateway of Rajasthan      | Bharatpur                |
| 17. Thermopylae of Rajasthan  | Haldighati               |
| 18. Hollywood of India        | Mumbai                   |
| 19. Gateway of India          | Mumbai                   |
| 20. City of Seven Isles       | Mumbai                   |
| 21. Steel City                | Jamshedpur               |
| 22. Pittsburgh of India       | Jamshedpur               |
| 23. Heart of India            | Delhi                    |
| 24. The Ganges of the South   | Kaveri River             |
| 25. Fruit Bucket              | Himachal Pradesh         |
| 26. Manchester of India       | Ahmedabad                |
| 27. Garden of India           | Bangaluru                |
| 28. City of Palaces           | Kolkata                  |
| 29. Spice Garden of India     | Kerala                   |
| 30. Queen of Chota Nagpur     | Netarhat Jharkhand       |
| 31. Queen of Mountains        | Mussoorie                |
| 32. Land of Five Rivers       | Punjab                   |
| 33. Blue Mountains            | Nilgiri Hills Phawngpui  |
| 34. Sorrow of Bengal          | Damodar River            |
| 35. Manchester of North India | Kanpur                   |
| 36. Samudra Putra             | Lakshadweep              |
| 37. Diamond Harbour           | Kolkata                  |
| 38. Twin Cities               | Hyderabad-Sikandrabad    |
| 39. City of Lakes             | Srinagar                 |
| 40. City of Nawabs            | Lucknow                  |
| 41. The Spine of Economy of   | River Ganges North India |
| 42. Sorrow of Bihar           | River Kosi               |

## 5. Major Lakes and Waterfalls in India

- The **natural** crater filled with water is called a **lake**.
- The shallow **saltwater** lakes formed in the coastal areas separated from the sea are called **lagoon**.
- The **largest coastal lake** in India is **Chilika Lake** (Odisha), is a saltwater lagoons. (MPPCS, 2014; UPPCS, 2021; UP Lower, 2008)
- Important tributaries of Kaveri river are- Arkavathy, Shimsha, Hemavati, Kapila, Shimsha, Honnuhole, Amaravati, Lakshmana Kabini, Lokapavani, Bhavani, Noyyal, and Tirtha.
- Chilika Lake spread across the districts of Puri, Khurda and Ganjam in the state of Odisha. (RAS, 1999; UPPCS, 2021)
- **Periyar Lake** is an artificial lake. It receives water from the Periyar river. (UPPCS, 2009, 2011, 2013)
- **Ashtamudi lake** is the backwater lagoon of Kerala which opens to the sea.
- Vembanad is the largest lake in Kerala and the longest Lake in India.
- **Loktak Lake**, located in Manipur, is the **largest freshwater lake** in northeast India. (CG PSC, 2008)
- Loktak Lake is home to **Keibul Lamjao National Park**, the **world's only floating wildlife sanctuary**. (UPPCS, 2005)
- **Didwana** and **Udayasagar** lakes are located in Rajasthan. Kolleru lake is located in Andhra Pradesh.
- **Fulhar Lake** is located near Madhotanda in Pilibhit district (Uttar Pradesh). (RAS, 2023)
- The **Gomti River** originates from Fulhar Lake.
- **Sambhar Lake** is the **largest saltwater lake (inland)** in India, located in Rajasthan.
- **Wular Lake**, the **largest freshwater lake**, in India, is located in Jammu and Kashmir.
- The **Tulbul** project is located on the Jhelum river.
- **Govind Ballabh Pant Sagar** is the largest artificial lake in India.
- Govind Ballabh Pant Lake is formed by a dam built upon the **Rihand River**, a tributary of the Son river.
- **Gurudongmar Lake (5154 m)** in Sikkim is located at the **highest altitude** in India.
- The **Teesta** river originates from Chola Lake (Tsho Lhamo).
- **Lonar Lake** is located in Buldhana district of Maharashtra.
- Lonar Lake was created by the impact of an asteroid collision with earth during the Pleistocene epoch.
- **Ukai Lake** is a man-made lake located on the **Tapti River** in Gujarat.
- **Tungabhadra Lake** is a **man-made** lake located on the Tungabhadra River.
- **Hussain Sagar Lake** is located between Hyderabad and Sikandrabad.
- **Vembanad Lake** is located on the west coast and is a lagoon in Kerala.

- India's second-largest lagoon located on the east coast is **Pulicat Lake**.
- Pulicat Lake is located on the border of Andhra Pradesh and Tamil Nadu on the Coromandel Coast. It is the second-largest brackish water lagoon in India.
- **Barrier Island** named Sriharikota separates Pulicat Lake from the Bay of Bengal.
- **Satish Dhawan Space Centre** is situated in Sriharikota.
- The Buckingham Canal is located on the west bank of Pulicat Lake.
- The height of the Kunchikal Falls, located in Karnataka, is reported to be at least 400 feet and a maximum of 800 feet (about 183 meters).
- Nohkalikai (340 m), Meghalaya is the **highest waterfall** in India, as per the current status of the world waterfall database.
- The major waterfall of India is **Garsoppa (Jog)** or **Mahatma Gandhi Falls**.
- Jog Falls is situated on the **River Sharavati**. (UPPCS, 2017; IAS, 2008)
- **Hundru Falls** (Ranchi) is on the River Swarnarekha (Subarnarekha).
- **Shivasamudram Falls** is located on the River Kaveri.
- **Punasa Falls** is located on the River Chambal.

### Major Waterfalls in India

| Waterfalls                  | Height (m) | Rivers       | Location                        |
|-----------------------------|------------|--------------|---------------------------------|
| Jog/Garsoppa Mahatma Gandhi | 253        | Sharavati    | Karnataka (UPPCS, 2008, 09, 05) |
| Chitrakoot                  | 29         | Indravati    | Chhattisgarh                    |
| Shivasamudram               | 98         | Kaveri       | Karnataka                       |
| Gautam Dhara/Jonha          | 45         | Ranu         | Jharkhand                       |
| Hundru                      | 98         | Subarnarekha | Jharkhand                       |
| Lodh Budhaghagh             | 143        | Budha        | Jharkhand                       |
| Gokak                       | 52         | Gokak        | Karnataka                       |
| Dasham                      | 44         | Kanchi       | Jharkhand                       |
| Pykara                      | 61         | Pykara       | Tamil Nadu                      |
| Kapil Dhara                 | 30         | Narmada      | Madhya Pradesh                  |
| Chulia                      | 15         | Chambal      | Rajasthan                       |
| Dhuandhar                   | 30         | Narmada      | Madhya Pradesh                  |

## 6. Climate of India

- The total weather conditions in a large area for a long period is called the **climate** of that region.
- The Wular lake, the Dal lake, Bhimtal, Nainital, Loktak and Barapani are examples of Fresh Water lake. (IAS, 2008)
- The climate of India is **Tropical Monsoon Climate**. (MPPCS, 2013)



- A monsoon is a seasonal change in the direction of the prevailing, or strongest, winds of a region.  
(UPPCS, 1996, 98; UP Lower, 1998)
- The state of the atmosphere for a short time (1 day or 1 week) at a particular place is called the **weather**.
- The meteorological service in India was started in 1875.
- Initially, the **headquarter of the Meteorological Department was located at Kolkata**, later was brought to Shimla and thereafter Pune and **finally to New Delhi**.
- Now **meteorological maps of India have been published from New Delhi**.  
(Jharkhand PCS, 2003)
- Factors affecting the Indian climate are - latitudinal position, relief, monsoon winds and distance from the sea.
- South India is closer to the Equator, there is a hot climate throughout the year.
- North India is located in the north of the Tropic of Cancer resulting in the cold in winter and hot in summer.
- Cold winds coming from Central Asia can't enter India because of the presence of the Himalayan Mountains in the north.
- The temperature decreases by 1°C at every 165 meters of altitude. That is why there is a difference in the temperature of the mountainous and plains even when located on the same latitude.
- The Himalayas create the barrier for the monsoon winds which causes rain in the country and changes the climate.
- In summer, the monsoon winds travel from **southwest to northeast**, and during winter, **northeast to southwest**.
- The surrounding areas of the sea have an Equable climate and are thus found to have an anomalous climate.
- The change in the direction of monsoon winds causes a change in the season. Based on this, there are four seasons in India-
  1. Winter Season (16<sup>th</sup> December to 15<sup>th</sup> March)
  2. Summer (16<sup>th</sup> March to 15<sup>th</sup> June)
  3. Rainy Season (16<sup>th</sup> June to 15<sup>th</sup> September)
  4. Autumn (16<sup>th</sup> September to 15<sup>th</sup> December)
- Rainfall in winter occurs due to **western disturbance** in the plains of northern India.
- Rainfall occurs during the winter months (January-February) on the coasts of Tamil Nadu due to the **returning monsoon**.
- North eastern monsoon is also called the returning monsoon.
- During the summer, intense humid winds are generated causing thunderstorms in Assam and West Bengal.
- The intense humid winds are called **Kalbaisakhi** in West Bengal and **Norwesters** in eastern India.
- The intense and humid winds in Karnataka and South India are called **Cherry Blossom Rain**.
- It is also known as **coffee rain** because it is congenial for coffee farming.
- The **mango shower** in south India (Kerala) is known for having strong humid winds being congenial for the mango crop in Kerala.
- The hot and dry winds blowing in the dry parts of northwestern India during the summer are called "loo".
- Due to the peninsular shape of India, the southwest monsoon divides into two directions, one towards the **Arabian Sea** and the other towards the **Bay of Bengal**.
- The monsoon of the Arabian Sea direction showers in **Kerala** in the first week of June.
- In Kerala, this monsoon collides with the Western Ghat Mountains and rains on the coasts of Kerala. This is called **monsoon burst**.
- Monsoon passing through Kerala affects the entire Indian subcontinent till 15<sup>th</sup> July via Mumbai by 10<sup>th</sup> of June.
- The winds that come from the Bay of Bengal (The West Monsoon) bring more rainfall to the **Garo, Khasi and Jaintia hills**.
- **Mawsynram (Meghalaya)** is the highest rainfall receiving a place in the world.  
(52<sup>nd</sup> BPSC, 2008; MPPCS, 2010; JK PSC, 2011; UPPCS, 2001)
- Koeppen has classified of climate — A-Tropical, B-Dry Climates, C-Warm Temperate, D-Cold Snow forest, E-Cold Climates, H-Highlands.
- **Leh** (Union Territory of Ladakh, 41.7 mm) receives the lowest annual rainfall in India. (UPPCS, 2008, 2009, 2010)
- The **southwest monsoon** is more powerful than the monsoon of the Arabian Sea.
- Mawsynram in the southern ranges of the Khasi hills.
- Aw (tropical climate with winter dry season e.g large part of peninsular India south of Tropic of Cancer) represents a two alphabet combination. It represents most of the Peninsular plateau, south of the Tropic of Cancer.
- The direction of the southeast trade winds in India during the southwest monsoon season is South-westerly.
- Tamil Nadu receives very little rainfall during the southwest monsoon as its location is in the mountain rain shadow region of the Western Ghats.
- The **retreating monsoon season** is called the autumn season.
- Tropical cyclones originate in the Bay of Bengal in autumn.
- Tropical cyclones cause more damage in Andhra Pradesh, Tamil Nadu, Odisha, West Bengal and Puducherry which are in the east coastal region and Gujarat in the west coastal region.
- A 'break' in the monsoon refers to a period of reduced rainfall or a dry spell during the monsoon season. It's a time when the usual heavy rains pause for several days to weeks, even though it's still technically the monsoon season.

- The 'Arabian Sea Branch' and 'Bay of Bengal Branch of Indian monsoon merge together over Punjab and adjoining Himalayas.
- Blossom shower is a weather phenomenon that occurs in Karnataka during the months of February and March, which helps the coffee flowers to blossom.
- Tamilnadu is divided in the 7 sub agro climatic Zones. ie., Cauvery delta, North Eastern, Western, North Western, High Altitude, Southern and High rainfall. Most of Tamil Nadu state falls broadly into 4 major categories of soil viz.
- There is hardly any difference in day and night temperatures in the Andaman and Nicobar islands or in coastal area of Kerala. It means that water takes more time to get hot or cold then land.

## 7. Soil of India

- The soil on the surface of the Earth is a layer of unorganized materials made up of rocks and biomass through the process of **degradation** and **decomposition**.
- The science of soil studies is called soil science.
- The Central Soil Conservation Board was set up in 1953 to check soil erosion and its adverse consequences.
- The Central Arid Zone Research Institute (CAZRI) was established in Jodhpur, Rajasthan to study the desert problem.
- Territorial variation is found in the soils of India due to variations in **relief** and **climatic conditions**.
- The Indian Council of Agricultural Research has divided India's soils into 8 categories.

### (i) Alluvial Soil :

- The **soil brought by rivers** is called alluvial soil.
- In India, the Gulf of Khambhat, the Gulf of Kachchh, and the Gangetic delta provide ideal conditions for utilizing Tidal energy.
- Alluvial soil is rich in potash, phosphoric acid, lime and organic matter but lacks nitrogen and humus.
- There are two types of alluvial soil - **Bhangar** and **Khadar**
- Bhangar is called **old alluvial soil** and Khadar is called **new alluvial soil**.
- Bhangar consists of **pebbles** and **calcium carbonate**.
- The deposition of salt is due to saline and alkaline eruptions on Bhangar soil.
- This soil is less fertile than Khadar, hence it requires regular use of fertilizers.
- Khadar is formed by deposits brought by floods annually.
- Khadar soil has a high water holding capacity.
- Paddy, wheat, maize, oilseeds, pulses, potatoes, are produced on alluvial soil.

### (ii) Black Soil :

- Black soil is also known as **Regur soil**, **Black Cotton soil**, **Tropical Black Earth** and **Tropical Chernozem**.

(44<sup>th</sup> BPSC 2000, 1998)

- Black soil is formed by regular **weathering and erosion** of **basalt lava**.

- The Black soil is mainly found in Maharashtra, Gujarat, Madhya Pradesh, Andhra Pradesh and Karnataka.

(44<sup>th</sup> BPSC, 2000)

- Black soil is highly suitable for **cotton cultivation**.
- Black soil has the **maximum water holding capacity**.
- Black soil is rich in iron, calcium, aluminium, lime and magnesium carbonate.
- The soil swells and becomes sticky when wet and shrinks when dry.
- During dry season, the soil develops wide cracks and there occurs a kind of 'self-ploughing'.
- The black colour of the soil is due to the presence of **titaniferous magnetite** and **fossils**.

(UPPCS, 1999)

### (iii) Red Soil :

- Red soil is formed due to the **disintegration** and **dissolution** of metamorphic rocks as a result of climatic changes.
- This soil is rich in silica and iron.
- It is mainly found in western Tamil Nadu, Karnataka, southern Maharashtra, Chhattisgarh, Telangana, Odisha and Chota Nagpur regions.
- It is red due to the presence of oxide of iron, **ferric oxide**.
- Red soil lacks lime, magnesium phosphate, nitrogen and humus.
- **Millet** cultivation in red soil is suitable for high places while **rice, ragi, tobacco, groundnut, potatoes and vegetables** are cultivated on this soil in low-lying areas.
- Red soil is also often found as infertile wasteland.

### (iv) Laterite Soil :

- Laterite soil is formed by the breaking of limestone and silica deposits in high rainfall regions.
- Laterite soil is rich in iron oxide and aluminium oxide.
- Laterite soil is found in Kerala, Odisha, Chota Nagpur Plateau, Meghalaya and mountainous regions of the Western Ghats.
- Laterite soil is categorized as deep Red Laterite, White Laterite and Underground Laterite.
- Laterite soil is most suitable for the cultivation of **cocoa, cashew, tea** and **cardamom**.
- Deep red Laterite soil is rich in iron oxide and potash.

### (v) Forest Soil :

- The layers of this soil are thin as it develops in the mountainous regions.
- The soil is **deficient in bacteria** and its **fertility is low**.
- The forest soil is more suitable for horticulture crops, tea, **coffee, spices** and **fruits**, etc.
- The colour of the alluvial soils varies from the light grey to ash grey.

#### (vi) Desert Soil :

- Desert soil is sandy soil with less than a normal amount of phosphorus.
- Desert soil is deficient in Nitrogen and humus.
- In desert soil coarse grains are mainly cultivated.

#### (vii) Saline and Alkaline Soil :

- These soils are also known as **Reh, Usar** or **Kallar**.
- The alkaline soil is developed in areas lacking proper drainage system.
- In alkaline soil, there is an excess of sodium chloride and free sodium in saline soils.
- **Gypsum** is used to remove the alkalinity of the soil.

#### (viii) Wet and Marshy Soil :

- Wet soil is formed due to the accumulation of a large amount of organic matter in highly humid conditions.
- The wet soil contains sufficient amount of soluble salts.
- The wet soil lacks phosphorus and potash.
- The wet soil is suitable for paddy cultivation.
- The marshy soil is formed in **waterlogged areas**.
- The marshy soil is rich in organic matter.
- It is unsuitable for farming.

### 8. Agriculture in India

- According to the Economic Survey of 2023-24, the Indian agriculture sector provides livelihood support to about 42.3 percent of the population and has a share of 18.2 percent in the country's GDP at current price.
- About **45.64%** of the total area of India is under cultivation. [2019-20(P)]
- Grassland constitutes 3.42% of the total landmass of India [2019-20(P)].
- Forest cover is **21.71%** of the total area of India (ISFR : 2021). [IAS (Pre), 2010]
- 5.4% [2019-20 (P)] of the total physical area of India is barren and uncultivated. (BPSC, 1999)
- **India's first agricultural university** was established on 17<sup>th</sup> November 1960 in Pantnagar, Uttarakhand (erstwhile UP). (UPPCS, 2013, 2014; UPPCS, 2013)
- Later, this agricultural university was named **Govind Ballabh Pant University of Agriculture and Technology**.
- The Planning Commission has divided India into fifteen regions based on agro-climatic conditions.
- Based on soil, natural climate and geographical conditions, the National Bureau of Soil Survey has divided India into **20 agro-ecological** regions and 60 agro-ecological sub-regions. (UP RO/ARO, 2013, 2010; UPPCS, 2016, 2017, 2010)

#### Classification of Crops :

##### A. Rabi Crop :

- It is generally sown in **October-November** and harvested in **March-April**. (MPPCS, 2000, 1994, 2013; UPPCS, 2016)

- Wheat, gram, pea, mustard, potato, etc. are the main crops of the Rabi season.

##### B. Kharif Crop :

- It is a rain-fed crop that is sown in **June – July** and harvested in **October – November**. (UPPCS, 2011, 2004)
- Paddy, sugarcane, oilseeds, jowar, millet, maize, pigeon pea, etc. are the main Kharif crops.

##### C. Zaid Crop :

- Zaid crops are grown in summer, i.e. between Rabi and Kharif seasons. It is sown in **March** and harvested in **June**.
- Watermelon, melon, cucumber, ladyfinger and urad are the main crops of **Zaid season**.
- Arid soils are characteristically developed in western Rajasthan, which exhibit characteristic arid topography.
- Coarse cereals include maize (*Zea mays*), sorghum (Jowar; *Sorghum vulgare*), oats (Jai; *Avena sativa*), barley (Jow; *Hordeum vulgare*), pearl millet (Bajra; *Pennisetum glaucum*) and other minor millets such as Finger millet (Ragi; *Eleusine coracana*), Kodo millet (Arikalu; *Paspalum setaceum*), Proso millet etc.
- India is second in the world in Wheat and Rice production after China (FAO 2022).
- As per Economic Survey 2023-24, Uttar Pradesh ranks first in the production of wheat in India while Telangana ranks first in rice production.

✎ **Note :** AGMARK is a central government sponsored scheme for grading and standardization of agricultural products.

- Cultivation of crops and animal husbandry are called **mixed farming**.
- Coarse grains refer to cereal grains other than wheat and rice or those used primarily for animal feed or brewing.
- The term “Green Revolution” was first used by William S. Gaud, the administrator of the U.S. Agency for International Development (USAID), in a speech on 8 March 1968.
- Norman Borlaug is often called “the father of the Green Revolution”.
- The credit for introducing the Green Revolution in India goes to **Dr. M.S. Swaminathan**.

(MPPCS, 1999; CGPSC 2003)

- The first phase of the Green Revolution lasted from **1966 to 1981**. (UPPCS, 2015)
- The second phase of the Green Revolution was from 1981 to 1995 and the third phase started in 1995.

(UPPCS, 2017, 2015)

- The crop that benefitted most from the green revolution was wheat.

- The second most beneficial impact of the Green Revolution was on **paddy** crop.
- The **Mission on Oilseeds Technology** was established in 1986 which was later converted into the National Mission on Oilseeds and Palm Oil (NMOOP) in 2014.
- India ranks first in the production of mango, banana, ginger, papaya. (FAO, 2022).
- India is the second-largest producer of fruits and vegetables in the world after China. (FAO : 2022).
- India ranks second in the world tobacco production (FAO: 2022).
- Krishna-Godavari Delta region is known as the **Rice Bowl of India**.
- Cotton is known as **white gold** in Maharashtra.
- Crop rotation is the practice of planting different crops sequentially on the same plot of land to improve soil health, optimize nutrients in the soil, and combat pest and weed pressure.
- Jute is considered as the golden fiber.
- Uttar Pradesh is called the **sugar bowl of India**.
- **Shakkarnagar** of the Telangana is a major sugar producing centre.
- The sugar industry is the largest agro-based industry in India after cotton textiles.

✎ **Note :** The author of the book, 'A History of Agriculture in India' is M.S Randhawa.

- Rapeseed, mustard sesame, linseed, soybean, sunflower, castor and cottonseed are the major oilseed crops of India.
- Peanut is the most suitable crop for **dry land farming**.
- Pulses, gram, pea and moong can **fix atmospheric nitrogen**, whereas the rajma plant does not fix the atmospheric nitrogen.
- It is a kharif crop which requires high temperature, (above 25°C) and high humidity with annual rainfall above 100 cm. In the areas of less rainfall, it grows with the help of irrigation.

| Major Agricultural Revolutions |                                                     |
|--------------------------------|-----------------------------------------------------|
| Revolution                     | Related Field                                       |
| 1. Green Revolution            | Food Grain Production                               |
| 2. Golden Revolution           | Fruit and Vegetables Production (UPPCS, 2022, 2016) |
| 3. White Revolution            | Milk Production                                     |
| 4. Grey Revolution             | Fertilizer Production (UPPCS, 2022, 2016)           |
| 5. Blue Revolution             | Fishery Production (UPPCS, 2016; MPPCS, 2016)       |
| 6. Red Revolution              | Tomato, Meat Production                             |
| 7. Black Revolution            | Petroleum Production                                |

|                       |                                      |
|-----------------------|--------------------------------------|
| 8. Yellow Revolution  | Oilseed Production                   |
| 9. Pink Revolution    | Lobster/Meat Export/Onion Production |
| 10. Amrit Revolution  | River Link Project                   |
| 11. Silver Revolution | Egg Production                       |
| 12. Almond Revolution | Spices Production                    |
| 13. Round Revolution  | Potato Production                    |

| Major Methods of Agriculture |                                                    |
|------------------------------|----------------------------------------------------|
| 1. Hydroponics               | Growing of Plants in Water (Soil-free Agriculture) |
| 2. Pomo Culture              | Fruit Production                                   |
| 3. Olericulture              | Vegetables Production                              |
| 4. Horticulture              | Gardening                                          |
| 5. Viticulture               | Grapes Cultivation                                 |
| 6. Pisciculture              | Fishing                                            |
| 7. Sericulture               | Silkworm Rearing                                   |
| 8. Apiculture                | Beekeeping                                         |
| 9. Floriculture              | Flower Production                                  |
| 10. Vermiculture             | Earthworm Production                               |

| Important Crops Producing States (Economic Survey 2023-24) Third Advance Estimates. |                |                |                |
|-------------------------------------------------------------------------------------|----------------|----------------|----------------|
| Crops/Crop groups                                                                   | States         |                |                |
| 1. Food Grains                                                                      | First          | Second         | Third          |
| Rice                                                                                | Telangana      | Uttar Pradesh  | West Bengal    |
| Wheat                                                                               | Uttar Pradesh  | Madhya Pradesh | Punjab         |
| Maize                                                                               | Karnataka      | Bihar          | Madhya Pradesh |
| Total coarse Cereals                                                                | Rajasthan      | Karnataka      | Madhya Pradesh |
| Gram                                                                                | Madhya Pradesh | Maharashtra    | Rajasthan      |
| Tur (Arhar)                                                                         | Karnataka      | Maharashtra    | Uttar Pradesh  |
| Total Pulses                                                                        | Madhya Pradesh | Maharashtra    | Rajasthan      |
| Total Food Grains                                                                   | Uttar Pradesh  | Madhya Pradesh | Punjab         |
| 2. Oil Seeds                                                                        | First          | Second         | Third          |
| Groundnut                                                                           | Gujarat        | Rajasthan      | Madhya Pradesh |
| Rapeseed and Musturd                                                                | Rajasthan      | Uttar Pradesh  | Madhya Pradesh |
| Soyabean                                                                            | Madhya Pradesh | Maharashtra    | Rajasthan      |



|                                                                   |                |                |                                            |
|-------------------------------------------------------------------|----------------|----------------|--------------------------------------------|
| Sunflower                                                         | Karnataka      | Haryana        | Odisha                                     |
| Total Oil seeds                                                   | Rajasthan      | Madhya Pradesh | Gujarat                                    |
| <b>3. Vegetables</b>                                              | <b>First</b>   | <b>Second</b>  | <b>Third<br/>(Economic Survey 2022-23)</b> |
| Potato                                                            | Uttar Pradesh  | West Bengal    | Bihar                                      |
| Onion                                                             | Maharashtra    | Madhya Pradesh | Karnataka                                  |
| Tomato                                                            | Madhya Pradesh | Andhra Pradesh | Karnataka                                  |
| Sugar cane                                                        | Uttar Pradesh  | Maharashtra    | Karnataka                                  |
| <b>3. Fibre Crops</b>                                             | <b>First</b>   | <b>Second</b>  | <b>Third</b>                               |
| Cotton                                                            | Gujarat        | Maharashtra    | Telangana                                  |
| Jute & Mesta                                                      | West Bengal    | Bihar          | Assam                                      |
| <b>Leading States in Production 2021-22 (3<sup>rd</sup> A.E.)</b> |                |                |                                            |
|                                                                   | <b>First</b>   | <b>Second</b>  | <b>Third</b>                               |
| Coconut                                                           | Karnataka      | Tamil Nadu     | Kerala                                     |
| Cashew                                                            | Maharashtra    | Andhra Pradesh | Odisha                                     |
| Tobacco                                                           | Gujarat        | Andhra Pradesh | Uttar Pradesh                              |
| Milk                                                              | Rajasthan      | Uttar Pradesh  | Madhya Pradesh                             |
| Fish Production (over all)                                        | Andhra Pradesh | West Bengal    | Gujarat                                    |
| Fish Production (Marine)                                          | Gujarat        | Tamil Nadu     | Andhra Pradesh                             |
| Fish Product (Inland)                                             | Andhra Pradesh | West Bengal    | Uttar Pradesh                              |
| Tea                                                               | Assam          | West Bengal    | Tamil Nadu                                 |

| List of Rabi Crops |             |                               |
|--------------------|-------------|-------------------------------|
| S.No.              | Common Name | Scientific Name               |
| 1.                 | Maize       | Zea mays, L                   |
| 2.                 | Lucerne     | Hedicago sativa               |
| 3.                 | Cumin       | Cuminum cyminum, L            |
| 4.                 | coriander   | coriandrum sativum, L         |
| 5.                 | Wheat       | Triticum vulgare, Vill        |
| 6.                 | Fenugreek   | Trigonella foenumgraecum, L   |
| 7.                 | Gram        | Cicer arietinum               |
| 8.                 | Onion       | Allium cepa, L                |
| 9.                 | Mustard     | Brassica juncea, L            |
| 10.                | Tomato      | Lycopersicum esculentum, Mill |
| 11.                | Fennel      | Foeniculum vulgare, Miller    |
| 12.                | Potato      | Solanum tuberosum             |
| 13.                | Isabgol     | Plantago ovata. Fors          |
| 14.                | Oat         | Avena sativa                  |

| List of Kharif Crops |             |                              |
|----------------------|-------------|------------------------------|
| S.No.                | Common Name | Scientific Name              |
| 1.                   | Paddy       | Oryza sativa, L              |
| 2.                   | Guar (F)    | Cymopsis tetragonaloba, Taub |
| 3.                   | Castor      | Ricinus communis             |
| 4.                   | Nagali      | Eleusine coracana, G         |
| 5.                   | Hy Cotton   | Gossypium hirsutum, L        |
| 6.                   | Chilly      | Capsicum frutescens, L       |
| 7.                   | Cotton      | Gossypium herbaceum, L       |
| 8.                   | Jowar       | Sorghum vulgare, Pers        |
| 9.                   | Sesamum     | Sesamum orientale            |
| 10.                  | Soyabean    | Glycine hispida, Merr        |
| 11.                  | Maize       | Zea mays, L                  |
| 12.                  | Urid        | Vigna mungo, L               |
| 13.                  | Bajri       | Pennisetum typhoideum, L     |
| 14.                  | Arhar       | Cajanus cajan, Milsp         |
| 15.                  | Ground Nut  | Arachis hypogaea, L          |
| 16.                  | Fennel      | Foeniculum vulgare, Miller   |

## 9. Irrigation and Multipurpose Projects

- There are three types of irrigation projects in India - A. Minor Irrigation Project, B. Medium Irrigation Project and C. Major Irrigation Project.

### A. Minor Irrigation Projects :

- Minor irrigation projects are projects for arable land **less than 2000 hectares**.
- In India, most of the irrigation is done by Small irrigation projects. (BPSC, 2008; UPPCS, 2017)

- The small irrigation projects include **wells, tube wells, diesel pumps, ponds, drip irrigation**, etc.

### B. Medium Irrigation Project :

- The Medium Irrigation Project is for irrigation of more than **2000 and up to 10,000 hectares** of arable land.
- **Canals** are the primary means of medium irrigation.

### C. Major Irrigation Project :

- The major irrigation projects are those used for irrigating **more than 10,000 hectares** of arable land.
- About 38% of irrigation in India is covered by major and medium projects. Major irrigation projects include dams.
- Uttar Pradesh has the highest net area under irrigation.
- According to the Statistical Year Book 2018, the major means of irrigation in the country is tubewell.
- In Uttar Pradesh, irrigation by tube wells covers the largest arable area.
- The Garland Canal System in India was proposed by **Captain Dinshaw J. Dastur**.

- In **peninsular India**, the primary means of irrigation are **ponds**.
- 48.1% Share of the Net Irrigated Area in India is related to Tubewells while the share of canals is 23.3%. (2019-20).
- In Tamil Nadu, ponds are a major source of water for cultivation.
- The Tehri Hydroelectric Project is upstream of the confluence of the Bhagirathi and Bhilangana rivers in the Tehri district of Uttarakhand.
- Ancient Bamboo Drip Irrigation System is commonly used in Meghalaya.
- The Bhupen Hazarika Setu, also referred to as the Dhola–Sadiya Bridge, at 9.15 kilometres (5.69 mi) in length, is the longest bridge in India over water.
- It is a beam bridge in India, connecting the northeast states of Assam and Arunachal Pradesh. The bridge spans the Lohit River, a major tributary of the Brahmaputra River.
- Dharoi Dam is a gravity dam on the Sabarmati river near Dharoi, Mehsana district of northern Gujarat in India. Constructed in 1978, the dam is meant for irrigation, power generation and flood control.
- The famous Hirakud Captive Thermal Power plant is located near the Hirakud Dam, Odisha.

### Major Multipurpose Projects of India and Their Respective States

| Project Name                      | River/Dam                     | Related State/Union Territories                                                                     |
|-----------------------------------|-------------------------------|-----------------------------------------------------------------------------------------------------|
| Bhakra Nangal                     | Sutlej<br>(UPPCS, 1994)       | Punjab, Haryana, Rajasthan, Himachal Pradesh<br>(BPSC, 1997)                                        |
| Beas (Pong-Dam)                   | Beas                          | Rajasthan, Punjab, Haryana, Himachal Pradesh                                                        |
| Indira Gandhi Canal               | Confluence of Beas and Sutlej | Rajasthan, Haryana and Punjab<br>(UPPCS, 1999)                                                      |
| Chambal                           | Chambal                       | Madhya Pradesh and Rajasthan                                                                        |
| Damodar Valley                    | Damodar                       | West Bengal and Jharkhand                                                                           |
| Hirakud Dam                       | Mahanadi                      | Odisha<br>(MPPCS, 2005)                                                                             |
| Mayurakshi                        | Mayurakshi                    | West Bengal, Jharkhand                                                                              |
| Kosi                              | Kosi                          | Bihar and Nepal                                                                                     |
| Tungabhadra                       | Tungabhadra                   | Karnataka and Telangana                                                                             |
| Nagarjuna Sagar<br>(UK PSC, 2006) | Krishna                       | Telangana and Andhra Pradesh [UPPRS (Pre), 1993; UPPCS, 2008, 2004, 1991; UK PSC, 2012; BPSC, 2015] |
| Farakka                           | Ganges                        | West Bengal Bhagirathi                                                                              |
| Kakrapar                          | Tapi                          | Gujarat                                                                                             |
| Tawa                              | Tawa                          | Madhya Pradesh                                                                                      |
| Ukai                              | Tapi                          | Gujarat                                                                                             |

|                                     |                             |                                                  |
|-------------------------------------|-----------------------------|--------------------------------------------------|
| Malprabha                           | Malprabha                   | Karnataka                                        |
| Pochampadu Shri Ram Sagar           | Godavari                    | Telangana                                        |
| Baglihar                            | Chenab                      | Jammu and Kashmir                                |
| Sardar Sarovar<br>(UPPCS, 1999, 82) | Narmada<br>(UP Lower, 2004) | Gujarat, Madhya Pradesh, Rajasthan & Maharashtra |
| Tilaiya                             | Barakar                     | Jharkhand                                        |
| Dulhasti                            | Chenab                      | Jammu and Kashmir                                |
| Tulbul                              | Jhelum                      | Jammu and Kashmir                                |
| Sirhind Canal                       | Sutlej                      | Punjab                                           |
| Jawahar Sagar                       | Chambal                     | Rajasthan                                        |
| Rana Pratap Sagar                   | Chambal                     | Rajasthan                                        |
| Gandhi Sagar                        | Chambal                     | Madhya Pradesh                                   |
| Shivasamudram                       | Kaveri                      | Karnataka (UPPCS, 2003, 99)                      |
| Bansagar                            | Son                         | Bihar, Uttar Pradesh, Madhya Pradesh             |
| Panchet Dam                         | Damodar                     | Jharkhand, West Bengal                           |
| Sharavati                           | Sharavati                   | Karnataka                                        |
| Hasdeo Bango                        | Hasdeo                      | Chhattisgarh                                     |
| Sharda Sahayak                      | Sharda, Gomti, Sai          | Uttar Pradesh                                    |
| Machhakund                          | Machhakund                  | Odisha, Andhra Pradesh                           |
| Kangsabati                          | Kangsabati                  | West Bengal                                      |
| Jaykwadi                            | Godavari                    | Maharashtra                                      |
| Bhadra                              | Bhadra                      | Karnataka                                        |
| Bhima                               | Pavana and Krishna          | Maharashtra                                      |
| Ghatprabha                          | Ghatprabha                  | Karnataka                                        |
| Rihand                              | Rihand                      | Uttar Pradesh                                    |
| Matatila                            | Betwa                       | Uttar Pradesh, Madhya Pradesh                    |
| Ramganga                            | Ramganga                    | Uttar Pradesh                                    |
| Tehri Dam                           | Bhagirathi                  | Uttarakhand                                      |
| Idukki                              | Periyar                     | Kerala                                           |

✎ **Note :** Tehri dam is constructed in Uttarakhand on Bhagirathi river. [UPPCS, 2002; UK PSC, 2012; IAS, 2009; MPPCS, 2010; IAS (Pre), 1999]

### Major Hill Cities of India

| City            | Altitude (m) | State/Union territory |
|-----------------|--------------|-----------------------|
| Ranchi          | 652          | Jharkhand             |
| Ranikhet        | 1869         | Uttarakhand           |
| Lansdowne       | 1706         | Uttarakhand           |
| Dalhousie       | 2036         | Himachal Pradesh      |
| Mussoorie       | 2005         | Uttarakhand           |
| Garh Mukteshwar | 2171         | Uttarakhand           |
| Nainital        | 2084         | Uttarakhand           |

|               |      |                   |
|---------------|------|-------------------|
| Kasauli       | 1951 | Himachal Pradesh  |
| Coonoor       | 1858 | Tamil Nadu        |
| Gangtok       | 1650 | Sikkim            |
| Manali        | 2050 | Himachal Pradesh  |
| Gulmarg       | 2653 | Jammu and Kashmir |
| Ooty          | 2240 | Tamil Nadu        |
| Pahalgam      | 2130 | Jammu and Kashmir |
| Darjeeling    | 2045 | West Bengal       |
| Kodaikanal    | 2133 | Tamil Nadu        |
| Srinagar      | 1730 | Jammu and Kashmir |
| Bhowali       | 1706 | Uttarakhand       |
| Almora        | 1650 | Uttarakhand       |
| Shillong      | 1491 | Meghalaya         |
| Nandi Hills   | 1478 | Karnataka         |
| Yercaud       | 1515 | Tamil Nadu        |
| Mahabaleshwar | 1371 | Maharashtra       |
| Kalimpong     | 1250 | West Bengal       |
| Panchgani     | 1305 | Maharashtra       |
| Munnar        | 1600 | Kerala            |
| Panchmarhi    | 1100 | Madhya Pradesh    |
| Kemmanagundi  | 1434 | Karnataka         |
| Mandi         | 1044 | Himachal Pradesh  |
| Lonavala      | 622  | Maharashtra       |
| Khandala      | 622  | Maharashtra       |

## 10. Mineral Resources in India

- Mineral resources are formed from rocks buried under the crust for billions of years.
  - The region of the south-east of India like Chota Nagpur Plateau, Dandakaranya and Odisha Plateau, etc. have the largest reserve of mineral resources. (UPRO, 2017)
  - The Mettur Dam is located across the river Kaveri (or Cauvery) in Salem district in the state of Tamil Nadu.
  - Mineral refers to a natural substance obtained from mining and has economic significance. (MPPCS, 2020)
  - Minerals can be grouped under two main categories of metallic and non metallic on the basis of chemical and Physical Properties.
1. **Metallic Minerals** – Metallic minerals are the source of metals and provide a strong Base for development of metallurgical Industry. Examples - Iron ore, Bauxite etc. metallic Minerals can be Further divided into ferrous and non ferrous metallic minerals.
- (A) **Ferrous Minerals** - Around 96% of hematite resources are confined in the states of Odisha, Jharkhand, Chhattisgarh, Karnataka and Goa.

- The remaining resources are spread in the states of Maharashtra, Madhya Pradesh, Uttar Pradesh, Rajasthan etc.

(B) **Non Ferrous Minerals** - Those minerals which do not contain iron are known as non ferrous minerals. Copper Bauxite etc.

- India is poorly endowed with Non ferrous metallic minerals except bauxite.

2. **Non Metallic Minerals** - Non metallic minerals are either organic or inorganic in origin and do not contain extractable metals in their chemical composition. Examples - limestone, dolomite, mica, kyanite, sillimanite, gypsum and phosphate.

- These minerals are used in Variety of industries such as cement, fertilizers, refractories etc. Non metallic minerals are classified into two Basic categories.

(A) **Fuel minerals** - Coal, Lignite, Crude oil and Natural gas etc.

(B) **Other Non-Metallic Minerals** - Mica Asbestos, Pyrite Salt Gypsum, Diamond, Timber Limestone, Baryte, Apatite, and alusite etc.

- Atomic Power minerals are the Part of Non metallic minerals. Examples - Uranium, Thorium, Beryllium etc.

➤ **Characteristics of minerals :**

- Formed by inorganic process.
- Occurrence in solid form.
- Definite chemical composition.
- Definite crystalline structure.

➤ **Distribution of Minerals :**

- 'Dharwar and Cuddapah System' contain resources of major metallic minerals like copper, Lead, Zinc etc.
- 'Vindhyan System' contains major non-metallic minerals like limestone, dolomite, gypsum, calcium sulphate etc.

**Major Mineral Regions in India :**

1. **North Eastern Plateau Region**

- It covers the Chhotanagpur Plateau, Odisha Plateau and the eastern Andhra Plateau.
- The belt contains
- North Eastern Plateau contains rich variety of minerals specially used for metallurgical industries such as '**iron ore, manganese, mica, bauxite limestone, dolomite**' etc.
- This region also has rich deposits of coal, along the river of Valleys of Damodar, Mahanadi and Son etc.
- This region also has substantial amount deposit of copper uranium, Thorium Phosphate etc.

2. **South Western Plateau Region**

- This region extends over the Karnataka Plateau and adjoining Tamil Nadu plateau and is rich in metallic minerals, particularly iron ore, manganese and Bauxite non metallic minerals.

- All three gold mines of India are found in this region.

### 3. North Western Region

- This belt extends from the Gulf of Khambhat in Gujarat to the Aravali range in Rajasthan.
- Copper Zinc has been major minerals in this belt.
- The '**Ministry of Mines**' is responsible for survey, exploration, and mining of all mineral, other than natural gas, Petroleum, atomic minerals and coal.
- The Ministry is responsible for administration of the Mines and Minerals (Development and Regulation) Act, 1957 (67 of 1957)
- Public sector Undertakings under the Ministry of Mines, namely -
  - National Aluminium Company limited (NALCO), Bhubaneswar.
  - Hindustan Copper Limited. (HCL), Kolkata.
  - Mineral Exploration and Consultancy Limited (MECL), Nagpur.
- Research Institutions under the Ministry of Mines namely:
  - Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC), Nagpur.
  - National Institute of Rock Mechanics (NIRM), Bengaluru.
- '**Critical Minerals**' are the building blocks of essential modern - day technologies and are at risk of supply chain disruptions.
- These minerals are now used every where from making mobile phones, computers to batteries, electric vehicles and green technologies like solar panels and wind turbines.
- Minerals such as antimony, Cobalt gallium, graphite, lithium, nickel, niobium, and strontium are among the 22 assessed to be critical for India.
- '**Strategic minerals**' have a substantial role to play in the development and security of the nation and play a crucial role in the development of the national economy.

#### 'KABIL'

- It is a joint venture company set up with the participation of three central public sector Enterprises namely. National Aluminium Company Ltd. (NALCO). Hindustan Copper Ltd. (HCL) and Mineral Exploration Company Ltd. (MECL), Under the '**Ministry of Mines**'.
- Out of 1391 reporting mines, most of the mines reported are in Madhya Pradesh, Gujarat, Karnataka, Odisha, Chhattisgarh, Andhra Pradesh, Rajasthan, Tamil Nadu, Maharashtra, Jharkhand and Telangana.
- The order was from Odisha with share of 44.11% followed by Chhattisgarh (17.34%) Rajasthan (14.10%), Karnataka (13.24%), Jharkhand (4.36%), Madhya Pradesh (2.44%) and Maharashtra (1.45%) in the total value of mineral production.

#### Iron ore :

- Most of the Iron ore found in the country is of three types : Haematite ( $\text{Fe}_2\text{O}_3$ ), Magnetite ( $\text{Fe}_3\text{O}_4$ ), Limonite ( $2\text{Fe}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$ ) and Siderite ( $\text{Fe}_3\text{CO}_3$ ).

| Iron ore  | State     |                |              |
|-----------|-----------|----------------|--------------|
|           | First     | Second         | Third        |
| Haematite | Odisha    | Jharkhand      | Chhattisgarh |
| Magnetite | Karnataka | Andhra Pradesh | Rajasthan    |

| States       | Regions                    | Important Mines                    |
|--------------|----------------------------|------------------------------------|
| Odisha       | Mayurbhanj                 | Gurumahisani, Salaipet, Badampahar |
|              | Sundergarh                 | Bonai                              |
|              | Jhar                       | Kiruburu                           |
| Chhattisgarh | Durg                       | Dalli Rajhara                      |
|              | Bastar                     | Dantewara, Bailadila               |
| Karnataka    | Bellari                    | Sandur-Hospet                      |
|              | Chikkamagaluru, Chitradurg | Baba Budan hills and Kudre mukh    |
| Jharkhand    | Poorbi Singhbhum           | Noamudi                            |
|              | Paschimi Singhbhum         | Gua                                |

- Iron ore :
 

|        |   |              |
|--------|---|--------------|
| First  | - | Odisha       |
| Second | - | Chhattisgarh |
| Third  | - | Karnataka    |
| Fourth | - | Jharkhand    |

(IMYB, 2022)

#### Coal :

- Coal Reserves - Jharkhand, Odisha, Chhattisgarh, West Bengal etc.
- Coal Production - Odisha, Chhattisgarh, Madhya Pradesh, Jharkhand etc.
- World Reserves - USA, Russia, Australia etc.
- World Production - China, India etc.

#### Manganese ore :

- Manganese in Alloy form is an essential Input in steel making and steel is one of the most important indicators of growth in industrial economy of any country.
- Manganese is used in dry battery industry.
- India Reserve - Odisha, Karnataka, Madhya Pradesh
- India Production - Madhya Pradesh, Maharashtra, Odisha.
- World Reserve - South Africa China (16% each), Brazil and Australia.
- World Production - South Africa, Gabon (IMYB 2022).
- The important mining areas are Sundargarh, Rayagada, Bolangir, Keonjhar - Jaipur, Mayurbhanj, Koraput, Kalahandi and Bolangir.



- Telangana, Goa and Jharkhand are other minor producers of manganese.
- Manganese is an important raw material of iron for smelting of iron ore and also for manufacturing ferro Alloys.

#### **Bauxite :**

- Bauxite is basically an aluminous Rock that contains hydrated aluminium oxides as main constituent and iron oxide silica.
- India's Reserves - Odisha, Chhattisgarh, Andhra Pradesh, Gujarat (IMYB 2022).  
India's Production - Odisha, Gujarat, Jharkhand (IMYB 2022).  
World's Reserves - Guinea, Vietnam, Australia.  
World's Production - Australia, Bosnia & Herzegovina.
- According to IMYB 2022, Odisha accounted for the highest production of 73% of India's overall Bauxite production. [2021-22(P)]
- Bauxite is used to make alumina and aluminium. (UPPCS, 1997)

| States                               | Region                                                                                     |
|--------------------------------------|--------------------------------------------------------------------------------------------|
| Jharkhand, Gujarat<br>Madhya Pradesh | Palamu, Ranchi and Lohardanga districts<br>Madla, Shahdole and Balaghat and Katni district |
| Chhattisgarh                         | Sarguja, Raigarh and Bilaspur in<br>Amarkantak Plateau                                     |
| Maharashtra                          | Kolhapur, Raigarh, Thana, Satara and<br>Patnagiri districts                                |
| Karnataka                            | North West Parts of Belagum district                                                       |

#### **Copper :**

- Copper is an important metal in the electrical industry for making wires, electric motors, transformer and generators.
- It is an important non-ferrous Base metal having wide industrial applications, ranging from defence, Space programme, Railways, Power Cables, Telecommunication Cables etc.  
India Reserves - Rajasthan, Madhya Pradesh, Jharkhand  
India Production - Madhya Pradesh, Rajasthan (IMYB 2022)  
World Reserves - Chile, Australia, Peru.  
World Production - Chile, Peru, China (IMYB 2022).

#### **Gold :**

- Gold is a precious metal and it occurs in auriferous lodes. It is used for making ornaments and is also used in International currency.
- There are three gold fields in the country, namely Kolar gold field, Kolar district, Hutti gold field in Raichur district (both in Karnataka) and Ram giri gold field in Anantpur district (Andhra Pradesh).  
India Reserves - Bihar, Rajasthan, Karnataka (IMYB 2022).  
India Production - Karnataka, Jharkhand.

World Reserves - Australia, Russia, South Africa.

World Production - China, Russia, Australia, (IMYB 2022).

#### **Silver :**

- Silver is typically used in making ornaments, making paste for solar cells. The photovoltaic cell (PV), has become one of the most important areas of silver demand.  
India Reserves - Rajasthan, Karnataka, Jharkhand (IMYB 2022).  
India Production - Rajasthan, Karnataka  
World Reserves - Peru, Australia  
World Production - Mexico, China (IMYB 2022).

#### **Lead & Zinc :**

- Both Lead and Zinc are found to occur together in ore along with other metals like silver and cadmium. It is mainly used in manufacturing of lead acid storage Batteries.  
India Reserves - Rajasthan, Andhra Pradesh, Madhya Pradesh  
India Production - Rajasthan  
World Reserves - Australia, China  
World Production - China, Australia

#### **Nickel :**

- It has a melting Point of 1453°C relatively low thermal and electrical conductivities, high resistance to corrosion & toughness at high temperatures.
- It is used in stainless steel making, catalyst chemical industries as an electroplating material, heat resistant alloys, alloying element for non ferrous metals, space defence and rocket industries, and nickel cadmium batteries.  
India Reserves - Odisha, Jharkhand, Nagaland.  
India Production - Jharkhand.  
World Reserves - Indonesia, Australia.  
World Production - Indonesia, Phillippines.

#### **Lithium :**

- The discovery of 5.9 million metric tonnes of lithium has been made in J & K. This is the first major lithium reserve that has been found in India.
- Earlier, a survey led by the Atomic Minerals Directorate for Exploration and Research showed the presence of 1600 tonnes (inferred category) of lithium resources in marlagalla area of Karnataka's Mandya district.  
World Reserves - Bolivia, Argentina, Chile, Australia, China.  
World Production - Australia, Chile, China.

#### **Asbestos :**

- Asbestos is a group of six naturally occurring fibrous silicate minerals.
- India's asbestos requirement is met through imports from Russia, Kazakhstan, Brazil and China.
- It is used in Asbestos fabrics, cement sheets, pipes and other products.

- It is also used in brake linings, insulation and fireproof clothing.  
India Reserves - Rajasthan, Karnataka.  
World Reserves - Kazakhstan, Zimbabwe, Russia (IMYB 2022).

#### **Limestone :**

- Limestone is a sedimentary rock composed mainly of calcium carbonate ( $\text{CaCO}_3$ ) in the form of the mineral calcite. About 10% of sedimentary rocks are limestone and most cave systems are through limestone bedrock.  
India Reserves - Karnataka, Andhra Pradesh, Rajasthan.  
India Production - Rajasthan, Madhya Pradesh (IMYB 2022), Andhra Pradesh.  
World Production - China, USA, India.

#### **Crude Oil and Natural Gas in India :**

- India Reserves - Assam, Gujarat, Rajasthan.  
India Production - Rajasthan, Assam (Nat. Gas), Gujarat (Raj NG).  
World Reserves - Venezuela, Russia (NG), Saudi Arabia, Iran (NG). Canada, Qatar (NG).  
World Production - USA, USA (NG), Saudi Arabia, Russia (NG).

#### **Cobalt :**

- Cobalt is associated mostly with copper, nickel and arsenic ores.
- Rechargeable Battery Industry.
- Manufacture powerful magnets.  
India Reserves - Odisha, Jharkhand and Nagaland (IMYB 2022).  
India Production - Imports - Netherlands, USA.  
World Reserves - Congo (Kinshasa), Australia.  
World Production - DRC Democratic Rep. of Congo, Russia.

#### **Tungsten :**

- Tungsten, also known as 'wolfram' is a very dense lustrous greyish white to steel-grey metal.
- It has good corrosion resistance, good thermal & electrical conductivity.  
India Reserves - Karnataka, Rajasthan, Andhra Pradesh.  
India Production - Rajasthan.  
World Reserves - China, Russia.  
World Production - China, Vietnam.

#### **Tin :**

- Its unique combination of properties like nontoxic nature, high malleability, chemical inertness etc.
- In India, tin ore is found to be associated with granite.
- Versatile packaging substrate used in edible oils, paints, pesticides, processed foods, beverages and other industries. As a pure metal, it can be used in storage tanks for pharmaceutical chemical solutions, in capacitors,

electrodes, fuse-wires, ammunitions, tinned iron sheets to protect victuals, sweets, tobacco etc.

India Reserves - Chhattisgarh, Haryana (IMYB 2022).

India Production - Chhattisgarh.

World Reserves - China, Indonesia.

World Production - Indonesia, China (IMYB 2022).

#### **Chromite :**

- It is Chemically known as iron chromium oxide ( $\text{FeCr}_2\text{O}_4$ ). The properties of chromium that make it most versatile and indispensable are its resistance to corrosion, oxidation, wear & galling and enhancement of harden-ability.
- Odisha has a monopoly on reserves and production of Chromite. (IMYB, 2022)
- Stainless steel, high-speed tool steel and corrosion & heat-resistant steel are some of the important varieties of chromium steel.  
India's Reserves - Odisha.  
India's Production - Odisha.
- Most of the deposits of Chromite are found in the Jaipur Kendujhar and Dhenkanal districts of Odisha.  
World Reserves - USA, South Africa (IMYB 2022).  
World Production - South Africa, Kazakhstan.

#### **Cadmium :**

- It has low melting points which is present generally in zinc ore deposits as greenockite ( $\text{CdS}$ ).
- Sphalerite, the most economically significant.
- Zinc ore mineral, commonly contains minor amounts of cadmium.
- Aerospace, electrical, defence, mining, nuclear fission, television and offshore industries.
- Imports of cadmium was mainly from China.  
India Reserves - Rajasthan.  
India Production - Rajasthan.  
World Production - China (IMYB 2022).

#### **Antimony :**

- It is found in Lahaul & Spiti district, Himachal Pradesh.
  - USES,
  - Electronic, space defence,
  - Photographic materials, electroplating, besides,
  - Cosmetic, paint, plastics and textile industries,
  - Traditionally, it is used in type metal in printing,
  - Battery Industry,
  - It is used in solar panels to improve stability of the solar performance.
- India Reserves - Himachal Pradesh, Madhya Pradesh (IMYB 2022).
- India Production - Imports - Russia.
- World Reserves - China, Russia.
- World Production - China, Tajikistan.



- According to the Annual Report, 2023-24 of the Ministry of Mines, India has a total of 95 minerals including 4 fuel minerals, 10 metallic minerals, 23 non metallic, 55 minor and 3 nuclear minerals.

#### Major Mineral Reserves: Top States IMYB 2022

| Minerals               | First             | Second            | Third          |
|------------------------|-------------------|-------------------|----------------|
| Apatite***             | West Bengal       | Jharkhand         | Meghalaya      |
| Rock Phosphate***      | Jharkhand         | Rajasthan         | Madhya Pradesh |
| Asbestos***            | Rajasthan         | Karnataka         | Andhra Pradesh |
| Bauxite***             | Odisha            | Chhattisgarh      | Andhra Pradesh |
| Chromite***            | Odisha            | Manipur           | Nagaland       |
| Coal****               | Odisha            | Jharkhand         | Chhattisgarh   |
| Dolomite*              | Madhya Pradesh    | Andhra Pradesh    | Chhattisgarh   |
| Dunite*                | Tamil Nadu        | Karnataka         | Jharkhand      |
| Felspar*               | Rajasthan         | Telangana         | Andhra Pradesh |
| Graphite**             | Arunachal Pradesh | Jammu and Kashmir | Odisha         |
| Iron Ore (Hematite)*** | Odisha            | Jharkhand         | Chhattisgarh   |
| Magnesite***           | Uttarakhand       | Tamil Nadu        | Rajasthan      |
| Manganese Ore**        | Odisha            | Karnataka         | Madhya Pradesh |

|                  |                |                |                |
|------------------|----------------|----------------|----------------|
| Crude Oil*****   | Assam          | Gujarat        | Gujarat        |
| Natural Gas***** | Assam          | Andhra Pradesh | Gujarat        |
| Copper Ore*      | Rajasthan      | Madhya Pradesh | Jharkhand      |
| Gold (Metal)**   | Karnataka      | Rajasthan      | Andhra Pradesh |
| Silver (Ore)**   | Rajasthan      | Karnataka      | Jharkhand      |
| Diamond***       | Madhya Pradesh | Andhra Pradesh | Chhattisgarh   |

📌 **Note :** \*, 1 April, 2015, \*\*, 1 April, 2020(P), \*\*\*; 1 April, 2020, \*\*\*\*, 1 April, 2022, \*\*\*\*\*; 1 April, 2021(P), P; Provisional.

#### Top Mineral Producing States of India 2021-22(P)

| Minerals                   | First          | Second         | Third        |
|----------------------------|----------------|----------------|--------------|
| Rock Phosphate (2020-21 P) | Rajasthan      | Madhya Pradesh | —            |
| Bauxite                    | Odisha         | Gujarat        | Chhattisgarh |
| Chromite                   | Odisha         | —              | —            |
| Coal                       | Odisha         | Chhattisgarh   | Jharkhand    |
| Copper Ore                 | Madhya Pradesh | Rajasthan      | Jharkhand    |
| Diamond                    | Madhya Pradesh | —              | —            |
| Gold                       | Karnataka      | Jharkhand      | —            |
| Graphite                   | Odisha         | Tamil Nadu     | Jharkhand    |
| Iron ore                   | Odisha         | Chhattisgarh   | Karnataka    |
| Magnesite                  | Tamil Nadu     | Uttarakhand    | Karnataka    |
| Manganese Ore              | Madhya Pradesh | Maharashtra    | Odisha       |
| Crude Oil (2021-22 P)      | Rajasthan      | Gujarat        | Assam        |
| Natural Gas (2020-22 P)    | Assam          | Rajasthan      | Tripura      |
| Silver (2020-21 P)         | Rajasthan      | Karnataka      | —            |

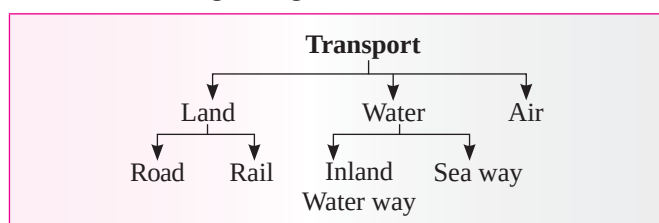
- Chotanagpur plateau has a huge concentration of steel and Iron industries.

#### Exam Oriented Facts

- Bailadila is famous for producing iron which is used for steel making.
- Odisha ranks first in steel production in India (IMYB).
- According to Indian Minerals Year Book, 2022, Rajasthan has the highest share of limestone production in India.
- Noonmati, Digboi Numaligarh, Ankleshwar, Navgram, Lunej (Gujarat) etc are famous for petroleum refineries.
- Petroleum is called liquid gold due to its high commercial value.

## 11. Transportation in India

- Transport is an important infrastructural service which facilitates agriculture and industry to grow to their fullest potential.
- Transport carries people and goods from one place to another. It helps the production, distribution as well as consumption processes.
- A dense and efficient network of transport is essential to promote social cohesion, accelerate economic prosperity and ensure security and territorial integrity.
- Transport consists of three different modes - Land, Water and Air. They complement each other and in the process constitute a single integrated network.



### Road Transportation

- Road construction can be traced to the time of the Indus Valley Civilization.
- In the medieval period, Sher Shah Suri and the Mughal emperors took a keen interest in road construction.
- In modern period, special attention was paid to the construction and development of roads by the British rulers, especially by Lord Dalhousie.
- The ministry of Road Transport and Highways is the apex body for formulation and administration of Rules, regulation and laws relating to road transport and transport research.
- It encompasses construction and maintenance of National Highways (NHs), administration of Motor Vehicle Act, 1988 and Central Motor Vehicle Rules 1989, National Highways Act 1956 and National Highways Fee Determination of Rates and Collection Rules, 2008, formulation of broad policies in relation to road transport, environmental issue, automotive norms etc.
- Currently, India has the second-largest road network (63.45 lakh km.) in the world. The road network includes state roads, district roads, rural roads and national highways.

### Classification of Roads in India

#### (1) National Highways :

- These roads are the primary roads of the country and connect large cities and major industrial centres.
- It is the responsibility of the Government of India for the

construction and maintenance of national highways fall in the area of responsibility of the centre.

- The national highways fall under the control of union body - National Highway Authority of India (NHAI).
- According to the annual report of 2023-24, the total length of the national highway in the country is 1,46,145 km. till 31 March, 2024.
- Government of India started National Highway Development programme (NHDP) under NHAI.

(UPPCS, 1999; MPPCS, 2019)

#### NHDP :

- It was launched in 1998 with the objective of developing roads of international standards which facilitate smooth flow of traffic.
- It includes components like Golden Quadrilateral is 5846 km. long 4/6 lane, high density traffic corridor that connects India's four big metro cities : Delhi, Mumbai, Kolkata, Chennai.
- With 4076 km. long Road, North South Corridor aims at connecting Srinagar in Jammu and Kashmir with Kanyakumari in Tamil Nadu.
- With 3640 km. of road length, the East West corridor has been planned to connect Silchar in Assam with the port town of Porbandar in Gujarat.

### Associated Organizations

#### National Highways Authority of India (NHAI) :

- It was set up through an act of Parliament, namely the National Highways Authority of India Act, 1988.
- The NHAI is responsible for the development, maintenance and management of the National Highways entrusted to it.
- It became operational in 1995.
- National Highways & Infrastructure Development Corporation Ltd. (NHIDCL).
- It was set up to exclusively carry out the task of construction/up-grading/denning of National Highways in part of the country which share international boundaries with neighboring countries in order to promote regional connectivity on a sustainable basis.
- Indian Academy of Highway Engineers (IAHE). IAHE is a registered society under the administrative control of Ministry of Road Transport and Highways. It is a collaborative body which was set up in year 1983 with the objective of fulfilling the long felt need for training of Highway engineers in the country.

#### Indian Road Congress (IRC) :

- The Indian Road Congress (IRC) is the Apex Body of Highway Engineers in the country. The IRC was set

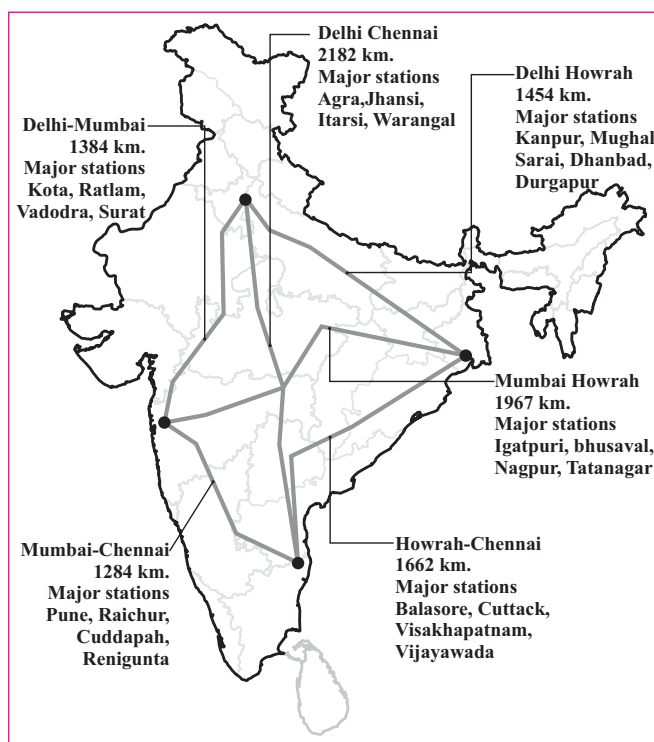


up in December, 1934 on the recommendations of the Indian Road development committee best known as the Jaykar committee set up by the Government of India with the objective of Road Development in India. It decides the Minimum requirements for roads, keeping in mind geography speed volume of traffic and safety.

- According to the Ministry of Road Transport and Highways, NH 27 EW (Porbandar to Silchar) (4112.62 km), is **India's longest national highway**.
- The five Indian states with the highest length of national highway (according to the report of 2023-24) are Maharashtra, Uttar Pradesh, Rajasthan, Madhya Pradesh and Andhra Pradesh.
- National Highway No. 1A runs from Jalandhar to Uri via undivided Jammu and Kashmir.
- The **Jawahar Tunnel** is on the Banihal Pass of **National Highway No. 1A**.
- The Jawahar Tunnel passes through the Banihal Pass in the Pir Panjal range in the former Jammu and Kashmir State.
- **NH 327B** (1.20 km) runs in West Bengal, is the shortest national highway in India. It runs from Mechi Bridge in West Bengal up to the Indo-Nepal border.

#### **Bharatmala Pariyojana :**

- In 2017, an umbrella programme for the National Highways "Bharatmala Pariyojana Phase-I" was approved for construction/up-gradation of NHS of 34,800 km over a period of 5 years (2017-18 to 2021-22).
- Bharatmala Pariyojana program focuses on optimizing efficiency of freight and passenger movement across the country by bridging critical infrastructure gaps through effective interventions like development of Economic Corridors, Inter Corridors and Feeder Routes, National Corridor Efficiency Improvement, Border and International connectivity roads, Coastal and Port connectivity roads and Green-field expressways.
- According to the report of 2023-24 of Ministry of Road Transport and Highways, the status of Bharatmala Pariyojan phase I entails a total length of 34,800 km in 31 states and UTs, 550 + Districts. The length awarded is 26,425 km. and the length constructed is 17,411 km so far.
- Multi-modal integration is also built into this program.
- Special attention has been paid to fulfilling the connectivity needs of backward and tribal areas, areas of economic activity, places of religious and tourist interests, border areas, coastal areas and trade routes with neighboring countries.



#### **(2) State Highways :**

- The roads connecting the state capital to the district headquarters are called the state highways.
- The state government is responsible for the construction and maintenance of state highways.
- According to Basic Road Statistics of India 2018-19, states with the highest state borders are- 1. Maharashtra (32005 km), 2. (Karnataka (19473 km), 3. Gujarat (16746 km), 4. Rajasthan (15061 km), 5. Andhra Pradesh (13500 km).
- The length of state highways in Uttar Pradesh totals 7427 kms.
- The roads connecting major sites of the district are called district roads.
- It is the responsibility of the district administration to maintain these roads.
- Rural roads are constructed and maintained by the Gram Panchayats in the country.
- Currently, 87% of the total passenger traffic and 60% of the freight traffic in the country is carried by road transport.
- The Border Road Organization (BRO) was established in 1960 to promote the construction of roads in areas bordering neighbouring countries.
- The headquarter of the Border Roads Organization is located in **New Delhi**.
- Pradhan Mantri Gram Sadak Yojana (25 December 2000) was launched to connect all villages in the country with paved all weather roads.

- The National Green Highway Policy 2015, has specified 1% of the total cost of road construction as plantation funds.

#### **Major District Roads :**

- They connect areas of production, main markets and the State and National Highways crossing the state.
- It is constructed and maintained by Zilla Parishad.

#### **Village Roads :**

- These connect villages to each other or to the nearest District Roads.
- These are the responsibility of Village Panchayats.
- In the year 2000, government launched Pradhan Mantri Gram Sadak Yojna (PMGSY) to provide rural connectivity to unconnected habitations.

#### **Expressways :**

- These are the best quality roads.
- Generally they have six lanes and controlled access.
- Lucknow Agra Expressway is the longest expressway with 302 km.
- Mumbai Pune Expressway was the first 6-lane expressway to be constructed.

#### **Border Roads :**

- These are constructed and maintained by Border Road Organization (BRO) which comes under Ministry of Defense.

#### **E-tolling and FASTag :**

- **National Electronic Toll Collection (NETC) programme**, the flagship initiative of the Ministry of Road Transport and Highways, has been implemented on pan-India basis in order to ensure seamless movement of traffic through fee plazas and increase transparency in collection of user fee using **FASTag** which is based on **Radio Frequency Identification (RFID)** Technology.
- The National Payment Corporation of India (NPCI) is the Central Clearing House (CCH).
- Towards the objective of achieving 100% collection through electronic payment, the Government has mandated to declare all lanes, except one lane in each direction as FASTag lane w.e.f. December 2019.
- This one lane in each direction will accept all other modes of payment including FASTag.

#### **Grand Trunk (GT) Road :**

- Sher Shah Suri built the Shahi (Royal) road to strengthen and consolidate his empire from the Indus Valley to the Sonar Valley in Bengal.
- It was called Uttarapatha and was the key feature of many empires in Ancient Indian history.
- The road was later renamed as the Grand Trunk (GT) road during the British period, connecting Calcutta and Peshawar.

- At present, GT Road extends from Amritsar to Kolkata. It is bifurcated into two segments :

- (a) National Highway (NH)-1 from Delhi to Amritsar.
- (b) NH-2 from Delhi to Kolkata.

- Now the numbering has been changed by National Highway (Amendment) Act 2010.

#### **International Roads :**

- These connect India with its neighboring countries.
- Some of the current projects are-
- **The India-Myanmar-Thailand (IMT) trilateral highway**
  - (1) It will connect Moreh in Manipur to Mae Sot in Thailand.
  - (2) India is undertaking construction of two sections of the Trilateral Highway in Myanmar.
    - Construction of Kalewa-Yagyi road section
    - Construction of Tamu-Kyigone-Kalewa (TKK) road section
  - (3) The highway will facilitate easy movement of goods and people among the three countries.
  - (4) The National Highways Authority of India has been appointed as the technical executing agency and project management consultant
- **Zaranj Delaram Road**
  - (5) It is being built in Afghanistan by the Border Road Organization. (BRO).
  - (6) It provides access to Indian goods from Chabahar port of Iran to Afghanistan and Central Asia.

- **International North - South Corridor (INSTC)**
- INSTC is a Multi modal connectivity Project that establishes transport Networks (ship, rail and road route) for moving freight between India, Russia, Europe, Iran and Central Asia.
- INSTC project was initiated by Russia, India and Iran in September 2000 in St. Petersburg.
- The agreement was signed on 16th May 2002.
- INSTC would enhance accessibility to the land locked central Asian nations.
- It links Indian Ocean and Persian Gulf to the Caspian Sea via Iran, and then onwards to northern Europe via St. Petersburg in Russia.
- The route primarily involves moving freight from India, Iran, Azerbaijan and Russia.
- The objective of the corridor is to increase trade connectivity between major cities such as Mumbai, Moscow, Tehran, Baku, Bandar Abbas and Astrakhan etc.
- India has recently proposed to include Chabahar port in INSTC.

## Rail Transport

### Railway Transport in India

- The Indian railway system is the largest in Asia and the fourth largest in the world. It is the biggest departmental public undertaking in the country.
- Total railway network in the world
  - 1st- USA                      ● 3rd-Russia
  - 2nd-China                ● 4th-India
- The first train in India ran between **Mumbai to Thane** on 16<sup>th</sup> April 1853 during the Governor-General's ship of **Lord Dalhousie**.
- The **first rail track** in India between **Mumbai VT and Kurla Harbour** was electrified in 1925 under Lord Reading.
- The first train to run on CNG in India was launched in January 2015 on the Rewari-Rohtak section.
- According to World Bank Data, 2021, Indian Railways has the longest rail network in the world after the United States, China and Russia in that order.
- The Railway Board was established in March 1905.
- The Railway budget was separated from the general Budget in 1921 at the suggestion of the **Acworth Committee**. In 2017, it was again merged in the general budget.
- Indian Railways was nationalized in 1944.
- The railway coach factory is located at Kapurthala, Banaras Locomotive Works (BLW) at Varanasi and Integral Coach Factory at Perambur.
- The Indian railways, for administrative purposes, is divided into 17 railway zones. 18<sup>th</sup> railway zone is Southern Coastal Railway whose headquarter is located at Vishakhapatnam in Andhra Pradesh, being the last, announced to constitute in February 2019.
- The second train ran between Howrah and Hooghly in 1854. The headquarters of Indian Railway is in New Delhi.
- The first electric train in India was 'Deccan Queen'. It was introduced in 1929 between Bombay and Poona.
- Indian Railways has the second biggest electrified system in the world after Russia.
- The first Metro Rail was introduced in Kolkata (West Bengal) on October 24, 1984.

### National Rail Plan (NRP) 2030 :

- A National Rail Plan (NRP) 2030 has been developed with a view to develop infrastructure by 2030 to cater to the traffic requirements up to 2050.
- Based on the NRP, a Vision 2024 document has been prepared to develop infrastructure by 2024 to enhance modal share of Railways in freight transportation to more than 40 per cent and to cater to the traffic requirements up to 2030.

- Indian Railway Finance Corporation (IRFC) is mobilizing resources with sufficient moratorium period and projects are being targeted to be completed well before expiry of moratorium period.

### Dedicated Freight Corridors :

- Dedicated Freight Corridor (DFC) project is a broad gauge freight corridor being constructed by the Indian Railways.
- It aims to provide an efficient and reliable transportation system through construction of freight corridors traversing the entire country.
- Dedicated Freight Corridor Corporation of India Limited (DFCCIL) is a special purpose vehicle of the railways which has been entrusted with the job to develop DFCS in the country.

### Western DFC :

- It runs from Dadri (Uttar Pradesh) near Delhi to Jawahar Lal Nehru Port Trust (JNPT) in Mumbai.
- It covers the States of Haryana, Uttar Pradesh, Delhi, Rajasthan, Gujarat, and Maharashtra.
- It is funded by World Bank.
- Along WDFC, Delhi Mumbai Industrial corridor (DMIC) is being developed.
- Its length is 1506 Km.

### Eastern DFC :

- It spans from Ludhiana in Punjab to Dankuni in West Bengal.
- It covers the States of Punjab, Haryana, Uttar Pradesh and Bihar, Jharkhand and West Bengal.
- It is funded by Japan International Cooperation Agency (JICA).
- Along EDFC, Amritsar-Kolkata Industrial corridor (AKIC) is being developed. The distance of EDFC is more than WDFC.
- Dadri (WDFC) and Khurja (EDFC) will link at Uttar Pradesh.
- There are three types of railway lines in India.

### Types of Rail Gauges

| Rail Line           | Width of the Track  |
|---------------------|---------------------|
| <b>Broad Gauge</b>  | 1.676 m             |
| <b>Meter Gauge</b>  | 1.00 m              |
| <b>Narrow Gauge</b> | 0.762 m and 0.610 m |

### Railway Zones and Their Headquarters

| Zone                           | Headquarters |
|--------------------------------|--------------|
| 1. Central Railway (CR)        | Mumbai (CST) |
| 2. Eastern Railway (ER)        | Kolkata      |
| 3. Northern Railway (NR)       | New Delhi    |
| 4. North Eastern Railway (NER) | Gorakhpur    |

|                                       |                       |
|---------------------------------------|-----------------------|
| 5. North East Frontier Railway (NEFR) | Maligaon Guwahati     |
| 6. Southern Railway (SR)              | Chennai               |
| 7. South Central Railway (SCR)        | Secunderabad          |
| 8. South Eastern Railway (SER)        | Kolkata (MPPCS, 2016) |
| 9. Western Railway (WR)               | Mumbai (Churchgate)   |
| 10. East Central Railway (ECR)        | Hajipur               |
| 11. North Western Railway (NWR)       | Jaipur                |
| 12. East Coast Railway (ECR)          | Bhubaneswar           |
| 13. North Central Railway (NCR)       | Prayagraj (Allahabad) |
| 14. South Western Railway (SWR)       | Hubli                 |
| 15. Western Central Railway (WCR)     | Jabalpur              |
| 16. South East Central Railway (SECR) | Bilaspur              |
| 17. Kolkata Metro Railway (KMR)       | Kolkata               |
| 18. Southern Coast Railway (SCR)      | Visakhapatnam         |

- Chhatrapati Shivaji Terminus (formerly Victoria Terminus), designed by the British architect F. W. Stevens, became the symbol of Bombay as the 'Gothic City' and the major international mercantile port of India.
- **Rohtak - Rewari DEMU train was India's first CNG train** to run on CNG.
- The Vivek Express (4205 km, from Dibrugarh to Kanyakumari) covers the longest distance in the country.
- The Konkan Railway runs from Maharashtra to Roha via Madgaon in Goa to connect Mangalore in Karnataka.
- In collaboration with Japan work has started on the project to run a bullet train from Mumbai to Ahmedabad.
- The oldest steam locomotive in the country was named **Fairy Queen**.
- India's first semi high-speed train is **Gatimaan** (5<sup>th</sup> April 2016), equipped with WAP-5 engine. The first engineless semi high-speed train in India is **Vande Bharat** (Train-18).
- Currently, the fastest running train in India is Vande Bharat. During the trial, this train recorded a speed of 180 kms per hour.
- The maximum speed of both the Gatimaan and the Vande Bharat trains to operate is 160 km/hour.
- The Vande Bharat Express was launched on 15<sup>th</sup> February, 2019. It covers the journey from New Delhi to Varanasi in eight hours.
- Gatimaan Express had an inaugural run from Hazrat Nizamuddin station in Delhi to Agra Cantt station on 5<sup>th</sup> April 2016.
- In India, Metro rail was first introduced in **Kolkata**.
- Kolkata Metro Rail Scheme was launched in 1972.

- **India's first underground metro** ran from Kolkata's Dum-Dum to Tollygunge Corridor.
- The Delhi Metro Rail Project was prepared in collaboration with the companies of Japan and Korea.
- On 25<sup>th</sup> December 2002, the first metro rail ran between Tis Hazari and Shahdara in Delhi.

#### Air Transport :

- The **first air flight** in India was started in **1911** between **Allahabad (Prayagraj) and Naini**.
- Two airlines were set up to provide air services in India - **Air India** and **Indian Airlines**.
- **Air India** was to run International flights **Indian Airlines** was restricted to domestic routes and immediate neighbours.
- The Indian National Aviation Company Limited came into existence on 27<sup>th</sup> August 2007 after the merge of Air India and Indian Airlines.
- The merged company retained its name Air India and this public sector airline is now on the block for privatization.
- In 1981, a new domestic airline, Vayudoot, with the specific purpose of providing air service to far away north-east area of the country, was launched which was later emerged with Indian airline.
- **Pawan Hans Limited** was also established in 1985 to meet the air traffic requirements of the petroleum sector. It also served the north-eastern states.
- The Airport Authority of India was formed on 1<sup>st</sup> April 1995.
- It manages India's airports designated both for international and domestic traffic.
- The first greenfield airport in India is **Cochin Airport** on a public-private partnership basis.

#### Major International Airports in The Country

|                                                   |                |
|---------------------------------------------------|----------------|
| Indira Gandhi International Airport               | New Delhi      |
| Chhatrapati Shivaji International Airport         | Mumbai         |
| Netaji Subhash Chandra Bose International Airport | Kolkata        |
| Babasaheb Ambedkar International Airport          | Nagpur         |
| Sardar Vallabhbhai Patel International Airport    | Ahmedabad      |
| Lal Bahadur Shastri International Airport         | Varanasi       |
| Tiruchirapalli International Airport              | Tiruchirapalli |
| Coimbatore International Airport                  | Coimbatore     |
| Jaipur International Airport                      | Jaipur         |
| Mangaluru International Airport                   | Mangaluru      |
| Kempegowda International Airport                  | Bengaluru      |
| Veer Savarkar International Airport               | Port Blair     |
| Cochin International Airport                      | Kochi          |



|                                                  |                    |
|--------------------------------------------------|--------------------|
| Rajiv Gandhi International Airport               | Hyderabad          |
| Calicut International Airport                    | Kozhikode (Kerala) |
| Lokpriya Gopinath Bordoloi International Airport | Guwahati           |
| Anna International Airport                       | Chennai            |
| Devi Ahilyabai Holkar International Airport      | Indore             |
| Chaudhary Charan Singh International Airport     | Lucknow            |
| Sheikh-ul-Alam International Airport             | Srinagar           |

### Water Transport :

- There are two types of water transport.
  1. Internal or Inland Water Transport
  2. Shipping Transport
- To promote internal water transport, the government has selected **111 waterways** and accorded them the status of national waterways.

### Major National Waterways of India

| Waterway Sl. N. | Range                                               | Distance (Kilometer) | Establishment |
|-----------------|-----------------------------------------------------|----------------------|---------------|
| NW-1            | Prayagraj-Haldia                                    | 1620                 | 1986          |
| NW-2            | Sadia-Dhubri Brahmaputra River                      | 891                  | 1988          |
| NW-3            | Kollam to Kottapuram (Kerala)                       | 205                  | 1993          |
| NW-4            | Kakinada-Marakkanam (Godavari-Krishna-River Region) | 1078                 | 2008          |
| NW-5            | Geonkhali-Talcher-Paradip (West Bengal and Odisha)  | 623                  | 2008          |
| NW-16           | Lakhimpur-Bhanga                                    | 121                  | 2016          |

- **Uttar Pradesh** has the longest inland waterways.

### Sagarmala Project :

- Sagarmala project is a port-led development programme of Ministry of Shipping. A Shipping ministry study has claimed that the project could lead to an annual saving of Rs 40,000 Crore by optimizing logistics.
- Currently 95% of India's trade by value and 70% by volume take place through maritime transport.
- India is lacking the high quantity of international trade via coastal line due to the lack of infrastructure facilities and advanced coastal technologies.
- The cost of shipping/evacuating goods through Indian maritime transport is quite high compared to that of China, South Korea, Japan and other developed countries. This

makes Indian goods uncompetitive in the international market.

- The vision of the Programme is to reduce logistics cost of EXIM and domestic trade with minimal infrastructure investment.

### Objectives of the project :

- Augmenting operational efficiency of ports (more terminals for loading and unloading cargo).

### Activate Wedows

- Optimizing logistics (rails, roads and inland waterways).

### Western coast-6 :

1. **Kandla Port** - Gulf of Kutch (Gujarat)-It is a tidal port of India. It is known for handling much of the crude oil imports of India.
2. **Mumbai Port** - Maharashtra-It is one of the oldest modern natural ports of India
3. **JNPT/Nhava sheva port** - Maharashtra - It is the largest container port of India. It was built to reduce the burden on Mumbai port. It is one of the high tech and busiest ports.
4. **Marmugao** - Goa - It is a natural port famous for iron ore exports,
5. **New Mangalore** - Karnataka-It is famous for iron ore exports.
6. **Kochi port** - Kerala-It is located on the Willingdon Island on the South West coast of India. It is located on the cross roads of the East-West Ocean Trade. It is a natural port. It is called as queen of Arabian Sea.

### East Coast-6 :

- Eastern coast has shallow water. Therefore requires dredging to remove silt.
1. **Chennai** - It is in Tamil Nadu. It is the oldest artificial port.
  2. **Ennore** - Tamil Nadu. It is latest port. It is first major private port. To reduce pressure of Chennai port.
  3. **V. O. Chidambarnar or Tuticorin port** - This port has been now renamed as V. O. Chidambarnar Port. It is located in the Gulf of Mannar. Tuticorin is the only port in South India to provide a direct weekly container service to the United States.
  4. **Visakhapatnam** - It is in Andhra Pradesh. It is an artificial port and deepest port of India.
  5. **Paradip** - It is located at the confluence of river Mahanadi in Bay of Bengal in Odisha. It was the first major port on East Coast commissioned in Independent India.
  6. **Kolkata (including Haldia)** - It is situated on the river Hooghly. It is the only riverine major port of India. It is known for twin dock systems i.e. Kolkata Dock System (KDS) on the eastern bank and Haldia Dock Complex (HDC) on the western bank of river Hooghly. Kolkata Port Trust is renamed as Syama Prasad Mookerjee Port in 2020.

### Shipping Transport :

- The country's 7516.6 km long coastline has 12 major ports and approximately 205 non-major ports located on it.
- Mumbai, Nhava Sheva (JNPT), Deendayal (Kandla), Mormugao, New Mangalore and Cochin are the ports on the west coast, while the major ports on the east coast are Kolkata-Haldia, Paradip, Visakhapatnam, Kamarajar Port (Ennore) and V.O. Chidambarnar (Tuticorin).
- 13<sup>th</sup> major port of India will be established in Maharashtra. This port has approved the setting up at Vadhavan (Maharashtra).
- **Port Blair Port (private sector)** was included in the category of major ports by the government in 2010. Later, it was given the status of a major port. But now, it has been demoted to the status of a small port.
- A natural harbour is located on the west coast of Mumbai. It is the largest container port in India.
- **Kandla** is a tidal container port located in the **Gulf of Kutch** in Gujarat on the west coast and has been declared a free trade zone.
- Chennai is the largest artificial port in India located in Tamil Nadu coast.
- Chennai is an open sea port.
- Cochin (Kerala) harbour is located on a lagoon. **Cochin Shipyard Limited** is the largest shipyard in India.

### Major Ports of India

| Name            | River/Sea/Bay | State/Union Territory |
|-----------------|---------------|-----------------------|
| Kolkata, Haldia | Hooghly River | West Bengal           |
| Chennai         | Bay of Bengal | Tamil Nadu            |
| Mumbai          | Arabian Sea   | Maharashtra           |
| Visakhapatnam   | Bay of Bengal | Andhra Pradesh        |
| Kochi           | Arabian Sea   | Kerala                |
| Paradip         | Bay of Bengal | Odisha                |
| Tuticorin       | Bay of Bengal | Tamil Nadu            |
| Mormugao        | Arabian Sea   | Goa                   |
| Kandla          | Arabian Sea   | Gujarat               |
| Nhava Sheva     | Arabian Sea   | Maharashtra           |
| New Mangalore   | Arabian Sea   | Karnataka             |
| Ennore          | Bay of Bengal | Tamil Nadu            |

- **Ennore (Kamarajar Port)** is the country's first largest computerized and corporate port, developed with the assistance of the Asian Development Bank.
- **Port Dahej**, Gujarat, is the first port in the country built for the disposal of chemical waste.

- **India's Largest Ship Cycling Yard** is located at **Alang**, Gujarat.
- **Cochin Shipyard Limited** was established in 1972. It is the biggest shipbuilding and repairing shipyard in the country.

## 12. Industries in India

### A. Iron Steel Industry :

- Iron production on an industrial scale began in India in 1870 with the establishment of a company, Bengal Iron works, at Kulti in West Bengal.
- In 1907, Tata Iron and Steel Company (TISCO) was founded at Sakchi (now Jamshedpur) in Bihar (now Jharkhand).
- The Tata Iron and Steel Plant lies near to Mumbai-Kolkata railway line and about 240 km away from Kolkata which is nearest port for the export of steel. This industry gets its raw materials from different source regions like: Water supply from Subamarekha and Kharkai rivers. Iron-ore from Noamundi and Badam Pahar.
- TISCO started pig iron production in 1911 and began producing steel in 1912 as a branch of Jamshetji's Tata Group.
- Maximum concentration of iron and steel industries can be found in the Chota Nagpur Plateau.
- The site was selected by Jamsetji Nusserwanji Tata.
- In 1918, the Indian Iron and Steel Company was formed at Hirapur (Burnpur), now West Bengal.
- The Mysore Iron and Steel Company (MISCO) was established in 1923 at Bhadravati on the banks of the Bhadravati River in Karnataka.
- It was founded by Dewan M. Visvesvaraya of Mysore.
- It was renamed as Visvesvaraya Iron and Steel Limited VISL on 16<sup>th</sup> February, 1976.
- The Mysore Iron and Steel Company is situated far away from the coal mining site.
- The Mysore Iron and Steel Company, being in the public sector, is jointly run by Govt. of India and the Karnataka state govt.
- It was the first alloy steel plant in India.
- To give impetus to the iron and steel industry, the government established **Hindustan Steel Limited** in 1954.
- It helped establish three factories with foreign cooperation at Bhilai, Rourkela and Durgapur.
- The **Durgapur** steel plant was established in collaboration with Britain.
- The **Rourkela** factory was established in collaboration with **Germany** while **Bhilai** and the **Bokaro** Steel Plants were set up in collaboration with the erstwhile **Soviet Union**.

- Under the fourth Five Year Plan, three steel factories were set up at Salem (Tamil Nadu), Visakhapatnam (Andhra Pradesh) and Vijayanagar, (Karnataka).
- These plants are located far- away from the sites of raw materials.
- **Vizag Steel Plant** at Visakhapatnam is the **first port-based plant**.
- On 24<sup>th</sup> January 1973, the **Steel Authority of India Limited (SAIL)** was given the responsibility of operating the Durgapur, Rourkela, Burnpur, Bhilai, Bokaro, Salem and Visvesvaraya iron steel factories simultaneously.

| Major Units of Iron Steel Industry |      |                     |
|------------------------------------|------|---------------------|
| Establishment                      |      |                     |
| Name                               | Year | Place               |
| Bengal Iron Works Company          | 1870 | Kulti (West Bengal) |

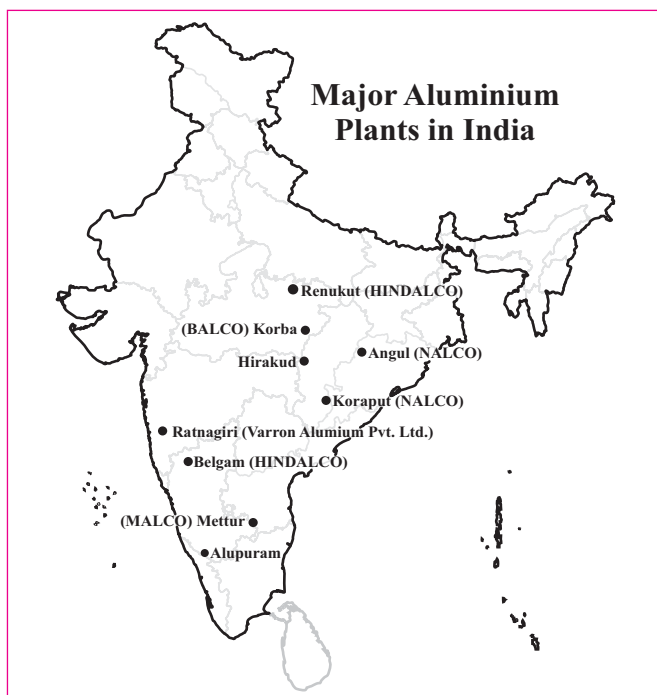
|                                          |      |                                |
|------------------------------------------|------|--------------------------------|
| Tata Iron and Steel Company (TISCO)      | 1907 | Sakchi (Jharkhand)             |
| Indian Iron and Steel Company (IISCO)    | 1918 | Burnpur (West Bengal)          |
| Visvesvaraya Iron & Steel Limited (VISL) | 1923 | Bhadravati (Karnataka)         |
| Rourkela Steel Plant                     | 1959 | Rourkela (Odisha)              |
| Bhilai Steel Plant                       | 1955 | Bhilai (Chhattisgarh)          |
| Durgapur Steel Plant                     | 1959 | Durgapur (West Bengal)         |
| Bokaro Steel Plant                       | 1964 | Bokaro (Jharkhand)             |
| Salem Steel Plant                        | 1972 | Salem (Tamil Nadu)             |
| Visakhapatnam Steel Plant                | 1971 | Visakhapatnam (Andhra Pradesh) |
| Vijayanagar Steel Plant                  | 1994 | Hospet (Karnataka)             |

| Location of Iron Steel Factories Along With Source of Raw Materials of India |                                                             |                                                                                    |                                          |                                                          |                                               |
|------------------------------------------------------------------------------|-------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------|----------------------------------------------------------|-----------------------------------------------|
| Location                                                                     | Iron Ore                                                    | Coal                                                                               | Limestone                                | Water                                                    | Market                                        |
| 1. Jamshedpur (Under Tata management in private sector)                      | From Noumundi Mines of Gurusimhani and Mayurbhanj in Odisha | From the Jharia mines                                                              | Mines of Jharkhand and Odisha            | From Dimma Nala Dam, Rivers of Subarnalekha and Kharkai  | Kolkata                                       |
| 2. Burnpur                                                                   | From Plateau of Chota-nagar also from Odisha's Keonjhar     | From the mines of Raniganj and Jharia                                              | From the mines of Odisha (Virmitrapur)   | From the rivers of Damodar and Barakar                   | Kolkata                                       |
| 3. Bhadravati (First Public Sector Factory, Small Manufacturer)              | From Baba-Budan Mountain                                    | Wood from forests (wood Gangur coal) and hydro electric obtained from Western Ghat | from Gangur                              | River Bhadra                                             | South India                                   |
| 4. Durgapur                                                                  | From the Plateau of Chotanagpur and Odisha                  | From Barakar Jharia areas of DVC Thermal Station                                   | —                                        | River Damodar                                            | Kolkata                                       |
| 5. Rourkela                                                                  | From Odisha (Sundargarh or Kendujhargarh Keonjhar area)     | From the mines of Jharia & Talohar also hydroelectric from Hirakund                | Virmitrapur of Odisha and from Hathibari | from the dam built on Shankh river and from Shankh river | Chennai, Mumbai, Vishakhapatnam               |
| 6. Bhilai                                                                    | From Dalli-Rajhara Area                                     | Best coal from Jharia & Bokaro Korba, Thermal Station                              | Raipur, Durg, Bilaspur and Nandini       | Tandula Canal and Gondli Reservoir                       | South India, Mumbai, Kolkata, Chennai & Delhi |
| 7. Bokaro                                                                    | From Odisha (by return-ing empty wagons)                    | Local coal, Jharia and Karanpura are nearby                                        | Odisha area                              | Damodar river                                            | Kolkata                                       |
| 8. Vishakhapatnam                                                            | From Bailadila Mines                                        | Import from Australia                                                              | from Chattishgarh Area                   | —                                                        | Internal and International market             |
| 9. Paradip                                                                   | From Odisha (Keonjhar Bonai Area)                           | From the mines of Jharia and Talcher                                               | Odisha Area                              | —                                                        | Internal and International market             |



### B. Aluminium Industry :

- India's first aluminium industry was established in 1937 at JK Nagar in West Bengal.
- In 1965, the first public sector Aluminium producing company, Bharat Aluminum Company Limited (BALCO) was established.
- The **Korba**, Chhattisgarh unit is being operated by **BALCO**.
- National Aluminium Company Limited (NALCO) was set up in 1981.
- **Hindustan Aluminium Corporation (HINDALCO)** was established at Renukoot (Sonbhadra, Uttar Pradesh).



### India's Leading Aluminum Companies

| Company  | Main Centre                                            | Coordinating Country |
|----------|--------------------------------------------------------|----------------------|
| BALCO    | Korba (Chhattisgarh) and Koyana (Maharashtra)          | USSR                 |
| NALCO    | Damanjodi (Odisha)                                     | France               |
| HINDALCO | Renukoot (UP)                                          | USA                  |
| INDALCO  | JK Nagar (W. Bengal) Muri (Jharkhand), Alwaye (Kerala) | Canada               |
| MALCO    | Mettur, Salem (Tamil Nadu)                             | Italy                |
| Vedanta  | Jharsuguda (Odisha)                                    | Germany              |

- NALCO unit at Bhubaneswar (Odisha) is the largest integrated aluminium industry in India.
- In 2004, INDALCO was merged with HINDALCO.

### C. Cotton Textiles Industry :

- The cotton textiles industry is the largest in India.
- The first cotton textiles mill in India was established in 1818 at Port Gloaster near Kolkata which soon closed.
- India's first successful cotton textiles factory was established in 1854 by **Cowasji Nanabhai Davar** Mumbai.
- The first cotton mill in India was established in 1818 at Fort Gloster near Kolkata but was a commercial failure.
- The second cotton mill in India was established by KGN Daber in 1854 and was named Bombay Spinning and Weaving Company.
- The cotton textiles industries are concentrated in Maharashtra, Tamil Nadu and Gujarat.
- Mumbai is known as the **Cotton Textiles Capital of India**.
- Coimbatore is known as the **Manchester of South India**.
- **Kanpur** is known as the Manchester of North India.
- **Ahmedabad** in India is called Boston of the East.
- The textiles industry is the second largest employment generator after agriculture.
- The National Textiles Corporation was formed by the Government of India for the development and modernization of the cotton textiles industry.
- Mumbai, Ahmedabad, Coimbatore, Kanpur, Kolkata, Bangaluru, Jaipur, Amritsar, etc. are major centres of the cotton textiles industry.
- Geo-economic factors on which the localization of cotton textile industry depends are as follows: Climate , Power, Raw Material, Labour , Transport, Markets.

### D. Cement Industry :

- The first cement manufacturing factory in India was established in Chennai in 1904, but it was soon closed.
- The Porbandar plant of the Indian Cement Company was established in 1914.
- Most of the cement factories of the country have been set up at places where limestone and coal are available in plenty.



- Madhya Pradesh, Tamil Nadu, Bihar, Jharkhand, Rajasthan, Andhra Pradesh, Gujarat, etc. are the major centres of the cement industry.
- India holds the second position in cement production only after China.

#### E. Jute Industry :

- Jute is a cash crop of the hot and humid environment and delta alluvial soil.
- The jute fibre is mainly produced in the **Hooghly River** valley region of West Bengal.
- Jute is known as the **Golden Fibre of Bengal**.
- Jute Corporation of India is responsible for the development and modernization of jute industry.
- The first jute factory in India was established in 1855 at **Rishra**, near Kolkata.
- The Jute Corporation of India was established in 1971 to look after import-export and internal market.
- The International Jute Organization (IJO) was established in 1984.
- The headquarter of International Jute Organization is located in **Dhaka (Bangladesh)**.
- On 27<sup>th</sup> April 2002, the International Jute Study Group was established in place of IJO. Its headquarter is also located in Dhaka, Bangladesh.
- West Bengal (Titagarh, Rishra, Bali, Serampore, Shyam Nagar, Holi Nagar, etc.), Andhra Pradesh (Angol, Guntur), Uttar Pradesh (Kanpur, Sahajanwa), Bihar (Purnia, Katihar, Saharsa, Kishanganj), are the states with the concentration of jute producing centres.

#### F. Sugar Industry :

- Sugar is produced mainly from sugarcane but now, sugarbeet and sweet potato also produce sugar.
- In India, the sugar industry has the concentration in sugarcane producing areas.
- The Sugar industry is a seasonal industry and sugarcane bagasse is mainly used as fuel to run a factory.
- The highest sugar producing state is **Uttar Pradesh**.
- Uttar Pradesh, Bihar, Maharashtra, West Bengal, Punjab, Haryana, Tamil Nadu, Andhra Pradesh and Rajasthan are the major sugar producing states.

#### G. Paper Industry :

- Paper is made from fibres and cellulose.
- Esparto grass, bamboo, cotton fibre and flax are used in the manufacture of high quality paper.
- The first modern paper mill in India was established at **Serampore** (West Bengal) which was soon closed.
- Later, a factory was established in Bali (West Bengal) in 1867.
- **Titagarh** Paper Mills, Titagarh (West Bengal) was established in 1882.
- Titagarh is India's **largest paper producing centre**.

- The first factory for the manufacture of newsprint was established in **Nepanagar**, Madhya Pradesh.
- The production of paper by the Nepanagar Paper Factory began in April 1956.
- Nepanagar is the first indigenous factory for newsprint.
- Mysore Paper Mill was established in 1937 in Mysore (Karnataka).
- Most of the paper producing factories in India are located in West Bengal.
- Titagarh, Raniganj, Naihati, Triveni, Kolkata, Bansberia (West Bengal); Tirupati, Kakinada, Rajahmundry (Andhra Pradesh); Sirpur (Telangana); Meerut, Saharanpur, Modinagar, Lucknow (Uttar Pradesh); Dumka (Jharkhand); Samastipur, Patna, Barauni (Bihar). Charanmahadevi, Chennai, Pattipalayam (Tamil Nadu); Chinchwad Roha Kamptee, Jalgaon, Kalyan (Maharashtra); Gondal, Khadki, Valsad, Vapi, Surat (Gujarat), etc. are the major paper industries.

#### H. Glass Industry :

- Sand, soda ash, limestone, sodium sulphate, salt, borax, lead, antimony, are raw materials required for the manufacture of glass.
- The glass industry in India is developed both at the cottage as well as modern factory level.
- Shikohabad and Firozabad are major centres of the glass industry.
- As a cottage industry, Firozabad has more than 100 factories. Bangles are made on a large scale in Firozabad.
- Firozabad is also known as Suhag Nagari.
- The glass factories in West Bengal are concentrated in Kolkata, Rishra, Dum Dum, Howrah, Raniganj and Asansol.
- In Uttar Pradesh, this industry is concentrated at Firozabad, Meerut and Bahjoi.
- In Bahjoi, sheets of glass are manufactured.
- Mumbai, Pune, Nagpur, Dhaulpur, Amritsar, Faridabad, are major glass producing centres.

#### I. Rail Equipment Industry :

- The first railway equipment factory in India was established in 1921, named Peninsular Locomotive Company located at Singhbhum, Jharkhand.
- Later, it was renamed Tata Engineering and Locomotive Company (TELCO).
- A railway locomotive factory named **Chittaranjan Locomotive Works** was established at Chittaranjan, West Bengal. The production started at this factory from 26<sup>th</sup> January, 1950.
- The diesel-locomotive is manufactured at Maduadih in Varanasi (U.P.).
- Locomotives are also manufactured at Jamshedpur (Jharkhand).

- Railway wheels are manufactured at Bela, Saran, (Bihar).
- Two factories for making electrical and diesel loco parts were set up at Dankuni, Hooghly in West Bengal.
- The Integral Coach Factory was established on 2<sup>nd</sup> October 1955 by Pandit Jawaharlal Nehru. The main centre for making railway coaches is located at Perambur, Chennai.
- The **Rail Coach Factory** was established in **1985 at Kapurthala**, Punjab.
- A modern coach factory was set up in Raebareli, Uttar Pradesh.
- Diesel locomotives are being manufactured at Madhaura in Saran district and electric locomotives are being produced in Madhepura district both in Bihar.
- In 2018, the Diesel Locomotive Works at Varanasi, in a rare case, converted the operation from Diesel locomotive manufacturing into electric manufacturing one.
- The country's first 12000 horsepower electric locomotive was developed using state of the art technology at the electric locomotive factory at Madhepura, Bihar.

#### **J. Aircraft Manufacturing Industry :**

- The first Indian aircraft manufacturing factory named Hindustan Aircraft Limited was established in Bengaluru in 1940.
- Hindustan Aircraft Limited is now known as Hindustan Aeronautics Limited (HAL).
- Hindustan Aeronautics Limited has 5 units in Bengaluru and one unit each at Koraput, Korba, Kanpur, Lucknow, Hyderabad, and Nashik for the manufacture of aircraft.
- The Barrackpore (West Bengal) unit of Hindustan Aeronautics Limited carries out assembly maintenance and repair work of Cheetah and Chetak Helicopters.

#### **K. Shipbuilding Industry :**

- Scindia Steam Navigation Company, the first Indian factory for shipbuilding, was established in 1941 at Visakhapatnam.
- The Hindustan Shipyard was formed on 21<sup>st</sup> January 1952 by the Government of India after acquiring the first shipbuilding factory in 1952.
- The following public sector units manufacture ships (1) Mazgaon Dock Limited, Mumbai (Maharashtra), (2) Garden Reach Shipbuilders Limited, Kolkata (West Bengal), (3) Goa Shipyard Limited, (Goa), (4) Hindustan Shipyard Limited (Visakhapatnam), (5) Cochin Shipyard Limited (Kochi), (6) Hooghly Dock and Port Engineers Limited (Kolkata).
- The first four of the above-mentioned factories fall under the administrative control of the Ministry of Defence while the latter two are under the control of Ministry of Shipping under the administrative control of the Ministry of Defence and 5 to 6 are in control of the Ministry of Shipping.

#### **L. Silk Industry :**

- Mulberry, Eri, Tasar and Muga, all 4 varieties of silk is produced in India.

- Karnataka produces (2021-22) more than 32% of the raw silk produced in the country.
- In Karnataka, mulberry is used to manufacture silk.
- The largest quantity of silk thread in the country is manufactured in Karnataka.
- Assam, Bihar, Jharkhand, Chhattisgarh, Odisha, West Bengal, Meghalaya, Manipur, Nagaland and Madhya Pradesh produce non-mulberry (tussar, eri, muga) silk.
- In silk production, India ranks second after China in 2022.
- The highest coral silk production in India occurs only in Assam.
- The Central Sericulture Research Training Institute is located in Mysore.
- The Central Tasar Research Training Institute is located at Ranchi, Jharkhand.
- The headquarter of the Central Silk Board is located in Bengaluru.

#### **M. Woollen Textiles Industry :**

- India's first woollen textiles mill was established at Kanpur in **1876**.
- The actual development of the woollen industry took place after 1950.
- Ludhiana, Jalandhar, Dhariwal and Amritsar are major centres of the woollen textiles industry in Punjab.
- The endangered animal Chiru or Tibetan antelope is hunted for getting raw wool.
- The wool extracted from this animal called mulberry which is light in weight and extremely hot.
- Bengaluru, Bellary (Karnataka), Srinagar (Jammu and Kashmir); Amritsar, Dhariwal, (Punjab); Kanpur, Modinagar, Shahjahanpur (Uttar Pradesh) are major centres of woollen textiles.

#### **N. Engineering Industries :**

- Heavy Engineering Corporation Limited (HEC) was established in Ranchi in 1958.
- Hindustan Machine Tools Limited was established by the Government of India at Bengaluru in 1953.
- Ajmer, Jadavpur, Hatia, Durgapur, Naini, Visakhapatnam and Bangaluru are major centres of the engineering industry.

#### **O. Automobile Industry :**

- The automobile industry currently manufactures all types of small and large vehicles in India.
- Ashok Leyland (Chennai), Mahindra & Mahindra Limited (Pune), Maruti Udyog Limited, Gurugram (Haryana), Sunrise Industry (Bengaluru), Hindustan Motors (Kolkata), etc. are the major centres of the auto industry.

#### **P. Leather industry :**

- Kanpur is known for manufacturing leather shoes.
- Kanpur, Agra, Mumbai, Kolkata, Patna and Bengaluru are the major centres of the leather industry in India.

### Q. Chemical Fertilizer Industry :

- The first factory for producing superphosphate fertilizer was established at **Ranipet** in Tamil Nadu in 1906.
- In 1937, a factory for producing ammonia fertilizer was established, named, Mysore Chemical and Fertilizer at Balegula in Karnataka.
- In 1943, Fertilizers and Chemicals Travancore Limited was established at Udyogamandal in Kerala. The production of Ammonium Sulfate started here in 1947.
- A fertilizer plant was established at Sindri (Jharkhand) in 1951 by the Fertilizer Corporation of India.
- India is entirely dependent on imports for potash fertilizer.
- Nitrogen fertilizer consumption is highest in India.
- The factories at Shahjahanpur and Jagdishpur in Uttar Pradesh, are gas-based.
- Krishak Bharati Cooperative Limited (KRIBHCO) has a gas-based urea ammonia plant at **Hazira**, Gujarat.
- The Fertilizer Corporation of India Ltd. has its units at Sindri (Jharkhand), Talcher (Odisha), Ramagundam (Telangana), Gorakhpur (U.P.) and Korba (Chhattisgarh).
- **Punjab** tops India in fertilizer consumption (kg. per hectare 2020-21), followed by Haryana and Andhra Pradesh in that order.

### R. Industrial Clusters :

- There are three types of **industrial clusters** in India.
  1. Large Industrial Areas
  2. Small Industrial Areas
  3. Industrial Districts
- There are 8 major industrial regions in large industrial areas-
  1. Kolkata - Hooghly Industrial Zone
  2. Mumbai-Pune Industrial Area
  3. Ahmedabad-Vadodara (Gujarat) Industrial Area
  4. Gurugram - Delhi - Meerut Industrial Area
  5. Chhotanagpur Industrial Area
  6. Bengaluru-Tamil Nadu Industrial Area
  7. Visakhapatnam-Guntur Industrial Area
  8. Kollam-Thiruvananthapuram Industrial Area
- There are 13 major small industrial regions – Ambala-Amritsar, Brahmaputra Valley, Saharanpur-Muzaffarpur-Bijnor, Indore-Dewas-Ujjain, Jaipur-Ajmer, Prayagraj-Varanasi-Mirzapur, Bhojpur-Munger, Durg-Raipur, Bilaspur-Korba, Kolhapur-Dakshina Kannada, North Malabar, Central Malabar, Adilabad-Nizamabad.
- There are 15 industry districts - Kanpur, Agra, Lucknow, Gorakhpur, Aligarh, Bareilly, Purnia, Jabalpur, Jalpaiguri, Hyderabad, Nagpur, Gwalior, Bhopal, Cuttack and Kota.

### 13. Major Wildlife Sanctuaries in India

- The **Wildlife Act** was passed by the Government of India in **1972** to create wildlife sanctuaries and national parks.

- Sanctuaries are created for protecting and preserving particular species of animals or birds.
- National parks are established to conserve the habitat of a particular animal.
- **Jim Corbett** National Park (Uttarakhand) is the **first national park in India**.
- It was established in 1936. Its former name was Hailey National Park.
- The **first tiger project** in Jim Corbett National Park in India was launched in **1973**.
- **In, 2021** the National Tiger Conservation Authority (NTCA) designated 53<sup>rd</sup> Tiger Reserve of the country in Chhattisgarh. The new tiger reserve is constituted by the combined area of Guru Ghasidas National Park and Tamor Pingla Wildlife Sanctuary.
- Ramganga and Kosi rivers flow through Jim Corbett Park.
- The largest tiger reserve in India is **Nagarjuna Sagar** in Srisailem (Andhra Pradesh and Telangana). In Telangana, it is called Amrabad Tiger Reserve now.
- **Hemis**, India's largest national park is located in Ladakh.
- **Project Tiger 1973** was launched by the efforts of Mr. Kailash Sankhala from Rajasthan.
- Mr. Sankhala is known as the **Tiger Man of India**.
- The smallest tiger reserve in terms of area is Bor (Maharashtra).
- In 1963, Sir Peter Scott first envisaged an International Red Data Book (IRBD).
- The **Red Data Book** provides information about endangered species of flora and fauna.
- The Red Data Book and rate list are issued by the International Union for Conservation of Nature.
- The first International Red Data Book was published in 1964.
- **Salim Ali** was an eminent nature lover and ornithologist of India.
- **Salim Ali National Bird Park** was established at Srinagar, in memory of Salim Ali.
- The maximum number of wildlife sanctuaries in India (96) is located in Andaman and Nicobar Islands and the maximum number of national parks (11) is in Madhya Pradesh.
- National Chambal Sanctuary, also called the National Chambal Gharial Wildlife Sanctuary, is a 5,400 sq. km tri-state protected area in northern India home to critically endangered gharial (small crocodiles), the red-crowned roof turtle and the endangered Ganges river dolphin.
- Located on the Chambal River near the tri-point of Rajasthan, Madhya Pradesh and Uttar Pradesh, it was first declared as a PAs in Madhya Pradesh in 1978 and now constitutes a long narrow eco-reserve co-administered by the three states.

- Within the sanctuary the pristine Chambal River cuts through mazes of ravines and hills with many sandy beaches along its banks.

| National Park/ Wildlife Sanctuary           |                                |
|---------------------------------------------|--------------------------------|
| State/Union                                 | Territory                      |
| Dudhwa National Park                        | Uttar Pradesh                  |
| Chandraprabha Sanctuary                     | Uttar Pradesh                  |
| Gir National Park                           | Gujarat                        |
| Nal Sarovar Bird Sanctuary                  | Gujarat                        |
| Corbett National Park                       | Uttarakhand                    |
| Bhadra Sanctuary                            | Karnataka                      |
| Bandipur National Park                      | Karnataka                      |
| Someshwar Sanctuary                         | Karnataka                      |
| Palamu Sanctuary                            | Jharkhand                      |
| Dalma Wildlife Sanctuary                    | Jharkhand                      |
| Hazaribagh Wildlife Sanctuary               | Jharkhand                      |
| Manas National Park                         | Assam                          |
| Kaziranga National Park                     | Assam                          |
| Keoladeo Ghana National Park                | Rajasthan                      |
| Ranthambore National Park                   | Rajasthan                      |
| Kumbhalgarh Wildlife Sanctuary              | Rajasthan                      |
| Sariska National Park                       | Rajasthan                      |
| Pench National Park                         | Maharashtra/<br>Madhya Pradesh |
| Borivali (Sanjay Gandhi) National Park      | Maharashtra                    |
| Bhitarkanika National Park                  | Odisha                         |
| Simlipal Wildlife Sanctuary & National Park | Odisha                         |
| Nandan Kanan Zoological Park                | Odisha                         |
| Mudumalai Wildlife Sanctuary                | Tamil Nadu                     |
| Periyar Wildlife Sanctuary                  | Kerala                         |
| Parambikulam Wildlife Sanctuary             | Kerala                         |
| Dampa Sanctuary                             | Mizoram                        |
| Kanha National Park                         | Madhya Pradesh                 |
| Pachmarhi Biosphere Reserve                 | Madhya Pradesh                 |
| Dachigam National Park                      | Jammu and Kashmir              |
| Kishtwar National Park                      | Jammu and Kashmir              |
| Bandhavgarh National Park                   | Madhya Pradesh                 |
| Nagarhole (Rajiv Gandhi) National Park      | Karnataka                      |
| Keibul Lamjao National Park                 | Manipur                        |
| Bhagwan Mahaveer Wildlife Sanctuary         | Goa                            |
| Great Himalayan National Park               | Himachal Pradesh               |
| Sultanpur National Park                     | Haryana                        |

|                                          |             |
|------------------------------------------|-------------|
| Sundarban National Park                  | West Bengal |
| West Sundarban Wildlife Sanctuary        | West Bengal |
| Abohar Wildlife Sanctuary                | Punjab      |
| Namdapha National Park Arunachal Pradesh |             |

- In 1991, the **Wildlife Protection Amendment Act** was passed.
- The Indian Wildlife Research Institute is located at Dehradun.
- **Fossil National Park** is located in Madhya Pradesh.

#### 14. Tribes in India

- Those people who remain untouched by civilization and outside of the mainstream life of the society, lead life according to their natural environment and protect and preserve their way of life, language and culture are called "Tribes".
- They are listed under **Article 342** in the Indian Constitution.
- The President of India has the right to notify a tribal community.
- **Thakkar Bapa** first used the word 'Adivasi' for them. He was thus given the name, '**Adivasi Messiah**'.
- According to the **15<sup>th</sup> Census 2011**, Scheduled Tribes accounted for 8.6% of the total population of the country.
- Madhya Pradesh has the highest number of Scheduled Tribes' population in India.
- The **Bhils** are the **largest tribal** group in India.
- **Gond** and **Santhal** are the second and the third largest tribes of India, respectively.
- The **Jarawa Tribes** has origins in the Andaman and Nicobar Islands.
- **Tharu** Tribes mourn on the occasion of **Deepavali**.
- The **Munda** Tribes celebrate the **Sirihul Festival**.
- **Jaunsari** and **Toda** tribes practice **polyandry**.
- Gaddis is the dominant tribe of the Dhauladhar Range (Himachal Pradesh).
- **Bhutias** migrate during seasons.
- **Shompen** Tribes is found in the **Nicobar Group** of Islands.
- **Tharparkar** is a tribe belonging to the border region of Rajasthan.
- The practice of visiting husband is prevalent among **Nayar Tribes**.

| Major Tribes in India |                                                 |
|-----------------------|-------------------------------------------------|
| State/UT              | Tribes                                          |
| Andaman Nicobar       | Sentinelese, Onges, Jarawa, Shompen, Nicobarese |
| Tamil Nadu            | Kurumba, Karikaran, Toda, Kota                  |
| Andhra Pradesh        | Chenchu, Koya, Gadaba, Lambada, Savara, Yenadi  |



|                             |                                                                                 |
|-----------------------------|---------------------------------------------------------------------------------|
| Telangana                   | Koya, Kondh Chenchu, Koulia, Gadaba                                             |
| Punjab                      | Sansi                                                                           |
| Kerala                      | Malayan, Pulayan, Kuruman Urali, Kadar, Paliyan                                 |
| Karnataka                   | Pardhi, Yereva, Naikda                                                          |
| Gujarat                     | Bhil, Charan, Koli                                                              |
| Maharashtra                 | Bhil, Dhanwar, Koli, Worli, Gond                                                |
| Rajasthan                   | Meena, Bhil, Garasia, Saharia, Koli, Damor                                      |
| Himachal Pradesh            | Gaddi, Kanaura, Jad, Bhot, Gujjar                                               |
| Jammu & Kashmir (Undivided) | Bakarwal, Gujjar, (Muslim) Gaddi, Chang Pa                                      |
| Ladakh                      | Balti, Beda, Bot, Boto, Changpa, Brokpa, Drokpa, Dard, Shin Garra, Mon, Purigpa |
| Uttarakhand                 | Tharu, Bhutia, Buxa, Jaunsari, Raji                                             |
| Odisha                      | Munda, Kharia, Bhumij, Santhal, Ho, Kol, Oraon, Saora                           |
| Jharkhand                   | Santhal, Munda, Ho, Birhor, Kol, Baiga, Asur                                    |
| Madhya Pradesh              | Bhil, Gond, Paharimaria, Muria, Baiga, Kol, Kamar                               |
| Chhattisgarh                | Muria, Kabar Sahariya, Khond, Gond Abhujmaria                                   |
| Meghalaya                   | Garos, Khasi, Jaintia, Kuki Mikir                                               |
| Manipur                     | Kuki, Medhi                                                                     |
| Nagaland                    | Naga, Kachari                                                                   |
| Mizoram                     | Hajong, Pawi, Mizo                                                              |
| Tripura                     | Halam, Riang, Tripuri                                                           |
| Arunachal Pradesh           | Momba, Kamba, Apatani, Mishmi, Singpho, Abor                                    |
| Assam                       | Garos, Khasi Jaintia, Karbi, Kuki, Bodo                                         |
| West Bengal                 | Lodha, Bhumij, Santhal, Lepcha                                                  |
| Sikkim                      | Lepcha, Bhutia                                                                  |

- The Khasi, Jaintia, Bhoi, and War are collectively known as the Hynniewtreps.
- These people predominantly inhabit the districts of East Meghalaya, also known to be one of the earliest ethnic groups of settlers in the Indian sub-continent, belonging to the Proto Austroloid Monkhmer race.
- Nongkrem dance festival is an annual festival of the Khasi tribe of Meghalaya.

### 15. India and Antarctica

- The first Indian to reach the **South Pole** was **Dr. Giriraj Sirohi** (Bulandshahar, Uttar Pradesh).
- **Dr. Saeed Zahoor Qasim** led India's first Antarctica expedition team (9<sup>th</sup> January 1982).

- India's first research centre in Antarctica was established at **Dakshin Gangotri** (1983-84). It does not exist now.
- India established Maitri, the second research centre in Antarctica in 1988-89.
- India's third research centre **Bharti** is located at Larsemann Hills.

### 16. The Census of India

- The census was also mentioned in Kautilya's Arthashastra and Ain-i-Akbari (1595 AD) authored by Abul Fazl.
- The first census was conducted in 1872 by Lord Mayo during British Rule.
- In 1881, a systematic enumeration of the population started **every ten years** from the time of **Lord Ripon** and that continues to this day.
- Since then, Fifteen censuses in India have been conducted so far.
- The first census of independent India was held in **1951**, under the Census Commissioner, **R A Gopalaswamy**.
- The population density of India in 2001 was 324 persons per square kilometre and in 1951 it was 117.
- The Census 2011 was the 15<sup>th</sup> and the **seventh** of Independent India.
- The Census 2011 is the second of 21<sup>st</sup> century.
- The slogan of the 15<sup>th</sup> Census 2011 was "**Our Census Our Future**".
- The mascot of the 15<sup>th</sup> Census 2011, was the **Female teacher (enumerator)**.
- The **census** of the country is the **subject of the Union List**, i.e. the census work is undertaken under the direction of the Central Government.
- The census organization functions under the Union **Ministry of Home Affairs**.
- Its higher authority is called **Registrar General and Census Commissioner of India**.
- The Census Commissioner directs census related operations across the country and releases census data.
- Currently, **Vivek Joshi** is the Registrar General and Census Commissioner of India.
- The Union Cabinet accepted in principle the caste-based census for the first time in September 2010 (after 1931) and accordingly a census was conducted separately from June 2011 to September 2011.
- In the demographic history of India, the year **1921** is called the **Great Division Year** because the decadal growth of population in India from 1911 to 1921 was **negative (-0.31%)**.
- India possesses 2.4 per cent of the complete land region of the world while India's population is **17.5%** of the total population living on this planet.

- India is home to second-largest world population close behind China which tops the world population chart. It is also the seventh in descending order in terms of area.

#### Key Facts of Census 2011 :

- Census 2011 covered 35 states / union territories, 640 districts, 5924 sub-districts, 7933 towns and 6,40,932 villages.
- The data of Census 2011 gives the figures of Telangana in undivided Andhra Pradesh and the figures of Union Territories of Jammu and Kashmir and Ladakh in undivided Jammu and Kashmir State ( from 31<sup>st</sup> October 2019).
- The total **population of India** as per Census 2011, is 1,21,08,54,977 of which 62, 32, 70,258 (51.47%) are males and 58, 75, 84,719 (48.53%) females.
- The annual **growth rate** of the population has decreased from 1.97% to 1.64% while the decadal growth rate has come down from 21.54% to 17.7%.
- The Crude Birth Rate (CBR) at the National level during 2011 stands at 21.8 exhibiting a decline of 0.3 points over 2010.
- The decadal growth rate in **Nagaland** remained **negative (-0.6%)**.
- India's **population density** has increased from 325 persons per sq km to 382 persons per sq km.
- The **sex ratio** has improved from 933 to 943.
- The **child sex ratio** (0-6 years) has declined from 927 to 919.
- The number of **literate** people has increased from 64.8% to 73% of the total population of India.
- **Male Literacy** has improved from 75.26% to 80.9% and **female literacy** from 53.67% to 64.6%.
- According to the Census 2011, Scheduled Castes in the country account for 16.6% of the total population of the country. In absolute numbers, they are 20.14 crores.
- The decadal growth rate of Scheduled Castes in the country from 2001 to 2011 was 20.8%.
- The sex ratio of the Scheduled Castes in 2011 was 945.
- According to the Census 2011, the absolute number of Scheduled Tribes in the country is about 10.43 crores accounting for 8.6% of the total population of the country.
- The sex ratio of Scheduled Tribes in the census 2011 was 990.
- The decadal growth rate of Scheduled Tribes in the country from 2001 to 2011 was 23.7%.
- According to the Census 2011, the **urban population** was 31.1%, the **rural population** is 68.9% of the total population of the country.
- **Rajasthan** is the largest state in terms of area, while **Goa** is the smallest.
- The largest State in terms of population is **Uttar Pradesh** while the smallest state by population is **Sikkim**.

- The **top 4 States** in terms of **population** are Uttar Pradesh (16.50 per cent), Maharashtra (9.28 per cent), Bihar (8.6 per cent), West Bengal (**7.54 per cent**).
- The **4 states** with the lowest **population** are - Sikkim (0.05%), Mizoram (0.09%), Arunachal Pradesh (0.11%), Goa (0.12%).
- The population inhabiting per square km is called **population density**.
- Population density = Total population of a place / Total area of that place
- The **four states** with the **highest population density** in descending order are Bihar (1106), West Bengal (1028), Kerala (860), Uttar Pradesh (829).
- The **4 states** with **lowest population density** are Arunachal Pradesh (17), Mizoram (52), Sikkim (86), Nagaland (119).
- The decadal growth rate is the increase in the population every 10 years.
- Decadal Population Growth (DGR)

$$= \frac{\text{Present Population} - \text{Previous Population}}{\text{Previous Population}} \times 100$$

- The four states with the **highest decadal growth** are Meghalaya (27.9%), Arunachal Pradesh (26%), Bihar (25.4%), Manipur (24.5%).
- Four states with the **lowest decadal growth** are Nagaland (- 0.6%), Kerala (4.9%), Goa (8.2%) and Andhra Pradesh (11%).
- The number of females per 1000 males is called **Sex Ratio**

$$\text{Sex ratio} = \frac{\text{Number of females}}{\text{Number of males}} \times 1000$$

- The 4 states with the **highest sex ratio** are Kerala (1084), Tamil Nadu (996), Andhra Pradesh (993) and Chhattisgarh (991).
- The four states with the **lowest sex ratio** are Haryana (879), Jammu and Kashmir (889), Sikkim (890) and Punjab (895).
- The number of girls in the age group of 0-6 years as compared to per 1000 boys in the age group of 0-6 is called **Child Sex Ratio**.
- Child Sex Ratio =  $\frac{\text{Number of Girls (0 – 6 years)}}{\text{Number of Boys (0 – 6 years)}} \times 1000$
- The four states with the **highest child sex ratio** are Arunachal Pradesh (972), Mizoram (970), Meghalaya (970) and Chhattisgarh (969).
- The four states with the **lowest sex ratio** are Haryana (834), Punjab (846), Jammu and Kashmir (862) and Rajasthan (888).

#### Literacy :

- Those in the age group of 7 years or more can read and write are called **literates**.
- The literacy rate of the population is the percentage of literate persons out of the total population in the age group of 7 years or more.

- Literacy Rate =  $\frac{\text{Number of Literates}}{7 + \text{age population}} \times 100$
- The four states with the **highest literacy** rates are Kerala (94%), Mizoram (91.3%), Goa (88.7%) and Tripura (87.2%).
- The four states with the **lowest literacy** rates are Bihar (61.8%), Arunachal Pradesh (65.4%), Rajasthan (66.1%) (4) Jharkhand (66.4%).
- The four states with the **highest male literacy** are Kerala (96.1%), Mizoram (93.3%), Goa (92.6%) (4) Tripura (91.5%).
- The four states with the **lowest male literacy** are Bihar (71.2%), Arunachal Pradesh (72.6%), Andhra Pradesh (74.9%) and Meghalaya (76%).
- The four states with the **highest female literacy** are Kerala (92.1%), Mizoram (89.3%), Goa (84.7%) and Tripura (82.7%).
- The four states with **lowest female literacy** are Bihar (51.5%), Rajasthan (52.1%), Jharkhand (55.4%) and Jammu and Kashmir (56.4%).

#### Rural Population / Urban Population :

- The four states with the **highest rural population** (in descending order) are Himachal Pradesh (90%), Bihar (88.7%), Assam (85.9%) and Odisha (83.3%).
- The four states with the **highest urban population** in relative numbers are Goa (62.2%), Mizoram (52.1), Tamil Nadu (48.4%) and Kerala (47.7%).
- The four states with the **highest urban population** in absolute numbers (in descending order) are Maharashtra (5,08,18,259), Uttar Pradesh (4,44,95,063), Tamil Nadu (3,49,17,440) and West Bengal (2,90,93,002).
- The four states with the **lowest urban population** in absolute numbers (in descending order) are Sikkim (1,53,578), Arunachal Pradesh (3,17,369), Nagaland (5,70,966) and Mizoram (5,71,771).

#### Scheduled Castes/ Scheduled Tribes :

- The four states with the **highest Scheduled Castes' population** in relative numbers are Punjab (31.9%), Himachal Pradesh (25.2%), West Bengal (23.5%) and Uttar Pradesh (20.7%).
- The four states with the **highest Scheduled Castes' population** in absolute numbers are Uttar Pradesh (4,13,57,608), West Bengal (2,14,63,270), Bihar (1,65,67,325) and Tamil Nadu (1,44,38,445)
- There is no Scheduled Castes population in Nagaland and Arunachal Pradesh.
- The four states with the **highest Scheduled Tribes' number** in absolute numbers are Madhya Pradesh (1,53,16,784),

Maharashtra (1,05,10,213), Odisha (95,90,756) and Rajasthan (92,38,534).

- Jharkhand ranks sixth in terms of Scheduled Tribes' population. Its Scheduled Tribes population is 86,45,042.
- The four states with the **highest Scheduled Tribes' population** in relative numbers are Mizoram (94.4%), Nagaland (86.5%), Meghalaya (86.1%) and Arunachal Pradesh (68.8%).
- The Scheduled Tribes' population is 30.6% in Chhattisgarh; 26.2% in Jharkhand and 21.1% in Madhya Pradesh.
- There is no Scheduled Tribes' population in Haryana and Punjab.

#### Population 2011- (Union Territories) :

- Delhi is the most populous Union Territory followed by Puducherry and Chandigarh in that order. Lakshadweep is a Union Territory with a minimum population.
- The largest Union Territory in terms of area is **Andaman and Nicobar Islands** while the smallest is **Lakshadweep**.
- **Dadra and Nagar Haveli** and **Lakshadweep** are the Union Territories with the highest decadal growth rate (55.9%) and with the lowest decadal growth rate (6.3%), respectively.
- The union territory of Delhi (11320) has the highest density while Andaman & Nicobar (46) has the lowest density.
- **Puducherry** is a Union Territory with the **highest sex ratio** (1037) and **Daman and Diu** is a Union Territory with the **lowest sex ratio** (618).
- **Andaman and Nicobar Islands** is a Union Territory with the highest child sex ratio (0–6 years) (968) and **Delhi** is a Union Territory with the lowest child sex ratio (871).
- **Lakshadweep** is a Union Territory with the highest literacy (91.8%) and **Dadra and Nagar Haveli** is a Union Territory with the lowest literacy (76.2%).
- **Lakshadweep** is a Union Territory with the **highest male literacy** (95.6%) and **Dadra Nagar Haveli** is a Union Territory with the **lowest male literacy** (85.2%).
- **Lakshadweep** is a Union Territory with the **highest female literacy** (87.9%) and **Dadra and Nagar Haveli** is a Union Territory with the **lowest female literacy** (64.3%).
- Chandigarh (18.9%) is a Union Territory with the highest population of Scheduled Castes in terms of percentage while Delhi is a Union Territory with highest population of Scheduled Castes (28.12 lakh) in terms of numbers.
- **No Scheduled Castes** reside in **Lakshadweep** and **Andaman and Nicobar Islands**.
- Lakshadweep (94.8%) is a Union Territory with the **highest Scheduled Tribes' population** and Dadra and Nagar Haveli is a Union Territory with the **highest Scheduled Castes' population** (1, 78, 564).
- No Scheduled Tribes reside in **Delhi, Chandigarh** and **Puducherry**.



# Economics & Indian Economy



## Topics of the Unit

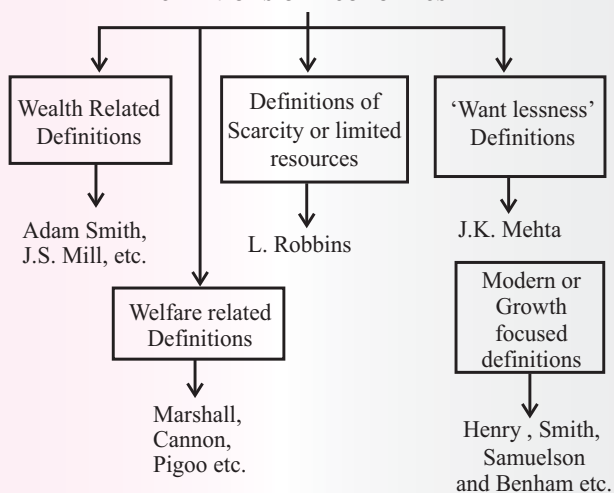
- Economics : An Introduction ● Market ● Classification of Economies ● Economic Growth and Economic Development
- Planning in India ● Planning Commission ● Poverty in India ● Poverty Prevention and Welfare Schemes ● Indian Agriculture ● Indian Industries ● Indian Public Finance ● UNION BUDGET, 2024-25 ● Fiscal Policy ● Major Taxes In India ● Miscellaneous

## 1 Economics : An Introduction

- Economics is the study of activities like production, consumption and distribution of goods and services.
- The study of achieving maximum welfare from limited resources is the main theme of this subject.
- In ancient India, Chandragupta Maurya's Prime Minister, Kautilya (Chanakya) wrote a book named '**Arthashastra**', although the theme of Arthashastra is based on polity.
- Aristotle, in his treatise '**Economics**' (originally Latin word- **Oeconomica**) defined economics by linking it to 'House Management'.

- **Adam Smith** is called the '**Father of Economics**'. He was the first to present economic ideas in a sequential manner.
- In his book '**An Inquiry into the Nature and Causes of the Wealth of Nations**' (1776), he defines economics as 'Science of Wealth'.
- According to Adam Smith, 'Economics is to investigate the nature and causes of the wealth of nations'.

### Definitions of Economics



## Major Books of Economics and Its Authors

| Books                                                       | Authors           |
|-------------------------------------------------------------|-------------------|
| Das Kapital (1867)                                          | Karl Marx         |
| The Wealth of Nations (1776)                                | Adam Smith        |
| Foundations of Economic Analysis (1947)                     | Paul A. Samuelson |
| The General Theory of Employment, Interest and Money (1936) | J.M. Keynes       |
| Nature and Significance of Economic Science (1932)          | L. Robbins        |
| How to Pay for the War (1940)                               | J.M. Keynes       |
| Principles of Economics (1890)                              | Alfred Marshall   |

## Market

- There are four forms of the market in economics :

1. Perfect Competition
2. Monopoly
3. Monopolistic Competition
4. Oligopoly and Duopoly

1. **Perfect Competition:** Perfect competition is the market situation where the buyer and the seller exist in large numbers and buy or sell a small part of the total production.
  - The commodities produced in it are completely homogeneous.
  - The same price of a similar item prevails in the market.
2. **Monopoly:** It is a market situation in which there is **one seller** and **many buyers**. There is no substitute for the commodity in the market. In this market, the price can be affected by changes in the supply.
3. **Monopolistic Competition:** It is a market situation in which the properties of both monopolistic and Perfect competition exist. There are many sellers of goods produced in this form of the market, but each seller's produce has specific characteristics that make it monopolistic. In this



market, the price can be affected to some extent, but it depends on the extent to which consumers consider that item to be exclusive and to some extent, there is competition with the substitute goods of that item.

### Important Economic Terminologies

- **Price :** The price of a commodity in the market is determined by the interaction of the forces of demand and supply.
- **Market :** It refers to the entire area in which buyers and sellers are in contact with each other for the purchase and sale of goods. In this view, there is a local, regional, national and international market of the commodity.
- **Commodity :** Any item that is produced for sale. Vegetables are not a commodity grown by the consumer for his own consumption, but the vegetables sold by the farmers in the market come under the category of commodity.
- **Demand :** It is the quantity of a commodity that the buyer is ready and able to purchase at a particular price at a specific time.
- **Supply :** It is the quantity of an item that the seller is willing to sell at a particular price at a specific time.
- **Law of Demand :** There is an inverse relationship between the price of a commodity and the quantity demanded. If other things remain the same, when there is an increase in the price, there will be a decrease in the demand and if there is a decrease in the price, there will be an increase in the demand.
- **Giffen Goods :** There is a direct relationship between the price of Giffen Goods and the quantity demanded, i.e; as the price increases, the demand for Giffen Goods increases and as the price decreases, the demand for Giffen Goods also decreases. Giffen Goods are inferior goods. The Law of demand does not apply to Giffen Goods.
- **The Price Elasticity of Demand :** The change in the quantity demanded of a product as an outcome of a change in price is called the price elasticity of demand.  

$$\text{Elasticity of demand} = \frac{\text{Proportional change in demand}}{\text{Proportional change in price}}$$
  - Demand for normal goods is Less elastic and the demand for luxury goods is highly elastic, while demand for essential goods is inelastic.
  - In the case of alternative use of a commodity, the demand is elastic.

- **Principle of Supply :** There is a proportional relationship between the price of the commodity and the quantity supplied. If the price of the commodity increases, the supply of the commodity also increases. On the contrary, when the price of the commodity decreases, the supply of the item also decreases.

- **Equilibrium Price :** The equilibrium price of a commodity is the price at which demand and supply are equal. The same quantity is demanded at this price, as it is supplied.

4. **Oligopoly :** This is the position between Monopoly and Monopolistic Competition. In this type of market, there are only a few selected sellers level and they also compete among themselves. If the number of sellers is only two, it is called **Duopoly**.

#### Note :

- According to Gresham's Law "Bad money drives out good money".
- In any economy, the income velocity of accumulated money (in active) by public is equal to zero.
- In the simple model of circular flow of the economy aggregate consumption exceeds aggregate expenditure.

## 2

## Classification of Economies

- An economy is a set of activities such as production, consumption, distribution, allocation, etc.
- From the point of view of economic development level, the economy is divided into three parts - 1. Developed economy, 2. Less developed economy and 3. Developing Economy. (UPPCS, 2017, Chhattisgarh 2017)

1. **Developed Economy :** Developed countries are those sustained with high per capita income. GDP of the country, technique and standard of living of the people is high and structural development is very good, but the level of population and unemployment is low.

#### Characteristics of a Developed Economy :

- Socially and economically advanced,
- High level of production and consumption,
- High level of national income and per capita income,
- High level of savings and investments,
- High rate of capital formation and
- Low population growth rate.  
Ex - America, Japan, Britain, Germany and France are considered as developed economies.
- 2. **Less developed Economy :**
  - Countries with Less developed economies are those in which the living standard, production level and per capita income of the people are very low, whereas the population level is high.

### ➤ **Characteristics of a Less developed Economy:**

- Socio-economic backwardness, (UPPCS, 1995)
- Low level of production and consumption, (UPPCS, 1998)
- Low level of national income and per capita income,
- Low rate of capital formation, (SSC MTS, 2018)
- High population growth rate and
- Dependence on agriculture, illiteracy and unemployment are considered as underdeveloped countries.  
E.g. Uganda, Burundi, Namibia (African countries) etc. are considered as underdeveloped economies.

### 3. **Developing Economy**

- Economies having the characteristics of less developed economy, but immense possibilities of being a developed country also exist there. E.g. India, China, Brazil, etc. (UPPCS, 2017; Chhattisgarh, 2017)
- The World Bank classifies economies on the basis of **Gross National Income Per Capita** (GNI Per Capita). (UPPCS, 2017; Chhattisgarh 2017)

### **Classification of Economy on the basis of production**

- Economy is divided into three categories on the basis of control over production.
- 1. Capitalist Economy, 2. Socialist Economy and 3. Mixed Economy (UPPCS, 2013; 15)

#### 1. **Capitalist Economy**

- Under Capitalist Economy, the objective of profit is predominant and production is under **private ownership**. (UPPCS, 2013; 15)
- In a capitalist economy, the market determines the quantity produced, the quantity to be produced and the price of the commodity. (UPPCS, 2013; 15)
- Capitalist Economy is also called **Market Economy** or **Unplanned Economy**. (UPPCS, 2013; 15)
- Government has no economic role in Capitalist Economy.
- This type of economy exists in America, U.K., Switzerland, Hong Kong and Singapore. (UPPCS, 2013; 15)

#### 2. **Socialist Economy :**

- In a Socialist Economy, the **government controls** over demand, supply, price and production. (UPPCS, 2013; 15)
- Socialist Economy is also called **'Planned Economy'**. (UPPCS, 2013; 15)
- In a Socialist Economy, ownership of the means of production is collective. Large industries are under state ownership whereas agriculture, trade and small industries are under cooperative ownership.
- The concept of a socialist economy appeared in Russia (the then Soviet Union) after the (Bolshevik) Revolution of 1917.

📌 **Note :** The concept of Socialist Economy was formulated by the German philosopher **Karl Marx**.

### 3. **Mixed Economy :**

- In a Mixed Economy, the ownership of the **public** and **private** sector exists simultaneously. (UPPCS, 2013; 15)
- Mixed Economy is a combined form of capitalist and state economy. (UP RO, 2016; UPPCS, 2013; 15)
- The Mixed Economy was suggested by the economist **John Maynard Keynes**. (UPPCS, 2013; 15)
- **Indian Economy** is an example of **Mixed Economy**. (UPPCS, 2013; 2015; 2007, B.P.S.C. 2011)

### **Sectors of Economy**

- On the basis of economic activities, the economy is divided into three sectors (1) Primary Sector, (2) Secondary Sector and (3) Tertiary Sector.

1. **Primary Sector :** It includes those production units which are derived from the **exploitation of natural resources** such as Agriculture, Animal Husbandry, Fisheries, Mining, Forestry, etc. It ensures the availability of raw materials for the secondary sector. (UPPCS, 2013; 15)
2. **Secondary Sector :** The sector of the economy which uses primary sector products as a raw material in its activities is called **Secondary Sector**. For example, Factories, Construction, Electricity Generation, Water Supply, are examples of the secondary sector. (UPPCS, 2013; 15)
- It is also known as **"Industrial Sector"**. (UPPCS, 2013; 15)
3. **Tertiary Sector :** Tertiary sector is also known as **'Service Sector'**. It consists of units providing various services. Examples are Transport, Education, Banking, Insurance, Hotel Industry, Medical, Tourism, Government Administration, Finance, etc. (UPPCS, 2013; 15)

## **Economic Growth and Economic Development**

### **Economic Growth :**

- Economic growth refers to the quantitatively sustained growth in country's per capita income or production, which is associated with the distribution to its labour force, consumption, capital and trade volume. If **Gross National Product** (GNP), **Gross Domestic Product** (GDP) and per capita income are increasing, it is called **'Economic Growth'**.

### **Economic Development :**

- The concept of economic development is more comprehensive than the concept of economic growth. (UPPCS, 2021; UPPCS, 2013; 15)
- Economic growth is objective, while economic development is subjective. (RAS, 2013; UPPCS, 2013; 15)
- Economic development is related to both qualitative and quantitative changes in social, cultural and economic variables. (UPPCS, 2013; 15)

- While economic growth is related to only quantitative changes, economic development is related to both quantitative and qualitative changes. (UPPCS, 2013; 15)

### Determining Factors of Economic Development

| Economic Factors              | Non-Economic Factors   |
|-------------------------------|------------------------|
| ● Natural Resources           | ● Social Factor        |
| ● Labour Force and Population | ● Religious Factor     |
| ● Capital Formation           | ● Political Factor     |
| ● Technology & Innovation     | ● International Factor |
| ● Capital-Output Ratio        | ● Scientific Factor    |
| ● Organisation                | ● Human Resource       |

- Economic development can be achieved only when the **quality of life** improves. (UPPCS, 2013; 15)
- Economic development has a broad concept. This includes economic growth, social sector development, inclusive growth, etc. (UPPCS, 2013; 15)
- Pakistani Economist Mehboob-ul-Haq, defining economic development, has said - "Regardless of the form of poverty, economic development is the fight against poverty". (UPPCS, 2013; 15)
- Nobel Laureate Economist Prof. Amartya Sen has said "**empowerment and capacity expansion is the economic development**". (UPPCS, 2013; 15)
- He says, "Economic development refers to sustenance, self-respect and independence. (UPPCS, 2013; 15)
- Amartya Sen says, "Economic development consists of the removal of various types of unfreedoms that leave people with little choice and little opportunity of exercising their reasoned agency". (UPPCS, 2013; 15)

### Measurement of Economic Development :

- The following are the methods for measuring economic growth and comparative state of economic development.
- 1. **Basic Needs Approach** was rendered by the World Bank in 1970.
- 2. **PQLI : Physical Quality Of Life Index Approach** was rendered by **Morris D Morris**. (UPPCS, 2013; 15)
- In this method, the average value of infant mortality, adult literacy rate and life expectancy index of a country is used to measure economic development.
- 3. **Purchasing Power Parity (PPP) Method** was presented by **Gustav Castle**. (UPPCS, 2013; 15)
- This method was first used by the International Monetary Fund (IMF) in 1993. (UPPCS, 2013; 15)
- The PPP method is currently being used by the World Bank to compare the standard of living of different countries. (UPPCS, 2013; 15)

✎ **Note :** According to the World Bank data, in the year (2021) India is the third-largest economy in the world on the basis of Gross National Income (GNI) purchasing power parity. China and America are in first and second position respectively. (UPPCS, 2013; 15)

- According to World Bank data, the United States (USA) has the world's largest economy in 2021 based on GDP. India ranks 5<sup>th</sup> after the United States, China, Japan and Germany respectively. (UPPCS, 2013; 15)

### Human Development Index, HDI:

- The concept of the Human Development Index was formulated in 1990 by the economist Mahboob-ul-Haq and his colleagues.
- The following three variables included under the Human Development Index are (A) Life Expectancy Index, (B) Education Index and (C) Income Index. (UPPCS, 2013; 15)

#### (A) Life Expectancy Index :

- Life Expectancy Index measures the life expectancy of a country's people at birth. (UPPCS, 2013; 15)

#### (B) Education Index :

- Two figures are included in Education Index
- 1. Average years of schooling
- 2. Estimated years of schooling (UPPCS, 2013; 15)

#### (C) Income Index :

- Standard of living is the amount of goods and services available to purchase in a country. Real GDP per capita and **Gross National Income per capita** are the two most common ways to measure the standard of living. (UPPCS, 2013; 15)
- The **Human Development Index**, has a value between 0 and 1, with worse performance leading to zero (0), while moving towards 1 indicates better performance. (UPPCS, 2013; 15)

- The higher the value of a country (closer to 1), the better it is considered to be in the category of Human Development Index. (UPPCS, 2013; 15)
- Countries with very high human development (0.800 and above).
- Countries with high human development (0.700–0.799).
- Countries with moderate human development (0.550–0.699).
- Countries with low human development (0.0-0.550).

(UPPCS, 2013; 15)

- Since 1990, 'Human Development Index' is released every year by UNDP under the Human Development Report.
- In Human Development Index (HDI), 2023-24, **India ranks 134<sup>th</sup> out of 193 countries**.
- Switzerland is the country with the highest Human Development Index in the Human Development Report 2023-24, and the lowest is Somalia.

### Top 5 Countries with Highest HDI 2023-24

| Rank (HDI)        | Country                | HDI Value |
|-------------------|------------------------|-----------|
| 1.                | Switzerland            | 0.967     |
| 2.                | Norway                 | 0.966     |
| 3.                | Iceland                | 0.959     |
| 4.                | Hong Kong, China (SAR) | 0.956     |
| 5.                | Denmark, Sweden        | 0.952     |
| 134 <sup>th</sup> | India                  | 0.644     |

### Happiness

- Happiness is the desire of human beings, which can be used as a measure of social progress. Whether the total population of the world is happy or not, the key to its correct measurement lies in the meaning of the word 'happiness'. The publication of the World Happiness Report was started Since 2012 by the **United Nations Sustainable Development Solutions Network (SDSN)**.
- The World Happiness Report measures the well-being of various nations of the world. Its main objective is to guide the 'public policy' of nations.
- Well-being is measured on the basis of the following six factors -
  1. GDP per capita (based on Purchasing Power Parity)
  2. Healthy Life Expectancy
  3. Generosity
  4. Social Support
  5. Perception of corruption and
  6. Freedom of Choice of Life

### World Happiness Report, 2024

- World Happiness Report, 2024 was published in March, 2023.
- **Finland** was declared the happiest in a survey amongst 143 countries while **Afghanistan** was found to be the saddest country.
- **India ranks** 126<sup>th</sup> in the World Happiness Report, 2024.
- The rank of India's neighbouring countries is as follows - **Pakistan (108<sup>st</sup>)**, **Nepal (93<sup>rd</sup>)**, **Bangladesh (129<sup>th</sup>)**, **Sri Lanka (128<sup>th</sup>)**.

### National Income :

- Income is an important means for meeting human needs which a person receives as a result of his contribution to the production process. The sum of the total value of the final goods and services produced in a financial year by the

citizens of a nation is called the **National Income** of the country. (IAS, 2013)

- Nobel laureate **Simon Kuznets** is considered the originator of national income accounting. (IAS, 2013)
- In India, **Dadabhai Naoroji** calculated first time India's **national income** and **per capita income**. (BPSC, 2016)

### Concept of Economic (Domestic) Boundry :

- National Income Accounting is a part of macro economics. Estimation of National Income and related sets is a part of it.
- National Income and any set related to it, is a measure of production activity in the country.

### Economic Boundry :

- According to United Nations, Economic Boundry of a country is the geographical boundry administered by the its government in which people, goods and capital can move freely without any barrier. Basis of this definition is freedom of flow of people, goods and capital.

### Areas of Economic Boundry :

- I. Political boundary of the country (including sea boundary and space area.)
  - II. Embassies, commercial consulates and military establishment of the country in foreign.
  - III. Shops and aircraft run by citizens of the country between two or more countries.
  - IV. Fishing boats, oil and natural gas exploration ships which are being operated in those areas in international sea boundaries over which country has absolute authority.
- There are two series of sets of National Income – **Domestic and National**. i.e. Domestic Product and National Product.
  - Production by production units based within economic boundry of the country, is known as **Domestic product**.

### Concept of Resident :

- Resident and Citizen are two different concepts.
- A person can be a citizen of one country but resident of another.
- Indian who lives in foreign are the citizens of India but resident of the country in which they live in.

### Definition of Resident :

- Any person or institution, is known as a resident of that country in which he lives or is based in and their economic interest is centred within its economic boundary.
- Two factors are included in the '**centre of economic interests**'.
  - That resident (**person are institution**) is living (or based in) within the economic boundary of that country.
  - and their earning, spending and saving related economic activities are carried out within this.
- The production carried out by the residents of a country is known as **National product**, irrespectived production was done within the economic boundary or outside of it.



- On the other hand, production done by all the Production Unit which are based within the economic boundary of the country is known as **Domestic Product**, whether production was carried out by resident or non-resident.

#### Relationship between National Product and Domestic Product :

- **National Product** = Domestic Product + Production by residents of the country outside the economic boundary – Production done by non-residents within the economic boundary of the country.

Or

- **National Product** = Domestic Product + Factor income received from abroad – Factor income given to foreign

Or

- **National Product** = Domestic Product + Net factor income from Abroad (NFIA).
- Net National Product (NP) at market price is the total value of Net National Product at the consumer point.
- If factor income received from abroad is more than the factor income paid to abroad, then net factor income from abroad (NFIA) will be positive.
- Net National Product at Net factor cost refers to the net money value of all final goods and services produced by ordinary residents.
- But if factor income received from abroad is less than the factor income paid to abroad, then the net factor income from abroad (NFIA) will be negative.

#### Industrial Classification :

- Grouping of production units in different production groups or sectors is known as industrial classification.

#### Primary Sector :

- In this sector those production units are included which produce by exploitation of natural resources. **For example** – Agriculture, husbandary, fishing, mining, forestry etc. This sector supply raw materials for secondary sector.

#### Secondary Sector :

- In this sector, those production units are included which transformed one type of goods into another. For Example – Factories, manufacturing, power generation, water supply etc.

#### Tertiary Sector :

- This sector is also called the service sector. Under this, Service provider units are included. **For example** – Transport, trade, Education Government Administration, Finance etc.
- The per capita income of India was stated as Rs 20 by Naoroji in 1868. (IAS, 2000; UPPCS 2007)
- For the calculation of national income, in 1949, by the Government of India, the National Income Committee was formed under the chairmanship of **P.C Mahalanobis**.

(UPPCS, 2015)

- V.K.R.V. Rao and R. Gadgil were the other members of this committee. (UPPCS, 2015)

- Before May, 2019 the calculation of national income was being done by the **Central Statistics Office (CSO)**, established in May 1951. At present this work is being done by National Statistical Office (NSO). (BPSC, 2020)

- The financial year for calculating India's national income is from 1<sup>st</sup> April to 31<sup>st</sup> March. (BPSC, 2020)

#### Calculation of National Income:

- National income is calculated by three methods - 1. Factor Cost or Income Method, 2. Production Method and 3. Expenditure Method.

1. **Factor Cost or Income Method:** When the national income is calculated by the sum of **income earned** by the citizens of the nation in the form of **rent, wages, interest, raw material, rent and profit** in a financial year, it is called 'Factor Cost' or 'Income Method'. (BPSC, 2020)

- National income in India was calculated on '**Factor Cost**', but since January 2015, the Central Statistics Office (CSO) has started calculating the national income at the **market price**. (BPSC, 2020)

2. **Production Method:** When the national income is calculated by the sum of the **net monetary value** of all final goods and services produced by a country in a financial year, it is called '**Production Method**'. (BPSC, 2020)

3. **Expenditure Method:** When the national income is calculated by the sum of all the **Final expenditure incurred** by the citizens of a nation in a year, it is called the '**Expenditure Method**'. (BPSC, 2020)

- Both the income method and production method are used to calculate national income in India.

- National income is generally calculated at current and constant prices.

✎ **Note :** Income from illegal activities such as income from lottery and gambling, are not included when using the income method to calculate national income.

#### National Income at Constant Prices :

- To study the real progress of a country, **National Income** is calculated at constant prices and national income for different years is calculated relatively to a particular base year. (BPSC, 2020)

- The base year is the year against which the position of the following years is compared.

- Currently, the **base year** for calculating India's national income is **2011-12**. (UPPCS, 2015)

National Income at constant prices

$$= \frac{\text{National Income at current prices}}{\text{Price index of current year}} \times 100 \quad (\text{UPPCS, 2015})$$

### National Income at Current Prices:

- When **national income** is measured at prevailing market prices, it is defined as '**National Income**' at Current Prices.
- National income at Current Prices is also known as **Nominal National Income**. (RAS/RTS, 2021)
- The following items are not included in the calculation of the national income of any country-value of intermediate goods, the value of old goods, domestic services, financial assets such as share letters, sale of letters of credit etc, transfer payments (pension, stipend) and gifts received from abroad. (RAS/RTS, 2021)

### Important Concepts of National Income :

- National Income is a broad concept, and the following concepts are commonly used to calculate - 1. Gross Domestic Products and 2. Gross National Products. (Uttarakhand PCS, 2021)
- **Gross Domestic Product, GDP** : The total income earned from the goods and services produced by all the people (including foreigners) living in a country in a single financial year is called '**Gross Domestic Product**'.

(Uttarakhand PCS, 2021)

🔗 **Note** : It is possible to obtain the value of a country's GDP. This is possible with the unit of account of currency.

🔗 **Note** : A Steady increase in Gross Domestic Product (GDP) leads to economic growth considered as a good indicator of development.

- **Gross Domestic Product Per capita (GDP per capita)** : It is a financial metric that breaks down a country's economic output per person and is calculated by dividing the GDP of a nation by its population.

$$\text{Gross Domestic Product per Capita} = \frac{\text{Gross Domestic Product}}{\text{Population}}$$

🔗 **Note** : If GDP is calculated at base year prices or constant prices then it is called real GDP.

- **Net Domestic Product, NDP** : The Value obtained by deducting the **depreciation** of capital goods from the Gross Domestic Product is the 'Net Domestic Product'.  
Net Domestic Product = Gross Domestic Product (GDP) - Depreciation
- **Gross National Product (GNP)** : When the production of goods and services is done by the residents of the country

whether it is outside the country or within the country, it is called 'Gross National Product'.

- Gross National Product is the net income earned from abroad (Income earned by Indian national residents abroad - foreign national residents earned in India) added in Gross Domestic Product.
- **GNP** is the most comprehensive concept of all concepts of national income in Indian context.

GNP = GDP + Net Factor income earned from abroad

GDP = GNP - Net income earned from abroad

- **Net National Product (NNP)**: The Net National Product is Value that is received by reducing the depreciation of capital goods from the gross national product.

NNP = GNP - Depreciation (Chattisgarh PCS, 2010)

- **Private Income** : Private Income consists of factor incomes earned within the domestic territory and abroad by private enterprises and workers (factor owners in the private sector) and current transfer from government and the rest of the world. (UPPCS, 2013; UP Lower, 2013; CGPSC, 2015)

### Private Income =

Net Factor income derived from Net domestic Product to private sector + Interest on national debt + Factor income from abroad + Net Transfer payments received from government + Net transfer payments from the rest of the world.

- **Personal Income**: Income from all sources by individuals and family units before payment of direct taxes in a financial year is called '**Personal Income**'. For this calculation, the undistributed profits and corporation taxes of the enterprises have to be reduced from personal income. Personal income is less than private income.

Personal Income = Private Income - Undistributed Profit - Corporation Tax, or

Personal Income = Private Income - (Undistributed Profit + Corporation Tax)

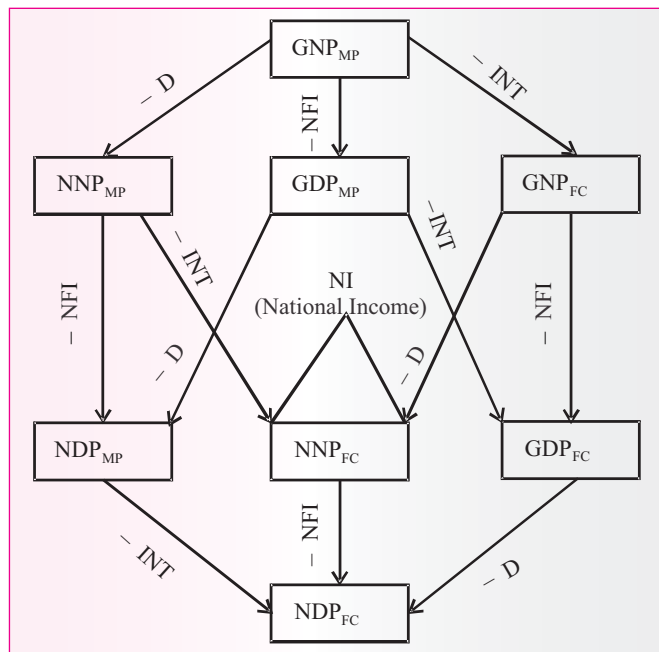
- **Disposable Income**: Disposable Income is the portion of personal income that is available for consumption for individuals. In other words, the amount received after deducting direct taxes from personal income is Disposable Income. This income is less than Personal Income.  
Disposable Income = Personal Income - Personal Direct Taxes

- **Per Capita Income**: When the national income of a country is divided by its population, the quotient that is received is called '**per capita income**'. Per capita income is less than personal disposable income. (UPPCS, 2013)

$$\text{Per Capita Income} = \frac{\text{National Income}}{\text{Population}}$$

- An increase in per capita income is considered to be the best indicator of economic development of a country or an increase in living standards of the people. (UPPCS, 2013)

### Relationship between various forms of National Product:



Where,

GNP = Gross National Product

NNP = Net National Product

GDP = Gross Domestic Product

NDP = Net Domestic Product

MP = Market Price, D = Depreciation, S = Subsidy INT = Net Indirect Tax

NFI = Net Factor Income derived from abroad

IT = Indirect Tax = INT + S, FC = Factor Cost

**Note :** As per the new announcement of CSO, basic prices are being used instead of factor cost for to estimate Gross Value Added (GVA) for calculating GDP. Net Income from abroad Figures are prepared and published by the **Reserve Bank of India (RBI)**.

- Gross Primary Deficit is equal to the difference between gross fiscal deficit and payments of inforest.

3

## Planning in India

- Economic Planning is the process of realizing of the pre-determined objective through the optimum use of natural resources.

- The beginning of the Five Year Plans in India is inspired by the planning method of the former Soviet Union.
- India has completed **12 five-year plans and 6 annual plans** in its development journey since 1951.
- The sources of planning, goals and social objectives in India are determined by the 'Directive Principles of State Policy' mentioned in part IV of the Constitution. Planning is also cited in the 'Concurrent List' of the 7th Schedule of the Constitution. (UP Lower 2002; UP UDA/LDA, 2006)
- The first discussion on economic planning in India started from **1934** when **M. Visvesvaraya** wrote a book known as '**Planned Economy for India**'. That is why Visvesvaraya is also called the '**Pioneer of modern planning in India**'. (MPPCS, 2018)
- After this, in 1938, then Congress President Subhash Chandra Bose established the **National Planning Committee** under the chairmanship of Jawaharlal Nehru. (MPPCS, 2013)
- In 1944, **Sriman Narayan Aggarwal** prepared the **Gandhian Plan** based on Gandhian principles. (UP PCS, 2015; IAS, 2016)
- In 1944-45, 8 industrialists of Mumbai (JRD Tata, Ghanshyam Das Birla, Ardeshir Dalal, Purushottam Das Thakur Das, Dr. John Mathai, Lala Shri Ram, Kasturi Bhai Lal Bhai and A.D Shroff) in India, presented a 15-year plan for the economic development of the country, known as the '**Bombay Plan/ Tata-Birla Scheme**'. (UPPCS 2015, IAS, 2016)
- The British Government also established the '**Planning and Development Department**' in 1944, headed by Sir Ardeshir Dalal. (UPPCS, 2015; IAS, 2016)
- On behalf of MN Rai and Bhartiya Shramik Sangh, a scheme called '**The People's Plan**' inspired by the Russian scheme was presented.
- In 1950, '**Sarvodaya Yojana**' was drafted by **Jayaprakash Narayan** to establish a society without exploitation. (MPPCS, 2013)
- After the independence, the 'All Indian Congress Committee' formed an 'Economic Programme Committee' in 1947 under the chairmanship of Jawaharlal Nehru. On **25<sup>th</sup> January 1948**, this committee recommended that a permanent Planning Commission should be established in the country. As a result of the recommendation, the Planning Commission was formed by a Cabinet resolution on **15<sup>th</sup> March, 1950**. First Five year plan came into existence on **1<sup>st</sup> of April, 1951** on the recommendation of Planning Commission.

(UPPCS, 2015; IAS, 2016; MPPCS, 2013)

## FIVE YEAR PLANS

| Plan                            | Objectives                                                                                                                                                                                   | Growth Rate Estimated | Growth Rate Achieved | Other Features                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| First Five Year Plan 1951-56    | Resettlement of Refugee, Development of Agriculture sector and the commencement of National Extension Service, Balanced Development Policy                                                   | 2.1%                  | 3.6%                 | Based on Harrod-Domar model, Community development policy was given top priority to achieve self-sufficiency in Food Grain Sector in minimum time, Renovation of small and cottage industries.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Second Five Year Plan (1956-61) | With the development of primary and heavy industries, the emphasis on rapid industrialization, an increase of 25% in national income, large scale employment generation, etc.                | 4.50%                 | 4.3%                 | Based on <b>P.C. Mahalanobis</b> Four regional <b>models</b> , Setting up of Steel Plants at Rourkela (Odisha), Bhilai (Chhattisgarh) and Durgapur (West Bengal)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Third Five Year Plan (1961-66)  | Making the economy self-reliant and self-sustaining, more emphasis on agriculture, increase in national income by 5% per annum, etc.                                                         | 5.6%                  | 2.8%                 | Based on Four Sector Models of Mahalanobis, J. Sandy's Demonstration Model and <b>Sukhmay Charaborty's input-output Model</b> , to achieve self-sufficiency in Food Grain Sector, <b>Causes of failure</b> : Drought of (1965-66), and Indo-China War (1962) Indo-Pak war (1965). <b>NOTE:</b> Between 1966-1969, <b>Three Annual Plans</b> were made, it is called <b>Plan Holiday</b> .                                                                                                                                                                                                                                                                                                                                                      |
| Fourth Five Year Plan (1969-74) | Economic growth and self-sufficiency, stability Reduction in regional inequality, emphasis on balanced development, promotion of industrialization and special emphasis on heavy industries. | 5.7%                  | 3.3%                 | Based on Gadgil Plan and Leontief input-output model, Nationalisation of 14 Banks, MRTP Act, 1969, concept of Buffer stock was introduced.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Fifth Five Year Plan (1974-79)  | Achieving Poverty Elimination and Economic Self-sufficiency                                                                                                                                  | 4.4%                  | 4.8%                 | Slogan of 'Garibi Hatao', Minimum Needs programme started, Food For Work (1977) program started. <b>Note:</b> Fifth Five Year Plan was completed <b>one year before</b> in 1978.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Sixth Five Year Plan (1980-85)  | Direct attack on the problem of poverty by moderization and expansion of the economy, self-reliance and social justice, etc.                                                                 | 5.2%                  | 5.7%                 | Based on input-output Model, with pecial emphasis on poverty elimination and employment creation, schemes related to elimination of rural unemployment such as IRDP, NREP, TRYSEM, DWACRA, RLEGP, etc was implemented. Five year plan was made keeping in mind the 15 years period. For this reason, it is also known as 'perspective planning'. The goal of modernisation of economy is included first time in this plan. <b>NOTE :</b> Sixth Five Year Plan was implemented twice. First time by Janta Party Government for the period of 1978-83, and second time by the Congress Government for the period of 1980-85. The plan was named 'Rolling plan' during 1978-80. The credit for <b>Rolling plan</b> goes to <b>Gunnar Myrdal</b> . |



|                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                       |      |      |                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Seventh Five Year Plan (1985 - 90)                                                                                                                                                               | Emphasis on modernisation, self-reliance and social justice                                                                                                                                                                                                           | 5.0% | 6.0% | Long-term development method and liberalization model, Indira Awas Yojana, Jawahar Rozgar Yojana and Nehru Rozgar Yojana were started. Emphasis on energy conservation and development of non-conventional energy sources. <b>Note : Two annual Plan</b> were run from 1 <sup>st</sup> April 1990 to 31 <sup>st</sup> March 1992.                                                                                |
| Eighth Five Year Plan (1992-97)                                                                                                                                                                  | Human resource development, full employment generation by the end of the century, control on Population Growth, to promote social welfare measures like improved healthcare, sanitation, communication and provision for extensive education facilities at all levels | 5.6% | 6.8% | Based on the John W. Miller model <b>Universalization of primary education</b> , eradication of illiteracy in the age group of 15-35 years.                                                                                                                                                                                                                                                                      |
| Ninth Five Year Plan (1997-002)                                                                                                                                                                  | To sustain quality of life, generation of productive employment to maintain regional balance and self reliance                                                                                                                                                        | 6.5% | 5.4% | The scheme emphasised seven basic minimum services including primary education for all, home for the homeless, nutritious food for children, roads for all villages and hamlets, improving public distribution system for the poor, etc. A policy of fiscal consolidation was implemented. The Ninth Five Year Plan reduced the tendency to focus on the public sector, and the Indicative Planning was started. |
| Tenth Five Year Plan (2002-07)                                                                                                                                                                   | To promote inclusive growth and equitable development                                                                                                                                                                                                                 | 8.1% | 7.6% | It emphasised reducing the gender gaps in the field of education and wage rates by 2007.                                                                                                                                                                                                                                                                                                                         |
| Eleventh Five year Plan (2007 - 12)                                                                                                                                                              | To increase enrolment in higher education and focused on distant education. Rapid and more inclusive growth.                                                                                                                                                          | 9.0% | 8.0% | 26 indicators were formed for measuring the performance of works related to poverty, health education, women and child development in the 11 <sup>th</sup> Plan.                                                                                                                                                                                                                                                 |
| Twelfth Five year (2012-17) Plan                                                                                                                                                                 | Faster, more inclusive and sustainable growth                                                                                                                                                                                                                         | 8.0% | —    | <b>Targets –</b> <ul style="list-style-type: none"> <li>● 8% growth rates of real DGP.</li> <li>● 4.0% growth rate of agriculture.</li> </ul>                                                                                                                                                                                                                                                                    |
|                                                                                                                                                                                                  | The Plan aimed at strengthening infrastructure projects and providing electricity supply in All Villages.                                                                                                                                                             |      |      | <ul style="list-style-type: none"> <li>● Manufacturing growth rate of 10.0 percent.</li> <li>● Head Count ratio of consumption poverty to be reduced by 10 percent points.</li> <li>● Creation of 50 million Jobs in non agriculture sector during the plan.</li> </ul>                                                                                                                                          |
| <b>Note :</b> Target for first three plans was in reference to National Income. Fourth Plan was in reference to Net Domestic Product. After that for all other plan, it was in reference to GDP. |                                                                                                                                                                                                                                                                       |      |      |                                                                                                                                                                                                                                                                                                                                                                                                                  |

## Planning Commission

- On 15<sup>th</sup> March, 1950, the Government of India constituted the 'Planning Commission' on the recommendation of the Niyogi Committee, whose first chairman and vice-chairman are Jawaharlal Nehru and **Gulzari Lal Nanda** respectively. (UPPCS, 1999; UK UDA, 2003; UPPCS, 2003)
- The objective of this commission was to improve the standard of living of the people by increasing production

through efficient use of resources and providing employment opportunities to the people.

- Planning Commission held the highest position in the Indian planning system. Its task was to formulate Plan and evaluate its progress.
- The **Chairman (ex-officio)** of the Planning Commission was the **Prime Minister** and it had a **Deputy Chairman**. The Deputy Chairman of the Commission was at par level

- of a Cabinet Minister who was appointed by the President (for 5 years) on the advice of the Prime Minister. (RAS, 1994)
- The Vice-President was responsible to the Union Cabinet and Parliament for its functions.
- The Planning Commission has no mention in the Indian Constitution. As a result, it was a **non-constitutional and advisory body**. It headquartered in **New Delhi**.
- Currently, the Planning Commission has been replaced by NITI Aayog. (UPPCS, 2020)

#### **National Development Council (NDC) :**

- On the recommendation of the '**Niyogi Committee**', the 'National Development Council' was formed on 6<sup>th</sup> August, 1952, with the main objective to create an atmosphere of cooperation between the States and the Planning Commission for economic planning. (UPPCS, 2004, 08; IAS, 2016; UPPCS, 2001; 03; 08; 14; 16)
- It was a high-level institution of policy-making related to the planning of the country, whose task was to study the Plan prepared by the Planning Commission and give final approval after deliberation. The **Prime Minister** of the country was its Chairman, the Secretary of the Planning Commission as its Secretary and among the members were all the **Union Ministers, Chief Ministers / Administrators of all the States and Union Territories and all the members of the Planning Commission were ex-officio members of this Council**. (IAS, 2013; BPSC, 2022)
- Like the Planning Commission, the NDC was also a non-constitutional body i.e. an advisory body. It was referred to as the '**Super Cabinet**' because its (NDC) membership was wide and its views could not be rejected by the Planning Commission and the Union Cabinet. (RAS, 1992)

#### **NITI Aayog: (National Institution for Transforming India) :**

(UPPCS, 2020, 2019)

- Establishment of National Institution for Transforming India in its new form (NITI Aayog) by a government resolution was made on **1<sup>st</sup> January 2015**. NITI Aayog takes the place of Planning Commission that was established on **15<sup>th</sup> March 1950** through a resolution.
- The NITI Aayog acts as a think tank to advise the Government of India on policy issues, following the principles of cooperative federalism.
- NITI Aayog is more inclusive than Planning Commission.

#### **Constitution of NITI Aayog :**

- By the resolution of **1<sup>st</sup> January 2015**, followed by the amendment of 16<sup>th</sup> February 2015, there is a provision for the formation of NITI Aayog in the following ways:
- Chairman :** Prime Minister of India.
  - Governing Council of NITI Aayog :** Chief Ministers of all the States and Union Territories with Legislatures and Lieutenant Governors (LGs) of other Union Territories.

- Special Invited Members :** Skilled, experts and working persons having knowledge of the relevant field.
- In full-time organisational structure besides the Prime Minister as Chairman, the following will be -
  - Vice-Chairman :** appointed by the Prime Minister.
  - Members :** Full-time
  - Part-time Members :** A maximum of two ex-officio members will be elected from leading universities, research institutes and other affiliated institutions. Part-time members will be appointed on a cyclical basis.
  - Ex-officio Members :** Maximum four members nominated by the Prime Minister from the Union Council of Ministers.
  - Secretariat as per requirement.**
  - Regional councils will be formed to address specific issues and contingencies impacting more than one state or a region. These will be formed for a specific tenure. The **Prime Minister** will be the convenor of the regional councils and the Chief Minister of all the states of that region and the Lieutenant Governor of the Union Territory will be its members. The Chairman of NITI Aayog or their nominee will be its Chairman.
- Chief Executive Officer:** A chief executive officer will be appointed by the prime minister for a fixed tenure, in the rank of secretary in the central government, while there will be a secretary as deemed necessary.

#### **Present Structure of NITI Aayog**

**Chairman: Narendra Modi**, Prime Minister of India.

**Vice-Chairman : Suman Bery** (Cabinet Minister Status). (UPPCS, 2018, 2017, 2020; BPSC, 2018)

**Chief Executive Officer:** B.V.R. Subrahmanyam

#### **Full-time members.**

(a) **Prof. Ramesh Chand** (Minister of State level status)

(b) **Dr. V.K. Saraswat** (Minister of State level status)

(c) **Dr. V.K. Paul**

(d) **Dr. Arvind Virmani**

#### **Comparison with Planning Commission:**

- NITI Aayog is considered more cooperative and inclusive than the **Planning Commission**.
- The Planning Commission was working on the principle of Top-down Approach to planning whereas the Bottom-up Approach has been adopted by **NITI Aayog**.
- The Planning Commission was originally an institution of the Central Government, with no representation of the States. In contrast, **NITI Aayog** is based on the principle of

**Cooperative Federalism.** It has representation from both the Centre and the State.

➤ **Note :** Cooperative Federalism implies the centre and states share a horizontal relationship, where they "cooperate" in the larger public interest. It's visualised as an important tool to enable states participation in the formulation and implementation of national policies.

- Due to the representation of the states, NITI Aayog is also capable of accomplishing the functions of the National Development Council.
- NITI Aayog also has a provision for the constitution of the Regional Council, in which the **Chief Minister / Lt. Governor of the concerned States / Union Territories** will be its members in the context of specific regional issues which makes it more specific in terms of cooperative federalism.
- While the Planning Commission used to determine the goals and strategy of economic growth rate, the NITI Aayog will decide the national development strategy in consultation with the states.
- The structure of the **NITI** Aayog is more efficient and practical.
- While the advisory and supervisory functions of the Planning Commission have been retained in the NITI Aayog, but it has not been given the executive work of preparing the plan and allocation of funds for the schemes supported by the Commission. Thus, it is a policy setting and advisory institute, not an executive institution.

4

## Poverty in India

- Poverty refers to the situation when a person does not have the most basic necessities of life such as food, clothing and housing. When a person is not in a position to fulfil his basic needs, he is counted as poor. (UPPCS, 2017)
- The first global poverty estimate concerning developing countries is found '**World Development Report**' in 1990.
- The World Development Report defines poverty as the inability to achieve the lowest standard of living. That is, when even the lowest standard of living could not be attained, that condition is called 'Poverty'. (UPPCS, 2017)
- In principle, two measure poverty-Relative and Absolute are used.

**A. Relative Poverty :** Relative Poverty explains the extent of disparity between different income groups. Two methods are commonly used to measure it - **1. Lorenz Curve, 2. Gini Coefficient.** (UPPCS, 2018)

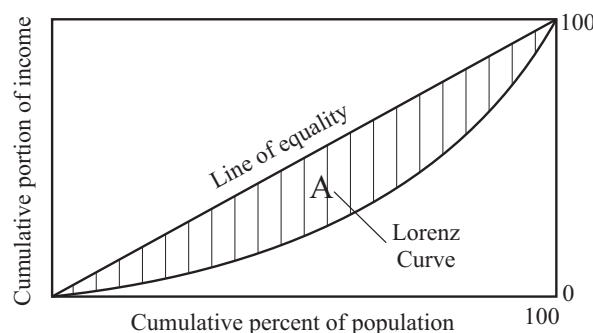
- Both the Lorenz Curve and the Gini Coefficient are related to the measurement of **inequality of income.**

- The Lorenz Curve was developed in 1905 by **Max O Lorenz**, and the Gini coefficient was developed in 1912 by **Corrado Gini** (Italy).

### 1. Lorenz Curve :

- The Lorenz Curve is the diagrammatic representation of income distribution of individuals. Under this, a curve is made between the recipients of income and the cumulative percentage of total income earned by them. The closer the Lorenz curve to the absolute parity line (when the income distribution is equal), the lower the skewness of income.

(Chhattisgarh PCS, 2018)



### 2. Gini Coefficient (G):

- The Gini Coefficient is the most prevalent method of measurement of inequality in the distribution of income. It is the ratio between the Lorenz curve and the area below the full parity line and the total area under the full parity line. The maximum value of the Gini coefficient is 1.

(UPPCS, 2018)

- Nobel Prize awarded economist Prof. Amartya Sen has developed an inequality-adjusted per capita income concept to measure the level of economic well-being by combining the level of income and its distribution dimension.

(IAS, 2019; UPPCS, 2009)

### B. Absolute Poverty :

- The minimum requirement criteria is used to estimate the actual number of the poor. That is, a person who does not meet the minimum requirements is called the poor.
- This set minimum consumption criteria is called '**Poverty Line**'.
- Absolute paradigm is used to measure poverty in India.

### Major Efforts to Determine Poverty in India:

- The concept of measurement of poverty was first introduced in **Dada Bhai Naoroji's** book '**Poverty and Un-British Rule in India**'.
- Major economists related to the measurement of poverty in India are - Dandekar and Rath, B.S.Minhas, P.D.Ojha, Pranab Vardhan, S.P.Gupta, Suresh Tendulkar, C.Rangarajan, etc.
- The first official attempt to determine the poverty line in India was made by the Planning Commission in July 1962.

- In 1977, the working group set up by the Planning Commission, considering the year 1973-74 as the base year, first determined poverty on the basis of minimum calorie intake per day. (UPPCS, 2020)
- According to this, a person from rural area who is unable to get 2,400 calories per day and a person from urban area who is unable to get 2,100 calories of food per day is poor. (UP Lower, 2008; MPPCS, 2006)
- For the **measurement of poverty** in the country by the Planning Commission in 1989, a committee was formed under the chairmanship of **Prof. D.T. Lakdawala**. (RAS, 2016)
- This Committee determined poverty based on the price level of each state. This committee recommended different poverty lines for each state.
- The committee set different price indices for rural and urban poverty.
- Lakdawala Committee suggested the Consumer Price Index for Agricultural Workers for Rural Area and Consumer Price Index for Industrial Workers in Urban Area and Consumer Price Index for other workers.
- Later on, the Planning Commission in India constituted a Committee headed by **Suresh Tendulkar** that submitted its report in 2009. (UPPCS, 2019; 21)
- Tendulkar committee took broad concepts for estimation of poverty.
- He decided the poverty line on the basis of six basic needs in addition to expenditure in consumption, education, health, infrastructure, clean environment and women's access to work and benefits.
- Using this method, 21.9 per cent of the population in India was found below the poverty line in 2011-12.
- **25.7 per cent in rural areas, while 13.7 per cent** of the population in urban areas were found below the poverty line.
- In 2012, the Planning Commission appointed a Committee formed under the chairmanship of Rangarajan for poverty determination. This committee submitted its report in 2014.
- **Rangarajan Committee** Considered expenditure below Rs. 972 per person per month for rural areas and Rs. 1407 per person per month for urban area as the poverty line. (Chhattisgarh PCS, 2016)

### **Multi Dimensional Poverty Index (MPI) :**

- According to UNDP, status of poverty of a person can not be measured only with his income.
- Measurement of other dimensions such as education, health and others are also important for comprehensive measurement of poverty. (IAS, 2010; 12 UPPCS, 2010; 20)
- Keeping this in mind, Since 2010 onwards Human Development Report started publishing Multidimensional Poverty Index (MPI) in place of Human Poverty Index (HPI), was published since 1997.
- Developed by Oxford Poverty and Human Development Initiative (OPHI) with assistance from UNDP, this index, in reference to three dimensions of HDI (education, health and standard of life), is based on 10 indicators of deprivations.
- These 10 indicators are :
  - Education – (i) Years of schooling (ii) School attendance (each indicator's weightage - 1/6<sup>th</sup>).
  - Health – (iii) Child mortality (iv) Nutrition (each indicator's weightage - 1/6<sup>th</sup>).
  - Standard of living – (v) Electricity (vi) Sanitation (vii) Drinking water (viii) Housing (ix) Cooking fuel (x) Assets (each indicator's weightage – 1/18<sup>th</sup>)

### **Global Multi Dimensional Poverty Index, 2023 :**

- On **11<sup>st</sup> of July, 2023**, Global Multidimensional Poverty Index (MPI), was released by the **United Nations Development Programme (UNDP) and the Oxford Poverty and Human Development Initiative (OPHI)**.
- As per the Global Multidimensional Poverty Index (MPI), 415 million people were lifted out of poverty in India within a 15-year span (**2005-2006 to 2019-2021**).
- According to this report, 25 countries, including India, successfully halved their global MPI values within 15 years, showing that rapid progress is attainable. These countries include Cambodia, China, Congo, Honduras, India, Indonesia, Morocco, Serbia, and Vietnam.
- In 2005/2006, about **645 million** people were in multidimensional poverty in India, with this number declining to about 370 million in **2015/2016** and **230 million in 2019/2021**.
- The report noted that deprivation in all indicators declined in India and “the poorest States and groups, including children and people in disadvantaged caste groups, had the fastest absolute progress.” According to the report, people who are multidimensionally poor and deprived under the nutrition indicator in India declined from 44.3% in **2005/2006 to 11.8% in 2019/2021**, and child mortality fell from **4.5% to 1.5%**.
- In the drinking water indicator, the percentage of people who are multidimensionally poor and deprived fell from 16.4 to 2.7 during the period, electricity (**from 29% to 2.1%**) and housing from **44.9% to 13.6%**.
- According to the 2023 release, **1.1 billion out of 6.1 billion** people (**just more than 18%**) live in acute multidimensional poverty across 110 countries. Sub-Saharan Africa (**534 million**) and South Asia (**389 million**) are home to approximately five out of every six poor people.
- Nearly two-thirds of all poor people (**730 million people**) live in middle-income countries, making action in these countries vital for reducing global poverty. Although low-



income countries constitute only 10% of the population included in the **MPI**, these are where 35% of all poor people reside.

- Children under the age of 18 account for half of MPI-poor people (**566 million**). The poverty rate among children is **27.7%**, while among adults, it is **13.4%**. Poverty predominantly affects rural areas, with **84%** of all poor people living in rural areas. Rural areas are poorer than urban areas across all regions of the world.
- **Cambodia, Peru, and Nigeria** showed significant reductions in their most recent periods, offering hope that progress is still possible. In Cambodia, the most encouraging case among these, the incidence of poverty fell from **36.7% to 16.6%**, and the number of poor people halved, from **5.6 million to 2.8 million**, all within **7.5 years**, including the pandemic years (**2014–2021/22**).

#### What is a Multidimensional Poverty Index?

Multidimensional poverty measures allow us to see how many households are experiencing deprivations at the same time. At a glance the measure shows an integrated picture of the situation. The MPI can also be used to examine whole populations, sub-groups or specific deprivations to see the impact of poverty on different communities. The multidimensional measurement is rigorous, easy to use, flexible, and adapts well to different contexts.

### Poverty Prevention and Welfare Schemes

#### National Food Security Act, 2013 :

- The **National Food Security Act, 2013** was passed by the government which aims to provide adequate food grains to every citizen of the country, so that they get food and nutritional security and can live a dignified life.  
(UPPCS, 2019; IAS 2018)
- Under this Act, **75 per cent** of the rural population and **50 per cent** of the urban population, that is, about two-thirds (**67 per cent**) of the population, have been given the legal right to food.
- Under the Act, eligible families will be given food grains at subsidized prices through the **Public Distribution System**. Rs 3 , Rs. 2 and Rs. 1 per kg of rice, wheat and coarse grains of 5 kgs each will be provided per person per month, respectively.
- The Act provides for the nomination of women of the age of 18 years or above as the head for the issuing ration cards to their names, and if not, there is a provision to nominate the eldest male member of the family as the head.
- **National food security Act (2013)** provides for reforms in the TPPS including scheme such as cash transfer for provisioning of food entitlement.

- In pursuance of enabling provisions under section 12 of **NFSA** for cash transfer, Govt. notified '**Cash Transfer of food subsidy Rule 2015**' in August, 2015.
- Under **Section 39(1) of NFSA**, the central Government may, in consultation with the state Governments and by notification, make rules to carry out the provisions of the Act.
- Under this Act, Pregnant women and lactating mothers are further entitled to receive cash maternity benefit of not less than **Rs. 6000** to partly, compensate for the wage loss during the period of pregnancy and also to supplement nutrition.  
(IAS, 2018)
- Currently, this Act is being implemented in all the States/ Union Territories and out of the targeted coverage of 81.35 crore persons, 80.72 crore persons are being covered.

#### Antyodaya Anna Yojana :

- This scheme started on **25<sup>th</sup> December, 2000**. 1 crore poorest families were targeted for providing subsidized food grains.
- It is noteworthy that at the beginning of Antyodaya Anna Yojana the family was allocated 25 kg of food grains per month, but with effect from **1 April 2002**, it has been increased to **35 kg per month per family**.
- Currently, under this scheme, 2.5 crore poor families in India get 35 kg of grains per month. The grain is being made available at concessional rates (**rice, wheat and coarse grains at Rs. 3, Rs. 2 and Rs. 1 per kg respectively**).
- It is noteworthy that on 3 June, 2009, the norms were revised to identify families under the Antyodaya Anna Yojana. Currently, **HIV** positive individuals from all **BPL** families are also included.

#### Poverty in India (2011-12)

Comparative Status of Tendulkar Method and Rangarajan Method in India

| Indicators                                          |                   | Tendulkar Method          | Rangarajan Method          |
|-----------------------------------------------------|-------------------|---------------------------|----------------------------|
| 1. Poverty in India                                 | Gross Rural Urban | 21.9<br>25.7<br>13.7      | 29.5<br>30.9<br>26.4       |
| 2. Numbers of poor (in lakhs)                       | Gross Rural Urban | 2697.8<br>2166.6<br>531.2 | 3629.9<br>2605.2<br>1024.7 |
| 3. Poverty line in India (Rs. per person per month) | Rural Urban       | 816<br>1000               | 972<br>1407                |
| 4. Poverty line in India (Rs. per person per month) | Rural Urban       | 27.20<br>33.33            | 32.40<br>46.90             |

### National Food Security Mission :

- The National Development Council, in its 53<sup>rd</sup> meeting held on 29 May 2007, had passed a resolution to launch the Food Safety Mission under which the National Food Security Mission - NFSM, Started in **October 2007**.
- The main objective of this scheme is to increase the production of wheat, rice, coarse grains and pulses and commercial crops to ensure food security in the nation.  
(UPPCS, 2008; 10; 13; 15; 19)
- Increasing the fertility and productivity of the land at the private farm level, increasing the confidence of the farmers and increasing the profit at the farm level was also its main objective.
- Under this mission, 25 million tonnes of additional food grains (10 million tonnes of rice, 8 million tonnes of wheat, 4 million tonnes of pulses and 3 million tonnes of coarse grains) was targeted to be produced during the 12<sup>th</sup> Five Year Plan period.

### Pradhan Mantri Kisan Sampada Yojana :

- In May 2017, the Centre Sponsored Scheme sampada (SAMPADA : Scheme for Agro-Marine Processing and Development of Agro-Processing clusters) was approved. This scheme was renamed as 'Kisan Sampada' Yojana on 26<sup>th</sup> May 2017. Currently, the scheme is being known as 'Pradhan Mantri Kisan Sampada Yojana (PMKSY)'.  
(UPPCS, 2019; IAS, 2018)
- The Ministry of Food Processing Industries implements the scheme.
- Pradhan Mantri Kisan Sampada Yojana is a comprehensive package that will create modern infrastructure with efficient supply chain management from farms to retail outlets.
- This will not only accelerate the growth of the food processing sector in the country, but it will provide better prices to farmers and double the income of farmers, especially in rural areas, creating substantial employment opportunities in the wastage of agricultural produce. **There will be a significant step towards reduction, processing and increasing the level of export of processed foods.**
- The following schemes will be implemented under Pradhan Mantri Kisan Sampada Yojana - Mega Food Park, cold chain, expansion of food processing and preservation capabilities, agro-processing cluster infrastructure, creation of backward and forward links, food safety and quality assurance infrastructure and human resources and institutions.
- In February, 2022 PMKSY scheme has been extended till March, 2026 with an allocation of Rs. 4600 crore.
- In Budget of 2024-25, 729 Crore Rs. is allocated for this scheme.

### Schemes Related to Poverty Alleviation and Unemployment

| Scheme                                     | Launch Year |
|--------------------------------------------|-------------|
| National Rural Employment Guarantee Scheme | 2006        |
| Bharat Nirman Program                      | 2005        |
| Antyodaya Anna Yojana                      | 2000        |
| Janashree Bima Yojana                      | 2000        |
| Pradhan Mantri Gramodaya Yojana            | 2000        |
| Annapurna Yojana                           | 2000        |
| Jawahar Gram Samridhi Yojana               | 1999        |
| Swarnjayanti Gram Swarozgar Yojana         | 1999        |
| Swarnjayanti Urban Employment Scheme       | 1997        |
| Employment Assurance Yojana                | 1993        |
| Pradhan Mantri Rozgar Yojana               | 1993        |
| Indira Awaas Yojana                        | 1985        |
| Jawahar Rozgar Yojana                      | 1989        |
| DWCRA                                      | 1982        |
| TRYSEM                                     | 1979        |

### Mahatma Gandhi National Rural Employment Guarantee Scheme (MNREGA) :

- After the President's approval on 5 September 2005, The National Rural Employment Guarantee Scheme (NREGA) was launched on 2 February, 2006 from Anantapur district of Andhra Pradesh in 200 selected districts of the country. It was expanded to 130 additional districts in 2007-08. It was expanded the whole country on **1<sup>st</sup> April 2008**, except Jammu and Kashmir.  
(MPPCS, 2008)
- On 2<sup>nd</sup> October, 2009 it was renamed from NREGA to **Mahatma Gandhi National Rural Employment Guarantee Scheme** (MNREGA).
- The goal of MNREGA is to provide a minimum of 100 days of unskilled employment to one adult member of each rural family.
- The guarantee of providing employment becomes effective **within 15 days** from the date of receipt of an application for employment under the Act.
- In the event of not providing employment within 15 days from the date of demand, the State (as per the Act) has to pay unemployment allowance to that beneficiary.
- The work is provided within the **circumference of 5 km**.
- In the event of the employment being provided beyond a distance of more than 5 km, 10 per cent extra salary is paid to meet additional transport and living expenses.

(UPPCS, 2008)

- At least **one-third** of the **women beneficiaries** are kept under this scheme.
- The Government of India notifies its wage rate state-wise and it is determined according to the inflation as determined by the Consumer Price Index. **(UPPCS, 2008)**
- The government of India bears 100 per cent of the cost of unskilled manual labour, 75 per cent of the cost of material, 75 per cent of the salary of skilled and semi-skilled workers and 6 per cent of the total administrative expenditure. State Governments bear the remaining expenditure.
- In this Act, it has been mandated that the ratio of expenditure to material expenditure should be 60:40 in the total cost of work done from a Gram Panchayat.
- Workplace facilities like infant home, drinking water and shed should be provided at all workplaces.
- It is noteworthy that Rs.86,000 crore has been allocated for MNREGA for the financial year 2024-25.
- DAY-NULM is being implemented by the Ministry of Housing and Urban Poverty Alleviation.
- DAY-NULM aims to remove the poverty and vulnerability of urban poor families by encouraging them for the opportunity of self-employment and skill-based employment in cities so that they can lead a prosperous and respectable life.
- **DAY-NULM** was implemented in all the district headquarters cities (regardless of population) and all other cities with a population of 1 lakh or more on the basis of 2011 census in the 12<sup>th</sup> Five Year Plan, but now its expansion to all cities has been done.
- Financing of DAY-NULM will be shared between the Centre and the States in the ratio of 60:40. For North-Eastern States and special category states, this ratio will be 90:10. **(BPSC, 2015; UPPCS, 2018)**

#### **Deendayal Antyodaya Yojana (Rural) :**

- Swarna Jayanti Gram Swarozgar Yojana (SGSY) is being implemented since 1999 to promote self-employment oriented and income-generating activities for the BPL families living in the rural areas of the country.
- The Swarna Jayanti Gram Swarozgar Yojana was formalized on **3<sup>rd</sup> June, 2011** by restructuring it as a '**National Rural Livelihood Mission**'. From November 2015, the scheme has been renamed **Deendayal Antyodaya Yojana - National Rural Livelihood Mission (DAY-NRLM)**.
- DAY-NRLM aims to provide gainful self-employment and skilled wage employment opportunities to poor families to reduce poverty which will lead to continuous improvement in the livelihood of villagers.
- DAY- NRLM, total individual beneficiaries will include 50 per cent SC / ST, 15 per cent minority and 3 per cent physically disabled people.
- DAY-NRLM is a centre sponsored scheme. The program is funded by the Centre and States in the ratio of 75: 25 (including Sikkim and North-Eastern states the ratio will be 90 : 10 and fully sponsored by the centre for the Union Territories).

#### **Deendayal Antyodaya Yojana (Urban) :**

- The National Urban Livelihood Mission (NULM) was launched on **23 September, 2013** in place of the Swarna Jayanti Shahari Rozgar Yojana with the strategy of self-employment and skill development. **(UPPCS, 2017; 19)**
- Currently, the name of NULM has been changed into Deendayal Antyodaya Yojana-National Urban Livelihood Mission (DAY- NULM), extending to all urban poor.

#### **Start-up India :**

- On **15 August 2015**, the Prime Minister announced a very ambitious scheme 'Start-up' to provide employment opportunities to the youth of the country through incentives for self-employment and setting up of new enterprises. It was launched on **16 January, 2016** by Prime Minister, Narendra Modi. **(UPPCS, 2016; 17)**
- 'Start-up India Campaign' has been named '**Deen Dayal Upadhyay Self Employment Scheme**' for rural areas in India.
- The scheme has two major goals :
  1. Start-ups expand beyond the digital / technology sector to broad areas such as agriculture, manufacturing, social sector, health, education, etc.
  2. Focus on presenting Tier-1 to Tier-2 and Tier-3 cities. This scheme also includes sub-urban and rural areas.
  3. As of August 2024, 137332 Start-ups have been operational all over the country.

**(IAS, 2016; UP RO/ARO 2021; Jharkhand 2016)**

#### **Stand-up India :**

- To promote entrepreneurship in the country and create employment on a large scale, on **15 August 2015**, Prime Minister Narendra Modi had launched an epoch-making scheme Stand-up India Scheme.
- Stand-up India Scheme was inaugurated on **5 April, 2016** on the birth anniversary of Babu Jagjivan Ram and **125<sup>th</sup>** birth anniversary Baba Saheb Dr. Bhim Rao Ambedkar by **Prime Minister Narendra Modi from Noida**.
- The three major objectives of the scheme are :
  - (i) To facilitate the access to institutional credit structure by SC / ST and women entrepreneurs who were hitherto deemed unfit for it.

- (ii) To make these classes also partners in the economic growth of the country.
- (iii) To benefit about 2.5 lakh loan seekers through the scheme via 1.25 lakh bank branches located all over the country.
- The goal of the Stand-up India scheme is to have at least one application from each branch of all commercial banks of the country. Rs. 10 lakh to 1 crore loan to be provided to at least one SC/ST and a woman loanee for any new venture.
- Refinance will be provided by SIDBI for implementation of this scheme.

#### **National Skill Development and Entrepreneurship Policy, 2015 :**

- The Union Cabinet chaired by Prime Minister, Narendra Modi approved India's first integrated National Skill Development and Entrepreneurship Policy on **1 July 2015**.
  - On **15 July, 2015**, the Prime Minister had launched the National Skill Development Mission in New Delhi, released the National Skill Development and Entrepreneurship Policy, 2015 and unveiled the logo of Skill India.
- (IAS, 2017)
- The main objective of this policy is to empower youth and employees and increase their productivity.

#### **Pradhan Mantri Kaushal Vikas Yojana :**

- The Union Cabinet chaired by the Prime Minister approved the 'Pradhan Mantri Kaushal Vikas Yojana' worth Rs 1500 crore on 20 March, 2015 and it was launched on **15 July, 2015**.
- The main objective of this scheme is to train 40 crore people in different skills by 2022.
- The scheme is being implemented by the National Skill Development Corporation under the Ministry of Skill Development and Entrepreneurship.

#### **Phase wise target and beneficiaries (in Lakh)**

| Phase               | Target | Trained |
|---------------------|--------|---------|
| PMKVY 1.0 (2015-16) | 24.0   | 19.86   |
| PMKVY 2.0 (2016-20) | 100.0  | 109.98  |
| PMKVY 3.0 (2020-22) | 8.0    | 4.45    |

- In the Union budget 2023-24, the Finance Minister announced that Pradhan Mantri Kaushal Vikash Yojana 4.0 will be launched to skill lakhs of Youth within next three years.
- The scheme will emphasize on-Job training, industry partnership and alignment of courses with need of industry.
- Scheme will also cover new age courses for Industry 4.0 like coding, AI, robotics, mechatronics, IoT, 3D Printing, Drones and Soft skills.

#### **Pradhan Mantri Suraksha Bima Yojana :**

- Pradhan Mantri Suraksha Bima Yojana is an accident insurance scheme supported by the Government of India which was announced by the then Finance Minister Arun Jaitley in the Annual Budget 2015-16. (UPPCS, 2015)
- It has been launched by Prime Minister, Narendra Modi on **9 May, 2015**, from Kolkata for the people who do not have any life insurance policy.
- This scheme has been linked to Pradhan Mantri Jan-Dhan Yojana.
- The duration of the scheme is one year, which falls from **1<sup>st</sup> June to 31<sup>st</sup> May**. It can be renewed every year.
- All savings bank account holders aged 18–70 years are eligible to join this scheme.
- Aadhaar Card and **KYC** will be compulsory for Bank Account.
- Each beneficiary has to pay a premium of Rs 12 (from **1 June 2022, Rs. 20**) per year.
- Rs 2 lakh will be provided on accidental death or total disability, while in case of partial disability, the beneficiary will receive **Rs 1 lakh**.

#### **Pradhan Mantri Jeevan Jyoti Bima Yojana :**

- Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY) is a life insurance policy that can be renewed on annual basis or for a longer period.
- In case of the death of the insured person, the next eligible beneficiary is provided with a death benefit including a death coverage of **Rs. 2,00,000**.
- The scheme was launched on **9 May, 2015** by Prime Minister, Narendra Modi.
- The objective of Pradhan Mantri Jeevan Jyoti Bima Yojana is to promote life insurance as well as financial assistance to the family of the policy holder.
- Pradhan Mantri Jeevan Jyoti Bima Yojana is made available to persons in the age group of 18-50 years.
- To get benefitted from Pradhan Mantri Jeevan Jyoti Bima Yojana, there should be a bank account of the beneficiary.
- If a person has more than one savings account in the same bank or other banks, he can join this scheme with only one account.
- Under Pradhan Mantri Jeevan Jyoti Bima Yojana, the beneficiary will have to pay Rs 330 (from **1 June, 2022 Rs. 436**) annually.
- This amount will be deducted annually from the bank account of the beneficiary.
- This amount will be deducted from the same bank where this insurance policy will start.
- Risk coverage under Pradhan Mantri **Jeevan Jyoti Bima Yojana** is **Rs 2 lakh**.



- The policy will end on the completion of the policyholder's age of 55 years.

#### **National Health Insurance Scheme :**

- The National Health Insurance Scheme was launched by the **Ministry of Labour and Employment**, Government of India from 1<sup>st</sup> April, 2008, to provide health insurance cover to families living below the poverty line.
- It is being implemented by the **Ministry of Health and Family Welfare** from 1<sup>st</sup> April, 2015.

(IAS, 2009; UPPCS, 2017)

- The National Health Insurance Scheme has two major objectives -
  - (i) To provide protection from financial liabilities arising out of health injuries.
  - (ii) To meet the hospital expenditures of the families below the poverty line and other weaker sections of the unorganized sector and improve their access to quality healthcare.
- Unorganized sector workers who belong to the **BPL** category, their family members (**family of five members**) are eligible for the benefits under the scheme.

(IAS, 2000; UPPCS, 2017)

- National Health Insurance Scheme is sponsored by the Central Government. (IAS 2009; UPPCS, 2017)
- **75 per cent** of the annual premium of Rs 750 is paid by the Central Government, while 25 per cent is paid by the State Government. In the context of the North Eastern States and Jammu and Kashmir, this ratio is 90 : 10.
- (IAS, 2009; UPPCS, 2017)
- The total sum assured on a family is Rs 30,000 per year.
- There is a provision of cashless treatment for all the diseases involved.

#### **Atal Pension Yojana (APY) :**

- Atal Pension Yojana (APY) is a very ambitious social security scheme for the unorganized sector workers, was announced by the then Finance Minister Arun Jaitley in the General Budget 2015-16. (IAS, 2016)
- The Prime Minister formally announced the scheme on **9 May, 2015** in **Kolkata**.
- The **Atal Pension Yojana** came into force on **1<sup>st</sup> June, 2015** and replaced the earlier Swavalamban Yojana.
- All bank account holders whose age is between 18-40 years are eligible for Atal Pension Yojana.
- Members of any statutory social security scheme and income tax payer are ineligible for this scheme.
- The starting age of pension under Atal Pension Yojana is 60 years.
- Under Atal Pension Yojana, after the death of the beneficiary, his life partner will get the pension. Thereafter an amount ranging from **1.7 lakh to 8.5 lakh** will be provided to the nominee by the beneficiary.

- The Atal Pension Yojana is administered by the Pension Fund Regulatory and Development Authority (**PFRDA**).
- In March, 2023 **PFRDA** raises Ombudsman upper age limit to 70 years from 65 years.
- It is noteworthy that in the financial year 2024-25, Rs. 521 crore has been allocated for this scheme.

#### **National Rural Health Mission :**

- National Rural Health Mission (NRHM) was launched on **12<sup>th</sup> April 2005**.
- It is especially concerned with ensuring health facilities for the rural poor and weaker sections.
- The role of trained ASHA (Accredited Social Health Activist) in National Rural Health Mission service is very important.

#### **National/Urban Health Mission (NUHM) :**

- This mission was started in 2013. Its aim is to provide comprehensive, affordable and quality healthcare services.

| Central Schemes / Projects |                                          |                                 |
|----------------------------|------------------------------------------|---------------------------------|
| Sl. No.                    | Scheme/Projects                          | Date of Implementation          |
| 1.                         | Pradhan Mantri Kisan Samman Nidhi Yojana | 24 <sup>th</sup> February, 2019 |
| 2.                         | KUSUM Yojana                             | 8 <sup>th</sup> March, 2019     |
| 3.                         | Election Bond Scheme                     | 2 <sup>nd</sup> January, 2018   |
| 4.                         | Waterways Development Project            | 3 <sup>rd</sup> January, 2018   |
| 5.                         | National Nutrition Mission               | 8 <sup>th</sup> March, 2018     |
| 6.                         | Pradhan Mantri Matru Vandan Yojana       | 1 <sup>st</sup> January, 2017   |
| 7.                         | Migrant Skills Development Scheme        | 8 <sup>th</sup> January, 2017   |
| 8.                         | Rashtriya Vayoshri Yojana                | 1 <sup>st</sup> April, 2017     |
| 9.                         | Darwaza Band Campaign                    | 30 <sup>th</sup> May, 2017      |
| 10.                        | Pradhan Mantri Vaya Vandan Yojana        | 21 <sup>st</sup> July, 2017     |
| 11.                        | Startup India                            | 16 <sup>th</sup> January, 2016  |
| 12.                        | E-National Agriculture Market (E-NAM)    | 14 <sup>th</sup> April, 2016    |
| 13.                        | Pradhan Mantri Ujjwala Yojana            | 1 <sup>st</sup> May, 2016       |
| 14.                        | Pradhan Mantri Yuva Yojana               | 9 <sup>th</sup> November, 2016  |
| 15.                        | Sukanya Samriddhi Yojana                 | 22 <sup>nd</sup> January, 2015  |
| 16.                        | Pradhan Mantri Mudra Yojana              | 8 <sup>th</sup> April, 2015     |
| 17.                        | Atal Pension Yojana                      | 9 <sup>th</sup> May, 2015       |
| 18.                        | Pradhan Mantri Kaushal Vikas Yojana      | 15 <sup>th</sup> July, 2015     |

#### **Swachh Bharat Mission :**

- Swachh Bharat Mission was started on **2<sup>nd</sup> October 2014**. The goal of Swachh Bharat Mission is to provide toilet facilities to all rural families and make India Open Defecation

Free (ODF) by October 2<sup>nd</sup>, 2019. (UPPCS, 2014; 15)

- On 1<sup>st</sup> October, 2021 Prime Minister Narendra Modi Launched Swachha Bharat Mission (Urban) 2.0 from Delhi.
- SBM 2.0 envisages to make all cities "Garbage Free" and ensure grey and black water management.
- Union Cabinet Chaired by Prime Minister approved the Phase II of Swachh Bharat Mission (Gramin) [SBM (G) 2.0] on 19<sup>th</sup> February, 2020.
- It will focus on Open Defecation Free Plus (ODF +) which includes ODF sustainability and Solid and Liquid Waste Management (SLWM).

#### Mission Indradhanush :

- On 25 December 2014, the Union Ministry of Health and Family Welfare has launched 'Mission Indradhanush' to vaccinate children and pregnant women.
- It is the national immunization program to ensure high immunization across the country.
- Special attention will be paid to those districts where the vaccination rate has decreased.
- The main objective of this mission is to protect all children (up to 2 years) and pregnant women from diseases that are preventable.
- The seven vaccines under this mission are: (1) Diphtheria, (2) Whooping Cough, (3) Tetanus, (4) Tuberculosis, (5) Polio, (6) Hepatitis - B and (7) Measles. Additionally, Japanese encephalitis Haemophilus Influenza Type - B vaccines will also be introduced in selected states.
- The implementation of the first phase of the mission was started on 7 April, 2015. Till August 2017, four phases of this mission have been organized and more than 2.53 crore children and 68 lakh pregnant women have been vaccinated.
- 6 states Rajasthan, Madhya Pradesh, Uttar Pradesh, Bihar, West Bengal and Jharkhand were given the top priority for vaccination.
- In February, 2022, Union Health and Family Welfare Minister Mansukh Mandaviya launched Intensified Mission Indradhanush (IMI) 4.0. It will be implemented in 416 districts of 33 states/UTs in three phases.

#### National Child Health Program :

- 'National Child Health Program' was launched on 6 February, 2013 from Palghar, a tribal block in Thane district, Maharashtra, to address the health problems of children. (BPSC, 2019; UPPCS, 2020)
- 'National Child Health Program' is an initiative taken by the Ministry of Health and Family Welfare of India under the National Rural Health Mission (NRHM).
- The National Child Health Program targets four types of deficiencies.
  - (i) Defects at Birth

(ii) Deficiencies

(iii) Diseases

(iv) Developmental Delays and Disabilities

- Under this, all children (rural and urban) in the age group of 0-6 years and all the students enrolled in class 1-12 will be benefited.

#### Pradhan Mantri Jan Aushadhi Scheme:

- Pradhan Mantri Jan Aushadhi Scheme was announced on 21 July, 2015 by the Prime Minister, Narendra Modi. (UPPCS, 2017; 20)
- Under this scheme, high-quality generic medicines will be provided by the government at a price lower than the market price.
- This initiative has been taken by the Department of Pharmaceuticals.
- Under the scheme, 10607 (As on 31 January, 2024) Government Jan Aushadhi centres are functional across the country.

✎ Note : In July 2024, India's first overseas Jan Aushadi Kendra inaugurated in Mauritius.

#### Beti Bachao, Beti Padhao Scheme :

- This scheme was launched on 22<sup>nd</sup> January, 2015 from Panipat in Haryana by Prime Minister Narendra Modi. (UPPCS, 2015)
- Objective of the scheme is to eradicate the gender discrimination and sex selection and ensure livelihood and safety of girls and promote their participation in education.
- Important targets in first phase was –
  - (i) 10 points increase in the sex-ratio of the 100 districts with low sex-ratio.
  - (ii) to increase the enrollment ratio of girls in intermediate education.
  - (iii) to improve the nutrition level of girls below age of 5 years suffering from low weight and anemia.
  - (iv) to ensure availability of ladies toilet by 2017 in each school of 100 districts with low child sex ratio.
  - (v) to reduce the gender gap in mortality rate of children below 5 years of age from 8 points in 2011 to 4 points till 2017.
- With extension of Beti Bachao, Beti Padhao Scheme, targets under it has also been expanded. Presently major targets under the scheme are as follows –
  - (i) to improve the sex-ratio of birth in selected districts by two points in one year.
  - (ii) to decrease the child mortality by 1.5 points every year.
  - (iii) to increase institution delivery by 1.5 percent every year.
  - (iv) to make available toilets in every school.
  - (v) to decrease the problem of anemia and low weight in girl child below age of 5 years by improving their nutrition level.

- In the 2024-25 budget, Rs. 3146 crore is allocated under mission Shakti including Beti Bachao, Beti Pado and some other schemes.

#### National Framework for Malaria Elimination :

- On **11 February 2016**, the then Union Health and Family Welfare Minister, J.P. Nadda has issued 'National Framework for Malaria Elimination, 2016-2030 (NFME). (UPPCS, 2015; 18)
- National Framework for the eradication of malaria underlines the strategy of India to eradicate malaria by 2030.
- The National Framework Scheme for the Elimination of Malaria has the following objectives:
  - (i) Elimination of Malaria by 2022 from all the **States / UTs** in the Low (**Category - 1**) and Medium (**Category - 2**) category.
  - (ii) To bring the level to less than 1 case per 1000 population in all **States / Union Territories and districts**.
  - (iii) Eradication of Malaria by 2024 in 31 States / UTs.
  - (iv) To prevent indigenous transmission of malaria by 2027 in all **States / UTs (Category 3)**.
  - (v) Maintaining the malaria-free status of the country by 2030.

## 5

### Agriculture in India

- India is primarily agrarian economy and about 55% of its population (as per census 2011) are engaged in agriculture and allied activities. (MPPCS, 1997; IAS, 2018)
- According to the Economic Survey, 2023-24, the Indian agriculture sector provides livelihood to about 42.3 per cent of the population. Notably, it has a share of 18.2 per cent in the country's GDP at current price.

#### Production of Important Crops (2023-24)

| Crop/Crop Group      | State          | Share in All India Production (%) |
|----------------------|----------------|-----------------------------------|
| Rice                 | Telangana      | 12.17                             |
| Wheat                | Uttar Pradesh  | 31.38                             |
| Maize                | Karnataka      | 15.39                             |
| Coarse Cereals       | Rajasthan      | 14.66                             |
| Pulses               | Madhya Pradesh | 25.23                             |
| Total food grains    | Uttar Pradesh  | 18.03                             |
| Groundnut            | Gujarat        | 45.12                             |
| Rapeseed and Mustard | Rajasthan      | 45.40                             |
| Soybean              | Madhya Pradesh | 41.92                             |
| Sunflower            | Karnataka      | 40.72                             |
| Total Oilseeds       | Rajasthan      | 24.17                             |

|                                   |               |       |
|-----------------------------------|---------------|-------|
| Sugarcane                         | Uttar Pradesh | 46.45 |
| Cotton                            | Gujarat       | 27.86 |
| Jute and Mesta                    | West Bengal   | 80.97 |
| Source : Economic Survey, 2023-24 |               |       |

#### Characteristics of Indian Agriculture :

- Indian agriculture is in a backward stage. Even today farmers use unscientific method for agriculture. Productivity (production per hectare) in Indian agriculture is significantly low. (UPPCS, 2019)
- Large scale disguised unemployment is prevalent in agriculture in India which is the one of the important factors for poverty of farmers.
- Even today, Indian agriculture suffers from Uncertainty, due to which there is good harvest if weather is good and bad harvest if weather is bad. (UPPCS, 2004; 08; 10)
- Small holdings is a major feature of Indian agriculture.
- Approx 68.45 percent of total holdings is marginal holdings (less than one hectare) and 17.62 percent are small holdings (1-2 hectare).
- Thus approximately 86.08 percent holdings are smaller than 2 hectares.

#### Distributions of Land Holdings in India : 2015-16

|                                           |        |
|-------------------------------------------|--------|
| 1. Marginal Holdings (0 - 1 Hectares)     | 68.45% |
| 2. Small Holdings (1 - 2 Hectares)        | 17.62% |
| 3. Medium Holdings (2 - 10 Hectares)      | 13.35% |
| 4. Large Holdings (more than 10 Hectares) | 0.57%  |

#### Crop Pattern in India :

- In India, crops are classified on the nature and seasons of the crops. Depending on the nature of the crops, the crops are divided into food Crops and non-food Crops. Rice, Wheat, Millet, Maize, etc. are food crops whereas pulses as Urad, Moong, Gram, etc. are included. (BPSC, 2016)
- Non-food crops include **oilseed crops** and **commercial crops** (Sugarcane, Cotton, Jute, Plantation Crops, etc.).
- On the basis of seasons, crops are classified into three parts (1) **Rabi Crop** (2) **Kharif Crop** and (3) **Zaid Crop**.
- **Rabi Crops** are **sown in November - December**, and harvested in **March - April**. Wheat, Barley, Gram, Peas, Mustard, Potato, etc. are the major Rabi season crops.
- **Kharif crops** are **sown in June-July** and **harvested in October-November**. Jowar, Millet, Maize, Rice, Sesame, Groundnut, etc. are the main Kharif crops.
- **Zaid crops** are also called '**summer crops**'. These crops are grown **between March and July**. These include watermelon, cucumber, etc.

### Green Revolution in India :

- The food crisis that originated in 1960s inspired the adoption of scientific agriculture in place of traditional one. (UPPCS, 2008; MPPCS, 2006; BPSC 2018)
- An array of strategies was created to increase agricultural production in which a strategic use of improved seeds, fertilizers and pesticides were adopted to increase agricultural production.
- As a result, a new technological change began in the agricultural sector from 1966-67 which has been termed as a new aphorism of agricultural development or the Green Revolution.
- Green Revolution was meant to increase agricultural production in irrigated and non-irrigated areas of the country by producing high yielding varieties of seeds.
- Nobel Laureate **Prof. Norman Borlaug** was the propounder of Green Revolution in the world. (UP Lower, 2015)
- The father of the Green Revolution in India is **MS Swaminathan**.
- The most positive impact of Green Revolution in India was on the production of Wheat and Rice. Its impact on the production of coarse grains and pulses was limited.
- The Green Revolution benefited the farmers of **Punjab, Haryana and Western Uttar Pradesh**.
- India got rid of food problem due to the Green Revolution and became self-sufficient in food grains.

📌 **Note :** Operation flood is credited with an eight times increase in milk production in India between 1951-2014.

### Agricultural Mechanization :

- When electricity, diesel or petrol is used instead of animal power and manpower in agricultural works , it is known as 'mechanization of agriculture'.

### Agricultural Loan :

- Agricultural loans are taken to fulfil many purposes, but they are generally divided into three categories - 1. Short term loan 2. Middle term loan and 3. Long term loan.

**1. Short Term Loan :** It is provided to farmers to meet the seasonal cost. In other words, short-term loans are taken for a maximum period of 15 months. Short-term loans are taken for the purchase of seeds, fertilizers, pesticides, etc.

(UPPCS, 2011)

**2. Middle Term Loan :** It is taken for a period of 15 months to 5 years It is called Middle Term Loan. These loans are taken for the creation of temporary assets such as arranging tools on the farm, purchasing milch animals, deepening wells, land reforms, etc.

**3. Long Term Loan :** It is taken for a period of 5-20 years and is called Long Term Loan. These loans are taken for the creation of permanent assets such as purchasing land,

making permanent improvements on land, purchasing tractors and machines, godowns, cattle sheds, wells for the collection of food grains on the farm, etc. (UPPCS, 2014)

### Sources of Agricultural Credit in India

- The sources of agricultural credit in India are divided into two parts - **Institutional Sources** and **Non-institutional Sources**. Institutional sources include government, cooperatives, commercial banks and regional rural banks, while non-institutional sources include moneylenders, traders, landlords, relatives, etc.
- The loan given by the government to the farmers is called '**Takabi**'. It is the loan given by the government to the farmers at the time of sowing the crop and at the harvesting time, it is taken back.
- **Co-operative Credit Societies :** These societies are the main sources of agricultural credit in India.
- Cooperative Societies in India are expanded after the Indian Cooperative Credit Societies Act, 1904 came into existence.
- The main objective of establishing cooperative credit societies in India is to nurture the financial needs of the farmers and protect them from the debt trap of moneylenders.
- Short-term, middle-term and long-term loans are provided to the farmers by the cooperative credit societies.
- The cooperative credit structure in India is three-tier. It consists of State Cooperative Banks at the top level, Central / District Cooperative Banks at the district level and Agricultural Credit Societies at the primary level.
- The main objective of the formation of Primary Agricultural Credit Societies is to raise funds to provide loans to the members and to instil a sense of self-reliance and austerity among the members.
- State Co-operative Bank which is the apex co-operative bank of the State is established to direct / coordinate the functions of District Cooperative Banks and provide credit facilities. Their members are only central cooperative banks. It does not give loans to common people.

### Land Development Bank :

- The Land Development Bank provides **long-term loans** to the farmers. (UPPCS, 2016)
- The purpose of establishing the Land Development Bank is to provide loans to the farmers for the land development works and to get rid of old debts.
- The Land Development Bank provides loans by mortgaging the land.



### Kisan Credit Card Scheme :

- In the financial year 1998-99, the Kisan Credit Card Scheme was introduced by the Central Government to solve the problems of agricultural credit of the farmers.

(IAS, 2020; UPPCS 2008; 10, UP RO/ARO 2014; 16)

- The objective of this scheme is to fulfil the short term, middle term and long term financial needs of the farmers.
- Under the scheme, a credit limit is fixed as per the year-long agricultural financial requirements of the farmers. The farmer can withdraw money as many times as he wants within the credit limit. Farmers will only have to pay interest on withdrawn money.

### Agricultural Prices :

- Agricultural prices refer to the prices of agricultural products. Major agricultural prices are as follows - Market Price, Normal Price, Maximum Price, Forward Price, Realization Price, Issue Price, Minimum Support Price, Fair Price, etc. (IAS, 1995)
- **Minimum Support Price (MSP)** is considered very important for the farmers.
- The price of agricultural commodities in any market is called 'Market Price'. Market prices are short-term prices.
- According to the demand of the goods, the price which prevails in the market after enough time has been found to coordinate the supply is called the 'normal price' of that commodity.

### Minimum Support Price (MSP) :

- The minimum support price related to the farmers is a type of crop insurance price. Through this, the government assures the productive farmers that the price of food grains will not be allowed to fall below the minimum fixed price and if the prices fall below the minimum support price, the government purchases food grains at the declared minimum support price.
- The purpose of declaring the minimum support price is to protect the farmers from the loss due to the fall in the prices of agricultural commodities and to get fixed income to the farmers so that the motivation for increasing agricultural production remains.
- The minimum support price for 23 crops in India is announced by the government on the recommendation of the **Commission for Agricultural Costs and Prices**, whereas along with 2 other crops, the Central Government declares a minimum support price of a total of 25 **Agricultural Crops**.
- Minimum Support Price is declared **twice a year** (for Rabi and Kharif Crops) by the Central Government.

### Commission on Agricultural Costs and Prices:

- In 1965, the Central Government had constituted the Agricultural Price Commission to make suggestions regarding the minimum pricing of agricultural products.

- Note that in January 1965, **Dantewala Committee** had suggested the minimum support price in a year.
- Initially, its tenure was fixed for three years, but later, it was given the status of a permanent and consultative institution.
- In 1985, its name was renamed Commission for Agricultural Costs and Prices.

### National Agricultural Policy, 2000:

- On 28 July 2000, the Central Government had announced the National Agricultural Policy, 2000. In this agricultural policy, the top priority had been given to increase the profitability of agriculture and to enable Indian agriculture to meet the future challenges arising from globalization.
- This agriculture policy aims to achieve a growth rate of 4% per year in the agriculture sector. (UPPCS, 2010; 17)
- Priority has been given to promoting privatization of agriculture, investing more, conserving soil-water and biodiversity, etc. in the **National Agricultural Policy**.
- The strategy of adopting the method of contract farming, leasing of land, technical transfer, capital inflow and transfer of crops to the new market had also been adopted in the **National Agricultural Policy**. In this policy, agricultural development had been emphasized to increase profitable, sustainable employment opportunities in rural areas.

### National Agricultural Cooperative Marketing Federation (NAFED) :

- National Agricultural Cooperative Marketing Federation was established on 2 October, 1958. Its Headquarter is located in Delhi and has offices in all States. (UPPCS, 1995; 07)
- It collects, markets and trades agricultural products at the national level. International trade of agricultural commodities is also done by this. **NAFED** procures and markets agricultural commodities through cooperative societies.

## 6

## Indian Industries

- Industries are considered the base of any economy.
- They occupy an important place in the Indian economy.
- According to the Economic Survey 2023-24, the Economic Growth of 8.2 per cent in FY 24 was supported by an industrial growth of 9.5 per cent.
- The share of manufacturing in total gross value added at current prices was 14.3 per cent in FY 23.

### Industrial Policy before 1991:

- After independence, on 6 April 1948, the then Minister of Industry and Commerce, Shyama Prasad Mukherjee had declared India's first industrial policy. (UP UDA/LDA, 2010)
- **The Industrial Policy, 1948** adopted the concept of a mixed economy (public and private sector) for India's economic development.

- **Second Industrial Policy** was presented on 30 April 1956. The main objective of this policy was to lay a strong foundation for basic and heavy industries, curb monopolistic trends and progressively develop a growth-oriented industrial cooperative sector.
- According to the **Industrial Policy, 1956**, industries were classified into three groups.
- **17 industries of social value**, social utility, basic industry, transport and mineral sector were kept in the first categories.
- 13 industries fell under the second category in which the government was expected to participate more progressively in future.
- All the remaining industries were included in the third category which were not included in the first and second category.
- **Industrial Policy, 1956** was practical, progressive and development-oriented. Through this policy, industrialization was not only encouraged in a balanced and rapid manner in the country but also large and basic industries got a strong foundation in the country for future industrial development.
- Industrial Policy, 1956 is considered to be the cornerstone of all industrial policies in India.
- India's third industrial policy was presented on **23 December, 1977** by the then Industry Minister George Fernandes.
- The main objective of the **Industrial Policy, 1977** was to remove the distortions prevailing in the industrial structure, promote small and cottage industries increasing employment and production of essential consumer goods.
- According to the **Industrial Policy, 1977**, the strategy of expansion of small and cottage industries was adopted.
- New Industrial Policy of India on **23 July, 1980** was presented in Parliament.
- The main objectives of the **Industrial Policy, 1980** were to increase the range of investment of industries, protection of small scale industries from the competition of large industries, to solve the problem of industrial sickness, increase the efficiency of financial management, etc.

#### **New Economic Policy:**

- The new economic policy has three major dimensions - **Privatization, Liberalization and Globalization**.
- The main areas of the **New Economic Reform Policy (1991)** were fiscal policy, monetary policy, pricing policy, foreign trade policy, industrial policy, foreign investment policy and public sector policy. (UPPCS 1997; 04; 08; 13)
- **Under the Fiscal Policy, 1991**, mainly four steps were taken - 1. Strict control of public expenditure, 2. Increasing tax and non-tax revenues, 3. Implementing fiscal discipline on Central and State governments, 4. Reduction in grant money.
- Restrictive measures were taken under the inflationary policy, 1991 for inflationary pressures.
- The scope of activities reserved for the public sector was limited and the private sector was allowed in the said area.
- **On 24 July, 1991**, the then Prime Minister P.V. Narasimha Rao announced the **New Industrial Policy, 1991**.
- Reducing the industrial licensing system through new industrial policy, a strategy was adopted to eliminate the unnecessary interference of industrial controls and bureaucracy.
- The main objectives of the new industrial policy are as follows :
  - (i) Maintaining continuous growth in production.
  - (ii) To create more employment opportunities.
  - (iii) To enhance the competitiveness of Indian industries and enable Indian products to compete internationally.
  - (iv) To provide more autonomy to the private sector.
  - (v) To encourage all industries in the public, private and cooperative sectors to improve and grow their performances.
- To achieve the above objectives, four major policy steps were taken in the Industrial Policy, 1991. 1. Public Sector Contraction, 2. Liberalization of the Licensing System, 3. Promotion of Foreign Investment and 4. Abolition of **M.R.T.P. Act, 1969**.
- The Industrial Policy, 1991 has reduced the number of industries reserved for the public sector to just 8.
- At present, it is noteworthy that only two industries like nuclear power and railway transport are reserved for the public sector.
- In this policy, the licensing system of the industries was also liberalised except for 18 industries, the remaining licenses were exempted.
- Currently, there are only 4 industries that are alcoholic beverages, tobacco and its products, electronic aerospace and defence equipment, industrial explosives and hazardous chemicals in which license is required.
- In the new policy, the maximum limit set under the Monopolies and **Restrictive Trade Act (MRTP Act)** for industries was abolished, so that the acquisition or merging of industries could be done. (UPPCS, 2004; 17)
- MRTP Act is currently replaced by the Competition Act.
- Apart from this, several policy steps were also taken to encourage foreign investment in the new Industrial Policy.

✎ **Note :** Small scale industries are separated on the basis of input prices of large scale industries.

✎ **Note :** If both the primary deficit and interest payment are doubled then the fiscal deficit increase by 100%.

### Export Promotion :

- Export promotion refers to all such governmental and non-governmental efforts to increase the country's exports. (UPPCS, 2015; BPSC, 2011)
- After independence, the Government of India formed the **Gorwala Committee** in 1949 to suggest solutions to the problem of foreign exchange and promotion of exports.
- The Gorwala Committee recommended the establishment of specific organizations for export promotion and the adoption of a policy of import substitution in its report.

### Export Processing Zone, EPZ's :

- India is the first country in Asia to establish an Export Processing Zone. The first EPZ was established in Kandla in 1965. (UPPCS, 2011; 17)
- The basic objective of setting up of export processing sector is to promote the export of manufactured goods.
- Through the export processing sector, a conducive environment is created for world-class production and export of selected goods.

### Special Economic Zones:

- The Special Economic Zones (SEZ) policy in India was announced in **April, 2000**. (UPPCS, 2017; 09; 14)
- Its main objective was to remove the bottlenecks in production and export in the country and attract foreign investment in India.
- In 2005, the SEZ Act, 2005 was enacted, which became effective from **10 February, 2006**.
- SEZ'S are Special Economic Zones where the liberal approach is adopted in the provisions of tax, duty, labour, standards, quota, etc. to encourage production and export.
- India's first SEZ was developed at Kandla.
- As on April, 2024, a total of 356 Special Economic Zones have been notified in India. Telangana has a maximum of 57 Special Economic Zones.

### Import - Export Bank :

- Import - Export Bank of India was established on 1<sup>st</sup> January 1982 which aims to provide financial assistance to meet the financial needs of exporters and importers. (BPSC 2015)
- It has been established under India's Import- Export Banks Act, 1981.

✎ **Note :** Term of trade refers to the ratio between manufacturer prices and import prices.

### External Debt:

- External debt is a loan that has been taken from foreign donors (individuals, banks, international financial institutions, governments, etc). (IAS, 2011; MPPCS, 2017)
- External debt is usually divided into short and long term loans on the basis of duration.
- In addition to the period and on the basis of nature, foreign debt is divided into multilateral, bilateral, export credit and commercial borrowings, etc.

- Loans provided from institutions like World Bank, International Monetary Fund (IMF), Asian Development Bank, etc. are called **Multilateral Loans**.
- **Bilateral Loans** are generally taken or given between two governments as the loan given by Japan to India.
- Loans given by the foreign governments to public sector undertakings of any other country are also included in this category.
- **Commercial lending** includes loans from Commercial Banks, India Development Bond, Foreign Currency Convertible Bonds, Foreign Investment Institutions, Letters of Credit, etc.
- Commercial loans are both bilateral / multilateral in nature. Loans received by buyers and suppliers fall under the FEMA Act category of export credit.
- **FEMA, 1999** (FEMA: Foreign Exchange Management Act, 1999) was enacted to replace the already existing FERA, 1973 (FERA: Foreign Exchange Regulation Act, 1973) by the Government for Foreign Investment and Trade.

### Foreign Direct Investment (FDI)

- Foreign Investment in India comes in the form of Foreign Direct investment and foreign portfolio investment. (UPPCS, 2006; UK PCS, 2016)

### Foreign Portfolio Investment:

- Foreign Portfolio Investment is done through the stock exchange.
- Investor has no role in the management of this investment.
- Portfolio Investment is volatile in nature and there is a fear of capital migration in the event of instability.
- Foreign Direct Investment is made by a company or entity located in another country under which modern technology, advanced management and new methods of production methods are obtained.
- There are two defined routes of FDI in India-

**[A] Automatic Route :** Automatic route is also known as '**Mumbai Route**'. Automatic route type does not require prior permission. But investment has to be registered with RBI.

**[B] Government Route :** Under the government route, the investor has to apply for it. This application is considered by the Cabinet Committee on Economic Affairs.

✎ **Note :** The sum of net investment and depreciation is called Gross investment.

- Total FDI inflows in the country in the FY 2023-24 is 70.95 Billion dollars and total FDI equity stands at 44.22 Billion dollars. Mauritius (25%), Singapore (23%), USA (9%), Netherlands (7%) and Japan (6%) emerge as top 5 countries for FDI equity inflows into India FY 2023-24.

- Government of India has Made following recent reforms in FDI Policy -
- (i) In order to prevent opportunistic take over of Indian companies due to Covid-19, Government changed the FDI Policy. According to it, Countries which share boundry with India or whose owner beneficiary of investment is based in India, Citizen of such countries can only invest through government route.
- (ii) Companies seeking new industrial licensing, has been allowed to invest 74% (earlier 49%) through the automatic route in Defence sector.
- **Telecom Sectors** : On 6<sup>th</sup> October, 2021, Government of India approves 100 per cent FDI through aotomatic route in telecom sector.
- **Insurance Sectors** : On 14<sup>th</sup> June, 2021 approval was issued for raising the approved limit of FDI in insurance sector from 49 per cent to 74 per cent along with foreign ownership and controle through automatic routes.

#### Foreign Direct Investment Prohibited Areas:

- (1) Lottery Trade (government and private lotteries), Online Lotteries,
- (2) Gambling and Betting including Casinos,
- (3) Chit Funds,
- (4) Fund Companies,
- (5) Convertible Development Rights Trading ,
- (6) Construction of Real Estate Business or Farmhouse,
- (7) Cigars, Cigarillos and Cigarettes, Tobacco and Tobacco Manufacture.

#### Public Enterprises in India :

- First Indian Prime Minister Jawaharlal Nehru called **public enterprises the Temple of Modern India**. (UPPCS, 1998)
- Many public enterprises in India are also given the status of gems to provide financial autonomy.
- At present, companies are given the status of **Maharatna**, **Navratna** and **Mini Ratna**.
- Navratna Status is given to companies by the Central Public Enterprises Department.

#### Maharatna Companies :

- Union Cabinet in December 2009 decided to create Maharatna status. (UPPCS, 2010; MPPCS, 2020; 21)
- The companies get the status of Maharatna are -
- (i) They have earned an average net profit of **Rs.5 thousand crores** in the last three years.
- (ii) Their average annual turnover in three years should have been at least **Rs. 25 thousand crores**.
- (iii) The average net worth of these companies during three years has also been **Rs. 15 thousand crores**.
- (iv) The company should have Navratna status and the company should also have business abroad.

- (v) They are listed on the Indian Stock Exchange with minimum prescribed public shareholding under SEBI rules.

➤ Maharatna companies get autonomy for investment proposals up to **Rs. 5,000 crores**.

➤ Maharatna status has been accorded to 13 PSUs, **on the above grounds (As on 18<sup>th</sup> October, 2023)**.

Their details are in the following table -

| Maharatnas of India |                                              |
|---------------------|----------------------------------------------|
| 1.                  | National Thermal Power Corporation (NTPC)    |
| 2.                  | Oil and Natural Gas Corporation (ONGC)       |
| 3.                  | Steel Authority of India Limited (SAIL)      |
| 4.                  | Indian Oil Corporation (IOC)                 |
| 5.                  | Coal India Limited (CIL)                     |
| 6.                  | Bharat Heavy Electricals Ltd. (BHEL)         |
| 7.                  | Gas Authority of India Ltd. (GAIL)           |
| 8.                  | Bharat Petroleum Corporation Ltd. (BPCL)     |
| 9.                  | Power Grid Corporation of India Ltd. (PGCIL) |
| 10.                 | Hindustan Petroleum Corporation Ltd. (HPCL)  |
| 11.                 | Power Finance Corporation                    |
| 12.                 | Rural Electrification Corporation Limited    |
| 13.                 | Oil India Limited (OIL)                      |

#### Navratna Companies

- In 1997, Navratna status was created for nine companies.
- As of 18<sup>th</sup> October, 2023, there are a total of 16 Navratna companies.
- Companies with Navratna status can take decisions on investment proposals upto 30% of their net worth or Rs. 1,000 crore, whichever is less, without prior approval of the central government.

#### Miniratna Companies :

- Mini Ratna scheme was launched in October 1977.
- Currently, as of 18<sup>th</sup> October, 2023 the number of Mini Ratna companies is 68.
- There are 57 companies in the Mini Ratna category-I, and 11 companies in the **Mini Ratna category-II**.

#### Industrial Development and Financial Institutions :

- Textile industry is the second largest employment generating industry in India after agriculture. (UPPCS, 2005; 11)
- India's largest textile industry hub is Mumbai.
- India is the second largest producer of raw silk in the world after China.
- According to the data released by the **Central Silk Board, Bangaluru** in 2018-19, regarding the production of raw mulberry silk, Karnataka ranked first, Andhra Pradesh was second, West Bengal is at third and Tamil Nadu at the fourth position.

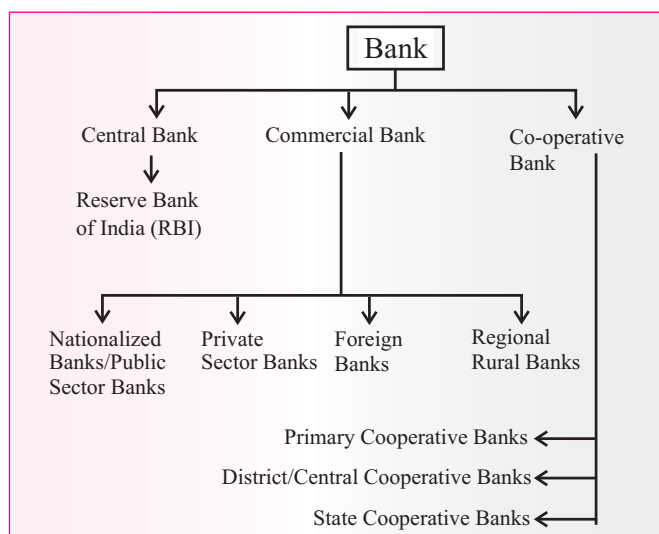


- Assam is the largest producer of Eri and Muga Silk.
- **Abdul Hussain Committee** is concerned with the improvement of small scale industries.
- **The Small Industries Development Organization** falls under the Union Ministry of Industry.
- **Small Industries Development Organization** was established in 1954.
- The Small Industries Development Organization acts as a policy-making and coordinating agency concerning to small scale industries.
- **National Small Industries Corporation**: It was established in 1955. Its main function is to provide machinery to small scale industries on hire purchase method.
- Indian Institute of Entrepreneurship is located in Guwahati.
- National Institute of Entrepreneurship and Small Development Business is situated in **Noida, U.P.**
- The National Small Industries Extension Training Institute is situated in **Hyderabad.**
- The state financial corporation has mainly provided assistance for the development of medium and small scale industries.
- **Small Industries Development Bank of India (SIDBI) :** It started functioning from 2 April, 1990.  
(UPPCS, 2004; 10; 13)
- The head-quarter of Small Industries Development Bank of India is located in Lucknow.
- It works to coordinate the work of all those institutions which are engaged in the promotion of small scale industries.
- **Industrial Finance Corporation of India:** It was established on 1<sup>st</sup> July, 1948 by the Special Act of the Constitution.  
(UPPCS, 2012)
- IFCI aims to provide long term and mid-term credit to private and cooperative sector enterprises.
- **Industrial Credit and Investment Corporation of India Limited (ICICI):** It was established in 1955 under the Indian Companies Act.  
(UPPCS, 2004)
- The function of ICICI is to provide financial assistance in the establishment, development and modernization of enterprises set up in the private sector.
- The role of the **Industrial Development Bank of India (IDBI)** is very crucial in the field of industrial finance.
- It was established in 1964.  
(UP Lower, 1998)
- The **Industrial and Financial Reconstruction Board (BIFR)** was formed in 1981 for the revival of old industries.
- **Disinvestment** means reducing government participation in enterprises.
- In 1996, the Disinvestment Commission was constituted to review, suggest and regulate the disinvestment issue, headed by G.V. Ramakrishna.
- **National Renewal Fund** was established in 1992 to assist and restore displaced workers of sick industrial units.
- **Make in India Programme:** On 25<sup>th</sup> September, 2014, Prime Minister, Narendra Modi had launched 'Make in India' programme to boost up industrial development by making the country world's favourite 'manufacturing hub'.  
(UPPCS, 2016)
- 'Make in India' aims to ensure that the manufacturing sector's contribution to GDP is increased to 25% by 2025.
- The symbol of 'Make in India' Program is a **lion made of instruments.**
- Under Make in India 2.0 Scheme presently focuses 27 Sectors.
- Emergence and Development of Banking Sector in India :**
- The modern banking system in India was launched in 1770 with the establishment of '**Bank of Hindustan**'. Bank of Hindustan was founded by **Alexander & Company** in collaboration with foreign capital.
- In 1806 Bank of Bengal, 1840 Bank of Bombay and in 1843 Bank of Madras were established. These banks were called **Presidency Banks.**
- The **Awadh Commercial Bank** (founded in 1881), based on limited liability, was the first bank operated by Indians. But absolutely the first bank by any Indian completely is **Punjab National Bank** which was **established in 1894.**
- Reserve Bank of India (RBI) :**
- The Reserve Bank of India was established as the central bank on **1<sup>st</sup> April, 1935** on the recommendation of the **Hilton Young Commission.** The bank was **nationalized on 1<sup>st</sup> January, 1949.**  
(IAS, 2018; UPPCS, 2011)
- Its head office is located in **Mumbai.** In addition, the Reserve Bank of India has regional 31 offices at different locations.
- The Reserve Bank of India is called Central Bank of India.
- RBI had given permission to Equitas Holding to start 15 small finance banks in the years 2016.
- In March, 2023, the RBI launched 'Har Payment Digital Mission'.
- The first governor of the Reserve Bank of India was **Sir Osbon Smith (1 April, 1935 to 30 June, 1937).**
- The first Indian Governor of Reserve Bank of India was **C.D. Deshmukh (11 August, 1943 to 30 June, 1949).** During this period, the Reserve Bank of India was nationalized.
- Function of RBI :**
- The main function of the Reserve Bank of India is to control and regulate the spread of currency and credit in the country.
- Initially, the Reserve Bank of India used to issue notes on the basis of the proportional reserve system, but in 1956 the proportional reserve system was abandoned and replaced with the minimum reservation system.  
(IAS, 2018; UPPCS 2011)

- The Reserve Bank of India regulates and controls all commercial banks.
- The Reserve Bank of India accepts deposits from banks and gives loans to them.
- The Reserve Bank of India provides loans and financial assistance to commercial banks in emergency.
- The Reserve Bank of India also manages the credit generation capacity of banks. This affects the liquidity of banks and their credit generation capacity by increasing and lowering the cash reserve ratios.
- The Reserve Bank of India also regulates branches of banks (transfer, closure, etc.).
- All Indian currency notes (2, 5, 10, 20, 50, 100, 200, 500) are incorporated by **Reserve Bank of India**.

(UPPCS, 2019; UK PSC, 2017)

- **Ministry of Finance** (Government of India) incorporates **one rupee note and coins**.
- All the coins of 25 paise and below value were ceased to be legal tender from July 2011.
- The decimal system currency is in circulation in India since **1<sup>st</sup> April, 1957**.
- India's retail credit market ranks fourth among emerging economies. It increased from \$ 181 billion in December 2014 to \$ 281 billion in **December 2017**.



- Financial stability report is a biannual report released by Reserve Bank of India.
- Commercial banks are an institutional source of credit in India.

**Note :** RBI is also known as a Lender of last resort (LOR).

- The Regulator of micro financial institution in India is RBI.
- Borrowed funds, recovery of loans, taxes and foreign aid are not included in capital receipts.
- Women SHG (Self Help Groups) member appointed as banking agent is known as '**Bank Sakhi**'.

- Disinvestment of public sector banks by government is an example of capital gains.
- Low interest rates would result in uneconomic demand for money.
- The value of currency is indirectly to the price level.
- RBI decides the monetary policy of India. The Monetary Policy Committee under the chairmanship of Governor of RBI sets the repo rate in India.

### History of Indian Currency :

- **Earlier, in 1861**, the paper currency was issued by private sector banks like The Bank of Hindustan, The General Bank of Bengal and Bihar, The Bank of Bengal, etc in India.
- After 1861, the letter currency began to be incorporated under the Government of India.

(UPPCS, 1995; 05; 10; UK UPCS, 2005)

- Later, the right of incorporation of letter currency was handed over to the Reserve Bank of India by the Government of India.
- After the Independence of India, from **1947**, on the Indian paper currencies, the picture of **Ashoka Pillar** replaced by the portrait of George VI.
- From **1996**, the **portrait of Mahatma Gandhi** began to be printed on all Indian paper currencies.
- All paper currencies incorporated by RBI are written the value of the currency in **15 languages**. In addition to the 15 languages of the panel, it also has currency written in Hindi and English.
- The symbol of Indian Currency (₹) was created by Dr. Uday Kumar.
- **On 8 November, 2016**, the demonetisation of **1000** and **500 rupee notes** which accounted for about 86 per cent of the Indian currency, was done by the Government of India.
- New notes of **2000** and **500** rupees were issued in place of these notes.

### Major Countries and Their Currencies

| Country     | Currency Name         |
|-------------|-----------------------|
| Bangladesh  | Taka                  |
| Nepal       | Rupiah                |
| Iraq        | Dinar                 |
| Italy       | Lira (currently Euro) |
| Thailand    | Baht                  |
| Vietnam     | Dong                  |
| Iran        | Rial                  |
| China       | (Reminbi) Yuan        |
| Japan       | Yen                   |
| India       | Rupee                 |
| Turkey      | Turkish Lira          |
| South Korea | Von                   |

### Banking in India :

- Banks registered under the Indian Companies Act, 1956 were designated as Commercial Banks.  
(UPPCS, 2019; BPSC, 2016)
- Commercial banks are regulated and governed under the **Indian Bank Exchange Act, 1949.**
- Commercial banks in India are classified on the basis of ownership and constitutionality.
- Commercial banks are divided into Scheduled and non-scheduled banks on a constitutional basis.
- Such banks referred to as Scheduled Banks are placed in the second schedule of the Reserve Bank of India. Banks that are not placed in the second schedule are called Non-Scheduled Banks.
- Banks are divided into public and private sector banks on the basis of ownership.
- Public Sector Banks fall Government of India **undertakings, while private banks are private** banks only.
- Disinvestment of Public Sector Banks is the example of capital receipts.  
(UPPCS, 2014; 05; 11; MPPCS, 2016)

### State Bank of India :

- The first public sector bank in India emerged in **1955** named **State Bank of India.**
- State Bank of India is considered to be the largest among public sector banks.
- State Bank of India is the first commercial bank in the country to enter the life insurance sector.
- Updated as of December 2020, there are 46 private - foreign banks in India.
- Punjab National Bank was the first public sector bank to implement the **Voluntary Retirement Scheme (VRS).**
- The country's **first floating ATM** was launched by the State Bank of India on 9<sup>th</sup> February, 2004, in Kochi.
- Kotak Mahindra Bank Ltd., the first bank to be merged with a bank from a non-banking financial company which was employed as Kotak Mahindra Finance Company.
- **Narasimham Committee** was formed in 1991 to give suggestions regarding the restructuring of the banking system.
- **Nationalisation of Banks in India:** After the failure of the policy of social control over banks, the Government of India decided to nationalize the banks.  
(UPPCS, 2007; MPPCS, 2014; UPSC 2011)

### First Phase :

- On 19 July, 1969, 14 banks with paid-up capital of Rs. 50 crores or more were nationalized.
- **The nationalized are-** (1) Central Bank of India, (2) Bank of Baroda, (3) Bank of India, (4) United Commercial Bank, (5) Canara Bank, (6) Dena Bank, (7) Syndicate Bank, (8) Union Bank of India, (9) Allahabad Bank, (10) India Bank,

(11) United Bank of India, (12) Bank of Maharashtra, (13) Indian Overseas Bank and (14) Punjab National Bank

### Second Phase :

- On 15 April, 1980, 6 commercial banks were nationalized.
- Nationalized banks in the second phase are - (1) Andhra Pradesh Bank, (2) New Bank of India, (3) Punjab and Sindh Bank, (4) Corporation Bank, (5) Oriental Bank of India and (6) Vijaya Bank.

### Regional Rural Banks :

- Regional bank in India was established by the recommendation of Banking Commission chaired by R.G. Saraiya (constituted in 1972) and Narsimhan Committee (constituted in 1975).  
(UPPCS, 2005; IAS 2013)
- The order of establishment of Regional Rural Banks in India started on **2 October, 1975.**
- The headquarter of first Regional Rural bank of India's Pratham Bank is Uttar Pradesh.
- 5 Regional Rural Banks were established on **2 October, 1975** - They are : Moradabad and Gorakhpur in Uttar Pradesh, Bhiwani in Haryana, Jaipur in Rajasthan, Malda in Bengal.
- 50% of the capital in the Regional Rural Banks is invested by the Central Government, of which 15% of the capital by the State Government and 35% by the Promoter Bank.
- **Currently (March 2022)** there are a total of 43 Regional Rural Banks are operating in India.
- The merger of Vijaya Bank and Dena Bank with Bank of Baroda became effective from **1<sup>st</sup> April, 2019.**
- In August 2019, Finance Minister Nirmala Sitharaman has announced the merger of 10 public sector banks. According to this announcement, Oriental Bank of Commerce and United Bank of India were merged with Punjab National Bank; Syndicate Bank was merged with Canara Bank, Andhra Bank and Corporation Bank were merged with Union Bank of India and Allahabad Bank was merged with Indian Bank.
- After the merger becomes effective the nationalized banks remain 12.
- The Malegam Committee had recommended the formation of a new category of micro finance institution that is known as **Non-Banking Financial Company (NBFC).**

### NABARD : National Bank for Agriculture and Rural Development :

- On **12 July 1982**, the Central Government established National Bank for Agricultural and Rural Development (NABARD) as a separate bank for agriculture and rural development.  
(UPPCS, 2003; 04; 05 14, MPPCS, 2015; 06)
- NABARD Bank was established on recommendation of **B. Sivaraman Committee.**
- NABARD is the apex institution providing finance for agriculture and rural development in the country.

- Its headquarter is located in **Mumbai**.
- Project E-Shakti for digitalization of all the member of self help groups was launched by **NABARD** in 2015. The first time this project was launched in the state of Jharkhand and Maharashtra.
- It has played an important role in introducing **Kisan Credit Cards** and connecting Self Help Groups with banks.
- The Kisan Credit Card Scheme was introduced in 1998 by the then Finance Minister, Yashwant Sinha.
- In the year 1987, an action research programme named MYRADA was started by NABARD. On the basis of which 25 pilot projects were launched to link 500 SHGs with bank.
- To promote livelihood of people in both agricultural and non-agricultural activities LEDP programme was launched by NABARD in the year 2015.
- **NABARD** has been accredited as a National Implementing Entity for Adaptation fund under **United Nations Framework Convention on climate change (UNFCCC)** in India.

#### **Banking Ombudsman Scheme :**

- On **14 June, 1995**, the Banking Ombudsman Scheme was launched across the country. The objective of this scheme is to resolve complaints against them at a quick and low cost to improve the quality of banking services. **(IAS 2010)**
- The Reserve Bank - Integrated Ombudsman Scheme, 2021 was launched on **12<sup>th</sup> November, 2021** by Prime Minister Narendra Modi.
- When General interest rates reach very low levels, economists will expect interest rates to rise in the future.

#### **Differential Interest Rate Scheme :**

- After the nationalization of banks (1969) the Differential Interest Project was started in the country in 1972.
- Under the differential interest rate scheme, it was made mandatory for public sector banks to pay a certain percentage of their deposits and loans given in the previous year to the weaker sections of the society at an interest rate of 4 per cent (concessional rate).

#### **Other Major Institutions :**

- Life Insurance Corporation of India (**LIC**) was established in 1956.
- The headquarter of the Life Insurance Corporation of India (**LIC**) is located in **Mumbai**. **(IAS 2002)**
- General Insurance Corporation of India (**GIC**) was established in 1972. **(IAS 2002)**
- The headquarter of the Insurance Regulatory and Development Authority of India (**IRDA**) is located in **Hyderabad**. **(UPPCS, 2007)**
- Unit Trust of India (**UTI**) was established in 1964 to encourage small savings to invest in mutual funds. **(IAS, 1995)**
- The headquarter of Unit Trust of India (**UTI**) is located in Mumbai.

- National Housing Bank was established in July 1988.
- Its headquarter is located in New Delhi. **(UPPCS, 2007)**
- In 2023, Axis Bank launches India's first pocket sized swipe machine.

### **Monetary Policy**

- Monetary policy refers to the use of instruments (**CRR, SLR, REPO, etc.**) under the control of the central bank, thereby controlling the availability, cost and utilisation of money and credit, and keeping inflation stable by banking. **(IAS, 2014)**
- In other words, the policy decided by the central bank of a country to achieve the goals of stability and development in that country is called **monetary policy**.
- The three major goals of monetary policy are :
  - A. Low and stable inflation (**Short-term target**)
  - B. Financial stability (**Mid-term Goals**)
  - C. Achieve inclusive growth (**Long-term target**)
- On 20 February, 2015, there was an agreement between the Government of India and the RBI by which two targets were set in terms of inflation.
- (i) Bringing down the inflation rate to below 6 per cent by January 2016.
- (ii) To maintain the inflation rate at the level of 4 (+/-2) per cent, in financial year 2016-17 and the following years.
- The Reserve Bank of India announces its monetary and loaning policy 6 times in the financial year (**every two months**).
- Public debt office is an autonomous government agency, which acts as an investment banker for the government and raises capital from markets for government.

#### **Monetary Policy Instruments:**

- Many direct and indirect instruments are used in the implementation of monetary policy. **(IAS 1995)**
- **Direct Instruments** include instruments that directly affect the amount of money. It includes CRR, SLR and refinance facilities.
- Instruments that indirectly affect the amount of currency are called **Indirect Instruments** of monetary policy.
- Through these, credit creation is affected. It includes open market actions, repo rate, reverse repo rate, etc.

#### **1. Cash Reserve Ratio (CRR):**

- The share of their entire deposit liabilities (Net demand and time liabilities) that scheduled banks are required to hold as cash balances in the Reserve Bank is called **CRR**. **(IAS, 2018)**
- The higher the cash reserve ratio, the lower the credit generation capacity. When the Reserve Bank of India wants the diffusion of currency, it reduces the **CRR**. Conversely, the cash reserve ratio for currency contraction is increased.
- Whenever **CRR** is increased by **RBI** meaning thereby it reduces money supply, increases interest rates on home loans, car loans etc.
- Reserve fund Ratio is used to calculate money multiple.



## 2. Statutory Liquidity Ratio (SLR):

- Statutory Liquidity Ratio (SLR) is a minimum percentage of deposits that a commercial bank has to maintain in the form of liquid cash gold or other securities. Significantly, it is basically the reserve requirement that banks are expected to keep before offering credit to customers.
- The inverse relationship is found between SLR and liquidity of banks i.e. increase in SLR leads to a decrease in liquidity.
- Under SLR, commercial banks keep a certain percentage of their total assets in liquid form.

## 3. Repo Rate:

- Repo rate is the rate at which the central bank of a country (RBI) lends money to commercial banks in the event of any shortfall of funds. (UPPCS, 2017; 14)
- RBI under repo rate affects the credit generating capacity of scheduled banks.
- Increase in repo rate will adversely affect the ability of credit creation of banks and conversely low repo rate will increase the credit generating capacity.

## 4. Reverse Repo Rate:

- Reverse Repo Rate is the rate which is given by RBI on short term deposits of commercial banks. It is always lower than the repo rate. (UPPCS, 2010)

📌 **Note :** It is important that CRR and SLR are used to control the amount of liquidity in the economy, while the repo / reverse repo rate is used for credit control.

## 5. Marginal Standing Facility Rate: (MSFR)

- Scheduled Commercial Banks to meet their (Over- night) emergency liquidity requirement, a fixed limit from RBI on MSFR in lieu of their SLR (net demand and fixed deposits of banks 2%). (IAS, 1995)
- Marginal Standing Facility Rate protects the banking system from unexpected liquidity shocks.

## 6. Bank Rate

- Bank rate is the rate charged by the central bank for lending funds to commercial banks. (IAS, 2011; 95; UPPCS, 2009; 02)
- Bank rates is a monetary policy used by RBI.
- It is important to mention here that bank rates influence lending rates of commercial banks. Higher bank rates will translate to higher lending rates by the banks.
- Bank rate is the MSF rate. Through this rate, the Reserve Bank affects the credit availability and cost of credit of Commercial Banks.

## Credit Control :

- There are two methods of credit control. Following is a brief description of them.

### 1. Quantitative Measure :

- The quantitative credit control method affects the amount of credit creation. It affects all sectors of the economy. The following devices are used under this -

- (a) Bank Rate
- (b) Marginal Standing Facility Rate
- (c) Open Market Actions
- (d) Repo / Reverse Repo Rate
- (e) Cash Reserve Ratio
- (f) Statutory Liquidity Ratio (UPPCS, 2007)
- There is a negative relationship between the above rates and credit generation.
- Recently Axis Bank has launched India's first pocket size swipe Machine 'Micro Pay'.

### 2. Qualitative Measure Ration :

- Qualitative credit control is also called a selective method. Under this, the flow of credit is controlled. (IAS, 1995)
- Under this method, RBI discourages loans given by commercial banks for undesirable economic actions while encouraging the flow of credit towards desired activities. The following methods are used under this.
- (a) Determination of Minimum Limit or Margin
- (b) Moral pressure
- (c) Determination of Credit Criteria

### Open Market Operations :

- By RBI when government bills in the money market are controlled by buying and selling in the money market and commercial banks in the country, it is called 'Open Market Actions'. (IAS 2013)
- When the Reserve Bank of India has to withdraw or reduce the currency prevailing in the market, it uses the open market.

## Presently Major Rates (September, 2024)

| Policy Rates                                                                                 |
|----------------------------------------------------------------------------------------------|
| (i) Repo Rate - 6.50%                                                                        |
| (ii) Reverse Repo Rate -3.35%                                                                |
| (iii) Bank Rate - 6.75%                                                                      |
| (iv) MSF - 6.75%                                                                             |
| (v) SDF - 6.25%                                                                              |
| Reserve Rates                                                                                |
| (vi) CRR - 4.50%                                                                             |
| (vii) SLR - 18%                                                                              |
| Currency Supply                                                                              |
| M1 = Cash in Treasury + Net Demand Deposits of Banks + Other Deposits with RBI [C + DD + OD] |
| M2 = M1 + Post Office Deposits                                                               |
| M3 = M1 + Fixed Deposits of Banks                                                            |
| M4 = M3 + Post Office Deposits                                                               |

### Inflation & Money Deflation:

- **Inflation :** Inflation refers to the rise in the prices of most goods and services of daily or common use, such as clothing, housing, food, recreation, transportation, etc.

- Inflation measures the average price change in a punnet of commodities and services over time.

(IAS, 2013; 1993; UPPCS, 1995; 98; 21)

- Inflation is also known as '**Currency Expansion**'.
- In the situation currency expansion, (due to the excess of note incorporation) the amount of currency increases. While the quantity of goods and services is less than that.
- In Inflation, generally, the price level rises.
- Not every increase in the price level leads to inflation.
- There are two reasons for the rise in inflation - an increase in demand (**monetary income**) and a decrease in supply (**production**).

✎ **Note :** Fiscal deficit is financed through borrowing.

- Increase in monetary income of the government is due to Monetary policy, deficit economy, increase in non-developmental expenditure, increase in currency movements and change in credit policy of commercial banks, relaxation in taxes, increase in the value of debt recovery and payment of old debts, import of foreign capital, financial dislocation.
- To deal with inflation in the economy, the RBI is most likely to increase the repo rate.
- The main reasons for the decrease in production are industrial unrest, the indirect trade policy of the government, lack of raw materials, storage. indirect, production structure, etc.

✎ **Note :** Macro economics examines economy - phenomena suchas chages in inflation, price level, economic growth rate, national GDP and unemployment.

### Currency Contraction or Deflation:

- Currency contraction or deflation is the opposite of inflation. (IAS, 2010)
- In deflation, the value of the currency increases and the price of goods and services falls. It is because of the imbalance in monetary income and production volume.
- When the monetary income is less than the amount of production, the price starts falling down, it is called '**deflation**'.

### Impact of Inflation and Currency Contraction on Different Classes / Sectors Class / Sector

| Class                    | Effect of inflation | Effect of deflation |
|--------------------------|---------------------|---------------------|
| 1. Consumers             | Loss                | Profit              |
| 2. Debtors               | Profit              | Loss                |
| 3. Lender                | Loss                | Profit              |
| 4. Fixed Income Group    | Loss                | Profit              |
| 5. Variable Income Group | Profit              | Loss                |
| 6. Public Savings        | Shortage            | Growth              |

|                                     |             |          |
|-------------------------------------|-------------|----------|
| 7. Public Expenditure               | Growth      | Shortage |
| 8. Import                           | Growth      | Shortage |
| 9. Export                           | Shortage    | Growth   |
| 10. Employment                      | Growth      | Shortage |
| 11. Banking and Insurance Companies | Development | Fall     |
| 12. Taxation                        | Growth      | Shortage |
| 13. Production / Merchant / Farmer  | Profit      | Loss     |
| 14. Pensioner                       | Loss        | Profit   |

**Reflation:** When inertia is created in the economy due to excessive currency contraction, artificial inflation is resorted to protect the economy from its ill effects.

- Under the monetary movement, the amount of money and credit is gradually increased in the economy as a strategic step, so that the general price level can be increased.

**Disinflation:** When the amount of currency is intentionally reduced to overcome the ill effects of inflation, it is called '**currency deflation**'. (IAS, 2010)

- In currency deflation, the amount of currency is deliberately reduced gradually, causing the price level to decrease.

✎ **Note :** Reduction in capital formation causes low demand (deflation gap)

**Stagflation:** It is a state of inflation in which economic inactivity and unemployment prevail along with price rise. (UPPCS, 2003; 08; 12; IAS 1999; 2011; 19)

### Devaluation:

- Devaluation refers to a country intentionally reducing the external value of its currency relative to the currency of another country.
- The purpose of currency devaluation is to improve the situation of adverse balance of payments, encourage exports and discourage imports, attract foreign capital, prevent black marketing of foreign currencies, etc.
- Due to devaluation, the external value of the country's currency is reduced which makes the goods of that country cheaper for foreigners. As the items are cheaper, more can be purchased in the same amount than before. **Thus, the devaluing country's exports are encouraged.**
- Devaluation makes imports expensive for the devaluing country, as the external value of its currency has decreased. Hence, it discourages imports.
- The devaluation has no direct effect on the internal price level or inflation.
- For the success of devaluation, it is necessary that the country whose currency has been devalued relative to it, should not devalue its currency. **Otherwise**, there will be no benefit from devaluation.

- For the success of devaluation, it is necessary that the demand for imports and exports should be elastic and there should be no restriction on the production and distribution of goods in the country.
- In India, **devaluation has been done three times** (1949, 1966 and 1991). (UPPCS, 2008; 03)
- The major reasons for the devaluation of the Indian currency in July 1991 were adverse payment balances, depletion of foreign exchange funds, falling rupee value, export incentives, etc.
- **Liberalised Exchange Rate Management System LERM** : It was implemented in 1992-93, under which rupee was converted into a trading account as partially convertible.
- In 1993-94, the rupee was made fully convertible into the trading account.
- In 1994, the rupee is made convertible in the current account.
- The **Tarapore Committee** was constituted to give suggestions on convertibility on the capital account of the rupee. The report presented in 1997, suggested introducing the convertibility of the rupee on the capital account in a gradual manner.

#### Indian Financial System:

- Indian Financial System has two parts - Money Market and Capital Market. (IAS 2007; UPPCS, 2007; 18)

#### Money Market :

- According to the Reserve Bank of India, the money market is the market in which short-term (less than one year) monetary assets are traded.
- Money transactions are not traded in the money market but exchange letters, covenants and short-term government securities. These short term bills are known as '**Near Money**' :
- Indian money market is both organized and unorganized form.
- **Organized money market** consists of Reserve Bank of India, State Bank of India, Commercial Banks, Foreign Banks, Insurance Companies, Semi-Government Institutions and Mixed Capital Companies.
- The Reserve Bank of India has effective control over the organized money market, while the unorganized segment is free from RBI control.
- Demand in the organized sector of the Indian money market includes call money market, fiscal bill, commercial bill, commercial money market, mutual funds, etc.
- The **unorganized money market** consists of domestic bankers, usurers, traders, etc., who provide finance for short term requirements. The most prevalent form of unorganized sector is hundi.
- **Treasury Bills, Ad-Hoc Treasury Bills, Commercial papers, certificates of deposit etc.** are money market instruments.

- The Indian money market is regulated by the RBI.
- Any situation of liquidity trap makes the demand for money infinitely elastic towards the interest rate.
- Consumption of fix capital is also known as depreciation.

✎ **Note** : Under the currency earning and baruri system, the dues of any work are indebted to it or which are owed by others on it.

✎ **Note** : When the rate of interest is at its maximum level, the inelastic demand for money will be zero.

#### Capital Market

- Funds are collected in the capital market for the medium term and long term. (UPPCS, 2010)
- Regulation of Indian capital market is done by SEBI.
- The capital market has two forms - **primary market** and **secondary market**.
- When a person buys his shares and debentures directly from a company or when a company directly receives from the public, it is called '**primary market**'.
- The secondary market is the stock market or stock exchange where the shares and debentures of various companies already registered are traded and sold. (IAS, 2000; 05; UPPCS, 2005; 14; 21)
- The stock exchange is the organization where various types of securities and loans are traded.
- The oldest stock exchange in India is the **Bombay Stock Exchange (BSE)**. It was established in 1875.
- SENSEX Index is based on the shares of 30 companies issued by BSE, SENSEX index whose full name is BSE Sensitive Index is based on the shares of 30 companies is issued by BSE.
- After this, the National Stock Exchange (NSE) was established in 1992 on the recommendation of the **Pherwani Committee**.
- The **NIFTY Index** was launched by the National Stock Exchange in April 1996 comprising 50 companies.
- The headquarter of National Stock Exchange is located in Mumbai.

#### Securities and Exchange Board of India (SEBI) :

- Securities and Exchange Board of India (SEBI) was established on **12 April 1992** under Securities and Exchange Board of India Act, 1992. (UPPCS, 2013; UP RO/ARO 2016)
- SEBI has been given the right to control and regulate mutual funds and stock markets.
- The headquarter of SEBI is located in **Mumbai**, while its regional offices have been established in Kolkata, Ahmedabad, Delhi and Chennai.
- **SEBI has the right to validate any stock exchange.**
- Credit card is not a common product provided by micro finance institutions in India, while personal loans, insurance

products and saving accounts are provided by micro finance institutions.

- Under the current regulatory regime, the maximum maturity period for a microfinance loan in India is now 32 months.
- Bangladeshi economist Mohammad Yunus was awarded Nobel Peace Prize for founding rural bonds and pioneering the concepts of micro - credit and microfinance.
- Micro financing was first introduced in the year by 1947 by SEWA Bank, a division of the Self-Employed Women's Association in the state of Gujarat.

### World's Major Stock Exchanges Index

| Stock Exchange | Share Index          |
|----------------|----------------------|
| Korea          | Kospi                |
| China          | SSE                  |
| Tokyo          | Nikkei               |
| Taiwan         | TAIEX                |
| Thailand       | Set                  |
| Germany        | Mid Dex              |
| Brazil         | Bovespa              |
| USA            | Nasdaq               |
| Singapore      | Cimax, Straits Times |
| Mexico         | Bolsa                |
| England        | FTSE - 100           |
| Hong Kong      | Hang Seng            |

### Securities / Banknote Printing in India:

- The responsibility of printing securities papers / currencies / coins, etc. is on **Security Printing and Minting Corporation of India Limited : SPMCIL**.  
(UP PCS, 2008; UP UDA/LDA, 2010)
- It was established in January 2006 in New Delhi under the Ministry of Finance.
- Under this corporation, nine establishments in India, including four mints, **four banknotes / securities press** and **a security paper mill** are functioning.

### Security Paper Mill, Hoshangabad, Madhya Pradesh:

- It was established in 1968.
- This mill produces various types of security papers.

### Security Printing Press:

- Security printing press includes printing of stamp papers, all types of postal stamps, passports, visas, cheques, credentials, banknotes, etc.
  - There are four banknote security printing presses in India
1. **Currency Note Press, Nasik, Maharashtra:** This (first) note printing press in India was established in 1928.
  2. **Bank Note Press, Dewas, Madhya Pradesh:** It was established in 1974. In addition to banknotes, high-quality inks are also produced in this press.

3. Establishment of Indian Copyhold Printing, Nasik **1925**.

4. Establishment of Securities Press Hyderabad, **1982**.

- In addition to the above, there is a subsidiary of the Reserve Bank for printing banknotes.
- The headquarter of Bhartiya Reserve Bank Note Printing Private Limited (**BRBNMPL**) is located in Bengaluru and was established in 1995. The following are 2 Printing Presses under this company.

1. Bank Note Press Mysuru, Karnataka - Establishment 1996
2. Bank Note Press Salboni, West Bengal - established in 1996.

### Mint :

- There are four government mints in India, where coins are minted.
- They are located in Mumbai, Hyderabad, Kolkata and Noida.

## Indian Public Finance

### Budget :

- **James Wilson** is considered the founder of the budget system in India. (IAS, 2020; UPPCS, 2017)
- In Viceroy Lord Canning's Executive Council, James Wilson presented the first budget in 1860.
- Under **Article 112** of the Indian Constitution, the President has been entrusted with the duty to submit a statement of the projected receipts and expenditures of the Central Government for each financial year which runs from 1<sup>st</sup> April to 31<sup>st</sup> March before the parliament.
- This '**Annual Financial Statement**' is called the Central Government Budget.
- The arrangement is related to the budget of the State Governments is mentioned in **Article 202**.
- The Railway Budget was separated from the General Budget in 1924 on the recommendations of the **Ekworth Committee**. On 21 September 2016, the Government of India has decided that from 2017 onwards the Railway Budget will be included in the General Budget. In this way, the practice of the railway budget which has been running for 92 years, was excluded. On 1<sup>st</sup> February 2017, the Joint Budget was presented in Parliament.
- The first budget of independent India was introduced by the first **Finance Minister, R.K. Shanmukham Chetty** on **26 November, 1947**.
- Budget in India generally expresses the following estimates:
  1. Actual Receipts and Expenditures of the previous years.
  2. Budget Estimates and Revised Estimates for the current year.
  3. Proposal of Budget estimates for next year.
- A budget consists of actual figures of the preceding year and the budgetary estimate for the current year.
- Budget is related to the fiscal policy of the Government.



## ECONOMIC SURVEY 2023-24

- On 22<sup>nd</sup> of July, 2024, the **Economic Survey for 2023-24** was presented by the **Union Minister for Finance** in the parliament.

### Key Takeaways from the Economic Survey for 2023-24

#### State of the Economy

- **Real GDP Growth-** India's real GDP grew by 8.2% in FY24, exceeding 8% in three out of four quarters.
- **Retail Inflation-** Retail inflation dropped from 6.7% in FY23 to 5.4% in FY24.
- **Current Account Deficit (CAD)-** The CAD improved to 0.7% of GDP in FY24, down from 2.0% in FY23.
- **Tax Revenue-** Direct taxes made up 55% of the total tax revenue, while indirect taxes contributed the remaining 45%.
- **Capital Spending-** The government increased capital expenditure and provided free food grains to 814 million people.
- **Monetary Policy-** The RBI kept the policy repo rate steady at 6.5% throughout FY24, leading to a 4% decline in core inflation from April 2022 to June 2024.
- **Credit Growth-** Scheduled Commercial Banks (SCBs) disbursed credit worth Rs 164.3 lakh crore, marking a 20.2% increase by March 2024.
- **Banking Sector-** Both gross and net non-performing assets hit multi-year lows, with the Gross Non-Performing Assets (GNPA) ratio falling to 2.8% in March 2024, a 12-year low. The Insolvency and Bankruptcy Code effectively addressed the twin balance sheet problem, disposing of 31,394 corporate debtors worth Rs 13.9 lakh crore by March 2024.
- **Capital Markets-** Primary capital markets contributed Rs 10.9 lakh crore, about 29% of the gross fixed capital formation of private and public corporates in FY23.
- **Insurance and Microfinance-** India is set to become one of the fastest-growing insurance markets and holds the second-largest microfinance sector globally.

#### Prices and Inflation

##### Inflation Trends

- 29 States and Union Territories recorded inflation below 6% in FY24.
- Core services inflation reached a nine-year low in FY24.
- Food inflation rose from 6.6% in FY23 to 7.5% in FY24.
- Price cuts on LPG, petrol, and diesel kept retail fuel inflation relatively low.
- **Future Projections-** The RBI forecasts inflation to decrease to 4.5% in FY25 and 4.1% in FY26.

#### External Sector

- **Exports:** Services exports increased by 4.9% to USD 341.1 billion in FY24, with notable contributions from IT/software and other business services.
- **Remittances:** India remained the top global recipient with USD 120 billion in remittances in 2023.
- **External Debt:** The external debt to GDP ratio was 18.7% as of March 2024.
- **Logistics Performance:** India's rank in the World Bank Logistics Index improved to 38th in 2023 from 44th in 2014.
- **Tourism:** India's share in world tourism receipts rose from 1.38% in 2021 to 1.58% in 2022.

| Key aspects of India's trade<br>(Calendar year-wise)                   |      |      |      |
|------------------------------------------------------------------------|------|------|------|
|                                                                        | 2020 | 2021 | 2022 |
| <b>Export performance (in per cent)</b>                                |      |      |      |
| Share in World Merchandise Exports                                     | 1.6  | 1.8  | 1.8  |
| Share in World Commercial Services Exports                             | 4.1  | 4.0  | 4.4  |
| Share in World Merchandise Plus Services Exports                       | 2.1  | 2.2  | 2.4  |
| <b>Import Performance (in per cent)</b>                                |      |      |      |
| Share in World Merchandise Imports                                     | 2.1  | 2.5  | 2.8  |
| Share in World Commercial Services Imports                             | 3.3  | 3.5  | 4.0  |
| Share in World Merchandise Plus Services Imports                       | 2.3  | 2.7  | 3.0  |
| <b>India's rank in world trade</b>                                     |      |      |      |
| Merchandise Exports                                                    | 21.0 | 18.0 | 18.0 |
| Merchandise Imports                                                    | 14.0 | 10.0 | 9.0  |
| Services Exports                                                       | 7.0  | 8.0  | 7.0  |
| Services Imports                                                       | 10.0 | 10.0 | 8.0  |
| Source: DGFT, Monthly Bulletin on Foreign Trade Statistics, April 2024 |      |      |      |

#### Medium-Term Outlook – A Growth Strategy for New India:

- **Growth Strategy:** To maintain a growth rate above 7%, a collaborative effort between the Union Government, State Governments, and the private sector is essential.
- **Key Focus Areas:** Emphasis on job and skill creation, resolving agriculture and MSME issues, green transition, and addressing the education-employment gap is vital for medium-term growth.

### **Climate Change and Energy Transition – Dealing with Trade-Offs:**

- **Renewable Energy:** As of May 2024, non-fossil sources accounted for 45.4% of installed electricity generation capacity.
- **Energy Needs:** India's energy requirements are expected to increase 2 to 2.5 times by 2047.
- **Investment in Clean Energy:** The clean energy sector attracted Rs 8.5 lakh crore in investments between 2014 and 2023.

### **Social Sector – Benefits that Empower:**

- **Welfare Expenditure:** Grew at a CAGR of 12.8% between FY18 and FY24.
- **Healthcare:** Over 347 million Ayushman Bharat cards have been issued.
- **Housing:** 26.3 million houses were constructed under PM-AWAS-Gramin in the past nine years.
- **Rural Infrastructure:** 1.514 million km of roads were built under the Gram Sadak Yojana since 2014-15.

### **Employment and Skill Development – Towards Quality:**

- **Unemployment Rate:** Dropped to 3.2% in 2022-23, with net payroll additions under the Employees' Provident Fund Organisation (EPFO) more than doubling to 13.15 million over the past five years.
- **Youth Unemployment:** Declined from 17.8% in 2017-18 to 10% in 2022-23.
- **Female Labor Force Participation:** Has been rising for six consecutive years, currently at 37.0%.
- **Gig Economy:** The workforce is expected to reach 23.5 million by 2029-30.

### **Agriculture and Food Management:**

- **Agricultural Growth:** The sector achieved an average annual growth rate of 4.18% at constant prices over the last five years.
- **Credit and Micro Irrigation:** Rs 22.84 lakh crore in credit was disbursed to agriculture, with 9 million hectares covered under micro-irrigation since 2015-16.
- **Kisan Credit Cards:** 75 million cards were issued with a Rs 9.4 lakh crore limit.

### **Industry – Small and Medium Matters:**

- **Industrial Growth:** Economic growth of 8.2% in FY24 was supported by an industrial growth rate of 9.5%.
- **Pharmaceutical and Clothing Sectors:** India's pharmaceutical market, valued at USD 50 billion, is the world's third-largest by volume. It is also the second-largest clothing manufacturer globally, with textile and apparel exports reaching Rs 2.97 lakh crore in FY24.

- **Electronics Manufacturing:** India's electronics sector accounts for an estimated 3.7% of the global market share. Domestic production rose to Rs 8.22 lakh crore, with exports reaching Rs 1.9 lakh crore in FY23.

### **Services – Fuelling Growth Opportunities:**

- **Sector Contribution:** The services sector accounted for 55% of the economy in FY24, growing by 7.6% during the year.
- **Digital Services:** India's share in global digitally delivered services exports increased to 6% in 2023. In 2022, India's services exports made up 4.4% of the world's commercial services exports and accounted for 44% of India's total exports in FY24.
- **Aviation:** Total air passengers increased by 15% year-on-year in FY24.
- **E-commerce:** Expected to surpass USD 350 billion by 2030.
- **Start-ups:** Increased from around 2,000 in 2014 to approximately 31,000 in 2023.

### **Infrastructure – Lifting Potential Growth:**

- **National Highways:** Construction pace increased from 11.7 km per day in FY14 to about 34 km per day by FY24.
- **Railways:** Capital expenditure on railways grew by 77% over the past five years.
- **Aviation:** 21 new airport terminal buildings became operational in FY24.
- **Logistics:** India's rank in the International Shipments category improved to 22nd in 2023 from 44th in 2014.
- **Space:** India has 55 active space assets, including communication, navigation, scientific, meteorological, and earth observation satellites.
- **Digital Infrastructure:** The DigiLocker platform has over 262.8 million registered users and over 6.74 billion issued documents.
- **Telecommunication:** Teledensity in India increased from 75.2% in March 2014 to 85.7% in March 2024, with internet density also rising to 68.2% in March 2024.

### **Climate Change and India:**

- **Global Strategies:** Current global strategies for climate change are flawed and not universally applicable, often focusing on substituting means rather than addressing overconsumption. Developing countries need the freedom to choose their own pathways.
- **Indian Ethos:** India's ethos emphasizes a harmonious relationship with nature, advocating for 'traditional multi-generational households' and 'Mission LiFE,' which promotes mindful consumption to combat overconsumption-driven climate change.

# UNION BUDGET 2024-25

## Part A

### Important Highlights of the Budget

- On 23<sup>rd</sup> of July, 2024, Finance Minister Nirmala Sitharaman presented her seventh straight Budget for the fiscal year 2024-25.

### Economic Growth

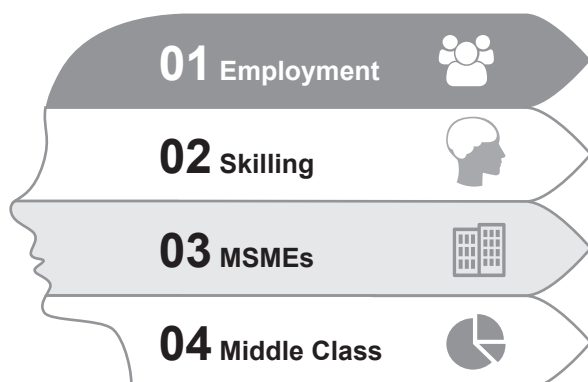
- **Economic Growth:** Despite global uncertainties, India's economic growth remains strong.
- **Inflation:** Inflation is low, stable, and moving towards a 4% target, with core inflation at 3.1%.

### Interim Budget Focus

- **Focus Areas:** The interim budget emphasizes four major categories: Poor (Garib), Women (Mahilayen), Youth (Yuva), and Farmers (Annadata).

### Budget Theme and Priorities

- **Employment and Skilling:** ₹1.48 lakh crore allocated for education, employment, and skilling. The Prime Minister's package includes 5 schemes to facilitate opportunities for 4.1 crore youth over 5 years, with a central outlay of ₹2 lakh crore.
- **Nine Priorities for 'Viksit Bharat':**
  1. Productivity and resilience in Agriculture
  2. Employment & Skilling
  3. Inclusive Human Resource Development and Social Justice
  4. Manufacturing & Services
  5. Urban Development
  6. Energy Security
  7. Infrastructure
  8. Innovation, Research & Development
  9. Next Generation Reforms



### Priority 1: Productivity and Resilience in Agriculture

- **Agriculture Review:** Comprehensive review to focus on raising productivity with 109 new high-yielding and climate-resilient crop varieties.

- **Natural Farming:** Initiate 1 crore farmers into natural farming.
- **Bio-input Resource Centres:** Establish 10,000 centres.
- **Self-sufficiency in Pulses and Oilseeds:** Strengthen production, storage, and marketing.
- **Digital Public Infrastructure in Agriculture:** Implement in partnership with states.
- **Allocation:** ₹1.52 lakh crore for agriculture and allied sectors.

### Priority 2 : Employment & Skilling

- **Employment Linked Incentive Schemes:** Implemented as part of the Prime Minister's package.
- **Women's Workforce Participation:** Setting up working women hostels and creches.
- **Skilling Programme:** New centrally sponsored scheme in collaboration with states and industry, aiming to skill 20 lakh youth over 5 years.
- **Model Skill Loan Scheme:** Revised to facilitate loans up to ₹7.5 lakh.
- **Higher Education Loans:** Financial support for loans up to ₹10 lakh with e-vouchers for interest subvention for 1 lakh students annually.

### Priority 3: Inclusive Human Resource Development and Social Justice

- **Saturation Approach:** Enhance implementation of schemes supporting craftsmen, artisans, self-help groups, scheduled caste, scheduled tribe, women entrepreneurs, and street vendors.
- **Purvodaya:** Plan for all-round development of the eastern region, covering Bihar, Jharkhand, West Bengal, Odisha, and Andhra Pradesh.
- **Pradhan Mantri Janjatiya Unnat Gram Abhiyan:** Improve socio-economic conditions of tribal communities.
- **India Post Payment Bank Branches:** Over 100 new branches in the North East region.
- **Rural Development Allocation:** ₹2.66 lakh crore for rural infrastructure.

### Priority 4: Manufacturing & Services

- **MSME Support:** Self-financing guarantee fund for MSMEs with up to ₹100 crore cover.
- **Mudra Loans:** Limit increased to ₹20 lakh.
- **Food Irradiation Units:** Financial support for 50 multi-product units and 100 food quality and safety testing labs.
- **E-commerce Export Hubs:** Set up in public-private-partnership mode.
- **Internships:** Provide opportunities in 500 top companies for 1 crore youth over 5 years.

### Priority 5: Urban Development

- **Urban Housing:** PM AwasYojana Urban 2.0 to address housing needs of 1 crore urban poor and middle-class families with an investment of ₹10 lakh crore.
- **Water Supply and Sanitation:** Promote projects for 100 large cities.
- **PM SVANidhi:** Support the development of 100 weekly 'haats' or street food hubs annually.

### Priority 6: Energy Security

- **PM Surya Ghar Muft Bijli Yojana:** Rooftop solar plants for 1 crore households.
- **Nuclear Energy:** Significant part of the energy mix for 'Viksit Bharat'.

### Priority 7: Infrastructure

- **Capital Expenditure:** ₹11,11,111 crore allocated, 3.4% of GDP.
- **Pradhan Mantri Gram Sadak Yojana Phase IV:** All-weather connectivity to 25,000 rural habitations.
- **Flood Mitigation in Bihar:** Support for projects like the Kosi-Mechi intra-state link.

### Priority 8: Innovation, Research & Development

- **Anusandhan National Research Fund:** For basic research and prototype development with ₹1 lakh crore financing pool.
- **Space Economy:** Venture capital fund of ₹1,000 crore to expand the space economy.

### Economic Policy Framework

- **Labour Reforms:** Integration of e-shram portal with other portals for one-stop solutions.
- **Climate Finance Taxonomy:** Enhance capital availability for climate adaptation and mitigation.
- **Foreign Direct Investment:** Simplified rules and regulations.

### Budget Estimates 2024-25

- **Total Receipts:** ₹32.07 lakh crore (excluding borrowings).
- **Total Expenditure:** ₹48.21 lakh crore.
- **Net Tax Receipts:** ₹25.83 lakh crore.
- **Fiscal Deficit:** Estimated at 4.9% of GDP.
- **Market Borrowings:** ₹14.01 lakh crore gross, ₹11.63 lakh crore net.

## Part B: Tax Reforms

### Direct and Indirect Taxes

- **Review:** Comprehensive review to simplify taxes, reduce tax incidence, and compliance burdens.
- **GST Rationalization:** Improve the tax base and support domestic manufacturing.
- **Income Tax Act Review:** Aim to reduce disputes and make the act more concise.

## Direct Tax Proposals

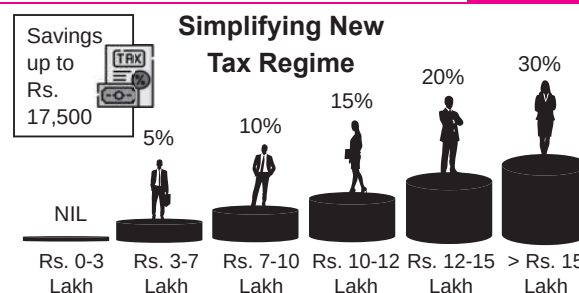
To reduce the compliance burden, promote entrepreneurial spirit and provide tax relief to citizens

### Rationalisation of capital gains

- Short term gains of financial assets to attract 20% tax rate
- Long term gains on all financial and non-financial assets to attract a tax rate of 12.5%
- Increase in limit of exemption of capital gains on financial assets to Rs. 1.25 lakh per year

### Employment and Investment

- Abolish ANGEL tax for all classes of investors.
- Simpler tax regime to operate domestic cruise
- Provide for safe harbour rates for foreign mining companies (Selling raw diamonds)
- Corporate tax rate on foreign companies reduced from 40% to 35%



Standard Deduction for salaried employees increased from Rs. 50,000 to Rs. 75,000

Deduction on family pension for pensioners increased from Rs. 15,000 to Rs. 25,000

### Tax Reliefs

- **Standard Deduction:** Increased from ₹50,000 to ₹75,000 for salaried employees.
- **Family Pension Deduction:** Enhanced from ₹15,000 to ₹25,000.
- **New Tax Regime Benefits:** Revised rates providing benefits up to ₹17,500.

### New Tax Regime Rate Structure:

| Income Slabs  | Tax Rate |
|---------------|----------|
| 0 – 3 Lakh    | NIL      |
| 3 – 7 Lakh    | 5%       |
| 7 – 10 Lakh   | 10%      |
| 10 – 12 Lakh  | 15%      |
| 12 – 15 Lakh  | 20%      |
| Above 15 Lakh | 30%      |



## Investment and Start-up Ecosystem

- **Angel Tax Abolished:** For all classes of investors.
- **Corporate Tax Rate:** Reduced to 35% for foreign companies.
- **Tax for Charities:** Simplified with merged exemption regimes.

## Capital Gains Tax

- **Short Term Gains:** 20% rate on certain financial assets.
- **Long Term Gains:** 12.5% rate on all financial and non-financial assets.
- **Exemption Limit:** Increased to ₹1.25 lakh per year.

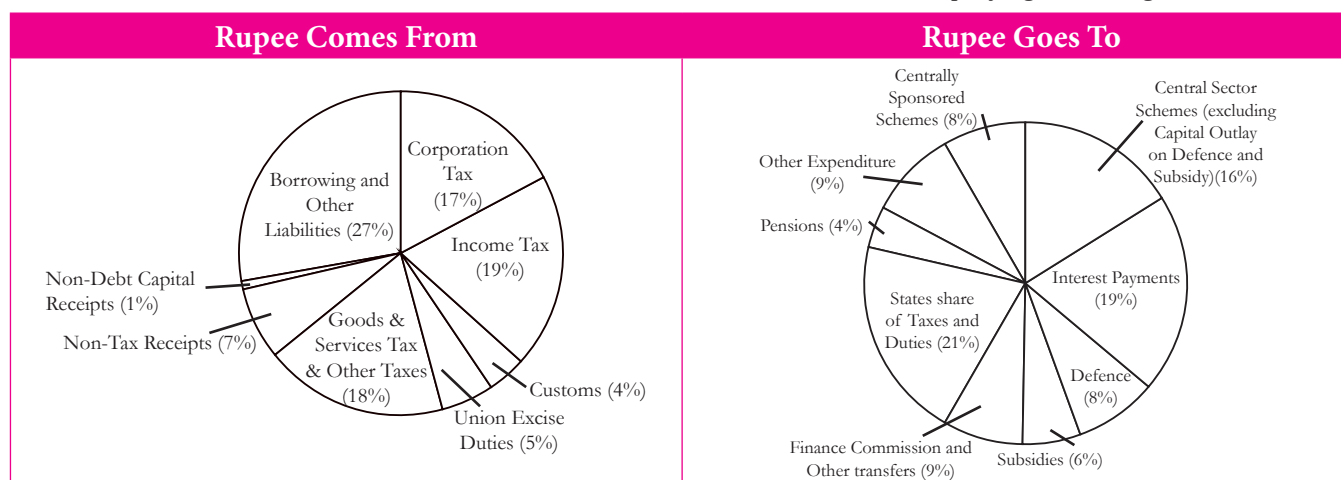
## Custom Duties

- **Cancer Medicines:** Fully exempted for three additional drugs.

- **Mobile Phones and Accessories:** Reduced to 15%.
- **Rare Earth Minerals:** Custom duties exempted or reduced.
- **Seafood Exports:** BCD reduced to 5%.

## Dispute Resolution

- **Vivad se Vishwas Scheme 2024:** For resolving income tax disputes.
- **Appeal Limits:** Increased for direct taxes, excise, and service tax appeals.
- The Union Budget 2024-25 reflects a comprehensive approach to sustaining economic growth, improving infrastructure, enhancing social justice, promoting innovation, and simplifying the tax regime.



| Budget at a Glance                               |                 |                          |                           |                               | (In Rs. Crore)           |
|--------------------------------------------------|-----------------|--------------------------|---------------------------|-------------------------------|--------------------------|
|                                                  | 2022-23 Actuals | 2023-24 Budget Estimates | 2023-24 Revised Estimates | 2023-24 Provisional Estimates | 2024-25 Budget Estimates |
| 1. Revenue Receipts                              | 2383206         | 2632281                  | 2699713                   | 2728412                       | 3129200                  |
| 2. Tax Revenue (Net to Centre) <sup>1</sup>      | 2097786         | 2330631                  | 2323918                   | 2326524                       | 2583499                  |
| 3. Non Tax Revenue                               | 285421          | 301650                   | 375795                    | 401888                        | 545701                   |
| 4. Capital Receipts                              | 1809951         | 1870816                  | 1790773                   | 1714130                       | 1691312                  |
| 5. Recovery of Loans                             | 26161           | 23000                    | 26000                     | 27338                         | 28000                    |
| 6. Other Receipts                                | 46035           | 61000                    | 30000                     | 33122                         | 50000                    |
| 7. Borrowings and Other Liabilities <sup>2</sup> | 1737755         | 1786816                  | 1734773                   | 1653670                       | 1613312                  |
| 8. Total Receipts (1 + 4)                        | 4193157         | 4503097                  | 4490486                   | 4442542                       | 4820512                  |
| 9. Total Expenditure (10 + 13)                   | 4193157         | 4503097                  | 4490486                   | 4442542                       | 4820512                  |
| 10. On Revenue Account of which                  | 3453132         | 3502136                  | 3540239                   | 3494036                       | 3709401                  |
| 11. Interest Payments                            | 928517          | 1079971                  | 1055427                   | 1063871                       | 1162940                  |
| 12. Grants in Aid for Creation of Capital Assets | 306264          | 369988                   | 321190                    | 303787                        | 390778                   |
| 13. On Capital Account                           | 740025          | 1000961                  | 950246                    | 948506                        | 1111111                  |
| 14. Effective Capital Expenditure (12+13)        | 1046289         | 1370949                  | 1271436                   | 1252293                       | 1501889                  |

|                                         |               |               |               |               |               |
|-----------------------------------------|---------------|---------------|---------------|---------------|---------------|
| 15. Revenue Deficit (10 – 1)            | 1069926 (4.0) | 869855 (2.9)  | 840527 (2.8)  | 765624 (2.6)  | 580201 (1.8)  |
| 16. Effective Revenue Deficit (15 – 12) | 763662 (2.8)  | 499867 (1.7)  | 519337 (1.8)  | 461837 (1.6)  | 189423 (0.6)  |
| 17. Fiscal Deficit (9 – (1 + 5 + 6))    | 1737755 (6.4) | 1786816 (5.9) | 1734773 (5.8) | 1653670 (5.6) | 1613312 (4.9) |
| 18. Primary Deficit (17 – 11)           | 809238 (3.0)  | 706845 (2.3)  | 679346 (2.3)  | 589799 (2.0)  | 450372 (1.4)  |

1 Provisional Actuals for FY 2023-24 are unaudited and subject to change.

2 RE 2023-24 is reduced by ₹7151 crore on account of net amount payable by Centre to the States for prior years.

3 Includes draw down of Cash Balance.

**Notes:**

(i) The GDP for Budget FY 2024-25 (Regular) is estimated at ₹3,26,36,912 crore which is 10.5% over the Provisional Estimates of FY 2023-24 at ₹2,95,35,667 crore.

(ii) Individual items in this document may not sum up to the totals due to rounding off.

(iii) Figures in parentheses are as a percentage of GDP.

### Expenditure of Major Items (In Rs. Crore)

|                                   | Actuals 2022-23 | Budget Estimates 2023-24 | Revised Estimates 2023-24 | Budgeted Estimates 2024-25 |
|-----------------------------------|-----------------|--------------------------|---------------------------|----------------------------|
| Pension                           | 241599          | 234359                   | 238049                    | 243296                     |
| Defence                           | 399123          | 432720                   | 455897                    | 454773                     |
| Fertiliser                        | 251339          | 175100                   | 188894                    | 164000                     |
| Food                              | 272802          | 197350                   | 212332                    | 205250                     |
| Petroleum                         | 6817            | 2257                     | 12240                     | 11925                      |
| Agriculture and Allied Activities | 125875          | 144214                   | 140533                    | 151851                     |
| Commerce and Industry             | 44363           | 48169                    | 47350                     | 47559                      |
| Education                         | 98567           | 116417                   | 108878                    | 125638                     |
| Energy                            | 65717           | 94915                    | 54989                     | 68769                      |
| External Affairs                  | 16661           | 18050                    | 29122                     | 22155                      |
| Finance                           | 11551           | 13574                    | 23982                     | 86339                      |
| Health                            | 73551           | 88956                    | 79221                     | 89287                      |
| Interest                          | 928517          | 1079971                  | 1055427                   | 1162940                    |
| IT and Telecom                    | 111629          | 93478                    | 95781                     | 116342                     |
| Rural Development                 | 238396          | 238204                   | 238984                    | 265808                     |
| Transfer to States                | 273393          | 324641                   | 273985                    | 322787                     |
| Transport                         | 390508          | 517034                   | 524941                    | 544128                     |
| Union Territories                 | 65907           | 61118                    | 66676                     | 68660                      |
| Urban Development                 | 77310           | 76432                    | 69271                     | 82577                      |
| <b>Grand Total</b>                | <b>4193157</b>  | <b>4503097</b>           | <b>4490486</b>            | <b>4820512</b>             |

### Outlay on Major Schemes

|                                                            | Actuals 2022-23 | Budget Estimates 2023-24 | Revised Estimates 2023-24 | Budgeted Estimates 2024-25 |
|------------------------------------------------------------|-----------------|--------------------------|---------------------------|----------------------------|
| Mahatma Gandhi National Rural Employment Guarantee Program | 90806           | 60000                    | 86000                     | 86000                      |
| National Social Assistance Program                         | 9651            | 9636                     | 9652                      | 9652                       |
| Pradhan Mantri Awas Yojana (PMAY)-Urban                    | 28653           | 25103                    | 22103                     | 30171                      |
| Pradhan Mantri Awas Yojana (PMAY)- Rural                   | 44962           | 54487                    | 32000                     | 54500                      |

|                                                                |       |       |       |       |
|----------------------------------------------------------------|-------|-------|-------|-------|
| Jal Jeevan Mission (JJM)/National Rural Drinking Water Mission | 54700 | 70000 | 70000 | 70163 |
| National Health Mission                                        | 33803 | 36785 | 33886 | 38183 |
| Samagra Shiksha                                                | 32515 | 37453 | 33000 | 37500 |
| Saksham Anganwadi and POSHAN 2.0                               | 19876 | 20554 | 21523 | 21200 |
| Pradhan Mantri Gram Sadak Yojna                                | 18783 | 19000 | 17000 | 19000 |
| National Livelihood Mission - Ajeevika                         | 12083 | 14129 | 14652 | 15047 |
| Pradhan Mantri Poshan Shakti Nirman (PM POSHAN)                | 12681 | 11600 | 10000 | 12467 |
| Pradhan Mantri Krishi Sinchai Yojna                            | 5637  | 8587  | 7031  | 9339  |
| AMRUT (Atal Mission for Rejuvenation and Urban Transformation) | 6500  | 8000  | 5200  | 8000  |
| Smart Cities Mission                                           | 8653  | 8000  | 8000  | 2400  |
| Rashtriya Krishi Vikas Yojna                                   | 5247  | 7150  | 6150  | 7553  |
| Ayushman Bharat- Pradhan Mantri Jan Arogya Yojana (PMJAY)      | 6186  | 7200  | 6800  | 7300  |
| Krishionnati Yojana                                            | 4716  | 7066  | 6378  | 7447  |
| Swachh Bharat Mission (SBM) - Urban                            | 1926  | 5000  | 2550  | 5000  |
| Swachh Bharat Mission (Gramin)                                 | 4925  | 7192  | 7000  | 7192  |
| PM Schools for Rising India (PM SHRI)                          | ...   | 4000  | 2800  | 6050  |
| Mission Shakti                                                 | 2340  | 3144  | 2326  | 3146  |
| Pradhan Mantri Uchchatar Shiksha Abhiyan (PM-USHA)             | 361   | 1500  | 500   | 1815  |
| Mission VATSALYA                                               | 1043  | 1472  | 1272  | 1472  |
| Vibrant Villages Programme                                     | ...   | ...   | 300   | 1050  |
| Pradhan Mantri Kisan Samman Nidhi (PM-KISAN)                   | 58254 | 60000 | 60000 | 60000 |
| Remission of Duties and Taxes on Exported Products (RoDTEP)    | 13175 | 15069 | 15669 | 16575 |
| Pradhan Mantri Matsya Sampada Yojana (PMMSY)                   | 1168  | 2000  | 1500  | 2352  |
| Atal Bhujal Yojana                                             | 1155  | 1000  | 1778  | 1778  |
| Prime Minister Employment Generation Programme (PMEGP)         | 2733  | 2700  | 2958  | 2300  |
| PM Vishwakarma                                                 | ...   | ...   | 990   | 4824  |

### Fiscal Policy

- Fiscal policy is a major component of economic policy, which consists of policies related to public expenditure, taxation, public debt and deficit financing.
- Under the fiscal policy, necessary steps are taken by the government to reduce the tax rate, broaden the tax base, control public expenditure and reduce public debt.
- In view of the need for fiscal accountability, the Parliament passed the '**Fiscal Responsibility and Budget Management Act**' (FRBM Act) in 2003 which provides for the legal obligation to control the fiscal deficit.
- Fiscal Responsibility and Budget Management Act provides for the responsibility of bringing the government's fiscal deficit to a nutritional limit of 3 per cent of GDP.
- **Following are the objectives of fiscal policy :**
  - (i) Development through the mobility of resources
  - (ii) Efficient Allocation of Resources

- (iii) Price Stability and Inflation Control
- (iv) Employment Generation
- (v) Balanced Regional Development
- (vi) Capital Formation

✎ **Note :** Monetary Policy Committee has made Hawkish on interest rate. In this context, Hawkish means enhance in interest rates. It is note worthy that in Hawkish Stance in the rates are increased while in Dokkish Stance the interest rates are reduced.

- The concept of Monetary Illusion was first given by Trving Fisher.

### Fiscal Policy Instruments :

- There are four instruments of fiscal policy :
  1. **Taxation**
  2. **Public Expenditure**
  3. **Public Debt**
  4. **Issue of New Currency**

## 1. Taxation

- Tax is a compulsory payment to the government, in return for which the taxpayer receives no compensation or benefits. (UPPCS, 2012; UK PSC, 2012)
- Tax is mainly divided into two parts - direct and indirect tax.
- Direct tax includes Income Tax, Corporation Tax, Minimum Alternative Tax (MAT), Wealth Tax, Gift Tax, Estate Duty, Capital Gains Tax, Fringe Benefits Tax, Banking Cash Transaction Tax and Commodity Transaction Tax, etc.
- Currently, only income tax, corporation tax and alternative minimum tax are applicable.
- Indirect Tax includes Central Excise, Customs, Service Tax, Value Added Tax, etc.
- Gross tax revenue is estimated at around 11.7 per cent during 2019-20 (B.E) during which is higher than 10.9 per cent during 2018-19 (P.A.).

## 2. Public Expenditure:

- An expenditure done by the government is termed as public expenditure.
- Public expenditure is mainly divided into two parts, revenue and capital.
- It is noteworthy that before the financial year 2017-18, the public expenditure was also divided into plan and non-plan expenditure. (UPPCS, 2012; UPRO/ARO, 2014)
- But from the financial year 2017-18, the public expenditure started being categorized into revenue and capital expenditure only.

## 3. Public Debt:

- Public debt refers to the borrowings taken by the government to meet its expenditure.
- It is mainly of two types - Internal Debt and External Debt.

### Fiscal Responsibility and Budget Management Act (FRBM Act), 2003 :

- FRBM Act, 2003 was passed in the Parliament by the Central Government for Fiscal Consolidation. (IAS, 2018)
- The Fiscal Responsibility and Budget Management Act came into effect since 5 July, 2004.
- The Fiscal Responsibility and Budget Management Act was aimed to bring the fiscal deficit to 3 per cent of GDP and to eliminate the revenue deficit by March 2009.
- But FRBM Act's goals could not be achieved as a result of the global financial meltdown in 2008-09.
- So, in May 2016, FRBM review committee headed by NK Singh was formed, whose main recommendations are mentioned below :

### Committee's Key Recommendations-

- The committee has proposed to bring the debt-GDP ratio to 60 per cent with a loan limit of 40 per cent for the Central

Government and 20 per cent for the State Governments. This target is to be achieved by 2022-23.

- To achieve the target of debt-GDP ratio, the committee suggested setting a lower annual target to reduce the fiscal and revenue deficit (as a percentage of GDP) by 2022-23.
- The committee suggested the formation of the fiscal council as an independent body to monitor the government's revenue announcements.
- The fiscal council comprised of three-member, a chairman and two members, to be appointed by the Central Government for a term of 4 years.
- At the time of appointment, the members of the council should not be in any employment under the Central or State Government.
- The committee has empowered the government to deviate from the goals set by the fiscal council in the following circumstances.
  - (i) In the event of national security, war, national disaster and severe crisis on farming.
  - (ii) Structural reforms to be done in the economy that have a fiscal impact.
  - (iii) There should be a decline in actual production growth by at least 3 per cent of the average of the last four quarters.
- Deviations in targets should not exceed 0.5 per cent of GDP in a year.
- The draft of the new 'Debt Management and Fiscal Responsibility Bill, 2017' was also presented by the committee.

### Finance Commission :

- The provision of Finance Commission has been made under Article 280 in the constitution to decide the framework of the division of financial resources between the Centre and the States. (IAS 2015; JK PSC, 2017)
- Finance Commission shall act as an independent semi-judicial expert body in accordance with the provisions contained in Article 280 and after deliberating the subjects assigned to it by the President.
- According to the constitutional provisions in India, there is a provision of the formation of the Finance Commission every 5 years. But if it is needful, the President can also appoint it earlier.
- First Finance Commission in India was chaired by K.C. Neogi in 1951 and since then 15 Finance Commissions have been formed.
- The formation of the 15<sup>th</sup> Finance Commission was announced by the Government of India on 27 November, 2017 after the President's assent. Its current chairman is N.K. Singh.



- The recommendations of the **15<sup>th</sup> Finance Commission** will be in force for a period of 5 years from 1 April, 2020.

#### **15<sup>th</sup> Finance Commission:**

- The Government of India has announced the formation of the **15<sup>th</sup> Finance Commission** on **27 November, 2017** after the President's assent. Its chairman is **Mr. N.K. Singh**.
- The first report of this Commission and the Action Taken Report were laid on the Table of the Parliament on **1<sup>st</sup> February, 2020**.
- In this first report, the Commission has recommended **41%** for divisional revenue for the states for the financial year **2020-21**.
- The Commission has recommended the share of States in the Central taxes for the 2021-26 period is to be 41%, same as in the report for 2020-21 in its final report for 2021-26.
- This is less than the 42% share recommended by the **14<sup>th</sup> Finance Commission** for 2015-20 period.
- The **15<sup>th</sup> Finance Commission** has used the 2011 Census data for its recommendations.
- The criteria and the parameters for determining the parameters of horizontal transfer are explained in the following table.

| <b>Criteria for Devolution</b> |                                   |                                                   |
|--------------------------------|-----------------------------------|---------------------------------------------------|
| <b>Criteria</b>                | <b>14<sup>th</sup> FC 2015-20</b> | <b>Weight (in%) 15th FC (2020-21 and 2021-26)</b> |
| Income Distance                | 50.0                              | 45.0                                              |
| Area                           | 15.0                              | 15.0                                              |
| Population (1971)              | 17.5                              | -                                                 |
| Population (2011)              | -                                 | 15.0                                              |
| Demographic Performance        | 10.0                              | 12.5                                              |
| Forest Cover                   | 7.5                               | -                                                 |
| Forest and Ecology             | -                                 | 10.0                                              |
| Tax and Fiscal Efforts         | -                                 | 2.5                                               |
| <b>Total</b>                   | <b>100</b>                        | <b>100</b>                                        |

#### **Share of States in Central taxes :**

- The share of states in the central taxes for 2021-26 period is recommended to be 41%. This is less than 42% share recommended by 14<sup>th</sup> Finance Commission. **The 1% adjustment is to provide for the newly formed Union territories of Jammu and Kashmir and Ladakh from the resource of the centre.**

#### **Revenue Deficit Grants :**

- 17 States will receive grants worth Rs. 2.9 lakh crore to eliminate revenue deficit.

#### **Sector Specific Grants :**

- **Sector - Specific** grants will be given to states for 8 sectors including health, education, agriculture etc.

#### **State - Specific Grants :**

- Commission recommended state - specific grants of Rs. 49,599 crore for the areas of social needs, administration, infrastructure etc.

#### **Grants to Local Bodies :**

- The total grants to local bodies will be Rs. 4.36 lakh crore (a partian of grants to be performance linked).

#### **Disaster Risk Management :**

- Commission recommended existing cost-sharing pattern between centre and state i.e. 90 : 10 for North - Eastern and Himalayan state's and 75 : 25 for all other states. State disaster management funds will have a corpus of Rs. 1.6 lakh crore (centre share is Rs. 1.2 lakh crore).

#### **Fiscal Roadmap :**

- **Fiscal deficit and debt levels** - The commission suggested that centre bring down fiscal deficit to 4% of GDP by 2025-24. For states it recommend fiscal deficit limit (as a % of GSDP) of (i) 4% in 2021-22 (ii) 3.5% in 2022-23 and (iii) 3% during 2023-24.
- Extra annual barrowing of 0.5% of GSDP will be allowed to states during first four years (2021-25). Upon undertaking power sector reforms.

| <b>Finance Commissions of India</b> |                           |                     |                    |
|-------------------------------------|---------------------------|---------------------|--------------------|
| <b>Finance Commission</b>           | <b>Establishment Year</b> | <b>Chairman</b>     | <b>Time Period</b> |
| First                               | 1951                      | K.C. Neogi          | 1952-57            |
| Second                              | 1956                      | K.Santhanam         | 1957-62            |
| Third                               | 1960                      | A.K. Chanda         | 1962-66            |
| Fourth                              | 1964                      | P.V. Rajamannar     | 1966-69            |
| Fifth                               | 1968                      | Mahavir Tyagi       | 1969-74            |
| Sixth                               | 1972                      | K.Brahmananda Reddy | 1974-79            |
| Seventh                             | 1977                      | J.M. Shellat        | 1979-84            |
| Eighth                              | 1983                      | Y.V. Chavhan        | 1984-89            |
| Ninth                               | 1987                      | N.K.P. Salve        | 1989-95            |
| Tenth                               | 1992                      | K.C. Pant           | 1995-2000          |
| Eleventh                            | 1998                      | A.M Khusro          | 2000-2005          |
| Twelfth                             | 2002                      | C. Rangarajan       | 2005-2010          |
| Thirteenth                          | 2007                      | Vijay Kelkar        | 2010-2015          |
| Fourteenth                          | 2013                      | Y.V. Reddy          | 2015-2020          |
| Fifteenth                           | 2017                      | N. K. Singh         | 2021-2026          |
| Sixteenth                           | 2023                      | Arvind Panagari     | 2026-2031          |

## Central and State Government's Taxes

| Central Government Direct Tax              | State Government Direct Tax      |
|--------------------------------------------|----------------------------------|
| 1. Personal Income Tax                     | 1. Tax on Employment             |
| 2. Property Tax                            | 2. Business Tax                  |
| 3. Gift Tax                                | 3. Tax on Agricultural Income    |
| 4. Capital Gains Tax                       | 4. Land - Revenue                |
| 5. Expenditure Tax                         | 5. Tax on non-urban fixed assets |
| 6. Corporation Tax                         | 6. Tax on hotel receipts         |
| 7. Estate Duty                             | 7. Road Tax                      |
| 8. Interest Tax                            |                                  |
| 9. Dividend Tax                            |                                  |
| 10. Securities Transaction Tax (STT), etc. |                                  |
| Indirect Tax of Central Government         | State Government Indirect Tax    |
| 1. Central Excise                          | 1. Sales Tax / Business Tax      |
| 2. Central Sales Tax                       | 2. Taxes on Vehicles             |
| 3. Custom Duty                             | 3. Taxes on Advertisement        |
| 4. Service Tax (from 1994-95)              | 4. Stamp and Registration Duty   |
| 5. GST State Excise                        | 6. Education Cess                |
|                                            | 7. Entry Tax                     |
|                                            | 8. Sales Tax on Diesel, Petrol   |

- In addition to direct and indirect classification, tax is also divided into specific tax and value-based tax, non-compliant, regressive, downward and progressive taxes.
- **Value-Added Tax** is a tax that is levied on the value of a commodity.
- Specific taxes are those taxes that are levied on the unit and quantity of the commodity.
- Those taxes are termed Regressive Taxes in which the tax rate decreases progressively with the increase in the tax base (**income**). This type of tax has a heavy burden on the poor.
- Regarding regressive taxes, the important fact is that on higher income, the total tax volume increases, but the tax rate decreases.
- Proportional taxes are those taxes in which the tax rate remains unchanged even after the change in the basis of tax.
- There is no change in the tax rate when income increases under proportionate taxes. Although the total amount of tax paid by the taxpayer increases as the income increases.
- A progressive tax is a tax in which tax rates increase with the increase in income.

- Forward tax is a tax in which the rate of tax increases at first as income increases, but after a limit, the tax rate becomes constant.

✎ **Note :** Both estate tax and gift tax are referred to as paper taxes.

✎ **Note :** Dividends received by the government from public sector undertakings (PSUs) are non-tax revenue receipts.

## Major Taxes In India

### 1. Income Tax :

- Income Tax in India is charged and collected by the Central Government. The Central Government distributes the revenue received from Income Tax on the recommendation of Finance Commission between the Centre and the States.

(IAS, 1995; UPPCS, 2008; 08)

✎ **Note :** Income Tax is not levied on income from agriculture.

### 2. Corporation Tax:

- The tax levied on the income of business companies and corporations is called '**corporation tax**'.
- It is also called 'company profit tax', but it is different from the tax which the shareholders of the companies pay on their income.
- It is being levied in India from 1960-61.
- It is levied by the Central Government.

### 3. Expenditure Tax:

- It is a type of direct tax levied on the amount of consumption expenditure incurred by the people. (UPPCS, 2004)
- The suggestion of levying expenditure tax in India was first given in 1956 by **Nicholas Kaldor**.
- Expenditure Tax Act was passed on **1 April 1957**. Consequently, it was imposed for the first time on **1<sup>st</sup> April, 1958** but finally abolished in 1964.

### 4. Estate Duty :

- Estate duty is a direct tax levied by the Central Government.
- Estate duty is levied on the transfer of property left by a person after his death. (IAS 1994; MPPCS, 2006)
- It was abolished in 1985.

### 5. Wealth Tax :

- Wealth tax is also a direct tax that is meant to be levied annually on total value of a person's wealth, capital or money. (IAS, 2011)
- The British economist, Keldar suggested the imposition of wealth tax in India which was resulted in the first taxation of wealth in 1957.
- It is levied as an annual tax on the net wealth of individuals, undivided families and companies.
- It was abolished from the financial year 2015-16.

## 6. Service Tax :

- Service tax in India was introduced in 1994-95. (UPPCS, 2008; 09; 19)
- For the first time in 1994-95, service tax was imposed at the rate of 5 per cent on telephone, general insurance and stock brokerage.

## 7. Central Excise Duty:

- Excise duty is an indirect tax levied by the Central Government and distributed amongst the states based on the formula prescribed by the Finance Commission
- It is applied to goods produced in the country.
- It is a type of commodity tax.
- It is not levied on the actual sale of goods, but on the production of goods and the tax is collected at the factory level itself. When the item reaches the consumers, the excise duty is attached to it. (UPPCS, 2005; UP RO/ARO 2016)

## 8. Customs Duty :

- Customs duty is an indirect tax. It is levied by the Central Government on import and export of goods by the Central Government.
- It is levied both in terms of value and quantity.
- When Customs duties are levied on value, they are called **Ad Valorem Tax** and when levied on quantity, it is called **Specific Duty**.

## 9. VAT: (Value Added Tax):

- VAT is known as Value Added Tax. In fact, it is imposed on the increase in the price of a commodity. In other words, it can also be said that it is a tax levied on the difference between the final value of an article and the goods (i.e. raw material). (UPPCS, 2006, 12)
- It is a type of sales tax that falls on the end consumer.
- France is believed to be the originator of VAT. In 1954, it was introduced in France as an alternative to sales tax.
- **Value Added Tax (VAT)** was first introduced in Haryana in 2003 and finally in Uttar Pradesh in 2008.

## 10. Inauguration of Goods and Services Tax:

- On 1 July, 2017 (at midnight of 30<sup>th</sup> June), Goods and Services Tax (GST) was launched from the historic Central Hall of the Parliament House by the then President Pranab Mukherjee and Prime Minister Narendra Modi. (UPPCS, 2009; 17)
- Prime Minister Modi addressed the Goods and Services Tax as Good and Simple Tax.
- It is an indirect tax that has covered most of its predecessor indirect taxes.
- It is a single tax on the supply of goods and services from manufacturer to consumer.
- Under this only the value addition is taxed at each stage.
- Provision for input credit (credit of tax already paid) has also been made under GST to avoid double taxation.
- The liability and actual obligation to pay **Goods and Services Tax (GST)** lies on two different persons.

- It is noteworthy that the provision of Goods and Services Tax in India has been made under **101<sup>st</sup> Constitutional Amendment Act** which was enacted on 8<sup>th</sup> September, 2016 and came into effect from 1 July, 2017.
- Under this Amendment Act of Constitution, Part 11 of the Constitution (Articles 248, 249 and 250); Part 12 (Articles 268, 269, 270, 271 and 286); Part 19 (Article 266); Part 20 (Article 368) and Sixth and Seventh Schedules have been amended.
- Under this amendment, three new Articles (Articles 246A, 269A and 279A) were added to the Constitution, and Article 268A was abolished.
- **GST has two components in view of the Indian federal structure** - Central GST (CGST) and State GST (SGST). Both the Centre and the State will simultaneously impose the Goods and Services Tax on the value chain.
- The Centre will levy CGST and collect tax on all businesses across the Indian territory while States will levy and collect SGST on all businesses within their States.
- In addition, the Integrated **Goods and Services Tax (IGST)** will be levied under **Article 269A (1)** on interstate trade of goods and services.
- It will be equal to the sum of CGST and SGST.
- **IGST** will be imposed and collected by the Centre and its distribution will be done between the Centre and the States.
- **The effective GST** rate on 178 items included in the 28 per cent tax slab has been reduced to 18 per cent from **November 15, 2017**, as per the recommendations made by the GST Council. Thus, now, only 50 such items are left which will attract **28 per cent GST**. Several other items which had a **GST** of 18 per cent till now, have been shifted to a 12 per cent slab.
- In the present form, all goods and services under GST are classified into five groups.
- **Excess essential items** like Milk, Egg, Curd, Open Food Grains, Health Services, Education Services, etc. are exempted from tax.
- The groups of the remaining items are placed in tax slabs of **5 per cent, 12 per cent, 18 per cent and 28 per cent** according to their utility.
- According to official information, 81 per cent of the items are kept either in **18 per cent or less slab**.
- **Only 19 per cent** of the items are in the tax slab of 28 per cent.

## Taxes included in GST:

- **Central Tax:** Central Excise, Additional Excise, Service Tax, Additional Customs Duty (**Countervailing Duty**), Special Additional Customs Duty and Surcharge and Cess.
- **State Tax:** State Value Added Tax (VAT) / Sales Tax, Entertainment Tax (**excluding taxes applicable by Local**

**Bodies**), Central Sales Tax (levied by the Center and collected by the States), Octroi and Entry Tax, Purchasing Tax, Luxury Tax, Taxes on Lottery, Betting and Gambling and Surcharge and Cess.

#### Taxes kept outside the purview of GST:

- Tax on intoxicating liquor for human use is exempted from GST, while five petrochemical products (**crude petroleum, high-speed diesel, motor spirit, natural gas and aviation fuel**) are temporarily excluded from the purview of GST.

#### Permanent Account Number: (PAN):

- PAN Card is issued by the Income Tax Department, bearing the person's name, date of birth and PAN number and signature of the person concerned. It does not authenticate the address.

#### Key Points of Foreign Trade Policy, 2023 :

- **On 31<sup>st</sup> March 2023** the Union Minister of State for Commerce and Industry, Consumer Affairs, Food and Public Distribution and Textile, Piyush Goel released '**Foreign Trade Policy, 2023**'.
- Foreign Trade Policy seeks to India's export to 2 trillion dollars by 2030.
- **4 pillars of FTP 2023 are** - Incentive to Remission, Export promotion through Collaboration, Ease of doing business and Emerging areas.
- The FIP 2023 is facilitating export by streamlining the popular Advanced Authorisation and EPCG Scheme.
- The New FTP is introducing one-time Amnesty Scheme.
- The FTP 2023 encourages recognition of new towns through "**Towns of Export Excellence Scheme**" and exporter through "**Status Holder Scheme**".
- 4 new towns namely Faridabad, Moradabad, Mirzapur and Varanasi have been designated as Town of Export Excellence (**TEE**) in addition to existing 39 towns.
- Earlier, Foreign Trade Policy 2015-20 has been extended till 2023 due to COVID and Russia - Ukraine War.
- The New Trade Policy (**FTP**) 2023 will come into implementation from **1<sup>st</sup> April, 2023**.

#### Miscellaneous

- Mainly three types of steps have been taken under land reforms in India - 1. Abolition of Middlemen (landlords) 2. Tenancy Reforms and 3. Reorganization of Agriculture.
- Under the Tenancy Reforms, mainly three types of measures were taken - **1. Regulation of Rent 2. Protection of Tenancy Rights** and **3. Tenants' Right to Own Land**.
- Under the restructuring of agriculture, mainly two types of measures have been taken. Holdings excess is considered illegal.
- Consolidation of holdings refers to the collection of divided and fragmented holdings, thereby increasing the size of the holdings.

- The maximum number of holdings in India is of marginal type.
- Holding with an area less than 1 hectare is called Marginal holdings, small holdings with 1 to 2 hectares, semi-medium holdings with 4-10 hectares and **large holdings** with an area larger than 10 hectares are called **large holdings**.
- As per **Agricultural Census** in 2015-16, the total number of operational holdings in the country is 138.35 million for 2010-11, 146.45 million hectares in 2015-16, showing an increase of **5.86 per cent**.
- The share of the operational area has come down from 159.59 million hectare in 2010-11 to 157.82 million hectare in 2015-16, indicating a decrease of **1.11 per cent**.
- The share of small and marginal in the total holdings is the 86.08 per cent according to Agriculture census **2015-16**.
- The share of such holdings in operated area was **43.99% in 2015-16**.
- The beginning of the Green Revolution is considered from the **Third Five-Year Plan**.
- It had the most positive effect on wheat which has increased the yield by about **500 per cent**.
- Agricultural Computation in 2015-16, the ratio of small and marginal holdings to total holdings is **86.08%**.
- The share of semi-mid and mid-sized holdings was **13.35 per cent** by number and **43.99 per cent** by area.
- **First National Farmers Commission** was formed in January 2004.
- The first Chairman of this commission was **Sompal**, later M.S. Swaminathan became its President.
- The agricultural year in India is considered from **1<sup>st</sup> July to 30<sup>th</sup> June**.
- According to the economic computation **2010-11**, the net irrigated area in the net sown area of India was **45.7 per cent**.

| Various Revolutions      | Priority Area                  |
|--------------------------|--------------------------------|
| Green Revolution         | Food Production                |
| White Revolution         | Milk Production                |
| Yellow Revolution        | Oilseed Production             |
| Blue Revolution          | Fisheries Production           |
| Silver Revolution        | Egg / Poultry Meat Production  |
| Red Revolution           | Tomato Production              |
| Silver Fibres Revolution | Cotton Production              |
| Golden Fibre Revolution  | Jute Production                |
| Golden Revolution        | Fruits & Vegetables Production |
| (Grey) Revolution        | Fertilizer Production          |
| Round Revolution         | Potato Production              |
| Pink Revolution          | Onion, Shrimp Production       |



- The main food crop in India is **rice**.
- After Brazil, India is the second largest sugarcane producing country.
- About 70 per cent of the total Coffee production in India is produced in Karnataka.
- **Uttar Pradesh** is the largest producer of **Wheat**. Punjab and Madhya Pradesh are on the second and third position, respectively.
- The largest producer of **Rice** is **West Bengal**. Uttar Pradesh and Punjab are on the second and third position respectively.
- National Agricultural Insurance Scheme was implemented in **October 1999**.

✎ **Note :** The method used to calculate the annual value of goods and services produced is called value added method.

- The velocity of circulation of money is the number of times a unit of currency is transferred in a unit period.
- In distinguished unemployment the person contributes less than his capacity.
- Expenditures on money transfers and services are also current accounts.
- **Pradhan Mantri Jan Dhan Yojna (PMJDY)** registered its name in the Guinness Book of World Records for opening the maximum number of bank accounts in a week.
- The number of times a currency is transferred from one unit to another is called the velocity of circulation of currency.
- The ratio of additional consumption to additional income is called marginal propensity to consume.
- Government expenditure on health facilities education and acquisition of fixed assets is called capital expenditure.

### Agricultural Produce Board

| Sl. No. | Board                                      | Establishment | Headquarters            |
|---------|--------------------------------------------|---------------|-------------------------|
| 1.      | Coffee Board of India                      | 1942          | Bengaluru (Karnataka)   |
| 2.      | Indian Rubber Board                        | 1947          | Kottayam (Kerala)       |
| 3.      | Tea Board of India                         | 1954          | Kolkata (West Bengal)   |
| 4.      | Tobacco Board of India                     | 1976          | Guntur (Andhra Pradesh) |
| 5.      | Indian Spices Board                        | 1987          | Kochi (Kerala)          |
| 6.      | National Meat and Poultry Processing Board | 2009          | Delhi                   |
| 7.      | Indian Grape Processing Board              | 2009          | Pune (Maharashtra)      |
| 8.      | National Fisheries Development Board       | 2006          | Hyderabad               |
| 9.      | National Jute Board                        | 2009          | Kolkata (West Bengal)   |

- India's largest textile industry centre is Mumbai. It is also known as the '**Virat Nagar of Cotton**'.
- India is not self-sufficient in terms of chemical fertilizers.
- In the Second Five-Year Plan, the Bhilai Steel Plant was established in collaboration with the then Soviet Union (USSR).
- Bhilai Steel Plant is located in Durg, Chhattisgarh.
- During the Second Five Year Plan, Durgapur Steel Plant (West Bengal) was established in collaboration with Britain and Rourkela Steel Plant (Odisha) was established in collaboration with Germany.
- The **Indian Diamond Institute (IDI)** is established in Surat.
- Bharat Sanchar Nigam Limited (BSNL) was established in 2000.
- **KRIBHCO** fertiliser plant at Shahjahanpur is based on natural gas.
- The most important small scale industry in India is handloom sector.
- Labour-Intensive industries are those in which the value of labour is more important than the capital value.
- The textile industry is on second position in the Indian economy after agriculture.
- The textile industry is the second largest employment generating sector in the country after agriculture.
- The major sugar producing state is Uttar Pradesh (as on 1 July 2019) and on the second position is Maharashtra.
- The centre for jute goods is **Titagarh of Bengal** and the centre of silk textile production is Bengaluru city of Karnataka.
- **Punjab** has maximum contribution in wool textile production. Most of the wool textile mills are located in Amritsar, Gurdaspur and Ludhiana.
- Bhadohi district located in Uttar Pradesh is a major centre of **carpet production**.
- The first industry which developed in India was the cottage industry.
- Newsprint is mostly produced in India National News Print and Paper Mills Ltd., Madhya Pradesh.

### Major International Organizations:

- **World Trade Organization (WTO)** it was established on 1 January 1995.
- Its headquarter is located **Geneva, Switzerland**.
- As of 29 July 2016, 164 countries become members of the World Trade Organization
- India is a member of the World Trade Organization since 1995.
- **South Asian Association for Regional Cooperation (SAARC)** was established in December 1985.

- Its headquarter is located in **Kathmandu**.
- SAARC member nations are Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka.
- **ASEAN** was established in 1967. Its headquarter is located in Jakarta.
- The **World Bank** was established in July 1945.
- World Bank Headquarter is located in **Washington D.C.**
- Indian origin Ajay Banga has been appointed as **14<sup>th</sup> President** of the World Bank.
- The headquarter of the European Economic Community is located in **Brussels**.
- There are two types of revenue receipts (tax revenue and non tax revenue) in the economy.

### Important Economic Glossaries

- **Embargo** : A ban on ports so that imports - exports remain suspended. In the prevailing sense, Embargo means Economic Restriction.
- **Credit Method** is not a part of the method of measurement of national income where as General investment product method and expenditure method are the measurement method of National income.
- **Balance Payment** : The accounting of the transactions of a country with the rest of the world in a given time period. Under the transaction comes the import of goods and services, exports, short and long term investments and gifts.
- **Balance of Trade** : The difference between the import and export of a country is called **Balance of Trade**.
- The full form of BFSI is Banking Financial Services and Insurance. It is a broad term used in the industry that covers financial services financial products and insurance products.
- **Bilateral Monopoly** : It is a market situation in which the monopoly of the buyer faces the monopoly of seller.
- **Break - Even - Point** : The point at which the total proceeds and the total cost are equal. In economics, cost has a common benefit. Hence, the equilibrium level point does not mean zero gain.
- **Reserve Repo Rate** : It is the rate at which RBI borrows money from commercial banks within the country.
- **Depression** : A state of trade cycle in which economic activities are relaxed. In a recession, prices, profits, consumptions and capital investments are all at low levels.
- **Open Market Operations** : It is the agricultural sales and purchases of government securities in the open market by RBI with the aim of infusing liquidity into the economy in the medium term.
- **Recession** : When the demand is less than the supply of goods is called '**recession**'. This situation arises due to lack of funds, due to which the goods are not sold, resulting in industry shutdown.
- **Derived Demand** : The demand for an item that arises from the demand for the item in which that item is used. Like the demand for bricks comes with the demand to build houses.
- **Devaluation** : Devaluation is deliberately depreciating the value of your country's currency against foreign currency. Devaluation encourages exports and discourages imports.
- **Deduction Rate**: The rate of interest on the loan given by the central bank to the member banks is called the **rate of deduction**. This is called the cut-rate because the interest on the loan is deducted at the time of granting the loan. It is called '**Bank Rate**'.
- **Equilibrium Price**: The price at which the demand and supply of goods will be equal in the market is called '**equilibrium price**'.
- **Credit Squeeze**: Market limiting or closing the flow of credit in the market by the Reserve Bank to deal with the prevailing price rise and inflation is called '**credit squeeze**'.
- **Reflation**: To deal with the prevailing economic crisis and crisis of price rise in the country to create more employment opportunities by investing more money in the economic sector is called '**Reflation**'.
- **Stagflation**: When a recessionary situation arises along with inflation, that condition is called '**stagflation**'.
- **Demonetization**: The process of bringing the new currency into circulation and taking out of circulation the old currency by the government is called **Demonetization**.
- **Boom**: The state of economic activities moving at a rapid pace is called the '**boom situation**' in the economy.
- **Buffer Stock**: To meet the shortage of goods in an emergency by storing them in large quantities is called **buffer stock**.
- **Buyers Market**: When the demand for a commodity is low and supply is high, it is said '**buyer market**'. The buyer is in a better position than the seller in the buyer market.
- **Demat Account**: To trade in the stock market, it is necessary to have a Demat account. Demat account is opened by recognized brokerage firms / banks.
- **Active Share**: The shares that are traded daily in the stock market are called **active shares**.
- **Insider Trading**: When a person or persons collect information about a company secretly and then purchase/sell a large number of shares of that company, it is called '**Insider Trading**'. Insider trading is an illegal act.
- **Tariff**: The tax levied on imports is called '**Tariff**'.
- **Share Certificate**: It is a certificate of share provided by a company to its shareholder on which all the details related to the shareholder's share are mentioned.
- **Volatile Share**: The shares of which there are many changes in prices are called volatile shares.

- **Short Selling:** If the sale of more shares or the shares which are not held by them are sold, it is called '**short-selling**'.
- **Grey Market:** Grey market is a parallel market where transactions take place without registration. The term is also used to refer to the transaction of shares without registration.
- **Primary Gold:** 24-carat pure gold is called '**primary gold**'.
- **Deficit Financing:** When a government's budget contains low income and high expenditure i.e deficit budget, then for that expenditure, the government takes a loan from banks or issues additional letter currency.

| Major Committees / Commissions |                               |                                                    |                  |
|--------------------------------|-------------------------------|----------------------------------------------------|------------------|
| Sl. No.                        | Committees                    | Functions                                          | Formation (Year) |
| 1.                             | Mahalanobis Committee         | Assessment of Income Distribution                  | 1960             |
| 2.                             | Khusro Committee              | Agriculture and Rural Credit                       | 1989             |
| 3.                             | Dantewala Committee           | Unemployment Estimate                              | 1969             |
| 4.                             | Sarkaria Commission           | Center - State Relations                           | 1983             |
| 5.                             | Goiporia Committee            | Banking Services Reforms                           | 1990             |
| 6.                             | Goswami Committee             | Industrial Illness                                 | 1993             |
| 7.                             | Narasimham Committee          | Financial Reforms                                  | 1991             |
| 8.                             | Raja Chelliah Committee       | Tax Reforms                                        | 1991             |
| 9.                             | Janakiraman Committee         | Securities Scam                                    | 1992             |
| 10.                            | Malhotra Committee            | Insurance Reforms                                  | 1993             |
| 11.                            | Bhandari Committee            | Restructuring of Regional Rural Banks              | 1994             |
| 12.                            | Abid Hussain Committee        | Small Scale Industries                             | 1995             |
| 13.                            | Meera Seth Committee          | Handloom Development                               | 1997             |
| 14.                            | Mahajan Committee             | Sugar Industry                                     | 1997             |
| 15.                            | S. Tarapore Committee         | Rupees Convertibility in Capital Account           | 1997             |
| 16.                            | VS Vyas Committee             | Agriculture and Rural Credit Extension             | 2000             |
| 17.                            | Suresh Tendulkar Committee    | Poverty                                            | 2005             |
| 18.                            | Sachhar Committee             | Social, Economic and Educational Status of Muslims | 2005             |
| 19.                            | Rangarajan Committee          | Balance of Payments                                | 1993             |
| 20.                            | Dr. Kirti S. Parikh Committee | Suggestions on Petroleum Products and Price System | 2013             |

- **Soft Loan:** When a loan is obtained on easy terms such as long repayment period and low interest, it is called '**soft loan**'.
- **Nostro Account :** It is a bank account that a bank holds with a foreign bank in the currency of the country where the funds are held.
- **Hot Money:** Early migration tendency of foreign currency is known as Hot Money. It is transferred to places with higher profits.
- **Draft:** A draft is a letter of credit in which an order is made by a bank to any of its branches on demand for money written in the draft as per the order of the recipient.
- **Patent:** The recognition of intellectual rights by a government to a person or institution related to the original discovery or creation is called a '**patent**'.
- **Division of Labour:** The process of getting a task done by more than one person at different stages is called '**division of labour**'. It encourages specialization.
- **Normal resident of a country:** Normal resident of a country means a person or entity who has been living in this country for more than one year and whose economic interest is concentrated in that country. For example- a person who has a passport and citizenship of India, but has worked in the US for years. He will be considered a normal resident of America, not American citizen and ordinary resident of India.
- **Productive and Unproductive Activities:** The actions that contribute to the flow of goods and services in an economy are called '**productive activities**'. The person who contributes to these activities earns income, while the activities that do not contribute anything to the flow of goods and services are called '**unproductive activities**'. When individuals receive payments (eg. - old age pension, scholarships, pocket expenses paid by father to son, etc.) without any contribution to the flow of final production, such payments are called '**Transfer Payment**'.
- **Stocks and Flows:** Stock is the variable amount that expresses its total volume at a given point of time, while the variable flow amount refers to the amount of change in a period of time.
- **Closed Economy:** A country that has no economic relation (import - export) from other countries is known as '**closed economy**'. Apart from this country, all other countries which are kept in one class group are called the '**Rest of the World**'. At present, no country in the world has to be considered closed economy.
- **Open Economy:** A country that has an economic relationship with the rest of the world is called an '**open economy**'. There is a difference between GDP and GNP, which can be less, equal or more. For example  $GDP < GNP$ ,  $GDP = GNP$  or  $GDP > GNP$ .



# General Science (Physics)



## Topics of the Unit

### A. Physics

● Units ● Dimensions of Physical Quantities ● Motion and Force ● Work, Power and Energy ● Gravitation ● Simple Harmonic Motion ● Floatation ● Surface Tension ● Viscosity ● Pressure ● Elasticity ● Wave Motion ● Sound ● Heat ● Light ● Static Electricity ● Electric Current ● Magnetism ● Nuclear Physics

### B. Chemistry

● Particle Nature of Matter ● Structure of Atom ● Classification of Elements and Periodicity in Their Properties ● Chemical Bonding ● Oxidation-Reduction or Redox Reaction ● Acid and Base ● Gaseous State and Nature of Gases ● Hydrogen and Its Compounds ● Hardness of Water ● Elements of s-Block ● Boron and Carbon ● Elements of Groups 15, 16, 17 and 18 ● Some Important Non-Metals and Their Uses ● Some Important Metals and Their Uses ● Methods of Extraction of Elements and Processes ● Polymer ● Chemistry : Important Facts ● General Chemistry ● Hydrocarbons ● Artificial Substances ● Fuel

### C. Biology

● Taxonomy ● Cytology ● Organic Evolution ● Genetics ● Plant ● Ecosystem ● Pollution ● Classification of Animal Kingdom ● Human Body ● Nutrients ● Other Diseases ● Other Important Facts

The word 'science' is originated from the Latin word 'Scientia', meaning 'knowledge' or 'information'. The Sanskrit word 'Vigyan' and the Arabic word 'ilm' also have the same meaning, 'knowledge'.

From the view of general science, it does not mean pure science rather, it covers science, that deals with day-to-day happenings in the physical environment. According to a famous scientist J.B. Conant - the study of such a series of ingrained ideas obtained by experiments and observations that prove useful for possible future experiments is called Science.

Science is divided into three parts - (a) Physics (b) Chemistry and (c) Biology.



## Physics

Physics is derived from the Greek word 'Phusis' which means "Nature" or "Knowledge of Nature". It is equivalent to Sanskrit word "Bhautiki" which is related to the study of the physical world.

We can describe physics as the study of the fundamental laws of nature governing various natural phenomena.

### 1. Units

➤ A standard is needed for the measurement of a physical quantity. This standard is known as the unit of that physical quantity.

➤ Unit divided into two categories are (i) Fundamental or Base unit (ii) Derived unit.

➤ The following four types are prevalent for the measurement of physical quantities –

(i) **C.G.S. System** : In this system, units of length, mass and time are expressed centimetre, gram and second respectively, hence it is called Centimetre, Gram, Second or CG.S. method.

✎ **Note** : All physical quantities coming in this mechanism are expressed in the units of length, mass and time.

➤ The units of these three quantities are completely independent to each other and none of them can be converted or related to other unit.

➤ Hence these quantities are called fundamental quantities and its units called fundamental unit.

(ii) **F.P.S. System** : It's also called **British method**. In this system the units of Length, Mass and Time are expressed in Foot, Pound and Second respectively.

(iii) **M.K.S. System** : In this system the units of Length, Mass and Time are expressed in metre, kilogram and second respectively.

(iv) **S.I. System** : In the year 1960, this method was accepted in the **11<sup>th</sup> General conference on weights and measures in Paris**.

Presently this method is used.

There are seven basic parametre in this method.



| SI Fundamental Quantities and Their Units |            |         |
|-------------------------------------------|------------|---------|
| Fundamental Quantities                    | S.I. Units | Symbols |
| Length                                    | Metre      | m       |
| Mass                                      | Kilogram   | kg      |
| Time                                      | Second     | s       |
| Electric Current                          | Ampere     | A       |
| Thermodynamic Temperature                 | Kelvin     | K       |
| Quantity of Matter                        | Mole       | mol     |
| Luminous Intensity                        | Candela    | cd      |

- The unit system is based on the units of above mentioned seven basic quantities (length, mass, time, electric current, temperature, amount of substance and light intensity) is called 'International System of Units or SI Units.

#### Definition of SI Units

- 1. Metre (m) :** It is defined by taking the fixed numerical value of the speed of light in vacuum  $c$  to be  $299792458$  when expressed in the unit  $\text{ms}^{-1}$ , where the second is defined in terms of the caesium frequency.
- 2. Kilogram (k) :** The kilogram is defined by taking the fixed numerical value of the planck constant  $h$  to be  $6.62607015 \times 10^{-34}$  when expressed in the unit  $\text{Js}$ , which is equal to  $\text{kgm}^2\text{s}^{-1}$ , where the metre and the second are defined in terms of  $c$  and  $V_{\text{cs}}$ . In 2019, the definition of  $\text{Kg}$  was changed. The kilogram is now defined in terms of the Planck constant.
- 3. Second (s) :** The Second is defined by taking the fixed numerical value of the caesium frequency  $V_{\text{cs}}$ , the unperturbed ground-state hyperfine transition frequency of the caesium-133 atom, to be  $9192631770$  when expressed in the unit  $\text{Hz}$ , which is equal to  $\text{s}^{-1}$ .
- 4. Ampere (A) :** The ampere is defined by taking the fixed numerical value of the elementary charge  $e$  to be  $1.602176634 \times 10^{-19}$  when expressed in the unit  $\text{C}$ , which is equal to  $\text{As}$ , where the second is defined in terms of.
- 5. Kelvin (K) :** The Kelvin is defined by taking the fixed numerical value of the Boltzmann constant  $K$  to be  $1.380649 \times 10^{-23}$  when expressed in the unit  $\text{JK}^{-1}$ , which is equal to  $\text{kgm}^2\text{s}^{-2}\text{K}^{-1}$ , where the kilogram, metre and second are defined in terms of  $h$ ,  $c$  and  $V_{\text{cs}}$ .
- 6. Mole (mol) :** One mole contains exactly  $6.02214076 \times 10^{23}$  elementary entities. This number is the fixed numerical value of the Avogadro constant,  $N_A$ , when expressed in the unit  $\text{mol}^{-1}$  and is called the Avogadro number. The amount of substance, symbol  $n$ , of a system is a measure of

the number of specified elementary entities. An elementary entity may be an atom, a molecule, an ion, an electron, any other particle or specified group of particles.

- 7. Candela (cd) :** The candela is defined by taking the fixed numerical value of the luminous efficacy of monochromatic radiation of frequency  $540 \times 10^{12} \text{ Hz}$ ,  $K_{\text{cd}}$ , to be  $683$  when expressed in the unit  $\text{lm} \cdot \text{W}^{-1}$ , which is equal to  $\text{cd} \cdot \text{sr} \cdot \text{W}^{-1}$ , or  $\text{cd sr kg}^{-1}\text{m}^{-2}\text{s}^3$ , where the kilogram, metre and second are defined in terms of  $h$ ,  $c$  and  $V_{\text{cs}}$ .
- **Derived Unit :** Units of all those physical quantities that can be represented by the combination of fundamental units.

| 22 Derived SI Units of Specific Names and Symbols |                             |                                                                |
|---------------------------------------------------|-----------------------------|----------------------------------------------------------------|
| Physical Quantities                               | Specific Names of the Units | Symbol s and values in terms Fundamental Units                 |
| Plane Angle                                       | Radian                      | $\text{rad} = \text{m/m}$                                      |
| Solid Angle                                       | Steradian                   | $\text{sr} = \text{m}^2/\text{m}^2$                            |
| Frequency                                         | Hertz                       | $\text{Hz} = \text{s}^{-1}$                                    |
| Force                                             | Newton                      | $\text{N} = \text{kg ms}^{-2}$                                 |
| Pressure, Stress                                  | Pascal                      | $\text{Pa} = \text{kgm}^{-1} \text{s}^{-2}$                    |
| Energy, Work, Quantity of Heat                    | Joule                       | $\text{J} = \text{kg m}^2\text{s}^{-2}$                        |
| Power, Radiant Flux                               | Watt                        | $\text{W} = \text{kgm}^2 \text{s}^{-3}$                        |
| Electric Charge                                   | Coulomb                     | $\text{C} = \text{As}$                                         |
| Voltage/Electrical Potential                      | Volt                        | $\text{V} = \text{kg m}^2\text{s}^{-3}\text{A}^{-1}$           |
| Electrical Capacity                               | Farad                       | $\text{F} = \text{kg}^{-1} \text{m}^{-2} \text{s}^4\text{A}^2$ |
| Electrical Resistance                             | Ohm                         | $\Omega = \text{kg m}^2\text{s}^{-3}\text{A}^{-2}$             |
| Electrical Conductivity                           | Siemens                     | $\text{S} = \text{kg}^{-1}\text{m}^{-2} \text{s}^3\text{A}^2$  |
| Magnetic Flux                                     | Weber                       | $\text{Wb} = \text{kgm}^2\text{s}^{-2} \text{A}^{-1}$          |
| Magnetic Flux Density                             | Tesla                       | $\text{T} = \text{kgs}^{-2} \text{A}^{-1}$                     |
| Inductance                                        | Henry                       | $\text{H} = \text{kgm}^2\text{s}^{-2}\text{A}^{-2}$            |
| Temperature                                       | Degree Celsius              | $^{\circ}\text{C} = \text{K}$                                  |
| Luminous flux                                     | Lumen                       | $\text{lm} = \text{cd sr}$                                     |
| Illuminance                                       | Lux                         | $\text{lx} = \text{cd sr m}^{-2}$                              |
| Activity of a Radio                               | Becquerel                   | $\text{Bq} = \text{s}^{-1}$                                    |
| Nuclide                                           |                             |                                                                |
| Amount of Absorbed Radiation                      | Gray                        | $\text{Gy} = \text{m}^2\text{s}^{-2}$                          |
| Ionizing Radiation (Dose equivalent)              | Sievert                     | $\text{Sv} = \text{m}^2 \text{s}^{-2}$                         |
| Catalytic Activity                                | Katal                       | $\text{Kat} = \text{mols}^{-1}$                                |

### Some Derived Units in Terms of Fundamental Units

| Derived Quantities                 | Derived Units in Terms of Fundamental Units |
|------------------------------------|---------------------------------------------|
| Area                               | m <sup>2</sup>                              |
| Volume                             | m <sup>3</sup>                              |
| Speed, Velocity                    | ms <sup>-1</sup>                            |
| Acceleration                       | ms <sup>-2</sup>                            |
| Wave Number                        | m <sup>-1</sup>                             |
| Density, Mass Density              | kg m <sup>-3</sup>                          |
| Surface Density                    | kgm <sup>-2</sup>                           |
| Specific Volume                    | m <sup>3</sup> kg <sup>-1</sup>             |
| Current Density                    | Am <sup>-2</sup>                            |
| Magnetic Field Strength            | Am <sup>-1</sup>                            |
| Amount of Substances Concentration | mol m <sup>-3</sup>                         |
| Mass concentration                 | kg m <sup>-3</sup>                          |
| Luminance                          | cd m <sup>-2</sup>                          |

### Some Other Units than SI Units

| Names                         | Symbols | Value in Terms of SI Units                             |
|-------------------------------|---------|--------------------------------------------------------|
| Minute                        | min     | 60s                                                    |
| Hour                          | h       | 60 min = 3600 s                                        |
| Day                           | d       | 24h = 86400s                                           |
| Year                          | y       | 365.25 d = 3.156×10 <sup>7</sup> s                     |
| Degree                        | °       | 1° = (π/180) rad                                       |
| Litre                         | L       | 1 dm <sup>3</sup> = 10 <sup>-3</sup> m <sup>3</sup>    |
| Ton                           | t       | 1000 kg                                                |
| Carat                         | c       | 200 mg                                                 |
| Bar                           | bar     | 0.1 M Pa = 10 <sup>5</sup> Pa(Pascal)                  |
| Curie                         | Ci      | 3.7 × 10 <sup>10</sup> Decays/second                   |
| Rontgen                       | R       | 2.58 × 10 <sup>-4</sup> A.s/kg                         |
| Quintal                       | q       | 100 kg                                                 |
| Barn                          | b       | 100 fm <sup>2</sup> = 10 <sup>-28</sup> m <sup>2</sup> |
| Are                           | a       | 1 dam <sup>2</sup> = 10 <sup>2</sup> m <sup>2</sup>    |
| Hectare                       | ha      | 1 hm <sup>2</sup> = 10 <sup>4</sup> m <sup>2</sup>     |
| Standard atmospheric pressure | atm     | 101325 Pa = 1.013×10 <sup>5</sup> Pa                   |

- The International System of Units (SI), commonly known as the metric system is the international standard for measurement.
- It is denoted by S.I.

- A Light year is used to measure the very long distance.  
**1 light year = 9.46 × 10<sup>15</sup> metre**
- Parsec is the highest unit to measure distance.  
1 Parsec = 3.26 light years = 3.08×10<sup>16</sup> metre
- A Nautical mile is a unit to measure **distance in the sea**.
- 1 Nautical mile is equal to **1852 metres**.
- A Megawatt is the unit of measurement of **electricity** that is generated at the power plant.  
**1 megawatt = 10<sup>6</sup> (million) watt**
- There are 746 watts in one horse power.
- Cusec (Cubic feet per second) is the unit of rate of flow of water.  
**1 Cusec = 28.317 liter/second**
- The thickness of the ozone layer in the atmosphere is measured in **Dobson** Unit.  
One Dobson unit expresses a **10 micrometre** ozone layer at standard heat and pressure.  
One Dobson Unit (DU) = 2.69×10<sup>20</sup> Ozone molecule per square metre
- **Ampere** is the unit of electric current.
- **Coulomb (Ampere-second)** is the unit of electrical charge.
- **Angstrom** is the unit of wavelength of electromagnetic waves and light.  
**1 Angstrom (Å) = 10<sup>-10</sup> m**
- The **bar** is a metric **unit** of **pressure**, but not part of the international system of **Units (SI)**.  
**1 bar = 10<sup>5</sup> pascal**
- **A Calorie** is the unit of energy.
- **Force** has the unit '**Dyne**' in the CGS system.
- S.I. Unit of force is **Newton**  
**1 Newton = 10<sup>5</sup> Dyne**
- One nanometre is – 10<sup>-7</sup> c.m.,  
– 10<sup>-9</sup> metre
- **Newton-Second** is the unit of Impulse.
- The S.I. Unit of **work** is the **joule**.
- C.G.S. unit of **work** is '**erg**'.  
**1 Joule = 10<sup>7</sup> erg**
- Unit of power is joule/second, known as **watt**.
- The Intensity of sound is measured in **decibel**.
- SI unit for the measurement of distance is **metre**.
- The abbreviation of word Radar Detection 'Radio and Ranging'.
- It is basically an electromagnetic system used to detect the location and distance of an object from the point where the RADAR is placed.
- It works by radiating energy into space and monitoring the echo or reflected signal from the objects. It operates in the UHF and microwave range.
- **The abbreviation of word SONAR is- Sound Navigation and Ranging.**

- A Sonar is a device that uses sound waves to detect objects.
- In the fishing industry, a Sonar is used to detect fish, structure, and the seafloor around the vessel, while a fish finder detects these objects directly under the vessel.
- A Sonar detects these objects by emitting ultrasonic waves into the sea and detecting the reflected echoes.
- It is important to mention here that the Sonar can detect and display the distribution, density, and movement of a school of fish at an angle of **360° or 180°** in all directions.
- Pyrometer also is known as an Infrared thermometer or Radiation thermometer or non-contact thermometer used to detect the temperature of an object's surface temperature, which depends on the radiation (infrared or visible) emitted from the object.
- The High Temperature Pyrometer has a very wide temperature measurement range from **-50°C to over 2200°C**.
- In the the past, the volume of oil was measured in **barrel**.
- Now it is measured in cubic metre.

**1 barrel = 0.158987 cubic metre**

**Note :** 1 barrel = 159 litres.

- Unit of **radioactivity** is **curie**.
- **Diopter** is the unit of the power of the **lens**.
- In the CGS system unit of **magnetic inductance** is **Gauss**.
- S.I. Unit of electrical resistance is the Ohm.

- **Symbols of various powers of 10 :** In physics, very huge and minimal quantities are represented by the powers of 10. Following are the names and symbols of the powers of 10 –

| Name  | Power of Ten | Symbol | Name  | Power of Ten | Symbol |
|-------|--------------|--------|-------|--------------|--------|
| Yotta | $10^{24}$    | Y      | Yocto | $10^{-24}$   | y      |
| Zetta | $10^{21}$    | Z      | Zepto | $10^{-21}$   | z      |
| Exa   | $10^{18}$    | E      | Atto  | $10^{-18}$   | a      |
| Peta  | $10^{15}$    | P      | femto | $10^{-15}$   | f      |
| Tera  | $10^{12}$    | T      | Pico  | $10^{-12}$   | p      |
| Giga  | $10^9$       | G      | Nano  | $10^{-9}$    | n      |
| Mega  | $10^6$       | M      | Micro | $10^{-6}$    | u      |
| Kilo  | $10^3$       | K      | Milli | $10^{-3}$    | m      |
| Hecto | $10^2$       | h      | Centi | $10^{-2}$    | c      |
| Deca  | $10^1$       | da     | Deci  | $10^{-1}$    | d      |

## 2. Dimensions of Physical Quantities

- Dimensions of a physical quantity are defined as the power to which the fundamental quantities are raised in order to represent that quantity.
- All physical quantities are expressed in terms of dimensions of **L(length)**, **M(mass)** and **T(time)**.

| S.N. | Derived Physical Quantities | Relation with other                                                                | Dimension Formula                         |
|------|-----------------------------|------------------------------------------------------------------------------------|-------------------------------------------|
| 1.   | Area                        | Length $\times$ Breadth                                                            | $[L \times L] = [L^2]$                    |
| 2.   | Volume                      | Length $\times$ Breadth $\times$ Thickness                                         | $[L \times L \times L] = [L^3]$           |
| 3.   | Density                     | $\frac{\text{Mass}}{\text{Volume}}$                                                | $\frac{[M]}{[L^3]} = [ML^{-3}]$           |
| 4.   | Velocity or Speed           | $\frac{\text{Displacement}}{\text{Time}}$ or $\frac{\text{Distance}}{\text{Time}}$ | $\frac{[L]}{[T]} = [LT^{-2}]$             |
| 5.   | Acceleration                | $\frac{\text{Change in velocity}}{\text{Time}}$                                    | $\frac{[LT^{-1}]}{[T]} = [LT^{-2}]$       |
| 6.   | Force                       | Mass $\times$ Acceleration                                                         | $[M] [LT^{-2}] = [MLT^{-2}]$              |
| 7.   | Torque                      | Force $\times$ Distance                                                            | $[MLT^{-2}] [L] = [ML^2 T^{-2}]$          |
| 8.   | Work                        | Force $\times$ Distance                                                            | $[MLT^{-2}] [L] = [ML^2 T^{-2}]$          |
| 9.   | Frequency                   | $\frac{1}{\text{Time period}}$                                                     | $[T^{-1}]$                                |
| 10.  | Impulse                     | Force $\times$ time                                                                | $[MLT^{-2}] [T] = [MLT^{-1}]$             |
| 11.  | Momentum                    | Mass $\times$ Velocity                                                             | $[M] [LT^{-1}] = [MLT^{-1}]$              |
| 12.  | Power                       | $\frac{\text{Work}}{\text{Time}}$                                                  | $\frac{ML^2T^{-2}}{[T]} = ML^2 T^{-3}$    |
| 13.  | Pressure                    | $\frac{\text{Force}}{\text{Area}}$                                                 | $\frac{MLT^{-2}}{L^2} = [ML^{-1} T^{-2}]$ |
| 14.  | Stress                      | $\frac{\text{Force}}{\text{Area}}$                                                 | $\frac{MLT^{-2}}{L^2} = [ML^{-1} T^{-2}]$ |

### 3. Motion and Force

- **Scalar Quantity** : Scalar quantities are those physical quantities that have no direction but **only have magnitude**, e.g. distance, volume, mass, density, work, energy, time, temperature, power, charge, frequency, potential and speed etc.
- **Vector Quantity** : Vector quantities are those physical quantities that have both **magnitudes** as well as **direction**, e.g. impulse, displacement, acceleration, velocity, force, momentum, electric field, magnetic field etc.
- **Distance and Displacement** : Total length covered by a particle in a fixed time on a path is called **distance**. At the same time, the minimum linear distance between the starting and destination point of an object is called **displacement**.
- Distance is a **scalar quantity** while displacement is a **vector quantity**.
- **Speed & Velocity** : Distance travelled by an object in a fixed period of time is called **speed**. Due to the speed of an object, its displacement in a fixed time period is known as its **velocity**.
- **Speed** is a **scalar** quantity and **velocity** is a **vector** quantity.
- S.I. unit of speed and velocity is **m/s**  
$$\text{Speed} = \frac{\text{Displacement}}{\text{Time}} \text{ and}$$
$$\text{Velocity} = \frac{\text{Distance}}{\text{Time}} = \frac{D}{T}$$
- **Acceleration : Rate of change** of velocity of an object is called its acceleration. The rate of decreasing velocity is known as **retardation**.
- Unit of acceleration in S.I. System is **metre/second<sup>2</sup>**.
- **Circular Motion** : When an object moves in a circular path, then its motion is called **circular motion**. If an object moves at uniform speed, its motion is called uniform circular motion.
- **Angular Velocity** : The rate of change of angular displacement of a particle with time is called the angular velocity of that particle.
- It is usually expressed by the Greek symbol 'ω' (Omega).
- Unit of angular velocity is **radian/second**.
- Angular velocity is a **vector quantity**.
- **Linear Velocity** : Velocity of a particle moving in a straight line is called a linear velocity. In other words, the rate of change of linear displacement of any particle in linear motion is known as the linear velocity of that particle.
- Unit of linear velocity is **metre/second**.
- Linear velocity is a **vector quantity**.

- **Newton's Laws of Motion** : Sir Issac Newton proposed three basic laws of motion based upon the assumptions of Galileo.

- Sir Isaac Newton formulated the following three basic laws of motion on the basis of Galileo's concepts –

1. **Newton's First Law of Motion** : According to this law, every object which remains in the state of rest or in uniform motion in a straight line, unless compelled to change its state by the action of an external force.

- This law is also known as the **Law of Inertia** or **Galileo's Law**.

- **Inertia** : Inertia means **resistance to change**. Inertia is a kind of property of an object which makes it resistant to any kind of change in its state of rest or the uniform motion.

#### Some Important Examples of Inertia–

- **Inertia of Rest** :

- (i) A traveller falls behind when a stationary bus suddenly moves ahead.
- (ii) Separation of dust particles on sudden jerking of a blanket.
- (iii) Falling of fruits from the tree when it is shaken.
- (iv) A hole is created in a windowpane of glass when hit by a bullet but it gets broken when hit by a stone.

- **Inertia of Motion** :

- (i) Leaning forward of the travellers when a moving vehicle suddenly stops.
- (ii) If a person throws a ball vertically upwards in a moving train, it comes back to his hand.
- (iii) The passenger falls forward when he suddenly steps down from the moving bus.

2. **Newton's Second Law of Motion** : According to this law, force applied on an object is equal to the mass of that objects times its acceleration.

$$\text{Force} = \text{mass} \times \text{acceleration}$$

$$F = ma$$

- Therefore, if no force is acting upon the object, its acceleration will be zero and zero acceleration means that an object is in a state of rest or moving in a constant velocity.

3. **Newton's Third Law of Motion** :

According to this law of motion, every action has an equal and opposite reaction. This is why this law is also called the '**Law of Action and Reaction**'.

- According to this law, when a body applies a force upon another body, it also applies equal and opposite force to that body.

#### Examples :

- (i) When we punch the wall, the wall also exerts the same force and we feel hurt.
- (ii) The boat moves back when we jump out of it.
- (iii) A man while drawing water out of a well in a bucket drawn by a rope is thrown backwards if rope breaks.



- **Force :** Force is that external factor that either changes the state of an object or tries to change its state.
- Force is a vector quantity and its S.I. Unit is 'Newton'.
- **Anemometer** is used to measure the velocity of the air and its direction.

- **Momentum :** The product of mass and velocity of an object is known as its momentum.

$$\text{Momentum} = \text{mass} \times \text{velocity}$$

$$\text{or } P = mv$$

Where P momentum, Mmass and Vvelocity

- S.I. Unit of momentum is kg m/s.
- **Change of Momentum :** The rate of change of momentum of an object is proportional to the external force acting on the object.
- Change in the momentum is always in the direction of force.
- This is another form of Newton's second law of motion.

$$\text{Force} \propto \frac{\text{Change in momentum}}{\text{Time}}$$

- If u is the initial velocity of an object of mass m, then its initial momentum – mu
- After a force 'F' acts on this object for time t, its final velocity becomes v. Hence final momentum of the object = mv

- **Change in momentum = mv – mu**

$$F \propto \frac{mv - mu}{t}$$

$$F \propto \frac{m(v - u)}{t}$$

$$F \propto ma$$

$$F = ma$$

- In SI units, the value of constant k is 1.

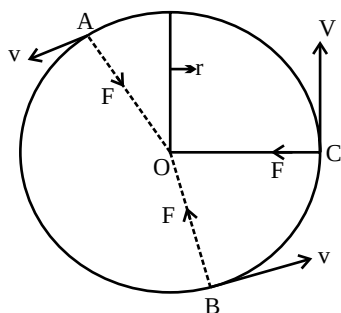
$$\therefore F = 1 \times m \times a$$

$$F = ma$$

- Which is Newton's second law of motion.

**Law of Conservation of Momentum :** The conservation of momentum states that, within some problem domain, the amount of momentum remains constant; momentum is neither created nor destroyed, but only changed through the action of forces as described by Newton's laws of motion

- **Centripetal Force :**



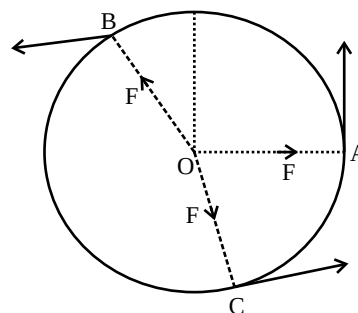
- When a body moves in a circular path, a force pushes the body towards the centre of the circle. This force is known as **centripetal force**.

- In other words, when a body moves with a uniform velocity 'v' on a circular path with radius 'r', an acceleration  $v^2/r$  exercises upon it directing it towards the centre. If the mass of the body is m, the centripetal force upon the body will be

$$F_c = \frac{mv^2}{r} \quad \frac{\text{Mass of the body} \times (\text{Velocity of body})^2}{\text{radius of the circle}}$$

- When a stone fastened with a rope is moved around by hand in a circular way if the rope suddenly breaks, the centripetal force is reduced to zero and as a result, the stone moves linearly in the direction of the tangent of the circle.
- Movement of a motorcycle in a 'well of death' is only possible because of centripetal force.
- A cyclist leans inwardly negotiating a turn on road to avoid falling down. This is how he receives centripetal force.
- At the turnings on the rail track and road inward slope is drawn to avoid the fall of vehicles. This is also done to get sufficient centripetal force.

- **Centrifugal Force :**



- Centrifugal force exercises itself on an object moving in a curved path, trying to push the object outwards from the centre.
- **It acts opposite to the centripetal force.**
- Centrifugal force is equal in magnitude to centripetal force
- This force is involved in the separation of cream from milk.

#### Examples :

- Hitting a person against the window on the left side when a car suddenly turns towards the right.
- The planets moving around the sun maintain their rotational motion and do not fall in the centre. This is because a significant amount of centrifugal force is experienced by all the celestial bodies that are revolving around the sun.

#### Moment of Force or Torque :

- The moment of force is a measure of its tendency to cause a body to rotate about a specific point or axis. The moment of a force about an axis is the product of force and the

perpendicular distance from the line of action of the force to the axis.

Moment of force = Force  $\times$  moment arm

- Moment of force is a **vector quantity** and its unit is **Newton-metre**.

#### Lever :

- This is a simple straight or bent rod pivoted at a fixed hinge or fulcrum.
- A lever is also called a **simple machine** and it can move around a fixed point.
- With the help of it, any heavy load can be lifted by applying small force. It has three main parts–

1. **Fulcrum** : The axis around which a lever freely moves is called **fulcrum**. Fulcrum is represented by F.
2. **Effort** : Force applied by the lever to lift a heavy load is called **effort**. Effort is represented by P.
3. **Load** : The weight lifted by a lever is called **load**. It is represented by W.

**The Mechanical advantage of lever** : The ratio of load (W) lifted by the lever and the effort (P) applied to lift this load is called mechanical advantage of the lever. The mechanical advantage of a lever is represented by MA.

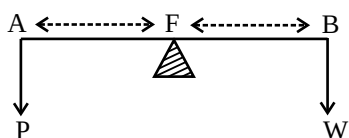
$$\text{Mechanical advantage, } MA = \frac{W}{P} = \frac{\text{Load}}{\text{Effort}}$$

$$= \frac{\text{Effort arm}}{\text{Load arm}}$$

- **Types of Lever** : Levers are of three types –

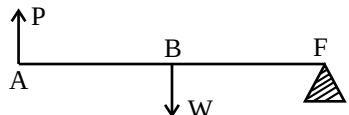
1. **First Class Lever** : In the lever of the first class fulcrum (F) falls between effort (P) and load (W). Therefore to lift more load by smaller effort, the effort arm should be greater than the load arm.
- In this process, mechanical advantage can be less than 1, 1 or greater than 1.

**Examples of first class levers are** : pliers, scissors, a crowbar, a claw hammer, a see-saw and weighing balance.



$$MA = \frac{AF}{BF} \quad (AF < BF; AF = BF; AF > BF)$$

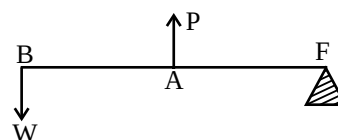
2. **Second Class Lever** : In second class levers, the load falls between fulcrum and effort.
- In such kinds of levers mechanical advantage is always greater than 1.



$$MA = \frac{AF}{BF} \quad (AF > BF) \Rightarrow MA > 1$$

- **Examples of Second Class Levers** : Lemon squeezer, wheelbarrow, staplers, nutcracker, nail clippers and bottle openers etc.

3. **Third Class Levers** : In levers of this kind, the effort falls between fulcrum and load. The mechanical advantage of this kind of lever is always less than 1.



$$MA = \frac{AF}{BF} \quad (AF < BF) \Rightarrow MA < 1$$

- **Examples of the lever of third class** : Plough, tongs, ladder, human hand etc.

#### Centre of Gravity :

- The centre of gravity is the place in a body or object where the weight is evenly distributed and all sides are in balance e.g. centre of gravity in the middle of the seesaw.

- **Equilibrium** : A body is said to be in equilibrium when the resultant of all forces and torques acting upon it is **zero**.

- **Kinds of Equilibrium** :

There are three types of equilibrium stable, unstable and neutral.

- **Stable Equilibrium** : If anybody is displaced slightly from its equilibrium state and after removing the force, the body again comes to its original state, this type of equilibrium is called **stable equilibrium**.

- **Unstable Equilibrium** : If the body on being displacing slightly from its equilibrium state, does not return to its original state and shifts to another new state, this type of equilibrium is called **unstable equilibrium**.

- **Neutral Equilibrium** : If a body on slightly being displaced from its equilibrium state takes to a new equilibrium state instead of coming into its original equilibrium, this kind of equilibrium is called a **neutral equilibrium**.

- In this kind of equilibrium, the position of the centre of gravity of the body remains the same even if the position of body changes.

- **Conditions of Stable Equilibrium**: Following are the conditions for a body to remain in stable equilibrium.

- Centre of gravity of the body must be lower as much as possible.

- The vertical line passing from the centre of gravity of the body must pass through the base of the object. That is why the Tower of Pisa does not fall even it is diagonal because

the vertical line passing through its centre of gravity goes through its base.

- A fielder pulls his hands gradually with the moving ball while holding a catch is not an application of third Law of motion. (SSC CHSL 2022 Tier-1)
- Philosophiae Naturalis Principia mathematica, popularly known as principia, published in 1687, is the great work of scientist Isaac Newton.

(SSC CHSL 2021 (Exam held in 2022))

#### 4. Work, Power and Energy

- **Work :** Work is that physical activity in which a force is applied upon an object to displace it in the direction of the force.
- Work done on applying a force upon an object is equal to the product of the magnitude of force applied and the displacement in the direction of the force.  
Work done (W) = Force (F) × Displacement (S)
- Work is a **scalar quantity** and S.I. Unit of work is the **joule**.
- If a force of one newton moves a body 1 metre in the direction of the force, the work will be done **1 Joule**.
- **Power :** The rate of doing work by any machine or a person is called **power**.

$$\text{Power} = \frac{\text{Work}}{\text{Time}}$$

$$P = \frac{W}{t}$$

- Power is a **scalar quantity** and its S.I. Unit is **joule/second** or **watt**.
- Another unit of power is also **horsepower**.  
1 Horsepower = 746 watts
- **Energy :** The capacity for doing any work by anybody is called Energy.
- Energy is a **scalar quantity** and its S.I. Unit is the **joule**.
- Energy has many types, for example - mechanical energy, heat energy, light energy, sound energy etc.

**Mechanical Energy** - It provides the ability to do some mechanical work on a body.

It's two type –

(i) Kinetic Energy (ii) Potential Energy

- **Kinetic Energy :** Energy present in a moving body due to its motion is called Kinetic energy. The Kinetic energy of a body of mass 'm' moving with velocity 'v' is equal to  $\frac{1}{2}mv^2$ .
- Kinetic Energy is a scalar quantity.  
**Kinetic Energy (K.E.)** =  $\frac{1}{2}mv^2$ .
- **Potential Energy :** The energy present in a body due to change in its state or the shape is called **potential energy**.
- Potential energy are many types, such as - elastic potential

energy, gravitational potential energy, electric potential energy, etc.

- The Potential Energy of a body of mass 'm' at the height 'h' from the surface of the Earth is mgh (where g = is the acceleration due to gravity)

➤ **Potential Energy (PE) = mgh**

**Examples :**

- (i) Stretched segmented energy.
- (ii) The energy of water held up by building dams.
- **Principle of conservation of Energy :** According to the energy conservation rule, 'Energy can neither be created nor be destroyed, it can be changed from one form to another form'.
- **Conversion of Energy :** According to the principle of conservation of energy, energy cannot be destroyed but its form changes. This is called the conversion of energy. This is also known as the transformation of Energy.
- Total energy always remains constant before and after the transformation.

#### Appliances that Transform Energy

| Appliance           | Transformation of Energy                     |
|---------------------|----------------------------------------------|
| Electric Fan        | Mechanical energy from electrical energy     |
| Electric Bulb       | Heat and light energy from electrical energy |
| Electric Cell       | Electric energy from chemical energy         |
| Candle              | Heat and light energy from chemical energy   |
| Photo-electric cell | Electric energy from light energy            |
| Dynamo              | Electrical energy from mechanical energy     |
| Loud Speaker        | Sound energy from electrical energy          |
| Sitar               | Sound energy from mechanical energy          |
| Steam Engine        | Mechanical energy from heat energy           |
| Turbine Rotation    | Electrical energy from mechanical energy     |
| Photosynthesis      | Chemical energy from solar energy            |
| Electric generator  | Electrical energy from mechanical energy     |
| Electric motor      | Mechanical energy from electric energy       |
| Diesel Engine       | Mechanical energy from chemical energy       |

## 5. Gravitation

- According to Newton every body in this universe attracts every other body towards itself by a force. This force is called '**Gravitation**'.
- **Law of Universal Gravitation :**
- Law of Universal Gravitation was given by Newton which is why it is also called Newton's Law of Gravitation.
- According to this law, the magnitude of the force of attraction acting between two objects is proportional to the product of their masses and inversely proportional to the square of the distance between them

$$\left( F = \frac{G m_1 m_2}{r^2} \right)$$

- Here,  $F$  = force,  $m_1$  = mass of first object and  $m_2$  = mass of second object,  $r$  = distance between  $m_1$  and  $m_2$ .
- Here  $G$  is Gravitational Constant and its value is  $6.67 \times 10^{-11}$  Newton meter<sup>2</sup>/kg<sup>-2</sup>.
- In the SI system, the fundamental unit of  $G$  be written as—  
**kg<sup>-1</sup> m<sup>3</sup>s<sup>-2</sup> (kg<sup>-1</sup> meter<sup>3</sup> second<sup>-2</sup>)**
- Constant  $G$  is a **scalar quantity**.

### Gravity :

- Gravity refers to that force of attraction by which the Earth attracts an object towards its centre.

### Acceleration due to Gravity of Earth :

- Any object freely released from a height starts falling towards the Earth due to the gravitational force of the Earth and its fall velocity increases continuously. Therefore, this per second increase in the velocity of the object is called acceleration due to gravity.
- Therefore, acceleration due to gravity is an increase in the velocity of the object per second falling towards the Earth.
- If the acceleration due to gravity of Earth suddenly disappears, the actual weight of the body is reduced to zero, but there will be no change in the mass of the body.
- **Acceleration due to gravity is represented by  $g$ .**
- The value of  **$g$**  on Earth is **9.8 m/s<sup>2</sup>**.
- Acceleration due to gravity does not depend upon the shape and mass of a body.
- Unit of acceleration due to gravity is **metre/second<sup>2</sup> or newton/kg**.

### Change in the value of $g$ :

- At the Poles of the Earth value of  $g$  is maximum and it is minimum at the Equator.
- The value of  $g$  decreases as one moves below the surface of the Earth.

### Weight of a body in a lift :

- When a lift goes downward, the weight of a body in it appears to decrease.

- When a lift moves upward, the weight of the body inside it increases.
- When a lift goes up or down with a uniform velocity, there is no change in the weight of the body.
- If during the downward motion of a lift its acceleration is greater than the acceleration due to gravity  $g$ , a body in the lift will rise from its floor to hit against the roof.
- If the rope of a lift suddenly breaks while moving downward, the lift will fall like a free body and in this situation, the weight of an object in the lift will be reduced to zero.

### Kepler's Laws of Planetary Motion :

- Kepler proposed three laws of planetary motion based upon the astronomical observations of the motion of planets around the Sun—
- **First Law :** First law is also called the **Law of Orbits**. According to this law, all the planets move in elliptical orbits and the Sun is located at its one of the focuses.
- **Second Law :** Second law is also called the **Law of Areal Velocity**. The line joining from the Sun to a planet traverses (sweeps) equal areas in equal periods of time, therefore the areal velocity of a planet remains constant.
- The Second law tells that when the planet is farthest from the Sun, its speed is minimum and when it is nearest to the Sun, its speed is maximum.
- The **Second Law of Kepler** is equivalent to the principle of conservation of angular momentum.
- **Third Law :** According to this law square of the **time period** ( $T$ ) of a planet is directly proportional to the third power of semi-major axis ( $R$ ) of the elliptical orbit of that planet, therefore  **$T^2 \propto R^3$** .
- It is clear from the third law that the more the planet is distant from the Sun, the more will be its time period.
- The nearest planet to the sun, mercury, has a time period of only 88 days, while the farthest planet from the sun Neptune has the time period of about **165 years**.
- **Satellite :** As the planets move around the Sun, in the same way, some celestial bodies also move around the planets. These bodies are called **Satellites**.

### Orbital Velocity of Satellite :

- Orbital velocity of a satellite depends upon its height from the surface of the Earth.
- The more the distance of a satellite from the Earth's surface, the less will be the velocity of the satellite.

### Revolution Period of Satellite :

- The time of one complete revolution by the satellite around the Earth is called the Revolution Period of Satellite.



$$\text{Revolution Period} = \frac{\text{Circumference of Orbit}}{\text{Orbital Velocity}}$$

- Period of revolution of a satellite also depends upon its height from the surface of Earth.
- The more the distance of a satellite from the Earth's surface, the more will be its period of revolution.
- Period of revolution of satellites is not dependent upon their mass.

#### Geo-synchronous Orbit :

- After a satellite launch, about 36000 km above the Earth's surface (35786 km or 22236 miles), it falls into a position where its orbit conforms to the Earth's rotation. Here the satellite starts to rotate in a circular orbit at the same speed as the Earth is revolving. This is called Geo-synchronous Orbit.
- This type of satellite completes 1 revolution around the Earth in 24 hours while the Earth makes one rotation about its axis in 24 hours. Therefore owing to the equal motion of both satellite and the Earth both appears to be stationary to each other.
- In the case of the geo-synchronous orbit being in the equatorial plane, the satellite appears to be stationary at a point. Such an orbit of the satellite is known as **Geo-stationary Orbit** and such type of satellite is known as **Geo-stationary Satellite**.
- The Communication satellite is generally launched into geo-stationary orbits.
- **Polar Satellites** : They belong to second class satellites, whose orbits are very short. Satellites whose orbit is very short (**generally 500-800 km**) in comparison to geo-stationary satellites and they move in the north-south direction around the poles, these kinds of satellites are called Polar Satellites.
- Polar satellites are mainly used for the study of meteorology, geological survey and environmental studies.
- **Escape Velocity** : Escape velocity is the minimum velocity by which a body is thrown above the surface of the Earth; it crosses the gravitational field of the earth and never returns to the Earth.
- The kinetic energy given to the body to throw it escape velocity is called '**escape velocity**'.
- Value of escape velocity for the Earth is **11.2 km/second**.
- If an object is thrown above with a velocity of **11.2 km/s** or more, then it will not return to the Earth.
- Value of escape velocity for the moon is 2.38 km/second.
- Weight of everything in an artificial satellite is zero, that is why the force of reaction exerted by the floor of the satellite upon astronaut is zero.

#### Relation between Orbital speed and Escape velocity :

If the orbital speed of a satellite near the earth is  $V$ , and the escape velocity of an object thrown from the earth is  $V_e$ , then

$$V_e = \sqrt{2}V_o$$

- It's clear that if the orbital speed of a satellite revolving near the earth increase to  $\sqrt{2}$  times due to some reason, then that satellite will leave the class and run away.
- In **June 1798** Henry Cavendish reported the measurement of the gravitational constant with the mass and density of the Earth

(SSC CGL 2023 Tier-1)

### 6. Simple Harmonic Motion

- **Simple Harmonic Motion** : The to and fro motion of an object on a mean position in a straight line and in a fixed period of time is called Simple Harmonic Motion.
- The mass spring system is an example of simple harmonic motion because a mass which is tied to a suspended vertical spring when set to oscillate in a straight line then its motion represents simple harmonic motion.
- If a simple pendulum is displaced with a minimal angle and then left its motion will be simple harmonic motion.
- The Motion of any object tied between two springs at a horizontal base is simple harmonic motion.
- **Oscillation or Vibration** : When a particle repeats its motion on a mean position, this is known as **Oscillation** or **Vibration** and such type of motion is known as **Oscillatory motion** or **Vibratory motion**.
- **Time period** : Time taken to complete one oscillation or one vibration is known as time period.
- **Second's Pendulum** : A pendulum having time period equal to two seconds is called a seconds pendulum.
- **Frequency** : Number of vibrations completed by a vibrating body in one second is called frequency.
- S.I. Unit of frequency is called **hertz** or **second<sup>-1</sup>**.
- If the frequency of a vibrating body is represented by  $n$  and time period by  $T$ , then the relation between them is -  $n = \frac{1}{T}$
- **Simple Pendulum** : A point mass attached to a light, twistless and inextensible string and suspended from fixed support is called **Simple Pendulum**.
- If this simple pendulum is displaced from its mean position then its motion is called **simple harmonic motion**.
- The Time period of a simple pendulum is represented by the formula  $T = 2\pi \sqrt{\frac{l}{g}}$ , where  $l \rightarrow$  is the length of string and ' $g$ ' is the acceleration due to gravity.

- It's clear that the time period of the pendulum does not depend on the mass of bob.
  - It is clear from the formula of time-period of a simple pendulum that  $T \propto \sqrt{l}$ , therefore with the increase in length, the time period will also increase.
  - During the summer season, pendulum clocks tend to run slower because the length of pendulum increases due to thermal expansion.
  - There is no effect upon the time period of a simple pendulum on changing its mass.
  - The Time period of a simple pendulum is  $T \propto \frac{1}{\sqrt{g}}$ , therefore, if the value of  $g$  decreases then its time period will increase. This is the reason that time period  $T$  increases while going at a height due to a decrease in the value of ' $g$ '.
  - Value of acceleration due to gravity ' $g$ ' at the moon is  $\frac{1}{6}$  of the value of  $g$  upon the Earth, therefore, on the moon time period of simple pendulum will increase.
  - The Time period of the simple pendulum of infinite length is about 84.6 minutes, (not infinite). This is the maximum limit of the time period of a simple pendulum.
  - In ideal condition (neglecting air resistance), similarly sized pieces of wood, iron and wax, dropped from the same height, will reach the Earth's surface at the same time, because all have the same acceleration due to gravity.
  - In the absence of air, the same weight of iron and wood are dropped from the same height, they will reach the ground simultaneously, but in the presence of air, same weight of iron and wood are dropped from the same height, the iron ball will reach first and wood ball drop later.
  - If the uncertainty in position and momentum are equal, the uncertainty in velocity will be :  $\frac{1}{2m} \sqrt{\frac{h}{\pi}}$
- (SSC CHSL 2023 Tier-1)

## 7. Floatation

- **Buoyancy** : The property of liquids or gases due to which they apply upward force or upthrust upon the objects absorbed by them is called buoyancy.
  - **Buoyant Force** : The upthrust or the upward force applied by the liquid or gases is called the buoyant force. The buoyant force acts at the centre of gravity of the liquid displaced by an object.
  - Archimedes first studied the Centre of Gravity.
  - **Archimedes's Principle** : When a body is partially or completely immersed in a liquid then there is an apparent decrease in its weight, this apparent decrease in weight of the body is equal to the liquid displaced by it.
  - **Law of Floatation** : An object floating in a liquid in a balanced state, displaces fluid equal to its weight.
  - The ship or a vessel floats upon the water due to buoyant force or upthrust.
  - A vessel displaces a huge amount of water and this displaced water in order to regain its original position applies an upward force (buoyant force) upon the ship.
  - It is easy to swim in the sea in comparison to the river because seawater applies more upthrust than the water in the river.
  - The Density of seawater is comparatively more than other sources of water, river, pond and well. Therefore, there is more upthrust in seawater.
  - **An object floats in any liquid if-**
    - (i) The Density of the material of the object is either equal to or less than the density of the liquid.
    - (ii) If the density of the material of the object is equal to the density of liquid, then it will float as completely immersed and in natural equilibrium.
  - **Density** : Density is a characteristic property of matter.
  - In the definite volume how much mass of matter is present, this relation is expressed by density.
  - Amount of mass concentrated in a unit volume of the substance is called the density of the substance.
- Therefore, Density =  $\frac{\text{Mass}}{\text{Volume}} \left\{ d = \frac{m}{v} \right\}$
- **S.I. Unit of density is kg/m<sup>3</sup>.**
  - **Relative Density** : Relative density is the ratio of the density of any substance to the density of a standard substance.
  - Water is usually taken as the standard substance at a temperature of 4°C for the relative density of solids and liquids. It can also be calculated by comparing the mass of an equal volume of substances.
  - **Relative density of a solid substance**

$$= \frac{\text{Mass of any volume of solid substance}}{\text{Mass of same volume of water}}$$
  - **Relative density of a liquid substance**

$$= \frac{\text{Mass of any volume of the liquid substance}}{\text{Mass of same volume of water}}$$
  - In all measurements of **Relative density**, the density of water should be taken only at 4°C temperature because below this temperature behaviour of water is abnormal. It means a density decrease below 4°C. **The density of water is maximum at 4°C temperature.**
  - There is no unit of relative density.
  - Relative density is measured by Hydrometer.

- The purity of milk is measured by **Lactometer**.
- Hydrometer and lactometer work on the principle of buoyancy.
- **Metacentre** : Point of the intersection of the lines going from the centre of gravity and centre of buoyancy of a floating object is called **Metacentre**.
- **Conditions of floating**–
  - Metacentre must be above the centre of gravity of the body.
  - Centre of gravity and the centre of buoyancy of displaced liquid (**metacentre**) both should be along the same vertical line.
- How much part of a solid material immerse in the liquid depends upon the relative densities of liquid and the solid. It can be calculated as–
 
$$= \frac{\text{Volume of immersed part of solid}}{\text{Total volume of solid}} = \frac{\text{Density of solid}}{\text{Density of liquid}}$$
- If the ice floats in water,  $\frac{1}{10}$  part of its volume remains above the water.
- **Bernoulli's Theorem** : The sum of the total energy (i.e. the pressure energy, the kinetic energy and the potential energy) of an ideal volume of the fluid at each point of its passage in a streamlined flow of an ideal fluid is constant.
- Equation of Bernoulli's Theorem is as follows–
 
$$P_A + \frac{1}{2} \rho v_A^2 + \rho gh_A = P_B + \frac{1}{2} \rho v_B^2 + \rho gh_B$$

Here  $P_A$ ,  $\frac{1}{2} \rho v_A^2$  and  $\rho gh_A$  are respectively pressure energy, kinetic energy per unit volume and potential energy per unit volume at point A respectively.
- Similarly, at point B,  $P_B$ ,  $\frac{1}{2} \rho v_B^2$  and  $\rho gh_B$  are the pressure, kinetic and potential energy per unit volume respectively.
- It is clear from **Bernoulli's Theorem** that at a place where the velocity is higher in the flow of fluid or gas, the pressure will decrease and where the pressure is high the velocity will be lower.
- The wings of the aeroplane are designed in such a way that the velocity of the air passing through the upper part is much higher than the air passing through the lower part which reduces the air pressure on the plane and increases the pressure upward which helps in flying.
- **Venturimeter** : This is an instrument based upon Bernoulli's Theorem. With its help rate of flow of liquid in a pipe is measured.

#### Examples of Bernoulli's Theorem :

- The design of an aeroplane.
- Flying of tiles and tin shed from the rooftops of houses during a storm.

- Fast approaching train drags the persons standing upon platform towards itself.
- Upon blowing air between two suspended balloons, they come closer to each other.

## 8. Surface Tension

- The tendency of a liquid surface to shrink its free surface into the minimum possible surface area possible is called **surface tension**.
- Due to the **cohesive force** among the molecules of the liquid, its free surface acts like a stretched elastic membrane. Thus, the surface of the fluid always remains in a state of tension and has a tendency to get minimum area. This tension of the surface of the liquid is called **surface tension**.
- S.I. Unit of surface tension is **newton/meter**.
- The value of surface tension for a liquid is dependent upon nature, temperature and medium on another side of the fluid surface.
- Surface tension decreases with a corresponding increase in temperature.
- The surface tension is zero at the **critical temperature**.

#### Examples of Surface Tension :

- Detergents work upon the principle of surface tension.
- The surface tension of the water decreases after mixing detergent in it.
- **A drop of oil** expands upon water because the surface tension of oil is much less than that of water.
- The shape of the falling drops of water is spherical because of surface tension.
- When water sprays from a tap in a small basin, you can see bubbles form, but they burst very soon. This is due to the fact that the surface tension of the normal water is high and it tends to draw the water molecules into the main body of the water.
- **Capillary action is the result of surface tension**.
- Iron needles put lightly upon the surface of water floats because of surface tension.
- Hairs of shaving brush cling together when it is removed from water due to the free surface of water tries to acquire a minimum surface area.
- **Adhesive Force** : The force of attraction acting between the molecules of unlike substances is called **adhesive force**.
- **Cohesive Force** : The force of attraction acting between the molecules of the same substance is called **cohesive force**.

#### Capillarity :

- A glass tube of very short radius and having both ends open is called a **capillary tube**.

- The effect of rising and falling down of any liquid in a capillary tube is called capillarity. The reason behind this phenomenon is surface tension.
- The capillarity effect depends on the radius of the capillary tube. The height or depth of any liquid that enters the capillary tube is inversely proportional to the radius of the capillary tube.

#### Examples of Capillarity :

- Blotting paper easily absorbs the ink because of the presence of small holes in it which work as small capillary tubes.
- Kerosene rises in a wick of lantern because of capillarity action in the wick.
- When a lump of clay is put into the water, it becomes wet up because of numerous holes in it which work as capillaries.
- It is only due to the action of capillarity that water and essential salts reach the branches, stems and leaves of plants.
- **Agnes Pockels** research was fundamental in establishing the modern discipline known as surface tension, which describes the properties of liquid and solid surfaces and interfaces. (SSC CGL 2023 Tier-1)
- At room temperature, the surface tension of water is less than ethyl alcohol. (SSC CGL 2023 Tier-1)

## 9. Viscosity

- **Viscous Force** : Internal tangential forces act between different layers of the liquid which try to resist the relative motion among the layers. This type of frictional force is called **viscous force**.
- **Viscosity** : Viscosity is that property of a liquid due to which it opposes the relative motion between its layers.
- S.I. Unit of viscosity is **Pascal-second (Pa. s)** while in CGS unit it is **"Poise"**.
- Viscosity is the property found in liquids and gases. There is no viscosity in solids.
- Viscosity in gases is minimal in comparison to liquids but the viscosity of an ideal fluid is zero.
- Cohesive forces between the two molecules are because of viscosity in liquids.
- The Viscosity of liquid decreases due to an increase in temperature but it increases in gases.
- It is hard to run inside the water in comparison to air because water is more viscous than air.
- If a liquid with lower viscosity (such as water) and one with higher viscosity (as honey and glycerine) are rolled on the floor, honey and glycerine will stop flowing sooner as they are more viscous but water will continue.

- They liquid is thicker, the more viscous it is.
- The order of viscosity is as follows -  
Honey > blood > water > air.

| Viscosity of some elements |                  |                              |
|----------------------------|------------------|------------------------------|
| Liquid                     | Temperature (°C) | Viscosity (mP <sub>1</sub> ) |
| Water                      | 20               | 1.0                          |
|                            | 100              | 0.3                          |
| Blood                      | 37               | 2.7                          |
| Machine oil                | 16               | 113                          |
|                            | 38               | 34                           |
| Glycerine                  | 20               | 830                          |
| Honey                      | -                | 200                          |
| Air                        | 0                | 0.017                        |
|                            | 40               | 0.119                        |

- **Critical Velocity** : If the flow of fluid is less than an absolute velocity then the flow of the fluid is a **streamline flow**. This fixed velocity is called **critical velocity**.
- When during the flow of any liquid each particle of the liquid flows through the same path to a point as followed by the other particles to the same point, then such kind of flow of a liquid is called **streamline flow**.
- When the velocity of the fluid is greater than the critical velocity, the flow of the fluid is not linear and becomes zig-zag.
- When the velocity of flow of a liquid is less than critical velocity then its flow mainly depends on viscosity.
- When the velocity of flow is more than critical velocity then the flow of liquid depends mainly on its density.
- Lava erupting from a volcano flows very fast even if it is very viscous because its density is less comparatively and only the density decides its velocity.
- **Terminal Velocity** : When a body falls into any viscous liquid then in the beginning, its velocity increase but after some time it starts falling with a constant velocity. This constant velocity is known as the terminal velocity of the body.

#### Examples of Terminal Velocity :

- Raindrops fall to the ground at a constant velocity (terminal velocity).
- Even by parachute, a person comes to the ground with terminal velocity.
- In 1851, **George Gabriel Stokes** founded the science of hydrodynamics with his law of viscosity describing the velocity of a small sphere through a viscous fluid.

(SSC CHSL 2023 Tier-1)



## 10. Pressure

- The force acting normally upon per unit area of the surface is called pressure. Therefore, pressure

$$= \frac{\text{Force}}{\text{Area}} \left\{ P = \frac{F}{A} \right\}.$$

- The pressure is a **scalar quantity**. S.I. Unit of pressure is **Newton/m<sup>2</sup>**, it is also called **Pascal** (pa).
- As there is an inverse relationship between the pressure and area, therefore objects with less area exert more pressure.
- The person standing upon one leg exerts more pressure upon the land in comparison to the person standing on both legs.
- The tip of a nail (**owing to its sharpness**) pierces deep into the wall.
- One can save himself/herself from getting trapped into the marshy land by creeping on it because in this situation of contact area considerably increases which results in lowering of pressure.
- **Atmospheric Pressure** : A pressure acts upon the surface of the earth because of the presence of different gases (**oxygen, nitrogen etc.**)
- This pressure is known as Atmospheric Pressure.
- **Barograph** is used to record atmospheric pressure.
- Standard atmospheric pressure is equivalent to the pressure exerted by the **76 cm (760 mm)** column of mercury barometer, and it represents an average atmospheric pressure at sea level. It is equal to **101325 Pascal (Pa)**.
- Atmospheric pressure can be represented in '**Bar**' also which is equivalent to **100,000 Pascal (10<sup>5</sup> Newton/m<sup>2</sup>)**.
- Atmospheric pressure is measured by **Barometer**.
- Prediction of weather can also be made through the barometer.
- Sudden fall in the height of mercury column in a barometer indicates atmospheric pressure has reduced sharply in that area.
- Rapid reduction of atmospheric pressure at any place is an indicator of the coming of storm or cyclone or blowing of fast winds.
- At higher places, from the surface of the earth, the amount of atmospheric pressure is low, this is the reason for leakage in ink-pens while flying.
- It is hard to cook food at mountains due to greater height because of low atmospheric pressure the boiling point of water is lowered.
- The gradual and slow rise in mercury level in a barometer is a forecast of clear weather.
- **Pressure in Liquid** : Any liquid (e.g. water, oil or alcohol) filled in a vessel exerts pressure upon the walls of the vessel

or on any object placed inside it, this pressure is called **liquid pressure**.

- Amount of liquid pressure at any (d) point is equal to the product of the density of that liquid, depth (h) of the point and acceleration due to gravity (g) at that place. i.e. liquid pressures are represented by P then **P = hdg**.
- **Some Specific Facts Related to Liquid Pressure** :
  - (i) The pressure at a point within a stagnant (**non-flowing**) liquid is the same in all directions.
  - (ii) At the same horizontal plane in a liquid amount of pressure remains the same.
  - (iii) The Pressure of a liquid depends on the density of the liquid, therefore if the density is high pressure will be high and if the density is low, the pressure will also be low.
- **Pascal's Law** : According to Pascal's law force applied at any part of incompressible liquid or gas enclosed in a vessel get distributed equally by that liquid or gas in all directions without any wastage. Hydraulic breaks and Hydraulic lifts work on this principle.
- **Jacobus Henricus van't Hoff** received the Nobel Prize in 1901 for 'recognition of the extraordinary services rendered by the discovery of the laws of chemical dynamics and osmotic pressure in solutions. (SSC CGL 2023 Tier-1)
- Fisher's quantity theory is explained by his famous equation given as \_\_\_\_\_ MV = PT. (SSC CGL 2023 Tier-1)
- The correct order of radiations in descending order of frequencies **X-rays > Infrared > Microwaves > Radio waves**. (SSC CGL 2022 Tier-2)
- In year **1842** was the Doppler effect discovered by Austrian scientist Christian Doppler, which describes the change in frequency of any kind of sound or lightwave produced by a moving source with respect to an observer. (SSC CGL 2022 Tier-2)

## 11. Elasticity

- **Elasticity** : When an external force is applied upon anybody then its shape changes but if the external force is removed, the body again restores to its original shape. This property of a body is known as **elasticity**.
- There is a certain value of force for a body below which a body remains elastic and this is called the **limit of elasticity** but if the force applied is greater than the limit of elasticity, the body **loses its elasticity**.
- In other words, we can say that elasticity is that property of bodies due to which they oppose the external deforming forces.
- The substances which had crossed the limit of elasticity are known as **plastic**.

➤ There are two types of object based on properties of Elasticity –

(i) The bodies which regain their original state (or shape) after removing the deforming force are called **Perfectly Elastic bodies**.

(ii) The bodies which do not restore to their original state even after removing the deforming force are called **Perfectly Plastic Bodies**.

➤ **Stress** : When a deforming force is applied on a body, a restoring force occurs in the body which is equal in magnitude but opposite in direction to the applied force. This restoring force per unit area is known as stress.

➤ If F is the force applied and A is an area of the cross-section of the body, then

$$\text{Stress} = \frac{\text{Force}}{\text{Area}} = \frac{F}{A} = \frac{\text{Deforming force}}{\text{Area}}$$

➤ S.I. Unit of stress is **Newton/m<sup>2</sup>**.

➤ **Strain** : The unit change in the length of an object due to external force is called **Strain**. If suspending a weight at one end of a wire of length L, there is a  $\Delta L$  increase in its length, then strain =  $\frac{\Delta L}{L}$

➤ The strain is of three types –

(i) Longitudinal Strain

(ii) Volumetric Strain  $\left(\frac{\Delta V}{V}\right)$

(iii) Shear Strain  $\left(\frac{\Delta V}{V}\right)$

➤ The strain is purely a ratio that has no unit.

➤ **Hooke's Law** : According to this law the strain of the material is directly proportional to the applied stress within the elastic limit of that material

Therefore, Stress  $\propto$  Strain

$\therefore \frac{\text{Stress}}{\text{Strain}} = E$  (constant) and it represents modulus of elasticity.

➤ **Young's Modulus of Elasticity** : Within the limit of elasticity, the ratio of longitudinal stress and longitudinal strain is called Young's Modulus of Elasticity of the body.

$\therefore \text{Young's Modulus of Elasticity} = \frac{\text{Longitudinal Stress}}{\text{Longitudinal Strain}}$

➤ **Volume Modulus of Elasticity** : If there is a distortion in the volume of an object due to volume stress, its ratio are called the Volume or Bulk Elasticity Coefficient.

Bulk Modulus of Elasticity :  $\frac{\text{Volume Stress}}{\text{Volume Strain}}$

➤ **Modulus Rigidity** : Ratio of shear stress and shear strain is called **Modulus of Rigidity**.

➤ It is also called shear modulus. It is represented by **Eta ( $\eta$ )**.

➤ Hooke's law was discovered in 1660, which states that for relatively small deformations of an object, the displacement or size of the deformation is directly proportional to the deforming force or load. (SSC Stenographer 2022)

## 12. Wave Motion

**Wave :**

➤ A wave is a type of disturbance produced in a matter which travels without any actual physical movement of the matter.

➤ Through the waves, energy is transferred from one place to another.

➤ **Waves are mainly of two types :**

(i) Mechanical Waves

(ii) Electromagnetic Waves

**(i) Mechanical Waves**

➤ Mechanical waves are those waves that propagate only through a physical medium (air, solid or liquid). It is because of the elasticity of the mechanical waves.

➤ Mechanical waves are also called **elastic waves**.

➤ Only the transmission of energy and momentum occur by the mechanical waves not matter.

➤ Water waves, sound waves, spring waves etc. are examples of mechanical waves.

➤ When a mechanical wave propagates in a medium, the particles of the medium start vibrating.

➤ According to the direction of vibration of the particles, mechanical waves are of two types -

**A. Longitudinal Waves :**

➤ In these waves, particles of the medium vibrating along the direction of wave transmission vibrate causing wave transmission. like, the transmission of sound waves into the air.

➤ Longitudinal waves can be produced in **all mediums** (solid, liquid and gases).

➤ Earthquake waves are spring generated waves and sound waves in air and water are longitudinal.

**B. Transverse Waves :**

➤ These types of waves are produced in the medium when the particles of the medium vibrate perpendicular to the direction of waves.

➤ Transverse waves can only be produced in **liquids** and **solids**.

➤ Transverse waves can be electromagnetic such as light waves.

➤ **Amplitude** : During the transmission of a wave (transverse or longitudinal) all the particles of the medium oscillate on both sides of their mean position. Therefore, the maximum

displacement of the oscillating particle from its mean position is called **amplitude**.

- **Wavelength** : During the propagation of a wave in a medium, the distance travelled by wave when a particle of the medium completes one vibration is called **wavelength**.
- Its S.I. Unit is meter and another unit is **Angstrom (Å)** ( $1\text{Å} = 10^{-10}\text{ metre}$ ).
- **Wave Velocity** : Distance travelled by the wave in one second is called wave-velocity. **Wave velocity is represented by  $v$ . Its S.I. Unit is m/s.**

#### (ii) Electromagnetic Waves :

- These waves are produced by the vibration of electromagnetic fields. These waves can travel without any medium (**a vacuum**). Their speed is equal to the speed of light.
- Electromagnetic waves are transverse waves.
- Light is also an electromagnetic wave with a speed of  $3 \times 10^8\text{ m/s}$ .
- The wavelength range of electromagnetic waves is in the band of  $10^{-14}\text{ meter to }10^{-4}\text{ meter}$ .
- The Frequency of electromagnetic waves of short wavelength is high and the frequency of electromagnetic waves of long wavelength is low.
- Electromagnetic waves exhibit both **particle** (photon) and **wave nature** (transverse wave).
- The Photoelectric effect can be explained only by the particle nature or **photon-model** of light (**electromagnetic waves**).
- The concept of electromagnetic waves was proposed by **Maxwell**.
- Cathode rays, canal rays,  **$\alpha$ -rays,  $\beta$ -rays**, sound waves and ultrasonic waves, etc are not electromagnetic waves. But gamma rays ( $\gamma$ ) are electromagnetic waves (**very high-frequency waves**).
- Waves of wavelengths from  $10^{-3}\text{ meter to }10^{-1}\text{ meter}$  are called **Microwaves**.
- The light of the sun is a mixture of seven colours, these colours are produced by the light of different wavelengths. The coloured band received in this way is known as the **spectrum of visible light**.
- In the spectrum of light violet, indigo blue, green, yellow, orange and red colours (**VIBGYOR**) are visible.
- In visible light, the **wavelength**, of **red colour is the longest** while the wavelength of **violet colour is the shortest**.
- Spectrum has tension on both sides of the visible spectrum. All this including visible spectrum, represents, all electromagnetic waves. It is known as the electromagnetic spectrum.

- The part of the wavelength above the red colour of the visible spectrum is called the Infrared Spectrum and the part with a shorter wavelength below the violet colour is called **Ultraviolet Spectrum**.
- The wavelength range of **ultra-violet** rays is from **400 nm to 10 nm** (Here, nm  $\rightarrow$  nanometer).
- The wavelength range of **infrared rays** is from 700 nm to 1 mm ( $7 \times 10^{-7}\text{m} - 1 \times 10^{-3}\text{m}$ ).

#### Sound Waves :

- Sound waves are a type of mechanical wave which we can feel through our ears.
- Sound waves can travel only through a medium. They cannot travel in a vacuum.
- Sound waves are **longitudinal waves**.
- Doppler weather Radar is an instrument that sends pulses of electromagnetic energy into the atmosphere to detect rainfall, determine its speed and intensity and identify precipitation types such as rain, snow or hail.

(SSC CGL 2023 Tier-1)

### 13. Sound

- Sound is a type of wave which propagates in the form of audible mechanical waves with the help of a medium.
- Sound waves are of three types—  
A. Infrasonic Waves B. Audible Waves or Sonic Waves C. Ultrasonic Waves.

**A. Infrasonic Waves** : Sound waves of a frequency **less than 20 hertz** are known as **infrasonic waves**. A human cannot listen infrasonic waves.

- Whales, Rhinoceros and Elephants produced infrasonic sound.

- Some animals get disturbed and start running and there just before the earthquakes they can hear infrasonic waves.

- Significantly, an earthquake produces an infra-sound before the main  $s \propto k$  wave.

**B. Audible waves** : Waves of frequency from **20 hertz to 20,000 hertz** are called **Audible Waves**. Human ears can only listen to audible waves.

**C. Ultrasonic waves** : Waves of a frequency **more than 20,000 hertz** are known as **Ultrasonic Waves**. The human ear cannot listen to these waves but a bat, dog and cat can easily listen to these waves.

#### Uses of Ultrasonic Waves :

- Ultrasonic waves are used for the following purposes –  
(i) In measuring the depth of the sea.  
(ii) In cleaning costly clothes, parts of watches and aeroplanes.

- (iii) To kill harmful bacteria present in milk.
- (iv) In the treatment of arthritis.
- (v) In finding out of a tumor inside the body.
- (vi) To clean the soot (smoke black) in the chimneys of factories.
- Sound can travel through different mediums such as **air**, **liquid** and **solids**.
- Sound waves are longitudinal waves.
- Speed of sound in solids is maximum while in liquid it is slower and slowest in gases.

| Speed of Sound in Different Mediums at 25°C |                       |
|---------------------------------------------|-----------------------|
| Mediums                                     | Speed of Sounds (m/s) |
| Hydrogen                                    | 1284                  |
| Helium                                      | 965                   |
| Air                                         | 346                   |
| Oxygen                                      | 316                   |
| Sulphur dioxide                             | 213                   |
| Seawater                                    | 1531                  |
| Distilled water                             | 1498                  |
| Ethanol                                     | 1207                  |
| Methanol                                    | 1103                  |
| Aluminium                                   | 6420                  |
| Nickel                                      | 6040                  |
| Steel                                       | 5960                  |
| Iron                                        | 5950                  |
| Brass                                       | 4700                  |
| Glass (Flint)                               | 3980                  |

- In moving from one medium to another frequency of sound remains constant, but there is a change in its speed and wavelength.
- There is no pressure effect on the speed of sound, but due to the change in atmospheric conditions as temperature, the speed of wind and sound also changes.
- The speed of sound also increases when the temperature of the medium increases. According to one calculation, the speed of sound increases by 0.61 m/s with a 1°C increase in air temperature.
- Speed of sound in the air of 0°C is 332 m/s and at 22°C it is 344 m/s.
- Speed of sound in moist air increases in comparison to dry air.

### Characteristics of Sound :

- There are three characteristics of sound –  
1- Pitch 2- Loudness 3- Quality.
- 1. **Pitch** : Sound may be grave or shrill, which is known as its pitch. Pitch depends upon the sound. When the frequency and pitch of the sound are higher, the sound is shrill, and when the sound is grave, its frequency and pitch are low.
- 2. **Loudness** : It is the loudness due to which sound appears to be sharp or dull. Units of loudness are **PHON** and **SONE**. Its utility unit is the **decibel (dB)**.
- 3. **Quality** : Different sounds emerging from different sources have the same pitch, and loudness represents the quality of sound.
- The World Health Organisation (WHO) recommends that noise exposure level should not exceed 70 db over a 24-hour period, and 85 db over a 1-hour period to avoid hearing impairment.

| Source of Sound          | Intensity (Desibal) |
|--------------------------|---------------------|
| Rustles of leaves        | 20                  |
| Whisper                  | 30                  |
| Room/Quiet office sound  | 40                  |
| Normal conversation time | 60                  |
| Truck sound              | 80-85               |
| Jet engine sound         | 120                 |
| Jet plane landing        | 150                 |
| Rocket engine            | 180                 |

- Green plants are planted in highly noise pollution area, as they have ability to absorb sound waves.
- The green plants which control noise pollution are called '**Green Muffler**'.
- The unit of sound, **decibel (db)** was named to appreciate the work of Scientist **Alexander Gramh Bel**.

### Intensity of Sound :

- The magnitude of sound energy passing through per unit area perpendicular to the direction of propagation of sound is called the **intensity of sound**. It is represented by **I**.
- S.I. Unit of the intensity of sound is **watt/m<sup>2</sup>**.

### Echo :

- Echo is the reflection of sound that reaches to the listener when original sound returns after hitting a hard surface distant away from the listener.
- To listen to the echo, the distance between the listener and the reflecting surface must be a minimum of 16.6 meters (about 17 meters).



- The effect of sound on the human ear can be experienced up to  $\frac{1}{10}$  second. Therefore, to listen to a clear echo, there should be a time interval of  $\frac{1}{10}$  second between a original sound and the reflected sound.

**Resonance :** When the frequency of original vibrations becomes equal to an external frequency applied by any force, and it results in the generation of abnormally large amplitude (or large vibration), this condition is known as **resonance**.

#### Interference of Sound :

- A sudden increase or decrease in the intensity of sound at any point in a medium during the simultaneous propagation of two sound waves of the same frequency and same amplitude is known as **interference of sound**.
- During the interference when the two different sound waves at any point reach the same phase, it is a **constructive interference**, therefore, the **intensity of sound increases**.
- During the interference, if the sound at any point in the medium is in the opposite phase, the **intensity of sound decreases**. Therefore, it is **interference destructive**.
- **Diffraction of Sound :** If there is any obstruction in the path of sound, then the sound quickly moves from the edge of the obstacle, this phenomenon is called **diffraction of sound**.
- **Doppler's Effect :** The apparent change in the frequency of the sound wave that occurs when either the source of the sound or the observer is moving relative to each other, is called **Doppler Effect**.
- Doppler effect is produced due to the **relative motion of source** and **observer**.
- **Mach Number :** Under the same conditions of temperature and pressure in any medium ratio of the speed of the body to the speed of sound is called **Mach Number**.

$$\text{Mach Number} = \frac{\text{Speed of Object}}{\text{Speed of Sound}}$$

- **Supersonic Speed :** When the speed of an object is **more than the speed of sounds**, it is called **supersonic speed**. Therefore, in this situation, the Mach Number for the moving body will be **more than 1**.
- If the speed of an object is **less than the speed of sound**, i.e. its Mach Number is **less than 1**, such speed is called **Subsonic Speed**.
- If the speed of a body is of Mach Number **more than 5** Mach, such speed is called **Hypersonic Speed**.
- The object moving with hypersonic speed leaves a trail of disturbance in a conical shape, known as **shock wave**.
- **An audiometer** is used to measure the intensity of sound.

## 14. Heat

- **Heat :** When two bodies at different temperatures are brought in contact with each other, the energy is transferred from the body with higher temperature to the body with lower temperature until their temperature becomes equal. This energy is known as **heat**.
- Heat always transfers from the body with higher temperature to the body with lower temperature.
- **Work** and **Heat** are mutually related e.g., when rubbing the palms get heated, this means that work done in rubbing was converted into heat.
- The Mechanical Equilibrium "J" of heat expresses the relation between work and heat, i.e, on doing work 'W', heat 'Q' is generated. Then mechanical equilibrium is  $J = \frac{W}{Q}$
- Value of mechanical equilibrium of heat J is 4.184 Joule/ Calorie.
- This means that if about 4.2 Joule work is done, one calorie heat will be generated.
- S.I. Unit of heat is '**Joule**'.
- Bolometer is an instrument used to measure **Heat Radiation**.
- Other units of heat are as follows–
- A. **Calorie :** Amount of heat required to increase the temperature of 1 gram of water to 1°C is equal to 1 calorie.
- B. **International Calorie :** Amount of heat required to increase the temperature of 1 gram of pure water from 14.5°C to 15.5°C is known as **1 International calorie**.
- C. **British Thermal Unit (BTU) :** Amount of heat required to increase the temperature of 1 pound of water to 1°F is called 1BTU.

#### Temperature :

The physical factor which decide the direction of the flow of heat between different bodies is called **temperature**.

- Heat transfer between the two bodies takes place from the body with higher temperature to the body with lower temperature.
- Two bodies are considered to be in thermal equilibrium when their temperatures are the same.
- **Thermometer :** An instrument that is used to measure the temperature is called **thermometer**.

#### Measurement of Temperature :

There are four main scales used to measure the temperature (i) Celsius (ii) Fahrenheit (iii) Kelvin (iv) Reaumur Scale

- (i) **Celsius Scale :** In this scale, the **freezing point** of water is marked as **0°C** and its **boiling point 100°C** and space between them is divided equally into 100 parts. Each part is equal to 1°C.

- A scientist of Swedish origin, **Anders Celsius** invented this scale.

**(ii) Fahrenheit Scale :** In this scale, 32°F is marked for the freezing point of water while 212°F is marked for the boiling point and space between these two points divided into 180 equal parts every part represents 1°F.

- Scientist of German origin **Fahrenheit** originated this scale.

**(iii) Kelvin Scale :** This scale is also known as **Absolute Temperature Scale**. This scale measures 273K as the freezing point of water and the boiling point as 373K.

- **Kelvin** was a British engineer who invented this scale in association with physicist William Thomson.
- Degree sign (°) is not placed with a Kelvin scale (i.e. with K).

- **Reaumur Scale :** On Reaumur scale freezing point of water is marked as **0°Re** and the boiling point at **80°Re** and the space between them is divided into 80 equal parts. In this way, each part on this scale represents 1° Re.

- **Absolute Zero : 0 K is known as absolute temperature**, it is also considered as a minimum limit of temperature. Therefore, no temperature can exist below the 0 K (**-273.15°C**) because at this temperature motion of the molecules of matter (molecular vibration) becomes minimum (approximately zero).

$$0\text{ K} = -273.15^\circ\text{C and } 273\text{ K} = 0^\circ\text{C}.$$

- Temperature considerably lower than 0°C (**such as -40°C, -50°C or lower**) are measured with the help of alcohol thermometer, because mercury starts freezing at -39°C, while freezing point of alcohol is -114°C.
- Relation between Celsius and Fahrenheit :

$$\frac{C}{5} = \frac{F - 32}{9}$$

- Relation between Celsius and Kelvin :

$$C = K - 273$$

$$K = C + 273$$

- **Mercury Thermometer :** It was discovered by Fahrenheit.
- Mercury thermometer can measure the temperatures from about -39°C to 357°C easily.
- **Gas Thermometer :** There are two types of thermometers used in this category **(i) Constant Volume Gas Thermometer (ii) Constant Pressure Gas Thermometer**.
- Only Constant Volume Gas Thermometer is used extensively.
- According to the **Ideal Gas equation, PV = nRT** absolute temperature of any gas at constant volume is directly proportional to its pressure.

- Using different gases in gas thermometer temperature of extensive range can be measured.

- Temperatures from -200°C to 500°C can be measured if hydrogen gas is used in a gas thermometer.

- If nitrogen gas is used in a gas thermometer, its range becomes from +500°C to +1500°C.

- **Helium** gas thermometer has a temperature measurement range of -270°C to 1500°C.

- **Platinum Resistance Thermometer :** It can measure temperatures in the range of -200°C to 1000°C.

- **Thermocouple Thermometer :** It can measure temperatures in the range of 270°C to 1800°C.

- **Total Radiation Pyrometer :** This thermometer measures the temperatures of more than 500°C of the objects which radiate energy and the temperature of such objects is measured without touching the object.

- This thermometer is based on **Stefan Boltzmann Law**. According to this law, the amount of radiation emitted by any objects at a high temperature is directly proportional to the fourth power of its absolute temperature.

$$E \propto T^4$$

$$\text{or } E = \sigma T^4$$

$$\sigma \rightarrow \text{Stefan Boltzmann Constant}$$

- **Specific Heat :** The amount of heat required for a unit increase in the temperature of the substance of unit mass is called the specific heat of that substance.

- Specific heat is represented by 'C'. Its S.I. Unit is **Joule/Kg. Kelvin**.

- Specific heat of water is highest in comparison to other substances. Its value is 1 calorie/gram°C or 4.184 Joule/gram 0°C.

- Water, due to its high specific heat plays an important role in the control of temperature.

- **Thermal Expansion :** When the length, area or the volume of an object increases on heating it, this is called **thermal expansion**.

- Thermal expansion can be defined in three ways –

(i) Coefficient of Linear Expansion ( $\alpha$ )

(ii) Coefficient of Area Expansion ( $\beta$ )

(iii) Coefficient of Volume Expansion ( $\lambda$ )

- Increase in length of any object due to heat is measured by the coefficient of linear expansion ( $\alpha$ ), Increase in an area measured by the coefficient of area expansion ( $\beta$ ) and measurement of increase of volume is measured by the coefficient of volume expansion ( $\gamma$ ).

- Relation among all the three coefficients of thermal expansion is as follows–

$$\alpha : \beta : \gamma = 1 : 2 : 3 \text{ or } \beta = 2\alpha \text{ and } \gamma = 3\alpha$$

- Liquid have no fixed shape, but their volume is fixed, therefore, in liquids volume expansion is measured for calculating the effect of heat.
- Generally, the volume of all liquids increases with the increase in temperature, but the volume of water with an increase in temperature (0°C to 4°C) **decreases**.
- A decrease in the volume of water even when its temperature increases (between 0°C to 4°C) is known as **abnormal expansion**. This behaviour is an exception to the general rule.
- It is only due to the abnormal expansion of water that the density of ice is smaller than that of water.
- **Transmission of Heat** : Flow of heat from one object to another is called **propagation** or **transmission of heat**. It can happen in three ways –
  - (i) **Conduction** (ii) **Convection** (iii) **Radiation**
- (i) **Conduction** : In conduction heat transfer takes place due to the vibration of molecules, i.e, in this process molecules of a substance without leaving their place pass on the heat to nearby molecules.
- (ii) **Convection** : In convection transfer of heat takes place because of the motion of molecules. This kind of heat transfer occurs in liquids and gases.
  - On heating liquids, their molecules shift their position to another object receiving heat.
  - Air heats up only due to the convection process.
- (iii) **Radiation** : Objects at very high temperature radiate heat in the form of electromagnetic waves and they can travel in vacuum.
  - Heat radiation travels with the speed of light in a straight line.
  - A large amount of heat is generated by the sun along with light which reaches the earth in the form of radiation.
  - **Cooling** : The process of cooling a heated body is called cooling. Anybody can cool down only when the temperature of the body is greater than its surroundings.
  - **Newton's Law of Cooling** : In stable conditions, the rate of cooling of an object through radiation is directly proportional to the difference in temperature between the object and its ambience.
 

Therefore,

$$\Delta T \rightarrow \text{difference in temperature of object and surroundings.}$$
  - **Kirchhoff's Law** : This law is called Kirchhoff's Radiation Law. According to this law, at the thermodynamic equilibrium, a system that absorbs or emits heat radiation has its absorptivity equal to emissivity. According to this, good absorbers of heat are also good radiators.
- **States of Matter** : There are three types of physical matter.
  - (i) **Solid** (ii) **Liquid** (iii) **Gas**
- **Solid** : In a solid state, the molecules of any matter are held together closely with a strong attraction force forming a definite **geometrical structure**.
- Solids have fixed shapes and volumes.
- Molecules of a solid can only vibrate, remaining at fixed place relative to their mean position.
- Molecules of solids do not perform translatory motion.
- **Liquids** : Liquids or fluids have the property to flow. **The Intermolecular force** between molecules of liquids is comparatively lower than that of solids.
- The volume of liquids is fixed, but their shape is not.
- Molecules of liquids are free to move in the liquid from one place to another but this motion takes place within the liquid's boundary.
- **Gas** : In the gaseous state of matter **intermolecular** force among the molecules is almost zero. Therefore, in gaseous state molecules move in free motion (**Random motion**) in different directions.
- In gaseous state shape and volume, both are uncertain.
- Change of State** :
  - When a solid is heated up to a certain temperature, it starts melting to change into a liquid, and this process is called Change of State. e.g. melting of ice at 0°C.
  - Change of state is not only from solid to liquid but also from liquid into gas when heated and this process also takes place at a certain temperature, e.g. boiling of water at 100°C and changing into a vapour.
  - Therefore, the change of state is the process that occurs at a certain temperature in which a substance changes from one physical state to another.
  - Change of state also occurs by absorbing heat instead of giving it, e.g. on cooling, water vapour (**converted to small drops of water**) gets liquified.
  - On gradually cooling water it turns into a solid in the form of ice at a fixed temperature, i.e. at 0°C.
  - **Melting Point** : A temperature at which the melting process of solids takes place is called the **melting point** of the solid.
  - **Boiling Point** : The temperature at which any liquid or fluid starts boiling is called the boiling point of that liquid. e.g. water boils at 100°C; therefore, its boiling point is 100°C.
  - **Condensation** : In the process of condensation, a substance or gas changes from the state of vapour to that of liquid and the fixed temperature at which this process takes place is called the **condensation point**.
  - Condensation is the opposite process of boiling or evaporation.

- Water vapour can be condensed at any temperature below **100°C** to convert into liquid.
- If any substance (solute) is dissolved into liquid, the boiling point of the liquid increases. It will now boil at a higher temperature compared to pure liquid.
- The boiling point of pure water is **100°C** while Benzene starts boiling only at **80°C**.
- The boiling point of chloroform is **61.2°C**.
- **Latent Heat** : Heat given or coming out from a substance during the change of state is called **latent heat**.
- The temperature of a substance when it undergoes a state of change is because of latent heat as this heat is consumed for changing the state of the substance.

**Latent Heat of Melting** : Amount of heat required to convert unit mass of a solid into liquid is called Latent Heat of Melting.

- Latent heat required to melt ice is 80 calorie/gram or  $3.34 \times 10^5$  Joule/kg.
- **Latent Heat of Vapourisation** : At the constant temperature, the heat required to convert unit mass of vapour is called **Latent Heat of Vapourisation**.
- Latent Heat of Vapourisation for water is **540 calorie/gram or  $22.6 \times 10^5$  joule/kg**.
- If the latent heat of a substance is L, the amount of heat (Q) required for the change of state of its mass m can be described as  **$Q = mL$** .
- S.I. Unit of latent heat is **joule/kg**.
- Getting a burn from water vapour is more painful than getting burned from the water at 100°C.
- Burning from water vapour is painful because it has extra heat in the form of latent heat, which is 540 calorie/gram extra in comparison to boiling water.
- Ice mixture is formed on mixing salt and potash ( **$KNO_3$** ) in ice and its melting point is much below (i.e.  **$-22^\circ\text{C}$** ) than that of the ice.
- Ice mixture is used to make ice cream.

#### **Evaporation :**

- Evaporation is the process that changes liquid water to gaseous water (**water vapor**). Water moves from the Earth's surface to atmosphere via evaporation.
- Clouds are formed by continuous evaporation of sea- water and through the rain, this water returns to the earth.
- Fast evaporation occurs at the different sources of water upon the Earth during the summer. Because of this ponds gets dry and water in the rivers recedes.
- **Wet clothes get dry only due to evaporation**.
- The process of evaporation becomes fast in dry (**moisture less**) air, and this is the reason that in dry weather owing

to a higher temperature, wet clothes become dry very soon due to higher evaporation.

- The rate of evaporation depends upon the area of the open surface of the liquid, its temperature and rate of vaporization.
- **Sublimation** : The transformation of solids directly into vapour (or gaseous form) on heating is called sublimation. The substances which sublime are Ammonium Chloride, Iodine, Camphor, Naphthalene etc.
- **Refrigerator** : A refrigerator (also called a fridge) is a household appliance that is thermally surrounded by a conductor and has a heat pump connection.
- The temperature inside the fridge or refrigerator may remain above the freezing point of  $0^\circ\text{C}$ , much lower than the room temperature.
- Because of the low temperature of the refrigerator or its coolness, it does not allow bacteria to grow in the food items stored in it so that items kept in it are saved from decay or spoilage.
- **Humidity** : The amount of water vapour in the air is called humidity. Humidity is measured in three ways-
  - (i) Absolute Humidity
  - (ii) Relative Humidity
  - (iii) Specific Humidity

**(i) Absolute Humidity** : The total mass of water vapour present in a certain volume of air is called **absolute humidity**, expressed in **grams per cubic metre**.

**(ii) Relative Humidity** : The ratio of the amount of water vapour present in a certain volume of air at a certain temperature and the amount of water vapour to saturate the air at the same temperature and at the same volume is called **relative humidity**.

- The relative humidity is measured by the **Hygrometer**.
- The relative humidity is expressed in **percentage**.
- Relative humidity also increases with an increase in temperature in the atmosphere.

**(iii) Specific Humidity** : It is the ratio of the amount of water vapour in the total mass of air.

- In other words, it expresses the amount of water vapour in a unit mass of humid air.
- **Air Conditioning** : The hygienic and comfortable conditions for humans are when relative humidity is between 60% and 65% and the temperature of the atmosphere is between 23 degree centigrade and  $25^\circ\text{C}$ . This state is called **air conditioning**.

#### **Thermodynamics :**

- **The First Law of Thermodynamics**: According to this law, the heat energy (Q) given to a system is equal to the



sum of the increase in internal energy of  $dU$  of the system and the external work done  $dW$  i.e.

$$Q = dU + dW$$

- **Isothermal Process:** When a change occurs in a body in such a way that the temperature of the body is fixed in this whole process, such process is called **Isothermal Process**.
- The isothermal process can occur or be performed in the same type of bodies, that have a system of heat regularization.
- **Adiabatic Process:** If the exchange of heat is completely blocked during any type of change in a thermodynamic body, such a process is called **Adiabatic Process**.
- When a gas suddenly expands, there is no time for heat exchange and this is known as adiabatic process. For example, when there is a sudden expansion of carbon dioxide, it cools so intensely that it turns into dry ice.
- **The Second Law of Thermodynamics :** According to this rule, it is impossible to completely change the function of heat and heat cannot flow from an object of low temperature to an object of higher temperature.
- **Stevenson Screen** is a unit designed for wet and dry bulb thermometers to protect temperature sensors from being affected by direct or reflected sunlight.

(SSC CHSL 2023 Tier-1)

- **Ralph H. Flower** coined the term 'zeroth law of thermodynamics' in 1931, which asserts that two bodies in equilibrium with a third are in equilibrium with each other.

(SSC CGL 2023 Tier-1)

- The Thermal energy of a body arising from the motion of its atoms or molecules.

(SSC Scientific Assistant IMD Recruitment 2022)

## 15. Light

- **Light :** Light is a form of energy like electricity or heat. The energy that moves in the form of radiation.
- Light itself invisible, but makes other objects visible.
- Light can pass through a vacuum and transparent medium.
- Light moves in a straight line in the form of electromagnetic radiation.
- Light passing in a straight line as electromagnetic radiation.

### Speed of light in different mediums

| Medium  | Speed of light (m/s) |
|---------|----------------------|
| Vacuum  | $3 \times 10^8$      |
| Water   | $2.25 \times 10^8$   |
| Glass   | $2 \times 10^8$      |
| Diamond | $1.24 \times 10^8$   |

- It's clear that the speed of light is different in different medium.
- The range of wavelengths of visible light is generally considered to be between 400 and 700 nanometres or  $4.00 \times 10^{-7}$  to  $7.00 \times 10^{-7}$  metre.
- Light waves move through a medium or a vacuum as transverse waves, i.e. light is a kind of **transverse electromagnetic waves**.
- Its transverse electromagnetic wave form can explain properties, i.e. Reflection, refraction, diffraction, polarization of light and straightline motion but the photoelectric effect of light cannot be explained by it.
- It is necessary to consider light as small bundles of energy (photons) to explain the photo-electric effect.
- The **Crompton Effect** can also be explained only by the photon theory of light.
- The photon theory of light was explained by the famous physical scientist Albert Einstein to illustrate the Photo-Electric Effect.
- **Albert Einstein** explained that light is of **dual nature**. He observed both the particle and wave-like behaviours of light.

**Note :** First in 1676 the Danish astronomer Ole Romer calculated the velocity of light.

- The speed of light is  $3 \times 10^8$  m/s in a vacuum while it is lower in other dense and transparent media (such as water and glass).
- Medium with higher refractive index has a lower light speed.
- The ratio of the speed of light in a vacuum to the speed of light in a medium is called the **Refractive Index** of a medium. Hence refractive index of a medium

$$\mu = \frac{\text{Speed of light in vacuum (c)}}{\text{Speed of light in a medium (u)}}$$

- The major source of light (for Earth) is the Sun from which a large amount of light and heat energy is released due to the ongoing **Thermonuclear Reactions**.
- Light travels approximately 150 million kilometres to reach the Earth from the Sun and it takes about **8 minutes 19 seconds**.
- The objects through which light passes out easily from one side of the object to the other side are called **Transparent Objects** (e.g., glass, freshwater etc.).
- Objects through which light cannot pass through are called **Opaque Objects**.
- The objects through which the light passes partially are called **Translucent Objects**.
- Oiled paper and tracing papers are translucent.

### Some Physical Phenomena related to light-

- **Diffraction of Light:** When light rays fall upon a very sharp or thin-edged obstacle, it turns and enters the shadow region of the obstacle, this phenomenon is called **diffraction of light**.

- It was the diffraction that proved that light rays do not always move in a straightline but they can also tilt from straight-line path.

**Scattering of Light :** When light rays collide with minute particles of dust which are always present in the atmosphere, they propagate or spread in different directions. This phenomenon is called **scattering of light**.

- The intensity of the scattering of light or the intensity of the scattered light ( $I$ ) is inversely proportional to the fourth power of the wavelength of light ( $\lambda$ ).

$$I \propto \frac{1}{\lambda^4} \text{ (Rayleigh's Law)}$$

- The **wavelength** of the **violet** colour of light is the **lowest** among all the colours of visible light, so the **scattering of violet light is the highest** due to the **Rayleigh's Law**
- **The Red** colour is **scattered the least**.
- The **blue colour** of the sky is due to **scattering of light**.
- In the light spectrum, the effect of the colours attached to the blue coloured edge emerges after scattering as **light blue (sky)**, making the entire sky appear blue during the day.
- Clouds appear white relative to the blue sky because the water droplets present in them are much larger than the dust particles and the sunlight emitted from them does not depend on the wavelength.
- **Reflection of Light :** When light collides with a smooth surface and returns. This phenomenon is called **Reflection of Light**.

There are two Laws of Reflection -

- A.** The Angle of Reflection is equal to Angle of Incidence.
- B.** At the incidence point, the normal, incident ray and reflected ray all lies on the same plane.
- Light also reflects from the surface of water.

### Plane Mirror :

- A plane mirror is a flat mirror with one surface polished and the other surface reflecting.
- The angle of incidence on a plane mirror is equal to the angle of reflection and the incident ray reflected ray and the normal meet at the same point.
- Images made by plane mirrors are virtual and upright.
- The mirror which is used on our dressing table is a plane mirror.

- Virtual images are those that form where the light rays do not actually meet.
- Reflection in a plane mirror causes lateral inversion, that is, if the person standing in front of the mirror raises his left hand, then his right hand will be seen raised in the image.
- The image of an object formed by a plane mirror is at the same distance as of the object from the mirror.
- If a person is moving towards the mirror with  $v$  velocity, then he will see his image approaching towards him with  **$2v$  (double)** velocity.
- A person needs a mirror of half his length to see his full image (**from head to toe**) through a plane mirror.
- If an object is placed between the two plane mirrors bent at an angle  $\theta^\circ$  the number of images ( $n$ ) of the object can be determined by the following method-
  - i.  $n = \frac{360}{\theta} - 1$  (**when  $360/\theta$  is an even number**)
  - ii.  $n = \frac{360}{\theta}$  (**when  $360/\theta$  is an odd number**)
- Three images will be formed by plane mirrors inclined at  $90^\circ$  of an object placed between them (Calculation can be done by the formula given in(i).
- A person standing between two plane mirrors placed in a mutually parallel position will be seen in countless (infinite) images.

### Spherical Mirror:

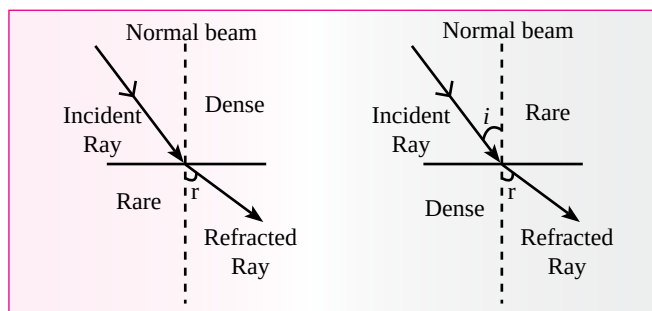
- A mirror obtained when polished on the surface of a small panelled part cut from a hollow sphere of glass is called a **Spherical mirror**.
- **Spherical mirrors are of two types -**
  - (i) Concave Mirror (ii) Convex Mirror
- Concave Mirror :** If a hollow sphere is cut into parts and the outer surface of the cut part is painted. Then it becomes a mirror with its inner surface as the reflecting (surface) known as concave mirror.
- Mostly **real images** are formed from concave mirrors.
- When an object is placed between the focus and the pole of a concave mirror, in this case, the object receives a much larger and virtual reflection than that of the object and is upright.
- Virtual and erect image is formed only by the concave mirror in the above situation.
- **Dentists, E.N.T** (Ear, Nose and Throat) specialists exclusively use a concave mirror because it enlarges images of nearby objects.
- The light rays emanating from the light source placed at the focus of a concave mirror become parallel to the principal axis after reflection.

- The rays propagating parallel to the principal axis of a concave mirror converge at the focus of the mirror after reflection from this mirror.
- Because of both the above properties, concave mirrors are used in **torches, searchlights, vehicle headlights** and **solar cookers**.

#### Different Conditions of Reflection made from Concave Mirror

| Position of object                        | Position of Image                        | Nature of Image     | Size of Image |
|-------------------------------------------|------------------------------------------|---------------------|---------------|
| At center of-curvature                    | At center of -curvature                  | Inverted and - Real | Equal in size |
| At infinity                               | At focus                                 | Inverted and - Real | Pointed       |
| At focus                                  | At infinity                              | Inverted and - Real | Very large    |
| Between Center of curvature- and Infinity | Between focus- & center of Curvature     | Inverted and- Real  | Small         |
| Between pole and focus                    | Behind the mirror                        | Erect & Virtual     | Large         |
| Between Center of Curvature & Focus       | Between Center of Curvature and Infinity | Inverted & Real     | Large         |

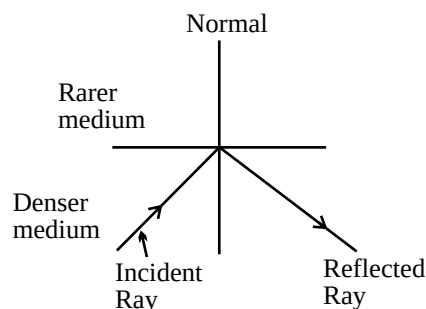
- **Convex Mirror** : If the concave part is polished in a spherical mirror then the convex part reflects light. Such a mirror is called a Convex Mirror.
- In every case of a convex mirror, the reflection of an object becomes **virtual, small** and **upright**.
- The convex mirror is used in vehicles as a **rear-view mirror** due to its large field of view and its reflection becomes straight.
- Convex mirrors are also used as **sodium reflector lamps**.
- **Reflection** : **Reflection** of light is the phenomenon in which light rays return after hitting a smooth and shining surface.
- Light is also reflected from the surface of the water.
- **Refraction** : If light rays are travelling from one medium to another, they change their direction at the point where two transparent media separate with different refractive indexes is called **Refraction**.
- In case of refraction, entering of light in a rare medium through a dense medium, the light rays move away from the normal through the incident point in the rare medium.



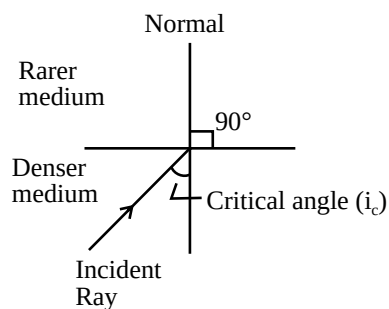
- During refraction, when the light rays from a rare medium enter the dense medium, it tends to bend towards the normal.

#### Total Internal Reflection of Light :

- The possibility of **Total Internal Reflection** of light arises when light enters the rare medium on contact with the surface of two transparent media but with different refractive indexes.
- During refraction of light from the denser to the rarer medium when the value of the incidence angle exceeds a particular value (**critical angle**), there is a complete internal reflection of light and the light has to return to the denser medium.



- **Critical Angle** : Critical Angle is the angle formed by refraction of light rays when refractive rays in a dense medium create a refraction angle of  $90^\circ$  from the normal.



#### Conditions of Total Internal Reflection:

- The light beam should move towards the rarer medium through the denser medium.
- The light beam should be incident to normal at an angle greater than the critical angle at the boundary (**or contact plane**) of the dense medium and the rare medium.

- **Sparkling of the diamond** and the **mirage** formed during the summer days in the desert occurs due to total internal reflection of light.
- The cracked glass sheet and bent stacked test tube in the water also shine because of total internal reflection.
- The **Endoscopy** (abdominal checkup) technique works on the principle of total internal reflection.
- **Optical Fibre** : Optical fibres are made on the principle of Total Internal Reflection of light.
- Optical fibres are used to easily transmit signals to distant locations without energy loss.
- In optical fibres, light travels long distances in a curved or zig-zag path.

**The following are the uses of optical fibres:**

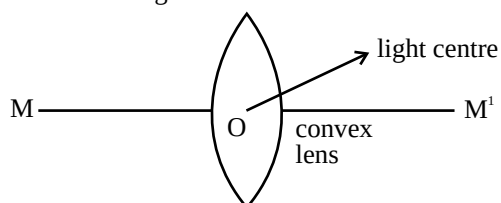
- Nowadays, in telecommunication optical fibre is used.
  - In the field of medicine too, optical fibres have proved very useful in that the internal parts of the body can be examined very well.
  - Optical fibres are ideal components for transmitting digital information.
- **Lens** : The lens is an optical component that can focus or diverge light rays.
  - Lenses are usually made of glass and light rays get refracted after passing through it.
  - The lens is a homogeneous transparent medium surrounded by **two curved surfaces**.
  - The curves of the lens may be spherical, cylindrical or parabolic, but they are usually spherical.

There are two types of lenses -

(1) Convex Lens and (2) Concave Lens

### (1) Convex Lens :

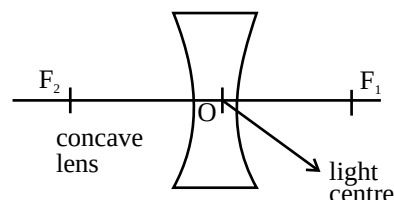
- A lens focusing light rays at a point after refraction is called a convex lens. It is also called **Convergent Lens**.
- Both sides of the convex lens are **outward facing**.
- The midpoint inside the convex lens is called the **Optical Centre**.
- The ray passing through the optical centre follows its initial path without being refracted from the lens.



- The line through the optical centre O and dividing the lens into two equal parts is called the Principal Axis (MM') of the lens.

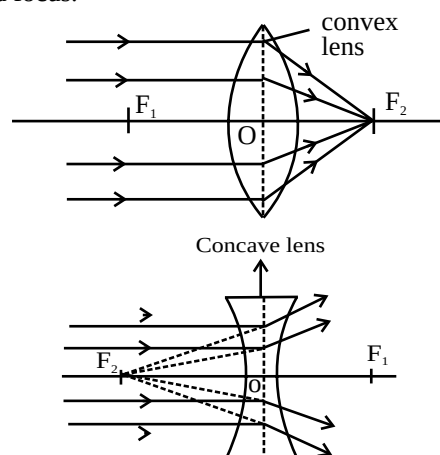
### (2) Concave Lens :

- A Lens that diverges light rays is called a Concave Lens, it is also called a **Divergent Lens**.
- Both sides of a concave lens are **bent inwards** (concave).
- In each case with a concave lens, only the virtual, erect and small reflection from the object is obtained, which is always formed between the second focus  $F_2$  and the optical centres of the lens.



### Facts Related to Lenses -

- **Focus F**: The point on either side of the lens on the principal axis of the lens (**convex and concave**) where the light is converged or from where the light appears to diverge is called focus.



### Formation of Image at Various Positions

| Object Location          | Image Location             | Image Nature & Size       |
|--------------------------|----------------------------|---------------------------|
| Infinity                 | At $F_2$                   | Real, Inverted, Reduced   |
| Beyond $2F_1$            | Between $2F_2$ and $F_2$   | Real, Inverted, Reduced   |
| Between $2F_1$ and $F_1$ | Beyond $2F_2$              | Real, Inverted, Enlarged  |
| At $F_1$                 | At infinity                | Real, Inverted, Enlarged  |
| At $2F_1$                | At $2F_2$                  | Real, Inverted, Same size |
| Between $F_1$ & O        | On the same side as object | Virtual, Erect, Enlarged  |



➤ **Note : Note:** The power of the **convex lens** is **positive** and that of the **concave lens** is **negative**.

- **Power of the Lens :** If the focus distance of the lens is expressed in meters, the inverse of the focus distance  $F$  is also called the power of the lens ( $P$ ).
- The SI unit of the power of the lens is **Diopter (D)**.  
That is,

$$P = 1/f \text{ (in metre)}$$

- If the lens has a focal length of 1 metre, its power is 1 diopter or 1 D.
- If the lens of the above focus distance is convex, then its power will be **+1D** and if the lens is concave, then the power will be **-1D**.
- The power of sunglasses is zero (0) Diopter.
- If the two lenses of similar nature having focal lengths  $f_1$  and  $f_2$  keep close together, the combination would behave like a single lens whose power is expressed by

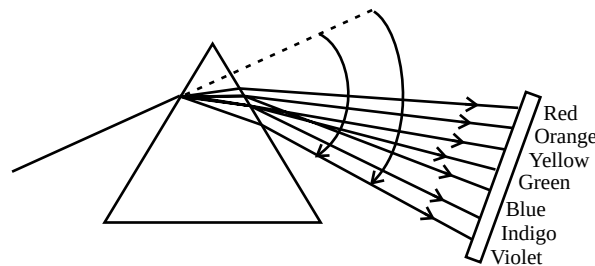
$$\text{Power, } P = \frac{1}{f_1} + \frac{1}{f_2}$$

Or

$$P = \frac{f_1 + f_2}{f_1 f_2}$$

- If the lens is immersed in a fluid, the power of the lens changes and the amount of such a change depends on the lens and the refractive index of the fluid.
- By immersing the lens into a fluid with a lower refractive index than the substance of the lens, the efficiency of the lens will decrease but nature will remain the same.
- In a fluid with a refractive index equal to the substance of the lens, then the lens will behave like an ordinary glass plate.
- If the refractive index of the substance of the lens is less than the refractive index of the fluid in which the lens is immersed and then the nature of the lens will change, i.e., the convex lens will behave like a concave lens and the concave lens will behave like a convex lens.
- The air bubble inside the water looks like a convex lens but display the nature of a concave lens.
- In carbon disulfide (refractive index 1.63), the glass-convex lens (refractive index 1.5) behaves like a concave lens while the concave lens behaves like a convex lens.
- **Dispersion of Light:** White Light (Light from the sun) or visible light is the combined effect of light split into **seven** different colours.

- In the event of dispersion, white light gets split into its component colours due to refraction from a particular angle, e.g. deflection of light from a **prism**.

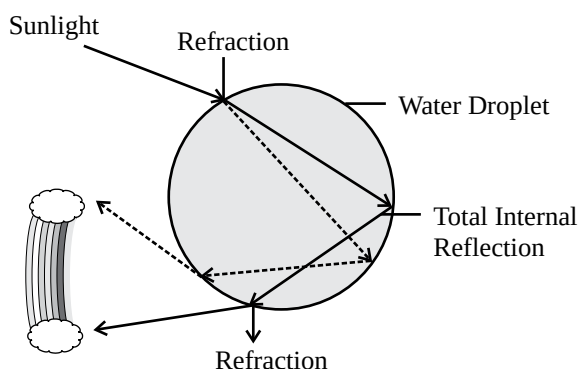


- Seven colours deflected from the prism are-**Violet, Indigo, Blue, Green, Yellow, Orange and Red** from the base upwards. The acronym of these prismatic colours is **VIBGYOR**.
- Colours with shorter wavelengths present in white light have higher dispersion.
- Therefore, the **dispersion** of **violet colour** is **highest** compared to other colours of white light because the violet colour has the shortest wavelength.
- **Red light** has the **least dispersion** because the wavelength of this colour is the lengthiest (**more than that of the other six colours combined**).
- The reason for the dispersion is the difference in refractive index for different colours of light.
- The unique natural example of dispersion is the formation of a rainbow.

#### Important Facts Related to Red and Violet Colours

| Colour | Refractive Index | Wavelength | Dispersion |
|--------|------------------|------------|------------|
| Red    | Highest          | Highest    | Lowest     |
| Violet | Lowest           | Lowest     | Highest    |

- **Rainbow :** A rainbow is formed owing to the dispersion of sunlight (**split of light into various colours**) by the tiny droplets of water present in the atmosphere (**colour deflection**).
- Minute water droplets of rain act as prisms for the light rays radiating from the Sun and in the event of light incident on them from a particular angle, they cause **dispersion of light**.
- In the process of rainbow formation, refraction of light, total internal reflection and refraction from water to air take place respectively for the dispersion of light.
- In the formation of the rainbow, a drop of rainwater causes the dispersion of light similar to the following diagram.



### Primary Colours

- The three colours that can be mixed to produce white light are called **Primary Colours**. These are Red, Green and Blue.

**Note :** Primary colours are used in colour television.

- Secondary colours are **Magenta, Cyan (Peacock, Blue)** and **Yellow**, in this category.

Red + Green = Yellow

Red + Blue = Magenta

Green + Blue = Cyan (Peacock Blue)

- Other colours derived from primary colours which are in addition to white colour are called Secondary Colours, as is clear from the above-mentioned example. Two colours with the help of which the light of white colour is obtained are called **Complementary Colours**.
- White colour can be formed from other colours :

Red + Peacock blue = White

Green + Magenta = White

Blue + Yellow = White

**Note :** Such colours are not obtained because of impurities found in the colours used in daily life.

- The colour of an object depends on the colour of the light reflected by the object, ie, the object appears of the same colour as the colour of light reflected by it.
- If an object absorbs all the colours of light, then it appears **Black**.
- Objects reflecting all the colours of light appear White.
- The colours of objects of different colours in light of different colours:

| Objects         |              |            |              |               |             |              |
|-----------------|--------------|------------|--------------|---------------|-------------|--------------|
| Colour of Light | White Object | Red Object | Green Object | Yellow Object | Blue Object | Black Object |
| White           | White        | Red        | Green        | Yellow        | Blue        | Black        |
| Red             | Red          | Red        | Black        | Black         | Black       | Black        |

|        |        |       |       |        |       |       |
|--------|--------|-------|-------|--------|-------|-------|
| Green  | Green  | Black | Green | Black  | Black | Black |
| Yellow | Yellow | Black | Black | Yellow | Black | Black |
| Blue   | Blue   | Black | Black | Black  | Blue  | Black |

### Interference of Light :

- Like sound, light waves can also be interfaced.
- When two waves of light (of equal frequency and amplitude), which are normally generated by the same source by passing through double slits appear at the fringes screen when they appear on the screen at a certain distance.
- Interference of light is actually a change in the intensity of light that results from the mutual overlapping of these rays during the movement of two light rays (having the same frequency and amplitude) in the same direction. There are two types of interference :

**1. Constructive Interference:** When at some point in the interference of light, light rays are in the same phase producing interference which is called **Constructive Interference**.

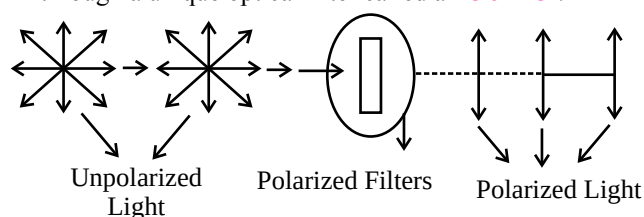
- **Bright fringes of light** are seen on the screen due to constructive interference.

**2. Destructive Interference :** In Destructive Interference, the light intensity becomes minimal when the light rays are in **Opposite Phase** at some point during the interference and **dark fringes are produced on the screen**.

- It is clear from the above description that the white and black fringes in the interference pattern of a monochromatic light source obtained by using double slit indicate the constructive and destructive interference, respectively.

### Polarization of Light :

- Light rays are transverse electromagnetic waves in which electromagnetic fields vibrate perpendicular to the direction of wave propagation.
- Wave vibrations perpendicular to the light beam occur in different directions.
- A standard light beam having different directions of vibrations is called **Unpolarized Light**.
- The phenomenon of converting unpolarized light into polarized light is called **Polarization of Light**.
- Polarization of light is the process in which light moves ahead following the same vibrational plane after passing through a unique optical filter called a **Polarizer**.



- One of the most commonly used forms of Polaroid, i.e. polarizers is currently made of iodine doping with polyvinyl alcohol plastic.
- Polaroid is used in sunglasses because it reduces the intensity of glare by absorbing polarized light in the horizontal plane.
- Polarized light is used to visualize the three-dimensional view (3D-view). For this, particular types of polaroids are used which have a vertical axis.
- The shape and size of viruses are measured by the polarization of light or polarized light.
- Polaroid filters are used in photographic cameras to capture more vivid colour photographs because polaroid filters significantly reduce the unnecessary amount of reflected light.
- Only the electric field vector (among perpendicularly vibrating electromagnetic field vectors) produces the optical effect from the vibrations through which the light rays move linearly.

#### Eye :

- The Eye is a part of the visual system. Along with expanding the vision of these organisms, it also performs many picture response functions for them.
- In higher organisms, the eye is a complex optical system that collects light from the surrounding environment and also controls its intensity through a diaphragm.
- In order to create an image by the eye, the naturally provided lens works with the help of the adjustment mechanism of the muscles.

#### Human Eye :

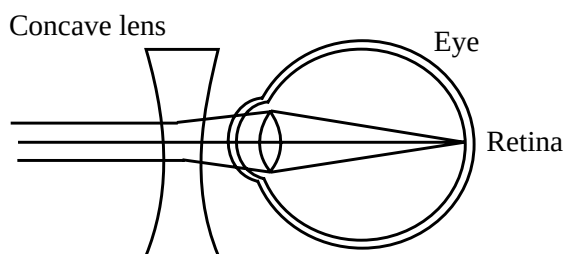
- The human eye is capable of presenting a three-dimensional view.
- All images in the eye are formed **on the retina**.
- The **conical-shaped cells** present in the retina are sensitive to colours, that is, they are used to **identify colours**.
- The retina also contains rod-like or rod-shaped cells that are sensitive to light intensity.
- The **minimum distance** of clear vision for the human eye is **25 cm**.

#### Vision Impairment :

- When a person is unable to see things near or far away, he may be suffering from vision impairment.
- Visual impairment is a term experts use to describe any kind of vision loss, whether it's, someone who can not see at all or someone who has partial vision loss.
- **Myopia (Near-Sightedness)** : In myopia, a person can see the closer object clearly but he cannot see the distant objects clearly.

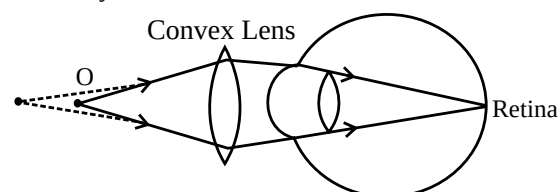
#### Myopia can occur for the following reasons:

- 1 Increased thickness of the eye lens.
  - 2 A decrease in distance between focus and eye lens.
  - 3 Increase in diameter or radius of the eyeball.
- In myopia, the image is formed ahead of the retina, i.e. just before the retina.
  - Myopia can be removed by using **Concave Lens**.



Treatment of Myopia

- By using glasses of a concave lens, the rays of light coming from a distant object diverge slightly after refraction from the lens and they now fall on the eye lens and this enables them to focus precisely on the retina.
- **Hypermetropia (Farsightedness)**: People with farsightedness are able to see distant objects clearly but nearby objects appear blurred or unclear to them.
- The reason behind this defect is due to-
  - i. Decreased thickness of eye lens.
  - ii. Increase in the focal length of the eye lens.
  - iii. The reduced diameter of the eyeball.
- Due to far-sightedness, the image of the object is formed **behind the retina** rather than on the retina.
- Hypermetropia can be removed by using a **Convex lens**.
- The convex lens converges the light rays from a nearby object and focuses on the retina with the help of the eye lens.
- Notably, the glasses used for reading purposes are essentially conver lenses.



Treatment of Hypermetropia

| Vision Defects          |                        |                        |                    |
|-------------------------|------------------------|------------------------|--------------------|
| Types of Vision Defects | Nearby object          | Distant Object         | Lens for Treatment |
| Near-Sightedness        | Can be seen clearly    | Cannot be seen clearly | Concave lens       |
| Far-Sightedness         | Cannot be seen clearly | Can be seen clearly    | Convex lens        |

- **Presbyopia:** It occurs in old age. In this disease, the adjustment of the muscles of the eye reduces and the person is not able to see things clearly both nearer and far away.
- Presbyopia is also called a **slight vision defect**. This defect is resolved with the help of a **bi-focal lens**.
- **Astigmatism:** This disease is caused by the **cornea not being completely round**. In this disease, horizontal and vertical lines are not visible clearly and simultaneously.
- Astigmatism can be removed by using **cylindrical lenses**.

#### Optical Instruments:

- Devices in which light is used are called **Optical Devices** like microscope, telescope, periscope and spectrometer.
- Microscopic objects such as cells, bacteria and viruses are studied under a microscope.
- Distant objects and celestial bodies such as planets stars and galaxies are observed from the telescope.
- There are different types of microscopes that have different capabilities, such as simple microscopes, combined microscopes and electron microscopes.
- **Simple Microscope :** A very short focus distance convex lens is used in simple microscopes.
- In a simple microscope, the size of the object depends on the vision it creates on the eye. That is, the larger the viewing angle, the larger the object and the smaller the viewing angle the smaller the object appears.
- The magnification ability of a simple microscope is determined by the following formula-

$$M = 1 + \frac{D}{f}$$

Where D least distance of distinct vision (25 cm) **f = focus**  
length of Convex Lens

- **Compound Microscope:** In this microscope, two convex lenses are placed upon a cylindrical pipe.
- The lens placed towards the object in a combined microscope is called an **Objective Lens** and the lens which is towards the eye is called the **Eye Piece**. The focal length of the objective lens in the microscope is less than the eyepiece lens.
- **Electron Microscope :** In electron microscopes, the electron beam is used to look at objects in place of light.
- **Telescope:** In a telescope, convex lenses are placed on both the open sides of a cylindrical pipe.
- In the telescope also the lens on the side of the object is the objective lens and the lens on the side of the eye is called the eyepiece lens.
- The focal length of the objective lens in the telescope is much larger than the lens in the eyepiece.

- Equation  **$P = v/c$**  was verified by American scientists Nichols and Hull in 1903 by measuring the radiation pressure of visible light. (SSC CHSL 2023 Tier-1)
- A non-SI unit called 'nit' is the unit of photometric quantities **Luminance** is used to measure a multitude of light intensities. (SSC CGL 2023 Tier-1)
- Measuring instrument Spherometer consists of a metal triangular frame supported on three legs, used to measure the radius of curvature of an object such as lenses and curved mirrors which are spherical in shape. (SSC CGL 2022 Tier-1)
- The speed of light in descending order in different mediums. **Air > Water > Glass > Dismond.** (SSC Selection phase X (August 2022))
- In 1928, CV Raman discovered that when a ray of coloured light enters a liquid, a fraction of the light scattered by that liquid is of a different course. (SSC CHSL 2021 (Exam held in 2022))

## 16. Static Electricity

### Static Electricity :

- Electrical charges of opposite nature (**+ve and -ve**) are generated when objects are rubbed with one another.
- The charging of substances is called **static electricity** because the charge being generated does not move.
- The positive (**+ve**) or negative (**-ve**) charge generated in static electricity were named by **Benjamin Franklin**.
- When two similar charges are brought closer such as positively charged objects, they repel one another.
- Oppositely charged objects such as positive (+ve) and negatively charged (-ve) objects attract one another.
- The main reasons for static electricity are electrons (**negatively charged atomic particles**).
- An atom is a neutral particle in which the amounts of positive and negative charge are equal.
- When two objects are rubbed with each other, the object on which the electrons remain low in number is positively charged and the object on which the electrons are in excess becomes negatively charged.
- **Surface Charge Density:** The amount of charge located in the unit area of a conductor is called the Surface Charge Density.
- The surface density of the charge on the point of any conductor is the highest.
- **Conductors :** The substances in which electric charge in electricity can flow with ease are called **conductors**.
- All metals and aqueous solvents containing salts etc. are electrical conductors.



- Copper and Aluminium are the most commonly used conductors of electricity.
- Silver is the best conductor of electricity while copper is close behind.
- **Non-Conductors:** Substances that obstruct the flow of electric current or such substances in which the flow of electric current is not possible are called non-conductors such as wood, rubber, plastic, paper and mica etc.
- **Semiconductor:** There are some materials whose electrical conductivity falls somewhere between conducting and non-conducting materials, they are called **semiconductors** such as Silicon, Germanium, Gallium, Arsenide, Selenium, Tellurium etc.
- **Low-resistivity** materials (such as metals) are **good conductors** of electricity while materials with **high resistivity** (such as non-metals) are **bad conductors** of electricity.
- Generally, the resistivity of metals increases with increasing temperature while the resistivity of semiconductor materials decreases with increasing temperature.
- **Coulomb's Law:** The electrostatic force of attraction or repulsion acting between fixed electric charges is directly proportional to the product of the amount of charges and the inverse of the square of the distance between them.
- The Coulomb's Law is also expressed with the help of the following formula-

$$F = K \frac{q_1 q_2}{r^2}$$

- Here  $q_1$  and  $q_2$  are two electric charges at a distance 'r'.
- and F is the electrostatic force between them and K is the constant.
- **Electric Field :** The area around a charged body as far as the electric effect can be experienced due to that charged body is called electric field.
- **Electric Field Intensity :** The force acting on the unit positive charge located at some point in the electric field is called the intensity of the electric field.

$$E = \frac{F}{q}$$

Where,

F → Electrostatic force

Q → charge

E → intensity of Electric Field

- The electric field inside a hollow conductor is zero, i.e. the charge on the hollow conductor remains on its surface.
- Any hollow conductor or sphere behaves like an electrostatic shield, i.e., if such a hollow conductor such as

a car or bus, if its windows are closed, etc. If the celestial lightning falls, the person sitting inside it is safe because the charge remains stuck on the surface.

- **Electric Potential :** The work done in carrying a unit positive charge from infinity to the point of an electric field is called electric potential of that point.
- The SI unit of electric potential is **Volts or Joule per Coulomb**. It is a **scalar quantity**.
- **Potential Difference :** The work done in bringing the positive unit charge from one point to another point in the electric field is called the potential difference between those points.
- The unit of potential difference is **volt**.
- If W work has to be done in moving the charge q between two points, then the potential difference V between those points is

$$V = \frac{W}{q}$$

- **Electric Capacitance:** The Capacitance (C) of a conductor is equal to the ratio of the charge (q) given to the conductor and the potential change (V) in the conductor.

$$\text{means, } C = \frac{q}{V}$$

The SI unit of electrical capacitance is **Farad (F)**

**Electrochemical Cell :**

- An Electrochemical cell is a device that converts **chemical energy into electrical energy**. It is of two types-  
(i) Primary cell  
(ii) Secondary cell
- An electrochemical cell has two terminals, a positive terminal, Cathode and a negative terminal, Anode.
- The direction of current flow is from the positive terminal of the power cell in the circuit to the negative terminal.
- **Primary Cell :** Primary cells convert **chemical energy directly into electrical energy**. Primary cells cannot be used again and again because they become unusable once used.
- Examples of primary cells are Leclanche cell, Daniel cell and Voltaic cell.
- **Secondary Cell :** Secondary cells are to be charged before they can be used.
- By charging the secondary cells, first, **the electrical energy** is converted into **chemical energy** and this accumulated **chemical energy** is later obtained as **electrical energy**.
- Secondary cells can be used again after being discharged by recharging them.
- A simple voltaic cell has a zinc anode and a copper rod as a cathode. These two rods are immersed in a glass vessel (jar) half-filled with sulfuric acid solution.

- The Voltaic cell was invented by **Alessandro Volta**.
- The Carbon rod is used as a cathode and as a zinc rod or body as an anode in a leclanche cell. Both these electrodes are dipped into an aqueous solution of an electrolyte ammonium chloride.
- Leclanche cell is also constructed in the form of a dry cell in which cathode (carbon rod) is dipped into the mixture of manganese dioxide and carbon, and ammonium chloride is put in the form of paste in a zinc pot (**anode**).
- Electromotive Force (**EMF**) of Leclanche cell is 1.5 volt.
- Leclanche cell is more useful when there is a need for current for a short duration or intermittent flow of current is required, e.g. in an electric bell, telephone and in the experiments of physics.

## 17. Electric Current

- **Rate of flow of charge** in a conductor is called **electric current**.
- Electric current flows in the direction of motion of positive (+ve) charge.
- Electric current is a **scalar quantity**. Its SI unit is **Ampere (A)**.
- There are two types of Electric current –
  - (i) Direct current (DC)
  - (ii) Alternating current (AC)

**Direct Current :** If the current in a circuit flows in only one direction, then it is called 'Direct current'.

**Example,** Battery.

**Alternating Current :** Such a current, whose value and direction keep on changing periodically with time, is called 'Alternating current'.

- The major advantage of alternating current over Direct current is that alternating current can be transmitted over long distance without much loss of electric energy.
- If in a wire  $6.24 \times 10^{18}$  electrons per second enter from one end and the same number of electrons come out from the other end of the wire then it implies that one **Ampere (1A)** current is passing through that conductor.
- **Resistance:** Resistance of a conductor is a physical quantity that obstructs the flow of current in that conductor. Resistance is denoted by  $R$ .
- SI unit of the resistance is **Ohm ( $\Omega$ )**
- **Ohm's Law :** When a potential difference is applied across a conductor, an electric current starts following through it.
- German Scientist George Simon Ohm established the relation between the applied potential difference and its resultant current in the form of experiments, this relation is called Ohm's law.

- Ohm's law states that if no physical change occurs in the state of the conductor, the potential applied at the ends of the conductor is directly proportional to the current flowing through it.
- If electric current  $I$ , flows in the conductor and the potential difference between the ends of the conductor is  $V$ , Ohm's law can be expressed as follows

$$V \propto I \quad \text{or,} \quad V = RI \Rightarrow R = \frac{V}{I}$$

- $R$  is a constant, it is called the Resistance of the Conductor.
- Some conductors follow Ohm's Law while others do not.
- The conductors which follow Ohm's Law are known as **Ohmic Resistance**, e.g., wire of manganese (Mn).
- The conductors which do not follow Ohm's Law are known as **Non-Ohmic Resistance**, e.g., Diode, Resistance of Transistor.

- **Conductance:** Inverse of the resistance of the conductor is known as the Conductance of the Conductor.
- Conductance is denoted by the symbol ' $G$ '.
- SI unit of Conductance is **S (Siemens)** or **Ohm<sup>-1</sup> ( $\Omega^{-1}$ )**, it is also called **mho**.

- Its formula is  $G = \frac{1}{R} = \frac{1}{V}$ , where  $R$  is resistance.

- **Specific Resistance:**
- Specific resistance is defined as the resistance offered per unit length and unit cross-sectional area when a known amount of voltage is applied.
- **Resistance** of a thick wire is less than resistance of a thin wire, made of the same material.
- The reason behind this is that resistance of the conductor is directly proportional to its length and inversely proportional to the area of the cross-section.
- If the length of the conductor is denoted by  $l$  and its area of the cross-section by  $A$ , the formula of its specific Resistance is denoted by-

$$R \propto \frac{l}{A} \quad \text{or} \quad R = \rho \frac{l}{A}$$

- Here,  $\rho$  is a constant which is known as specific resistance or the resistivity of the conductor. Its SI unit is Ohm-metre ( **$\Omega\text{-m}$** ).
- **Specific Conductivity:** Inverse of the specific resistance of the conductor is known as Specific Conductivity of that conductor.

It is denoted by  $\sigma$ ,  $\sigma = \frac{1}{\rho}$

Its SI unit is **Ohm<sup>-1</sup>-metre<sup>-1</sup> ( $\Omega^{-1} \text{m}^{-1}$ )**

**Combination of Resistances:**

- In an electrical circuit combination of resistance is done mainly in two ways-
  - a. Series Combination
  - b. Parallel Combination

- When the resultant of combined resistance is equal to the sum of all the resistance, they are in a series combination. If the combined resistances are represented by  $R_1$ ,  $R_2$ , and  $R_3$ , the total resistance  $R$  is –  

$$[R = R_1 + R_2 + R_3]$$
- Similarly, when the inverse of the combined resistance is equal to the sum of the inverse of the resistance, the total resistance is said to be in parallel combination.
- If the combined resistance is represented by  $R_1$ ,  $R_2$ , and  $R_3$  then in parallel combination inverse of the total resistance  $R$  is –  

$$[1/R = 1/R_1 + 1/R_2 + 1/R_3]$$
- **Electric Power:** The rate of consumption of energy in an electric circuit is known as Electric Power. SI unit of electric power is the **watt**.
- Electric power ( $P$ ) = Potential Difference ( $V$ ) x Electric Current ( $I$ )
- **Unit:** The electrical energy that is consumed in an electrical circuit in the presence of 1 kilowatt (kW) electrical power in an hour is known as Unit.
- 1 unit is also known as a **kilowatt-hour (KWh)**.  

$$\text{Kilowatt-hour or unit} = \frac{\text{Volt} \times \text{Ampere} \times \text{Hour}}{1000}$$

$$= \frac{\text{Watt} \times \text{Hour}}{1000}$$
- **Ammeter:** Ammeter is an instrument used to measure the **current in ampere**.
- An Ammeter is always connected to the circuit in **series**.
- An ideal ammeter should have **zero resistance**.
- **Electric Fuse:** Electric fuse is used for the safety of the appliances connected to the circuit.
- Fuse is always connected to the circuit in series. Its **melting point is low**.
- An electric fuse is generally made of an alloy of tin (63%) and lead (37%).
- **Voltmeter:** Voltmeter is used to **measure the potential difference** between two points in a circuit.
- The Resistance of an ideal voltmeter is **infinity**.
- A Voltmeter is connected to the circuit in **parallel**.
- **Galvanometer:** Galvanometer is an instrument that signals the **presence of electrical current** in an electrical circuit.
- The current up to  **$10^{-6}$  Ampere** intensity can be measured by the Galvanometer.
- **Transformer:** Transformer is an instrument that works on the principle of Electromagnetic Induction. Which works to increase or decrease the alternative voltage.
- A Step-Up transformer changes low AC voltage into high AC voltage and Step Down transformer changes high AC voltage to low AC voltage.
- Transformer works with electrical equipment that operates at a voltage different from the main voltage.
- Step-down transformers are used at power substation to step-down the voltage for distribution to consumers.
- High-voltage transformers are used in power generating stations, X-ray tubes etc.
- **Electric Motor:** Electric motor is an instrument to convert **Electrical energy into Mechanical energy**.
- Electric motors are used in many devices like electric fans, washing machines, mixers and grinders.
- **Microphone:** Microphone works on the principle of **electromagnetic induction**.
- Microphone converts **sound energy into electrical energy**.
- **Electric Generator:** Electric generator converts **mechanical energy into electrical energy**. It is an application of electromagnetic induction.
- **Switch:** Switch is a simple tool that is used to break or start a circuit for starting or stopping the flow of the current.
- In a star network, N-1 lines are required for connecting N nodes to the host node. (SSC CHSL 2022 Tier-1)
- Poor conductor is a component of identical size that offers a higher resistance to electricity. (SSC CGL 2022 Tier-1)
- **Hard Rubber** is NOT a conductor. (SSC CGL 2022 Tier-1)
- i. Voltmeter An instrument that measures the magnitude of the current
- ii. Ammeter An instrument that measures voltage
- iii. Galvanometer An instrument that measures resistance
- iv. Ohmmeter An instrument that measures the direction and the magnitude of the current (SSC CPO 2022 General Awareness)
- In 1785, Charles Augustin Coulomb balance to measure the force between electric charges. Charles Augustin Coulomb. (SSC CPO 2022 General Awareness)
- In 1859, physicist **Gustav Robert Kirchhoff** did Robert Wilhelm Bunsen invented flame spectroscopy, an instrument that allows elements to be identified by their emission spectra. (SSC Stenographer 2022)

## 18. Magnetism

- Magnets have the property to attract the iron towards themselves.
- This property of the magnet is known as **Magnetism**.
- Magnets are natural and also can be made artificially.
- Natural magnets are generally made of **Oxides of Iron** ( $\text{Fe}_3\text{O}_4$ ) (SSC CPOSI, 2022)
- Magnetite (lodestone) is a natural magnet.

- Artificial magnet is formed by Iron, Nickel and Cobalt etc.
- Artificial magnets are of different types, e.g. **Bar Magnet, Magnetic Needle, Horse Shoe Magnet etc.**
- Steel is used in making the permanent magnet and the temporary magnet is made of soft iron.
- Most of magnetism is found near the ends of a magnet.
- A Region near the ends of a magnet is known as the Pole of the Magnet.
- Magnetism is **absent** just at the **centre of the magnet**.
- If a magnet is freely suspended in a horizontal plane, then it's one will always stay toward the north and another will always stay towards the south.
- In a magnet, the pole which stays towards the north is called the **North Pole**.
- The pole of a magnet that stays towards the south is called the **South Pole**.
- The line which joins the two poles of a magnet is called **Magnetic Axis**.
- Opposite poles **attract** one another while similar poles **repel**.
- In magnetic materials, magnetism is produced through the induction by a magnet.
- **Magnetic Field:** The area around a magnet in which the influence of the magnet can be experienced is known as **Magnetic Field**.
- **Magnetic Lines of Force:** Imaginary lines which are located on the magnetic field and represent the magnetic field are known as **Magnetic Lines of Force**.

#### **Nature of Magnetic Lines of Force:**

- The tangent drawn at any point of a magnetic line of force represents the direction of the magnetic field at that point.
- Magnetic lines of force are close to each other at the place where the magnetic field is strong.
- Magnetic lines of force of similar magnetic fields lie at equal distances.
- Magnetic lines of force always remain parallel to each other.
- Magnetic lines always emerge from the south pole of the magnet and make a curved path enter the South Pole. Again these lines return to the North Pole of the magnet.

- **Terrestrial Magnetism:** At a particular place, the magnetic field of the Earth can be represented by three elements. These three elements are-

- The Angle of Declination;
- The Angle of Dip or Inclination; and
- Horizontal Component of Earth's Magnetic Field

- **A. Angle of Declination:** At a certain place, the angle between geographical meridian and magnetic meridian is called the **Angle of Declination**.

- **B. Angle of Dip or Inclination:** Angle of Dip or Inclination is the angle made with the horizontal by the Earth's magnetic field lines.

- Value of Angle of Dip is  $0^\circ$  at the Equator of the earth and  $90^\circ$  at the Poles.

- **C. Horizontal Component of the Magnetic Field:** Earth's Horizontal Component of Magnetic Field is different at different places.

- **Magnetic Substances:** Magnetic substances are of three types-

A-Diamagnetic Substances, B-Paramagnetic Substances and C- Ferromagnetic Substances

- **A- Diamagnetic Substances:** The Diamagnetic Substances, when placed in a magnetic field get magnetized in the opposite direction of the magnetic field.

- Gold, silver, Diamond, Carbon, Copper, Zinc, Water and Salt are diamagnetic substances.

- **B- Paramagnetic Substances:** Paramagnetic Substances when placed in a magnetic field, get slightly magnetized in the direction of the magnetic field.

- Sodium, chromium, aluminium platinum etc. are paramagnetic substances.

- **C- Ferromagnetic Substances:** Those substances which, when placed in a magnetic field get strongly magnetized in the direction of the magnetic field are called Ferromagnetic Substances.

- Iron, Steel, Nickel and Cobalt etc. are Ferromagnetic Substances.

- In a Ferromagnetic Substance, each atom behaves as an independent magnet.

- **Domain:** In Ferromagnetic Substances, a large number of atoms joins to form a group which is called a Domain.

- These domains are the cause of strong magnetism in Ferromagnetic Substances.

- **Curie Temperature:** Curie temperature is the temperature above which a substance becomes Paramagnetic and below which it remains Ferromagnetic.

- It is noticed that Curie temperature for iron is  $770^\circ\text{C}$ , for Cobalt is  $1127^\circ\text{C}$  and for Nickel is  $354^\circ\text{C}$ .

- The neutral point in the magnetic field of a horizontally positioned bar magnet is the; point where the magnetic field is zero. (SSC CHSL 2023 Tier-1)

- The purpose of the Earth's magnetic field on : To shield the Earth from solar wind and cosmic radiation.

(SSC CHSL 2023 Tier-1)

- The right relationship between geometric length (Lg) and magnetic length (Lm) :  $L_m = \frac{5}{6} \times L_g$

(SSC CHSL 2023 Tier-1)



- The radius of curvature of a charged particle's passage in a homogeneous magnetic field is proportional to : momentum of particle. (SSC CHSL 2023 Tier-1)
- In 1839, American **Joseph Henry** scientist created the world's most powerful electromagnet, the Albany magnet, which could lift up to 750 pounds of metal at a time. (SSC CHSL 2023 Tier-1)
- In 1851, **Leon Foucault** discovered the phenomenon of Eddy currents which flow in closed loops within conductors in planes perpendicular to the magnetic field. (SSC CHSL 2023 Tier-1)
- Carl Friedrich Gauss and Wilhelm Eduard Weber invented the world's first electromagnetic telegraph in 1833. (SSC CGL 2023 Tier-1)
- Scientist **Andre Marie Ampere** suggested that the magnet must also exert an equal and opposite force on the current-carrying conductor. (SSC CGL 2022 Tier-2)
- Fresnel's equations describe the reflection and transmission of electromagnetic waves at an interface. (SSC Scientific Assistant IMD Recruitment 2022)

## 19. Nuclear Physics

- The Nucleus of an atom is studied under Nuclear Physics.
- The number of protons (Z) present in the nucleus is known as the **Atomic Number**.
- The total number of protons and neutrons (A) present in the nucleus is known as the **Mass Number** of an atom.

| Particle | Mass (kg)                | Charge (Coulomb)          |
|----------|--------------------------|---------------------------|
| Electron | $9.109 \times 10^{-31}$  | $-1.6022 \times 10^{-19}$ |
| Proton   | $1.6726 \times 10^{-27}$ | $+1.6022 \times 10^{-19}$ |
| Neutron  | $1.675 \times 10^{-27}$  | 0 (neutral)               |

### Constituents of an Atom:

- Atoms and their interactions are studied under Atomic Physics.
- There is a nucleus at the centre of the atom in which the whole mass of an atom is located in the form of proton and neutron.
- In an atom, the number of electrons is equal to the number of protons.

### Fundamental Particles of the Matter:

- **Electron:** It was discovered in the form of cathode rays by **JJ Thomson** in 1897. These are very minute negatively charged particles and they revolve round the nucleus.
- **Proton:** Proton was discovered by **Goldstein** in 1886 while it was named by **Rutherford**. These are the positively charged particles present inside the nucleus.

- **Neutron:** It was discovered by **Chadwick** in 1932 by bombing alpha ( $\alpha$ ) particles upon a beryllium sheet. It is a chargeless (Neutral) nuclear particle. It has maximum penetration power.
- **Positron:** It is a **positively charged** fundamental particle, whose mass and charge is equal to an electron. Therefore it is called the Anti Particle of an electron.
- **Neutrino:** These are approximately massless and chargeless fundamental particles.
- **Pi- Meson:** Pi- Meson was discovered by **Hideki Yukawa** in 1935.
- These particles are of three types –Neutral ( $\pi^0$ ), positive ( $\pi^+$ ) and negative ( $\pi^-$ ). They are unstable particles.

### Nuclear Stability:

- Those nuclei in which the value of n/p (where n and p are the numbers of neutrons and protons respectively) is approximately 1 are very stable.
- When the value of n/p in a nucleus is more than 1.5, then it becomes very unstable and radioactive.

### Radioactivity:

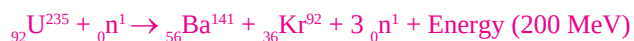
- In order to gain stability, unstable nuclei themselves start emitting alpha ( $\alpha$ ), beta( $\beta$ ) and gamma( $\gamma$ ) rays.
- The elements in the nucleus that contain atoms are called radioactive elements and the phenomenon of emission of the above-mentioned rays is called **Radioactivity**.
- **Half-Life Period:** The amount of time taken for a given amount of the radioactive substance to decay and reduce to half is known as the Half-Life Period of that substance.
- **Transmutation:** Transformation of a radioactive element into another element is known as Transmutation.
- **Radioactive Isotope:** Radioactive Isotopes are made by bombing a substance with neutrons inside the nuclear reactor.

### Uses of Radioactive Isotopes:

- Cobalt- 60 is a radioactive isotope that emits high energy gamma ( $\gamma$ ) rays. These rays are used in the **treatment of cancer**.
- Iodine-131 (I-131) is a radioactive isotope that is used in the treatment of **thyroid gland cancer**.
- Radioactive isotopes are used to find out the amount of fertilizers received by the plants. This is called **Radioactive Tracer Method**.
- Radioactive tracer method is used to find out the decay in automobile engines.
- The **Carbon dating method** is used to determine the age of an object through its remains.
- The age of the remains of an organism is determined by the carbon dating method. In the living state, every organism takes Carbon-14 (radioactive isotope) elements

along with normal Carbon-12 and after death, it ceases to be ingested. Therefore, the time from death to the present can be calculated by the comparative ratios of radioactive Carbon-14 (which continues to decay) and normal carbon-12 in a dead organism.

- **Binding Energy:** The energy released in the formation of the nucleus by the combination of proton and neutron is called the Binding Energy of the nucleus.
- **Nuclear Fission:** Breaking of a heavy nucleus into two equal parts is known as Nuclear Fission.



- An Atom bomb is an example of nuclear fission. An uncontrolled fission reaction takes place in it.
- The uranium in which abundant fissile Uranium-235 is present is called **Enriched Uranium**.
- **Plutonium-239** is also used in an atom bomb.
- **Nuclear Fusion:** When two or more light nuclei combine to form a heavy nucleus and energy is released this reaction is called **Nuclear Fusion**.
- The energy obtained from the fusion of heavy hydrogen nuclei is much greater than that obtained from the fission of  $\text{U}^{235}$  of the same mass.
- Nuclear fusion is the only source of light and heat energy of the Sun.
- The **Hydrogen Bomb** is also based on nuclear fission.
- The process of fusion in a hydrogen bomb is an '**uncontrolled process**'. This can use only destructive.

### Important Inventions Related to Physics and Discoveries

| Inventions                | Scientists              |
|---------------------------|-------------------------|
| Electron                  | J.J. Thomson            |
| Proton                    | Goldstein/Rutherford    |
| Neutron                   | James Chadwick          |
| Atom                      | John Dalton             |
| Atom Bomb                 | Auslohn                 |
| Atomic Structure          | Neils Bohr & Rutherford |
| Laws of Motion            | Newton                  |
| Radioactivity             | Henry Becquerel         |
| Radium                    | Madame Curie            |
| Theory of Relativity      | Albert Einstein         |
| Electromagnetic Induction | Michael Faraday         |
| Raman Effect              | C.V. Raman              |
| X-Rays                    | Wilhelm Roentgen        |

|                                  |                               |
|----------------------------------|-------------------------------|
| Quantum Theory                   | Max Plank                     |
| Photo-Electric Effect            | Albert Einstein               |
| Laws of Electrostatic Attraction | Coulomb                       |
| Photography (In metal)           | J. Neipce                     |
| Photography (on paper)           | W. Fox Talbot                 |
| Photography (Celluloid)          | John Cabot and George Eastman |
| Periodic Table                   | Mendeleev                     |
| Laws of Electrical Resistance    | G.C. Ohm                      |
| Laws of Floatation               | Archimedes                    |
| Diode Valve                      | Sir J.A. Fleming              |
| Nuclear Reactor                  | Enrico Fermi                  |
| Laws of Electrical               | Faraday                       |
| Decomposition                    |                               |
| Telegram                         | Marconi                       |
| Dynamite                         | Alfred Nobel                  |

### Contribution of Some Physicists of Different Countries

| Name                         | Important Contributions/Inventors               |
|------------------------------|-------------------------------------------------|
| R.A. Millikan                | Measurement of Electron Charge                  |
| Ernest Rutherford            | Nuclear Model of an Atom                        |
| Neils Bohr                   | Quantum model of hydrogen atom                  |
| Chandra Shekhar Venkataraman | Inelastic scattering of light by the atoms      |
| Louis Victor de Broglie      | Wave nature of matter                           |
| Meghnath Saha                | Thermal Ionisation                              |
| Satyendra Nath Bose          | Quantum Mechanics                               |
| Wolfgang Pauli               | Exclusion Principle                             |
| Enrico Fermi                 | Controlled Nuclear Fission                      |
| Werner Heisenberg            | Quantum Mechanics and Uncertainty Principle     |
| Paul Dirac                   | Relativistic Electron Theory, Quantum Mechanics |
| Edwin Hubble                 | Expanding Universe                              |
| Hideki-Yukawa                | Principle of Nuclear Forces                     |
| Homi Jehangir Bhabha         | Cosmic Radiation                                |

|                        |                                                                                |
|------------------------|--------------------------------------------------------------------------------|
| Lev Davidovich Landau  | Superfluidity Principle, Liquid Helium                                         |
| S. Chandra Shekhar     | Chandra Shekhar Limit Structure of Stars and Development                       |
| John Bardeen           | Transistor, Principle of Superconductivity                                     |
| C.H. Townes            | Maser and Laser                                                                |
| Abdul Salam            | Electroweak theory, concerned quantum electrodynamics and quantum field theory |
| Galileo Galilei        | Law of Inertia                                                                 |
| Christiaan Huygens     | Wave Theory of Light                                                           |
| Isaac Newton           | Universal Law of Gravitation, Laws of Motion, Reflector Telescope              |
| Michael Faraday        | Laws of Electromagnetic Induction                                              |
| James Clerk Maxwell    | Principle of Electromagnetic Radiation Light and electro- magnetic wave        |
| Heinrich Rudolf Hertz  | Electro-magnetic waves                                                         |
| Jagadish Chandra Bose  | Microwaves, Wireless-Transmission Crescograph                                  |
| Marie Sklodowska Curie | Discovery of Radiation & Polonium, Study of Natural radioactivity              |
| Albert Einstein        | Photo-electric Principle, Theory of relativity                                 |
| Victor Francis Hess    | Cosmic Rays                                                                    |

### Instruments and Their Inventors

| Name of Instruments | Discoverers                   |
|---------------------|-------------------------------|
| Hydrometer          | Antony Baume                  |
| Microphone          | Berliner                      |
| Gobar Gas Plant     | A.V. Desai                    |
| Sextant             | Campbell                      |
| Bunsen Burner       | Robert Wilhelm Bunsen         |
| Seismometer         | John Milne                    |
| Seismograph         | Luigi Palmieri                |
| Teleprinter         | Emile Baudot and Samuel Morse |
| Transformer         | Michael Faraday               |
| Air Brake           | George Westing House          |
| Holography          | Dennis Gabor                  |
| Lift                | Alice Otis                    |

|                    |                     |
|--------------------|---------------------|
| Television         | John Logi Baird     |
| Calculator         | B. Pascal           |
| Dialysis           | Kolff               |
| Heart lung machine | John Heysham Gibbon |

### Relation Between Technology & Physics

| Technologies                            | Scientific Principles                                                   |
|-----------------------------------------|-------------------------------------------------------------------------|
| Steam Engine                            | Laws of Thermodynamics                                                  |
| Nuclear Reactor                         | Controlled Nuclear Fission                                              |
| Radio & Television                      | Generation of Electromagnetic waves transmission, detection             |
| Computer                                | Numerical Reasoning                                                     |
| Generation of Intense magnetic field    | Superconductivity                                                       |
| Laser                                   | Light amplification by stimulated emission of radiation                 |
| Rocket Propulsion                       | Newtons Laws of Motion                                                  |
| Electric Generator                      | Faraday's Laws of Electro-magnetic Induction                            |
| Hydro-Electric Power                    | Transformation of gravitational potential energy into electrical energy |
| Aeroplane                               | Bernoulli's Principle in Fluid Dynamics                                 |
| Particle Accelerator                    | Motion of charged particles in electromagnetic fields                   |
| Sonar                                   | Reflection of Ultrasonic Waves                                          |
| Optical Fibers                          | Total internal reflection of light                                      |
| Non-Reflecting Surface                  | Thin-film interference of light                                         |
| Electron Microscope                     | Wave nature of electrons                                                |
| Solar Cell                              | Photovoltaic effect                                                     |
| Fusion Testing Reactor (Tokamak)        | Magnetic Confinement of Plasma                                          |
| Giant Metre Wave Radio Telescope (GMRT) | Detection of Cosmic Radio Waves                                         |

### Inventions & Inventors

| Name of Instruments | Name of Inventors       | Year | Main function of Instruments                                              |
|---------------------|-------------------------|------|---------------------------------------------------------------------------|
| Are Lamp            | Humphry Davy            | 1809 | Generate intense light by electric sparking between two carbon electrodes |
| Air conditioner     | Willis Haviland Carrier | 1902 | Atmosphere is kept cool or hot by controlling temperature and humidity    |

|             |                         |      |                                                                                         |
|-------------|-------------------------|------|-----------------------------------------------------------------------------------------|
| Barometer   | Evangelista Torricelli  | 1644 | Measures atmospheric pressure                                                           |
| Chronometer | John Harrison           | 1735 | To know the correct time in a ship                                                      |
| Cyclotron   | Ernest Orlando Lawrence | 1929 | An important instrument which accelerates the production of particles in atomic science |

### Scientific Instruments and Their Uses

| Instruments           | Uses                                                                                                              |
|-----------------------|-------------------------------------------------------------------------------------------------------------------|
| Altimeter             | An instrument used to measure the height of an object placed higher than a certain level.                         |
| Ammeter               | An instrument used to measure the electrical current in a circuit.                                                |
| Anemometer            | An instrument used to measure the velocity and direction of air.                                                  |
| Audio Phone           | An instrument used for calculation of hearing acuity.                                                             |
| Binoculars            | An instrument used to see distant objects.                                                                        |
| Barograph             | An instrument used to record pressure.                                                                            |
| Crescograph           | An instrument used to record the growth in plants.                                                                |
| Chronometer           | To measure the proper time in ships.                                                                              |
| Calipers              | Used to measure the distance between the opposite ends of an object, or measuring internal or external diameters. |
| Dip Circle            | Used to measure the angle of dip of a place.                                                                      |
| Dynamo                | Used to change mechanical energy into electrical energy.                                                          |
| Epidiascope           | Instrument used to project film or an opaque image on the screen.                                                 |
| Fathometer            | An instrument used to measure the depth of the sea.                                                               |
| Galvanometer          | It is an instrument used for detecting indicating an electric current.                                            |
| Geiger Muller Counter | It is an instrument used to detect and measuring ionizing radiation.                                              |
| Manometer             | It is a scientific instrument used to measure gas or liquid pressure.                                             |
| Microtomes            | This is a tool used to cut extremely thin slices of material, known as sections.                                  |

|                  |                                                                                 |
|------------------|---------------------------------------------------------------------------------|
| Odometer         | This instrument is used to measure the distance travelled by a wheeled vehicle. |
| Periscope        | This instrument is used to see the objects not falling in the line of sight.    |
| Photometer       | An instrument used to measure the power of illuminance.                         |
| Pyrometer        | An instrument used to measure very high temperatures.                           |
| Radiometer       | An instrument used to measure radiant flux.                                     |
| Seismometer      | An instrument used to measure the shocks caused by earthquakes.                 |
| Sextant          | An instrument used to measure the angular distance between two objects.         |
| Sphygmomanometer | An instrument used to measure the blood pressure in arteries.                   |
| Stethoscope      | An instrument used to listen to the sounds of heart and lungs.                  |
| Oscillograph     | An instrument for detecting electrical and mechanical vibrations.               |
| Aerometer        | It is an instrument to measure the density & weight of air and other gases.     |
| Actinometer      | An instrument for measuring the intensity of radiation of rays of the sun.      |
| Accelerometer    | This is a tool that measures proper acceleration.                               |
| Escalator        | A moving staircase that carries people between floors of the buildings.         |
| Epidoscope       | Instrument to show slides on the screen in cinema.                              |
| Commutator       | An instrument that periodically reverses the direction of current.              |
| Compass Needle   | An instrument to locate the direction of a specific place.                      |
| Carbureter       | An instrument to mix a proper amount of air in petrol in an engine.             |
| Calorie meter    | An instrument to measure heat.                                                  |
| Kinescope        | A television picture tube.                                                      |
| Kymograph        | An instrument for recording pressure in blood, heartbeat etc.                   |
| Gramophone       | An instrument to reproduce sound inscribed on a record.                         |
| Gravimeter       | An instrument to measure the acceleration due to gravity.                       |



|               |                                                                                 |
|---------------|---------------------------------------------------------------------------------|
| Gyroscope     | An instrument for measuring angular velocity.                                   |
| Xylophone     | Music instrument made of wood.                                                  |
| Telescope     | An instrument to watch distant objects.                                         |
| Tachometer    | An instrument for measuring the rotation speed of a shaft or disc in an engine. |
| Teleprinter   | An instrument to print automatically the information through a telegraph.       |
| Transformer   | An instrument to increase or decrease the AC voltage.                           |
| Dictaphone    | A voice recorder.                                                               |
| Dialysis      | Purification of blood in case of failure kidney.                                |
| Thermometer   | Temperature measuring instrument.                                               |
| Thermostat    | An instrument to stabilise the temperature.                                     |
| Photocell     | Changes solar energy into electrical energy.                                    |
| Battery       | Collection of electrical energy.                                                |
| Megaphone     | To send the sound at a distant place.                                           |
| Microscope    | Used to see the minute objects on magnified form.                               |
| Radar         | Used to locate the position of aeroplanes and missiles.                         |
| Refrigerator  | Used to cool the things.                                                        |
| Radiator      | Used to cool the engine of the vehicle.                                         |
| Rain Guage    | Used to measure the amount of rain.                                             |
| Refractometer | Used to find the refractive index of the mediums.                               |
| Lactometer    | Used to measure the purity of milk.                                             |
| Voltmeter     | Used to measure the potential difference.                                       |
| Van-de-Graph  | Used to generate the high voltage direct current (D.C.).                        |
| Generator     | An instrument to change mechanical energy into electrical energy.               |
| Stereoscope   | A device to create three-dimension picture.                                     |
| Spectrometer  | An instrument used to separate parts of spectrum and study Therom.              |
| Hydrometer    | An instrument used to measure relative density of liquids.                      |
| Hygrometer    | This instrument is used to measure the relative humidity in the air.            |
| Hydrophone    | It is used to detect sound inside the water.                                    |

|                                 |                                                                                                              |
|---------------------------------|--------------------------------------------------------------------------------------------------------------|
| Hypsometer                      | An instrument to measure the height of a place by measuring the boiling point of water.                      |
| <b>Main Branches of Science</b> |                                                                                                              |
| Acoustics                       | Study related to sound.                                                                                      |
| Anthropology                    | Study of human development.                                                                                  |
| Astrology                       | Study of the effects of planets on human life.                                                               |
| Astronomy                       | Study of celestial bodies.                                                                                   |
| Hymnology                       | Scientific study of sleep.                                                                                   |
| Astrophysics                    | Study of physical and chemical properties of celestial bodies.                                               |
| Agrostology                     | Study of grasses.                                                                                            |
| Acarology                       | Study of mites and ticks.                                                                                    |
| Arthrology                      | Study of joints of bones.                                                                                    |
| Biometry                        | Application of mathematical processes in biology.                                                            |
| Cardiology                      | Study of heart in diseases.                                                                                  |
| Conchology                      | Study of mollusc shells.                                                                                     |
| Chronology                      | Study of determining the period of time.                                                                     |
| Criminology                     | Study of crime and criminals.                                                                                |
| Ceramics                        | Art of making earthen pottery and the science related to it.                                                 |
| Cosmology                       | Study of formation and development of Universe.                                                              |
| Chromatology                    | Study of different colours.                                                                                  |
| Cryogenics                      | Study of various applications at very low temperature.                                                       |
| Cytology                        | Study of Cell biology                                                                                        |
| Cryptography                    | Study of techniques for secure communication.                                                                |
| Demography                      | Study of the human population.                                                                               |
| Cartography                     | Study and practice of making maps.                                                                           |
| Embryology                      | Study of development of the embryo.                                                                          |
| Ethology                        | Study of the behaviour of an animal.                                                                         |
| Aetiology                       | Study of causes of diseases.                                                                                 |
| Exobiology                      | Study of creatures outside the Earth.                                                                        |
| Ecology                         | Study of interrelation between plants and environment of animals.                                            |
| Eugenics                        | Study of growth of desired genetic characteristics by controlled reproduction for improvement in population. |

|                 |                                                                                                          |
|-----------------|----------------------------------------------------------------------------------------------------------|
| Entomology      | Scientific study of different species of insects.                                                        |
| Epidemiology    | Study of distribution and possible control of diseases and other factors among the population.           |
| Genetics        | Study of genetic properties.                                                                             |
| Genealogy       | Study of family history and the tracing of their lineages.                                               |
| Gynaecology     | Study of health related to women.                                                                        |
| Geonomy         | Study internal structure of the Earth.                                                                   |
| Gastronomy      | Art of eating and cooking good food.                                                                     |
| Geology         | Study of physical states of the Earth.                                                                   |
| Geogony         | Study of the Earth's formation.                                                                          |
| Geognosy        | It is a branch of study that deals with the materials of the Earth.                                      |
| Hematology      | Study of blood and related diseases.                                                                     |
| Hepatology      | Study concerned with the prevention, diagnosis and management of diseases related to liver, gallbladder. |
| Histology       | Study of the structure of the tissues.                                                                   |
| Herpetology     | Study concerned with amphibian and reptiles.                                                             |
| Hydroponics     | Growing of plants in water without using soil.                                                           |
| Hydropathy      | Study of cure of diseases by using water.                                                                |
| Hydrotherapy    | Technique of treatment of diseases by water.                                                             |
| Horology        | Study of time.                                                                                           |
| Holography      | Art of making three dimensional photography using laser.                                                 |
| Hygiene         | Study of the technique of care of health.                                                                |
| Ichthyology     | Study of fishes.                                                                                         |
| Laryngology     | A branch of medicine that deals with disorders, diseases of the throat.                                  |
| Lepidopterology | Study related to butterflies and moths.                                                                  |
| Limnology       | It is the study of inland waters lakes, rivers, streams etc.                                             |
| Meteorology     | Study of atmospheric sciences.                                                                           |
| Morphology      | Study of the forms of living organisms and relationship between their structures.                        |
| Mammography     | The process of examining the human breast to diagnose cancer.                                            |

|                     |                                                                             |
|---------------------|-----------------------------------------------------------------------------|
| Metallurgy          | Study of extracting metals from its ores.                                   |
| Mycology            | Study of fungi.                                                             |
| Myology             | Study of the muscular system.                                               |
| Metrology           | Science of measurement.                                                     |
| Myrmecology         | Scientific study of ants.                                                   |
| Mastology           | Study of human breast.                                                      |
| Numismatics         | Study or collection of currency.                                            |
| Numerology          | Astrology of numerals.                                                      |
| Nematology          | Scientific discipline concerned with nematodes or round worms.              |
| Nephrology          | Study of Kidneys.                                                           |
| Nephology           | Study of clouds.                                                            |
| Nomology            | Study of the thought process of brain.                                      |
| Neurology           | Study of diseases in the brain and the nervous system.                      |
| Nidulogy            | Study of the nests.                                                         |
| Odontology          | The scientific study of the structure and diseases of teeth.                |
| Obstetrics          | The branch of medicine and surgery concerned with childbirth and midwifery. |
| Osteology           | Scientific study of bones.                                                  |
| Optics              | Study of the light and its nature and properties.                           |
| Ophthalmology       | Study of diseases related to eye.                                           |
| Oncology            | Study related to the treatment of cancer and tumours.                       |
| Ornithology         | Study of birds.                                                             |
| Otology             | Study of ear and related diseases.                                          |
| Otorhinolaryngology | Study of ear, nose and throat (ENT).                                        |
| Pathology           | Study of causes of diseases and their effects.                              |
| Psychiatry          | Study of mental illness and their cures.                                    |
| Pediatrics          | Study of infants, children and diseases related to them.                    |
| Pneumatics          | Study of gases.                                                             |
| Pharmacology        | Study of medicines and its effects.                                         |
| Phrenology          | Study of skull.                                                             |
| Pomology            | Study of fruits and their productions.                                      |
| Pedology            | Study of soil.                                                              |
| Philology           | Study of the science of language.                                           |
| Petrology           | Study of creation of rocks.                                                 |

|            |                                                                |
|------------|----------------------------------------------------------------|
| Posology   | Study of the part of medicine concerned with dosage.           |
| Phonetics  | Study of the tone of sound and its pronunciation.              |
| Plasmology | Microscopic study of cells of a living organisms.              |
| Serology   | Study related to an examination of blood serum.                |
| Saurology  | Study of lizards.                                              |
| Taxonomy   | Science of nomenclature or classification of living organisms. |

- The famous physicist Victor Franz Hess is known for the discovery of : cosmic radiation. (SSC CGL 2023 Tier-1)
- **Gieger** and **Nutall** found an empirical relationship between the half-life of alpha decay and the energy of the emitted alpha decay and the energy of the emitted alpha particles in 1911. (SSC CGL 2022 Tier-2)
- MS Livingston co-invented the device called Cyclotron in 1934 along with Ernest Lawrence to investigate the nuclear structure. (SSC CPO 2022 General Awareness)
- The approach called 'magnetic confinement of plasma' is the scientific principle Fusion reactor technique. (SSC Stenographer 2022)
- Tritium is a beta-emitting radioactive isotope of hydrogen that has one proton and two neutrons in its nucleus, making it three times as heavy as a hydrogen nucleus and one and a half times heavier than deuterium. (SSC Stenographer 2022)
- In the year 1896 **Henri Becquerel** discovered that uranium salts emit penetrating radiation that can be registered on a photographic plate. (SSC Stenographer 2022)
- Indian physicist **Satyendra Nath Bose** introduced a new statistical method in 1924 to derive the blackbody radiation law with respect to a gas of light quanta (photons). (SSC Stenographer 2022)

## 20. Miscellaneous

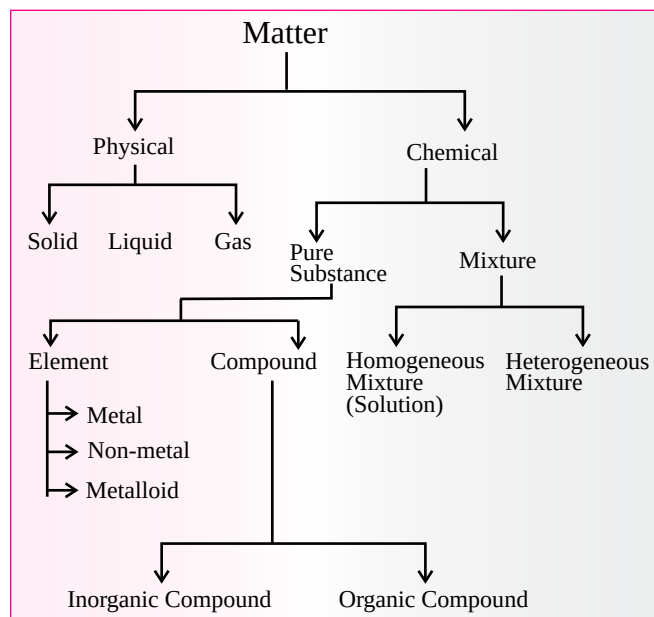
- Klystron is the name of the thermionic electron tube used to oscillate and amplify microwave frequency signals. (SSC CHSL 2023 Tier-1)
- Physicist team Baptiste Joseph Fourier is known for discovering that any periodic wave can be represented as an infinite number of weighted sinusoids, i.e., the sum of sine and cosine waves. (SSC CHSL 2023 Tier-1)
- The reflecting telescope was invented by Isaac Newton in the 17<sup>th</sup> century by using a concave mirror to collect light instead of a simple lens, which produces false colors due to the dispersion of light. (SSC CHSL 2023 Tier-1)

- Silicon doped with gallium forms \_\_\_\_\_ : p-type semiconductor. (SSC CHSL 2023 Tier-1)
- In 1995, **Carl Wienn** with Eric Cornel experimentally produced the first Bose-Einstein condensate in a rarefied gas of rubidium atoms at extremely low temperatures. (SSC CGL 2023 Tier-1)
- Pioneer scientist **Guglielmo Marcon** used radio waves to transmit signals over distances of several kilometers in the 1890s. (SSC CGL 2023 Tier-1)
- For the **Discovery of transistor effect** William Bradford Shockley, John Bardeen and Walter Houser Brattain jointly received the Nobel Prize in Physics in 1956. (SSC CGL 2023 Tier-1)
- **Helium** is used as a cooling medium for the Large Hadron Collider (LHC) and the superconducting magnets in MRI scanners and NMR spectrometers. (SSC CGL 2023 Tier-1)
- Cathode ray Tube is a sealed glass vacuum tube containing an electron beam that is focussed on a phosphor-coated glass screen when light is emitted. (SSC CGL 2023 Tier-1)
- In 1887, **Michelson** and **Morlus's** experiment was an attempt to find the velocity of the Earth with respect to the hypothetical luminiferous ether. (SSC CGL 2023 Tier-1)
- A repeater is an electronic device that receives a weak signal and regenerates it. (SSC CHSL 2022 Tier-1)
- Year 1924 Albert Einstein predicted a new state of matter, the Bose-Einstein condensate (BEC), based on a quantum formulation by the Indian physicist Satyendra Nath Bose. (SSC CGL 2022 Tier-2)
- A piezoelectric transducer is a type of electroacoustic transducer used in a seismograph to measure vibrations in rockets. (SSC Scientific Assistant IMD Recruitment 2022)
- Jean Baptiste Perrin was awarded the Nobel Prize in Physics in 1926, 'for his work on the discontinuous structure of matter. (SSC CHSL 2021 Exam held in 2022)
- Radio waves are a type of radiation designated a part of the electromagnetic spectrum with frequencies approximately from 300 GHz to 3 kHz, or equivalent, wavelengths approximately from 1 mm to 100 km. (SSC CHSL 2021 Exam held in 2022)
- Magnetic resonance Imaging technology uses a combination of a large magnet and radio waves to view organs and structures inside our body. (SSC CHSL 2021 Exam held in 2022)
- Otto Von Guericke is famous for the invention of the vacuum pump in the 17<sup>th</sup> century and also pioneered the concept of the absolute vacuum of space, measured the weight of air and used air pressure to predict the weather. (SSC CHSL 2021 Exam held in 2022)

- Chemistry studies the composition, structure, physical and chemical properties of substances and their chemical reaction. Chemistry is an English word that is called Rasayan Vigyan in Hindi.
- The word "**chemistry**" is derived from Alchemy which has its origin in the Arabic word Al-Kimia covering a wide range of disciplines- chemistry, metallurgy, philosophy, astronomy and medical science during the ancient civilization period.
- A study of Chemistry provides Scientists with insights into other aspects of Physical Science.
- Its origin is also said to be in the word, keme, the ancient name of Egypt. Keme means "**black earth**". Its study was called **Chemetechning**.
- **Jacob Berzelius** is called the **father of chemistry** and **Antoine Lavoisier**, the **father of modern chemistry**.
- The credit of establishing chemistry as a separate discipline goes to **Robert Boyle**.
- Due to a wide scope of study chemistry is divided into different branches, which are as follows :
  - Inorganic Chemistry
  - Organic Chemistry
  - Physical Chemistry
  - Analytical Chemistry
  - Industrial Chemistry
  - Bio-Chemistry
  - Agriculture Chemistry
  - Nuclear Chemistry
  - Green Chemistry
  - Environmental Chemistry
  - Medicinal Chemistry
  - Polymer Chemistry
  - Phytochemistry

### 1. Particle Nature of Matter

- Every object that occupies space and has mass and opposes the changes in its structure is called **substance** or **matter**.
- The matter is formed with very small particles which are called **atoms**.
- **Classification of Matter** : Matter is classified into two forms—
  - (a) Physical
  - (b) Chemical



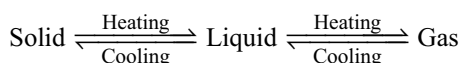
#### (a) Physical Classification of Matter :

- Under normal conditions of temperature and pressure, the matter based on its physical conditions is divided into three states - **solid, liquid and gas**.
- **Solid** : That physical state of matter which has fixed volume and shape, is called **solid** e.g. metals, wood, salts, bricks etc.
- There is very little intermolecular space in solids. Thus, the density of solid is very high.
- **Liquid** : That physical state of matter which has fixed volume but its shape is uncertain is called **liquid**. The liquid takes the shape of the vessel in which it is kept e.g. **water, milk, alcohol, mercury etc.**
- The density of a liquid is less than the density of a solid.
- Within a limit, molecules of liquid remain in a disorderly state and fall one over another and thus they behave like a liquid.
- **Gas** : That physical state of matter in which volume and shape both are uncertain is called gas. It spreads in the whole vessel in which it is filled e.g. **Hydrogen, oxygen, carbon dioxide, air etc.**
- In gaseous state, particles of the matter are comparatively farther than in solids and liquids. Therefore, most of the space between them remains empty.
- Compressibility in gases is maximum because of the large intermolecular space.
- The kinetic energy of gas molecules is higher. Therefore molecules of the gas move independently in all possible directions with great velocity.
- **Difference between Vapour and Gas** :  
Vapour represents the gaseous state of the substance, which remains in a liquid state at normal temperature, while gas is



the substance that remains in a gaseous state even at normal temperature (room temperature). E.g, Ammonia is called a gas while the gaseous state of water is called **vapour** because water remains in a liquid state at room temperature.

- There are other two states of matter other than solid, liquid and gas – **Plasma and Bose-Einstein Condensate**.
- **Plasma** : The state of matter at a high temperature in which atoms of the matter are in an ionic-state is called plasma. Therefore plasma is a good conductor of electricity. It is one of the fourth states of matter.
- **Bose - Einstein Condensate** :  
It is the state of matter obtained when a dilute gas of low density is cooled to near absolute zero temperature (–273.15°C).
- **Interconversion of the states of matter** :  
Three Fundamental states of matter exist because of the different forces at work and the distance among the particles in it. It also depends upon the packing of constituent particles of different types of matter.
- These three states of matter interchange on account of changes in temperature and pressure.



- **Melting Point** : Continuous heating brings in a state where a solid substance completely changes its state into a liquid. This is called **melting** and the temperature at which this occurs is called the **melting point**.
- **Boiling Point** : On heating any liquid, the kinetic energy of its constituent particles highly increases and pulling force among them becomes negligible and the liquid changes into the gas. It is called **evaporation of liquid** and the fixed temperature at which this happens is called the **boiling point**.

#### (b) Chemical Classification of Matter :

On the basis of the chemical composition, the matter is divided into two sub-groups. 1-Pure Substance and 2. Mixture Substance.

- **Pure Substance** : The substance or matter which cannot be converted into other types of matters through any physical process is called a **pure substance**.
- **Element** : The simplest form of any substance having fixed physical and chemical properties and which can neither be converted by any physical or chemical process into another element nor state is called **element**.
- In modern Chemistry, we can define element as – “An element is a substance that cannot be broken down into anything simpler.”

- In other words we can say that- An element is a substance which cannot be broken down into anything simpler by chemical methods.

➤ E.g. carbon, sulphur, hydrogen, iron and gold etc.

#### Important Elements Found on Earth & Their Shares in Earth's Crust

| Element   | Percentage in the Earth's Crust |
|-----------|---------------------------------|
| Oxygen    | 46.60                           |
| Silicon   | 27.72                           |
| Aluminium | 8.23                            |
| Iron      | 5.63                            |
| Calcium   | 4.15                            |
| Sodium    | 2.36                            |
| Magnesium | 2.33                            |
| Potassium | 2.09                            |
| Titanium  | 0.56                            |
| Hydrogen  | 0.14                            |

#### Average Quantity of Elements in Human Body

| Element    | Percentage |
|------------|------------|
| Oxygen     | 65.0       |
| Carbon     | 18.5       |
| Hydrogen   | 9.5        |
| Nitrogen   | 3.2        |
| Calcium    | 1.5        |
| Phosphorus | 1.0        |
| Potassium  | 0.4        |
| Sulphur    | 0.3        |
| Sodium     | 0.2        |
| Chlorine   | 0.2        |
| Magnesium  | 0.2        |
| Iron       | 0.004      |
| Others     | 0.046      |

- The most abundant non metal found in the earth's crust is oxygen. **Silicon** is the **metalloid** found in huge quantity on the earth's crust, while aluminium is the **metal** found in the Earth's crust in huge quantity.
- **Metals** : The elements which are good conductors of heat and electricity, with high melting and boiling points and shine are called **metals**. They have the property of ductility and malleability e.g. Iron, Silver, Copper, Gold and Aluminium etc.

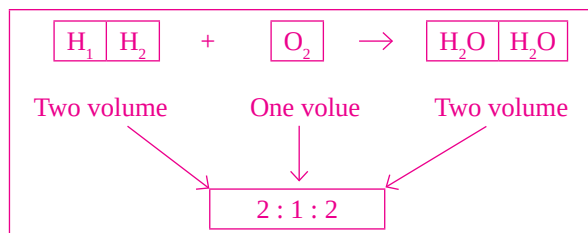
- **Non-metals** : The elements having opposite characteristics of metals, i.e. which have no glitter, (except iodine) and no property of ductility and malleability are called non-metals, e.g. sulphur, benzene phosphorus etc.
- **Metalloids** : The elements which have characteristics common to both metals and non-metals are called **metalloids**. E.g. arsenic, silicon, antimony bismuth etc.
- **Compounds** : A pure substance in which two or more elements are present in a definite composition of weight and which can be changed into another state or converted into a suitable chemical process another element by are called **compounds**. The properties of a compound are completely different from those of its constituent elements, e.g. in water ratio of hydrogen and oxygen's mass always remains 1 : 8 whatever may be its process of making and water is completely different from hydrogen and oxygen.
- Compounds are of two types :  
A- Organic compound B- Inorganic Compound
- A. Organic Compound :**  
Those compounds which are mainly obtained from life sources and in which one or more carbon atoms are combined with **covalent bonds** of the elements (like Hydrogen, Oxygen and Nitrogen) are called organic compounds.
- B. Inorganic Compound :**  
Those compounds which are formed by the combination of two or more elements (generally other than carbon) are called inorganic compounds, e.g. water, salt etc.
- **Mixture** : When two or more substances are mixed in any ratio, it is called a **mixture**. Constituents of a mixture can be separated by ordinary physical processes.
- **Mixtures are of two types :**  
A- Homogeneous mixture B-Heterogeneous mixture
- A. Homogeneous Mixture :**  
The mixture in which the composition of substances are **uniform** is called **homogeneous mixture**, e.g., oxygen, nitrogen, carbon-dioxide etc. are constituent gases of air and their composition in the air is uniform everywhere.
- B. Heterogeneous Mixture :**  
When the substances are mixed in any **ratio**, the mixture so formed is called a **heterogeneous mixture**. E.g. smoke is a mixture of carbon particles and air.
- **Laws of Chemical Combination :**  
When two or more substances combine mutually, then this combination is based upon certain laws, which are known as laws of chemical combination. These laws are— law of conservation of mass, law of constant proportion, law of multiple proportion, law of inverse proportion and the law of gaseous volume by **Gay-Lussac**.
- Russian scientist **M V Lomonosov** in 1756 proposed the **law of conservation of mass**. According to this law "mass is indestructible, i.e. matter neither can be created, nor it can be destroyed."
- In a chemical reaction, the total mass of the substance remains intact even after the change.
- Due to this reason, when a chemical reaction occurs atoms are neither created nor destroyed. Instead the atoms rearrange themselves to form new chemicals. This incident is known as a chemical change.
- French scientist **J.L. Proust** in 1799, had proposed the **law of constant proportion**. According to this law, "In every compound masses of the elements are always combined in a fixed proportion, therefore in a compound, certain elements remain combined in a fixed proportion in terms of mass".
- **Example** : Carbon dioxide ( $\text{CO}_2$ ) is the compound of Carbon and Oxygen ( $\text{O}_2$ ).
- The English scientist **John Dalton** in 1803, had proposed the **law of multiple proportions**. According to this law "When two elements by mutually combining form more than one compound then there is a simple mathematical ratio between the masses of the elements combined with the common element".
- **Example** - Carbon combines with oxygen to form two oxide, Carbon Dioxide ( $\text{CO}_2$ ) and Carbon Mono oxide ( $\text{CO}$ ).
- The weight of carbon and oxygen in one gram of their molecule are as follows -

| Some major radioactive drugs |                 |                  |                  |
|------------------------------|-----------------|------------------|------------------|
| S.N.                         | Name of Oxide   | Carbon           | Oxygen           |
| 1.                           | Carbon monoxide | 12 gram (weight) | 16 gram (weight) |
| 2.                           | Carbon dioxide  | 12 gram (weight) | 32 gram (weight) |

- German Scientist **Richter** in 1792, had proposed the **law reciprocal proportions**.
- According to this law "when two different elements combine with the same mass of a third element, the ratio of the masses in which they do so must be same or multiple of the mass ratio in which they combine.
- Hydrogen and Oxygen combine differently with carbon to form Methane ( $\text{CH}_4$ ) and Carbon Dioxide ( $\text{CO}_2$ ).
- In carbon dioxide ( $\text{CO}_2$ )  $\text{C} : \text{O} = 12 : 32$   
In Methane ( $\text{CH}_4$ )  $\text{C} : \text{H} = 12 : 4$
- **Gay-Lussac** in 1808, had proposed the **law of gaseous volume**. According to this law, "Whenever gases react

with one another, the volume of the reacting gases as well as the products can be expressed in a simple whole-number ratio, provided all the volumes are measured under similar conditions of temperature and pressure.

- **Example** - Two volumes of hydrogen combine with one volume of oxygen to form two volume of water vapour ( $\text{H}_2\text{O}$ ).



### Concept of Elements, Atoms and Molecules :

- Indian philosopher **Maharshi Kanada** (800 B.C.) first said that matter was formed by very small indivisible particles. These small particles form molecules after combining with one another.
- **John Dalton**, a teacher in New College of Manchester, England, after going through study of structure of matter in 1808, had proposed the systematic view about the structure of atom and structure of matter in his hypothesis which is known as **Dalton's Atomic Theory**.

### Dalton's Atomic Theory :

- Matter or element is made of numerous small particles which are called **atoms**.
  - Atom is the smallest particle of an element that cannot be divided and during the chemical reaction, it remains unchanged.
  - Atoms of the same element are equal in terms of weight, shape and other properties.
  - Atoms of two or more elements join in small whole numbers in a fixed ratio and form compounds.
  - **Berzelius Hypothesis** : According to this hypothesis "At equal temperature and pressure the number of atoms in the equal volumes of all gases remain the same."
  - **Avogadro's Hypothesis** : According to this hypothesis "At equal temperature and pressure, number of molecules in the equal volumes of all gases remains the same."
  - The smallest particle of any substance (element or compound) which can remain in an independent state and still retain the composition and chemical properties of that substance is called **Molecule**.
  - Molecules can be divided into two categories (A). **Molecules of Elements** and (B). **Molecules of Compounds**.
- A. Molecules of Elements** : Such types of molecules are formed by the same type of atoms, because of this they are called **Homoatomic** or **Homonuclear molecules**.
- B. Molecules of Compounds** : Such types of molecules are formed by different and more than one type of

atoms. Because of this, they are called **Hetroatomic** or **Heteronuclear molecules**.

### Applications of Avogadro's Law :

- (i) Ratification of Dalton's theory of atom
- (ii) Explanation of Gay-Lussac's law of gaseous volume
- (iii) To find the atomicity of gaseous elements
- (iv) In finding the relation between vapour density and molecular weight of a gas  

$$\text{Molecular Weight} = 2 \times \text{Vapour Density}$$
- (v) To find out the molecular volume of a gas at N.T.P. (which is 22.4 litre)
- The number of molecules present in a gram molecular weight of a substance is called **Avogadro's Number**.
- The number of atoms in one gram atomic mass of each element is  $6.022 \times 10^{23}$ .

### Atomic and Molecular Mass :

- The atomic mass of an element

$$= \frac{\text{Mass of one atom of an element}}{\text{Mass of one atom of Hydrogen}}$$

- Atomic mass is a ratio, therefore it has no unit.

- **Atomic mass** of an element

$$= \frac{\text{Mass of one atom of an element}}{\text{Mass of } 1/16^{\text{th}} \text{ part of one atom of oxygen}}$$

- Carbon-12 method :

### Atomic mass of an element

$$= \frac{\text{Mass of one atom of an element}}{\text{Mass of } \frac{1}{12}^{\text{th}} \text{ part of one atom of } ^{12}\text{C}}$$

- The Real mass of an isotope of Carbon-12 is  $1.9926 \times 10^{-23}$  gram, which is equivalent to 12 amu.

$$1 \text{ amu} = \frac{1.9926 \times 10^{-23}}{12} \Rightarrow 1.66 \times 10^{-24} \text{ gram.}$$

- Number of grams atoms of an element

$$= \frac{\text{Weight of element (in grams)}}{\text{Gram atomic mass of element}}$$

- According to the **mole concept**, the amount of substance in which  $6.022 \times 10^{23}$  particles (atom/molecules/ions) are present is called **one mole**.

- It was accepted as a unit in the year 1967.

- The value given  $6.022 \times 10^{23}$  is called Avagadro's number for the scientist that found the number of atoms in 12 grams of carbon 12.

- This is the theoretical atomic mass of the Carbon-12 isotope (6 protons and 6 neutrons). This means that the atomic mass or atomic weight (12 grams) of carbon is equal to exactly 1 mole of carbon.

- Calculation of reactants and products in chemical reactions is called **stoichiometry**.

- The reactant in a chemical reaction, that is totally consumed when the chemical reaction is completed and limits the amount of forming product is called **limiting reagent**.

- **Molarity** : The number of moles of a solute dissolved in a solution of one litre of the volume is called the molarity of that solution.

Molarity (M)

$$= \frac{\text{Number of moles present in the substance}}{\text{Volume of solution (in litre)}}$$

- **Normality** : The number of gram equivalents of a solute dissolved in a litre volume of a solution is called the normality of that solution.

normality (N) =

$$= \frac{\text{Number of gram equivalents of solvent in a solution}}{\text{Volume of the solution (in litre)}}$$

Normality (N) =

$$= \frac{\text{Mass of solute in the solution (in gram)}}{\text{Volume of solution (in litre)} \times \text{equivalent weight}}$$

$$N = \frac{W \times 1000}{E \times V (\text{in ml})}$$

- **Molality** : The number of moles of a solute dissolved in 1 kg weight of a solution is called the Molality of that solution. S.I. Unit of molality is **mol/kg**.

## 2. Structure of Atom

- The advent of the modern age in chemistry brought with it the atomic principle of chemical reaction proposed by **John Dalton**.
- He proposed this theory in his book "**A New System of Chemical Philosophy**" in 1808.
- **Atom** : The smallest particle of the matter which has the property of participating in a chemical reaction is called **atom**.
- **Atomic Size** : Hydrogen is the smallest atom among atoms. The radius of hydrogen atom is about  $0.20\text{\AA}$ . Other elements have atomic radii between  $0.7\text{\AA}$  to  $2.5\text{\AA}$  ( $1\text{\AA} = 1.0 \times 10^{-8} \text{ cm}$ ).
- **Atomic Weight** : Atomic weight of any element is the number that represents how many times one atom of that element is in weight to  $\frac{1}{12^{\text{th}}}$  part of carbon-12 or 1.008 part of the mass of hydrogen atom. That is, the mass of a hydrogen atom is 1.008 amu.
- The atomic masses of other elements range from 2 to 260 amu.
- **Atomic Structure** : Middle of the 19th century, atoms were believed to be the smallest invisible particles of the matter.

- But from the scientific discoveries in the last decade of the 19th century and after that, it has been known that the atoms are made up of different types of microscopic particles, which are called sub-atomic or elementary particles.

- Some of these particles are stable, and the rest are unstable.
- Stable particles can exist outside the atom in free state, Unstable particles have momentary existence inside the atom and outside the atom.

- The distribution of fundamental parts inside the atom is called atomic structure. Three fundamental particles are found in an atom - **Electron**, **Proton** and **Neutron**.

- Positrons, Neutrino, anti-neutrino and Meson are **unstable** particles.

- **Cathode rays** are the beams with negatively charged particles that flow from cathode to anode.

- The positively charged rays moving backwards of the porous cathode are called **Anode rays**.

**Molecule** : A molecule is the smallest particle in a chemical element or compound that has chemical properties of that element or compound. Molecules are made up of atoms of different or similar kinds. Atoms in a molecule are held together by a strong chemical bond.

- **Molecular Weight** : Molecular weight of any element or compound is the number which represents that, how many times the weight of one molecule of it is in comparison to the weight of  $\frac{1}{12}$  part of atom carbon-12.

**Electron** : Electron is the negatively charged particle that has a unit negative charge and mass equal to  $9.109 \times 10^{-31} \text{ kg}$ .

**Proton** : Proton is a positively charged particle with a unit positive charge and mass equal to  $1.6726 \times 10^{-27} \text{ kg}$ .

**Neutron** : Neutron is a neutral particle. Its mass is  $1.675 \times 10^{-27} \text{ kg}$ .

### Some other Sub-Atom Particles

| Particle    | Symbol                | Discoverer                   | Mass (amu)                                     |
|-------------|-----------------------|------------------------------|------------------------------------------------|
| Positron    | ${}^+_1e^0$           | C.D. Anderson (1932)         | Negligible (0.000548)                          |
| Meson       | $\pi^+, \pi^-, \pi^0$ | Yukawa (1935)                | Approximately 200 times of mass of an electron |
| Neutrino    | $\nu^{(\text{Neu})}$  | Pauli (1930)                 | Uncertain (< 0.000548)                         |
| Antiproton  | $p^-$                 | Segre and Chamberlain (1955) | 1.00757                                        |
| Antineutron | $\bar{n}$             | Cork (1956)                  | 1.00893                                        |

## SI Fundamental Quantities and Their Units

| Fundamental Particle | Symbol                | Discoverer                            | Mass                  |                          | Charge                                                            | Radius (in cm)        |
|----------------------|-----------------------|---------------------------------------|-----------------------|--------------------------|-------------------------------------------------------------------|-----------------------|
|                      |                       |                                       | On atomic scale (amu) | In gram (g)              |                                                                   |                       |
| Electron             | e or $-1e^0$          | J. J. Thomson (1897)                  | 0.000548              | $9.109 \times 10^{-28}$  | $-1.602 \times 10^{-19}$ coulomb or, $-4.808 \times 10^{-10}$ esu | $2.8 \times 10^{-13}$ |
| Proton               | p or ${}_1\text{H}^1$ | Goldstein (1886)<br>Rutherford (1919) | 1.00727               | $1.6726 \times 10^{-24}$ | $+1.602 \times 10^{-19}$ coulomb or, $+4.808 \times 10^{-10}$ esu | $0.8 \times 10^{-13}$ |
| Neutron              | n or ${}_0\text{n}^1$ | James Chadwick (1932)                 | 1.0087                | $1.675 \times 10^{-24}$  | Zero (netural)                                                    | $0.8 \times 10^{-13}$ |

- **Composition of Atomic Nucleus :** The atomic nucleus is made up of **Protons** and **Neutrons**.
- The mass of nucleus is due to Protons and Neutrons and the positive charge of nucleus is due to proton only.
- Protons and Neutrons are collectively called '**nucleuuous**', because these particles are components of the atomic nucleus.
- The electrons in the atom reside close to the nucleus and move around the nucleus in different orbits at relatively short distance.
- The number of **electrons** in an atom is equal to the number of **protons**. So **atoms** are electrically **neutral**.
- **Mass Number :** The sum of the total number of protons and neutrons in the nucleus is called mass number.
- Mass number of atom (A) = Number of protons (Z) in the nucleus + Number of neutrons (N)  
i.e.  $A = Z + N$
- The mass number is not a fundamental characteristics of an element. Different atoms of an element have different numbers.
- **Atomic Number :** The number of protons in a nucleus of an atom or the number of electrons in a neutral atom is called its atomic number.
- The atomic number of each element is definite and fixed.
- Different elements have different atomic number.
- The atomic number of hydrogen element is 1, It means, there is one proton in the nucleus of hydrogen atom.
- **Atomic mass :** The atomic mass of an atom is approximately equal to its mass number.  
**Atomic mass = Mass number (A)**  
Atomic mass = Number of protons in the nucleus (Z) + number of neutrons in nucleus.
- **Isotopes :** The elements which have the same atomic number but different atomic weight are called **isotopes**, e.g. hydrogen has three isotopes  ${}_1\text{H}^1$  (Protium),  ${}_1\text{H}^2$  (Deuterium) and  ${}_1\text{H}^3$  (Tritium).
- Oxygen has three isotopes, whose atomic number is 8, but their mass numbers are 16, 17 and 18 respectively. These isotopes are called oxygen-16, Oxygen-17 and Oxygen-18.
- Isotopes of an element have the same number of protons, but the number of neutrons varies.
- Isotopes were discovered by **Frederick Soddy**.
- **Polonium** is an element with the highest number of isotopes.
- **Isobars :** The elements which have the same atomic masses but different atomic numbers are called **Isobars**, e.g.  ${}_{18}\text{Ar}^{40}$  (Argon),  ${}_{19}\text{K}^{40}$  (Potassium) and  ${}_{20}\text{Ca}^{40}$  (Calcium).
- **Isotones :** Those atoms of different elements having the same number of neutrons in the nucleus but with different atomic numbers and different atomic weight are called **Isotones**. e.g. Number of neutrons in  ${}_7\text{N}^{15} = 15 - 7 = 8$  and in  ${}_8\text{O}^{16}$  number of neutrons =  $16 - 8 = 8$ , therefore they are known as **isotones**.
- **Isoelectronic :** The particles (molecules, atoms, ions or compounds) which have an equal number of electrons are called Isoelectronic, e.g.  $\text{Na}^+$ ,  $\text{Mg}^{++}$ ,  $\text{Al}^{+++}$  and  $\text{F}^-$ .
- **Isodiapheres :** Those atomic species in which the difference between the number of neutrons and the number of protons is the same are called **Isodiapheres**, e.g.  ${}_{15}\text{P}^{30}$  or  ${}_{16}\text{S}^{32}$  and  ${}_{92}\text{U}^{235}$  and  ${}_{90}\text{Th}^{231}$ .
- **Isosteres :** The molecules or ions which have the same number of atoms and valency electrons are called **Isosteres**, e.g.  $\text{N}_2$ ,  $\text{CO}$ ,  $\text{CN}^-$  are isosteres.
- **Isoprotonic :** Those atoms, anion and cations of the same element which have the same number of protons are called **isoprotonic**, e.g.  $\text{Fe}$ ,  $\text{Fe}^{2+}$  and  $\text{Fe}^{3+}$ .
- **Wave nature of electromagnetic radiation :** There is a correlation between the electric and magnetic field vectors and they reinforce change mutually.
- This change has a contagion effect in the whole circuit in the form of a wave. These waves are called **electromagnetic waves**.



➤ There is the following relation among frequency  $f$ , wavelength  $\lambda$  of electromagnetic wave and velocity of light, (C)  $f = \frac{C}{\lambda}$

➤ **Quantum Numbers** : The necessary numbers required to determine the position, nature and energy of an electron are called **Quantum Numbers**. These are of four types –

(i) **Principal Quantum Number (n)** : The first quantum number describes the electron shell or energy of an atom. The value of  $n$  ranges from 1, 2, 3,.... to  $n$  i.e. it can take any integer other than zero.

(ii) **Azimuthal Quantum Number (l)** : The second quantum number, known as the angular or orbital quantum number that describes the subshell or its shape. The minimum value of  $l$  is 0 and the maximum value can be  $(n - 1)$

(iii) **Magnetic Quantum Number (m)** : The magnetic quantum number describes the energy levels available within a subshell and yields the projection of the orbital angular momentum along an specified axis. The value of  $m$  depends on the values of  $l$ . For any value of  $l$ , value of  $m$  ranges from  $-l$  to  $+l$ .

(iv) **Spin Quantum Number (s)** : The fourth quantum number describes the spin of the electron within that orbit and gives

the projection of the spin angular momentum ( $s$ ) along the specified axis. For any value of magnetic quantum number ( $m$ ) value of the spin quantum number ( $s$ ) is either  $+1/2$  or  $-1/2$ .

➤ Radioactivity is the release of energy from the decay of the nuclei of certain kinds of atoms and isotopes. Atomic nuclei consist of protons and neutrons bound together in tiny bundles at the center of atoms.

- Radioactivity has always been present on Earth, but it was not scientifically studied until 1896.

- The largest source of ionizing radiation for the average American is from naturally occurring radon in the air.

- Without heat from naturally occurring radioactivity, the Earth's core would have frozen billions of years ago.

- Henri Becquerel Discovers Radioactivity. In one of the most well-known accidental discoveries in the history of physics, on an overcast day in March 1896, French physicist Henri Becquerel opened a drawer and discovered spontaneous radioactivity.

- Marie Curie coined the phrase "radioactivity." She defined radioactivity at the time to be this activity of rays to be dependent on uranium's atomic structure, the number of atoms of uranium.

### Difference among Alpha ( $\alpha$ ), Beta ( $\beta$ ) and ( $\gamma$ ) rays :

| Character                                       | $\alpha$ -rays                                                                                                                                                                                                                                                                                      | $\beta$ -rays                                                                                                                                                                                                                                  | $\gamma$ -rays                                                                                                                                                                                                                                                     |
|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Nature</b>                                | <ul style="list-style-type: none"> <li>● These have two positive charges</li> <li>● Its mass is equal to the atomic mass of nucleus of Helium atom (4 amu)</li> <li>● These are nuclei of Helium</li> <li>● It is represent by <math>{}_2\text{He}^4</math> or <math>{}_2\alpha^4</math></li> </ul> | <ul style="list-style-type: none"> <li>● They carry negative charge</li> <li>● These are electrons</li> <li>● Its weight is 0.0005486 amu</li> <li>● These are represents by <math>{}_{-1}^0\beta</math> or <math>{}_{-1}^0e</math></li> </ul> | <ul style="list-style-type: none"> <li>● These are Electroradiations.</li> <li>● Their Wavelengths approximately 1 Å.</li> </ul>                                                                                                                                   |
| <b>2. Velocity</b>                              | Velocity of $\alpha$ -rays is approximately equal to $\gamma_{10}$ th of the velocity of light                                                                                                                                                                                                      | Velocity of $\beta$ -rays is approximately equal to the velocity of light.                                                                                                                                                                     | Velocity of $\gamma$ -rays is equal to the velocity of light.                                                                                                                                                                                                      |
| <b>3. Penetrating power</b>                     | These can penetrate 0.002 cm. thick aluminium sheet.                                                                                                                                                                                                                                                | These can penetrate 0.2 cm thick aluminium sheet.                                                                                                                                                                                              | $\gamma$ -rays can penetrate 100 cm, thick aluminium sheet.                                                                                                                                                                                                        |
| <b>4. Ionising Power</b>                        | <ul style="list-style-type: none"> <li>● <math>\alpha</math>-rays ionise gases</li> <li>● Their ionizing power is 100 times that of <math>\beta</math>-rays and 10,000 times of <math>\gamma</math>-rays.</li> </ul>                                                                                | <ul style="list-style-type: none"> <li>● <math>\beta</math>-rays ionise the gases</li> <li>● Their ionizing power is 100 times of the <math>\gamma</math>-rays.</li> </ul>                                                                     | <ul style="list-style-type: none"> <li>● <math>\gamma</math>-rays ionize the gases.</li> <li>● Their ionizing power of <math>\gamma</math>10000 times that of <math>\alpha</math>-rays and <math>\gamma</math>100 times that of <math>\beta</math>-rays</li> </ul> |
| <b>5. Effect of electric and magnetic feild</b> | <ul style="list-style-type: none"> <li>● <math>\alpha</math>-rays are deflected towards negative charge plate.</li> <li>● <math>\alpha</math>-rays are also defected in magnetic field.</li> </ul>                                                                                                  | <ul style="list-style-type: none"> <li>● <math>\beta</math>-rays are deflected towards positive charge plate.</li> <li>● <math>\beta</math>-rays are deflected more than <math>\alpha</math>-rays in electric field.</li> </ul>                |                                                                                                                                                                                                                                                                    |
| <b>6. Effect on photographic plate</b>          | $\alpha$ -rays darken the photographic plate                                                                                                                                                                                                                                                        | $\beta$ -rays darken the photographic plate less than the $\alpha$ -rays.                                                                                                                                                                      | $\gamma$ -rays less darken the photographic plate.                                                                                                                                                                                                                 |

- **Charles Wilson** with Arthur Compton received the Nobel Prize in 1927 for the development of the cloud chamber for the detection of charged particles. (SSC CGL 2023 Tier-1)
- **Geiger and Nuttall** found an empirical relationship between the half-life of a alpha decay and the energy of the emitted alpha particles in 1911. (SSC CGL 2023 Tier-1)
- In Year **1862** AEB de Chancourtois organise the elements by atomic weight, by graphing the elements around a cylinder with a circumference of 16 units, corresponding to the weight of oxygen (O). (SSC CGL 2022 Tier-1)

### 3. Classification of Elements and Periodicity in Their Properties

- A chemical element or element is a species of atoms having the same number of protons in their atomic nuclei.
  - Notably, there are 118 elements that have been identified of which the first 94 occur naturally on Earth with the remaining 24 being synthetic elements.
- The main objective of the classification of elements is a gradual study of their properties. Remarkable efforts were undertaken for this purpose by many chemists, e.g. Dobereiner, Newland, Lothar Meyer, Mendeleev, Rang, Burner etc.
- **Mendeleev's Periodic Law** : Russian scientist D.I. Mendeleev proposed a law for the comparative study of elements and their compounds, according to it "**Physical and Chemical Properties of elements are the periodic function of their atomic weight**".
- The original periodic table of Mendeleev was based upon the above periodic law.
- **Modern Periodic Table** : Modern Periodic Table was given by **Moseley** in 1913. According to this law "**Physical and chemical properties of elements are periodic functions of their atomic numbers**".
- There are 18 groups and 7 periods in the modern periodic table. Horizontal rows are termed as **Period** while vertical columns are known as **Groups**.
- Long-form periodic table is based on the configuration of the outer shell of elements. It contains groups from 1 to 18 and 7 periods. According to the position of the last electron, it has been divided into s, p, d and f blocks.
- The gradual change of properties along a group or a period is called **period properties**.
- **Atomic Radius** : Atomic radius is the distance from the outermost shell to the centre of the nucleus. It is of the following types – (i) **Covalent Radius** (ii) **Van der Waals Radius** (iii) **Metallic Radius**.
- There is the following sequence among these radii – Van der Waals Radius > Metallic Radius > Covalent Radius.

- Noble gases always have the Van der Waals radius.
- **Ionic Radius** : Ionic radius may be defined as the effective distance from the centre of the nucleus of the ion up to which it exerts its influence on its electron cloud. It reduces with the increase in atomic number for iso-electronic species.
- **Ionization Potential** : Ionization potential is the measure of the amount of energy required to remove an electron from a neutral atom or lowest energy state.
- **Electron Affinity** : Electron affinity is defined as the change in energy of a neutral atom (in the gaseous phase) when an electron is added to the atom to form a negative ion.
- Chlorine has the maximum electron affinity.
- Elements of the groups VII-A of the periodic table have maximum electron affinity.
- **Electronegativity** : The relative tendency of an atom in a molecule to attract a bound electron pair to itself is called **electronegativity**.
- **Fluorine** has the highest electronegativity.
- First, second and third periods of the periodic table are called **short periods** while fourth, fifth and sixth periods are known as **long periods**.
- **Metals** are good conductors of electricity and heat.
- **Silver** is a good conductor of heat.

#### Some Other Important Facts :

- **Hydrogen** is the element of the smallest radius and francium and Cesium are the elements of the largest radius elements regarding the Van der Waals radius.
- **Carbon** is the element with the highest melting point, while **helium** is an element with the lowest melting point.

#### Comparative Properties of Periods of Groups in Periodic Table

| Properties           | In a Period                                           | In a Group                                                          |
|----------------------|-------------------------------------------------------|---------------------------------------------------------------------|
| 1. Valence Electrons | Increases from 1 to 8 on moving from left to right    | Remains same in all elements of the same group                      |
| 2. Valency           | First increases from 1 to 4 moving from left to right | Remains, same for all elements in a same group then reduces to zero |
| 3. Atomic Radii      | Reduces on moving from left to right                  | Increases on moving down                                            |
| 4. Metallic Property | Reduces on moving from left to right                  | Increases on moving down                                            |

|                         |                                          |                          |
|-------------------------|------------------------------------------|--------------------------|
| 5. Ionization Potential | Increases on moving from left to right   | Decreases on moving down |
| 6. Electron Affinity    | Increases on moving from left to right   | Decreases on moving down |
| 7. Electronegativity    | Increases on moving from left to right   | Decreases on moving down |
| 8. Oxidation Property   | Increases on shifting from left to right | Decreases on moving down |
| 9. Reduction Property   | Decreases on shifting from left to right | Increases on moving down |

- **Tungsten (W)** is a metal with the highest melting point while **mercury (Hg)** is the metal with the lowest melting point.
- At normal room temperature, liquid metal is mercury (Hg).
- Tungsten and Rhenium are the elements with the highest boiling point, while Helium is an element with the lowest boiling point.
- **Hydrogen** is an element that has the lowest density (lightest element) and **Osmium** and **Iridium** are the elements that have the highest density (heaviest elements), while lithium is a metal that has the lowest density.
- **Iodine** is a solid volatile non-metal.
- **Plutonium (Pu)** is the most toxic metal.
- **Astatine (At)** is the metal found naturally upon the Earth in very small amount.
- **Francium (Fr)** is a **liquid** radioactive element.
- The **melting point** of inert gases is the **lowest**.
- The melting point of group IV-A elements is the highest.
- In year 1865 John Alexander Newlands propounded a new concept of the "Law of Octaves" proposing the periodicity of chemical elements arranged in order of atomic weight.  
(SSC MTS 2011, 2009; SSC CSHL 2023 Tier-1)
- In the 1920s **Charles Janet** created the Left-Step Periodic Table (LSPT) of the chemical elements, basing the positions of the elements on patterns in the arrangement of electrons around the atomic nucleus. (SSC Selection Phase X, 2022)

#### 4. Chemical Bonding

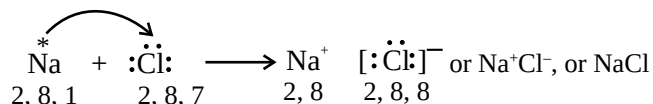
- **Chemical Bonding** : Chemical bonding is that alternative force that forms the molecules by combining two or more atoms.

#### Valency :

- In 1852, the scientist, **Frankland**, used the term Valency for the 'combining capacity of atoms of elements'.
- Valency has the origin from the Latin word Valentia (Power or Capacity).
- According to Frankland "**Valency of any element is represented by the number of hydrogen atoms that combine with one atom of that element**".
- Electronic theory of chemical bonding proposed independently by Kossel & Lewis, a chemical bond between atoms is formed in order to get nearest inert gas configuration. This can be achieved by either losing or gaining or sharing electrons.
- The force of attraction which holds the different atoms in a molecule of a compound is called **Chemical Bond**. There are three types of atomic bonds – (i) electrovalent or ionic bond. (ii) covalent bond and (iii) coordinate covalent bond.

#### (i) Electrovalent or Ionic Bond :

Ionic bonding is a type of chemical bond in which valence electrons are lost by one atom and gained by another. This exchange results in a more stable bond, e.g.-



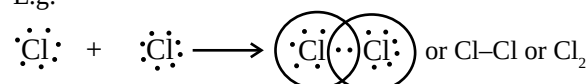
#### ➤ Properties of Ionic Compounds :

- Ionic compounds are generally soluble in polar solvents (Water, HCl, NH<sub>3</sub> etc.).
- The boiling and melting point of these compounds are very high.
- Amount of ionization is generally high.
- Aqueous solution of these compounds is a good conductor of electricity.

- **Lattice Energy** : The energy released during the formation of **one mole** of **ionic crystal** by the mutual combination of cations and anions is called **lattice energy**.

- Covalent Bond** : The bonds formed between the atoms of the elements by sharing electrons are called **covalent bonds**. Many bonds are neither purely ionic nor they are purely covalent, but they contain partial covalent tendency along with ionic tendency or a partial ionic tendency along with covalent tendency.

E.g.



#### Properties of Covalent Compounds :

- The covalent bond is rigid and directional. Therefore it remains indifferent spatial arrangements and exhibits stereo isomerism.

- Covalent compounds remain in **molecular** form.
- Under normal conditions of temperature and pressure, covalent compounds generally exist in the form of gas, volatile-liquid and soft solid.
- The boiling and melting point of covalent compounds are low.
- Covalent compounds are generally insoluble in polar solvents but they dissolve in non-polar solvents.

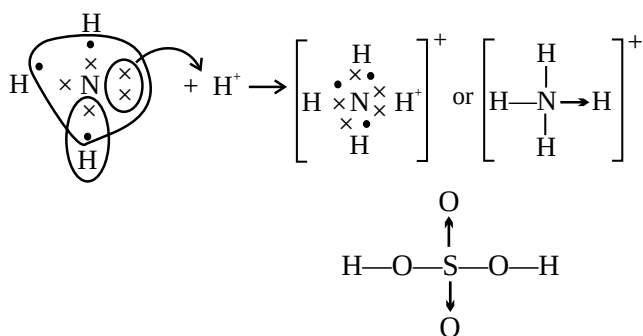
➤ **Electro-negativity and bond-nature :**

1. When there is a large difference between the electronegativity of two atoms, then bonds between the two will be Ionic, 2. When the difference between the electronegativity of two atoms is less, then the bond between them will be coordinated covalent and 3. Covalent Bond will be formed between the atoms if it is negligible or zero difference between their electronegativity.

(iii) **Coordinate Covalent Bond :**

A Coordinate bond is a type of alternate covalent bond that is formed by combining a pair of electrons from an atom. It is also called **Dative Bond** or **Dipolar-Bond**. In such bonds, the atom which provides the electron pair is called **Donor** and the atom which accepts the electron pair is called **Acceptor**.

Coordinate covalent bond directed from donor to acceptor and is denoted by an arrow ( $\rightarrow$ ) e.g. formation of ammonium ion, the formation of  $\text{H}_2\text{SO}_4$ .



**Properties of Coordinate Covalent Compounds :**

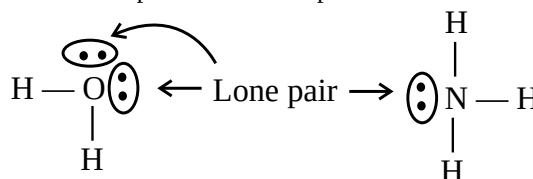
- Coordinate covalent compounds may exist in all three states, i.e. as solid, liquid and gas.
- These compounds are insoluble in polar solvents but dissolve in non-polar solvents.
- The melting and boiling point of coordinate covalent compounds are greater than that of covalent compounds and smaller than ionic compounds.
- Coordinate covalent compounds are not ionized in molten or solid states.
- Coordinate covalent compounds are good conductors of heat and electricity in comparison to covalent compounds.

- Ions and molecules exception to **Octet rule**-

- (i) Ion [ $\text{Ti}^{3+}$ ,  $\text{Cr}^{3+}$ ,  $\text{Cu}^{2+}$  etc.]
- (ii) Molecules [ $\text{BF}_3$ ,  $\text{BCl}_3$ ,  $\text{BeCl}_2$  etc.] ( $< 8e$ )
- (iii) Molecules [ $\text{ICl}_3$ ,  $\text{ClF}_3$ ,  $\text{PCl}_5$ ,  $\text{SO}_4^{2-}$ ,  $\text{IF}_7$ ,  $\text{SF}_6$  etc.] ( $> 8e$ )
- (iv) Molecules [ $\text{NO}$ ,  $\text{N}_2$ ,  $\text{ClO}_2$ , etc.] (Molecules with odd number of electrons)

**Lone Pair of Electron :**

- Pair of electrons that do not take part in the formation of covalent bonding is called Lone Pair of electrons.
- Acids tend to accept the lone pair of electrons.
- Bases tend to provide the lone pairs of electrons.



➤ **Hydrogen-Bond (H-bond) :**

- The bond formed by the attraction force between a hydrogen atom in a compound molecule and a more electronegative atom (mainly fluorine, oxygen, nitrogen) is called **hydrogen bond**.

Molecules of compounds formed by the combination of fluorine, oxygen or nitrogen with hydrogen via the hydrogen bond are polar. Such as,  $\text{HF}$ ,  $\text{H}_2\text{O}$ ,  $\text{NH}_3$ , etc.

- A Hydrogen bond is not found in  $\text{H}_2\text{S}$ .
- A Hydrogen bond is weaker than the covalent bond.
- A Hydrogen bond is found only in the compounds of **oxygen, nitrogen** and **fluorine**.
- A Hydrogen bond is a weak electrostatic force.

➤ **Sigma Bond ( $\sigma$ -bond) :**

When the orbitals of two atoms linearly overlap the bond formed between the two atoms is called **Sigma ( $\sigma$ ) Bond**. It is the **strongest covalent bond**.

- **Pi-Bond ( $\pi$ -bond) :** Pi-bonds are formed by the lateral overlapping of atomic orbitals along a plane perpendicular to the internuclear axis.

➤ **VSEPR (Valence-Shell Electron Pair Repulsion) :**

This principle was first presented by **Sidgwick** and **Powell** and later developed by **Gillespie** and **Nyholm**.

- According to this theory, the geometry of covalent molecules depends upon the number and arrangement of electron pairs, i.e. due to electrostatic repulsion between bond pair and lone pair of electrons.
- VSEPR theory explains that molecules with 2, 3, 4, 5 or 6 bond pairs of electrons take geometrical shapes: linear, trigonal tetrahedral, trigonal bipyramidal and octahedral respectively.

### Orbital Hybridization : Main Types

1.  $sp$  hybridization – It is of linear shape
2.  $sp^2$  hybridization – It is of triangular shape
3.  $sp^3$  hybridization – It is of tetrahedral-pyramidal shape
4.  $sp^3d$  hybridization – It is of triangular bipyramidal shape
5.  $sp^3d^2$  hybridization – It is of octahedral shape

#### ➤ Paramagnetic and Diamagnetic Species :

If there are electrons without a pair in a species, it is Paramagnetic Species and whenever it contains pair of electrons, it is called **Diamagnetic Species**.

Paramagnetic : ( $O_2$ ,  $O_2^-$ ,  $N_2^+$ ,  $N_2^-$ ,  $N_2^{2-}$  etc.)

Diamagnetic : ( $O_2^{2-}$ ,  $H_2$ ,  $N_2$  etc.)

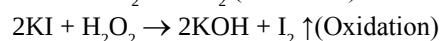
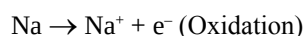
#### ➤ Molecular Orbital Theory :

According to the molecular orbital theory when two or more atoms combine to form a molecule, the atomic orbitals of the atoms reshape themselves to form molecular orbital. On this basis, the paramagnetic behaviour of oxygen can be explained. It was formulated by **Hund** and **Mulliken**.

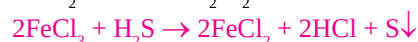
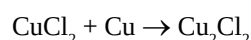
- In **1848** Louis Pasteur discovered molecular chirality and observe that crystals of some compounds exist as mirror images which laid the foundation for modern stereochemistry. (SSC MTS, 2010; SSC CSHL 2023 Tier-1)
- **Sidgwick and Powell** first introduced the idea of a relationship between molecular geometry and the number of valence electrons in the 1940s. (SSC CSHL 2023 Tier-1)
- In **1954** Linus Carl Pauling receive the Nobel Prize in Chemistry for 'his research into the nature of the chemical bond and its applications to the elucidation of the structure of complex substances. (SSC CGL 2023 Tier-1)
- The Correct Lewis structure of  $O_3$  is : (SSC CGL 2023 Tier-1)
- **Vladimir Prelog** received the Nobel Prize 'for his research in the stereochemistry of organic molecules and reactions' in 1975. (UPPCS Mains, 2010; SSC CGL 2023 Tier-1)
- In the early nineteenth century, **Auguste Bravais** demonstrated that there are fourteen space lattices, or regularly repeating arrangements of points in space, that differ in symmetry and geometry. (SSC CGL 2023 Tier-1)
- Hideki Yukawa, who received the Nobell Prize in 1949, is well known for discovery of Theory of nuclear force. (DRDO, 2010; Selection Post Phase XI)

## 5. Oxidation-Reduction or Redox Reaction

- **Oxidation** : An oxidation-reduction (redox) reaction is a type of chemical reaction that involves the transfer of electrons between two species. An oxidation-reduction reaction is any chemical reaction in which the oxidation number of a molecule, atom or ion undergoes changes by gaining or losing an electron e.g.



- The pages of old books **turn yellow** due to oxidation.
- **Reduction** : Reduction is a chemical reaction that involves the gaining of electrons from one of the atoms involved in the reaction between two chemicals. The term refers to the element that accepts electrons, as the oxidation state of the element that gains electrons is lowered. e.g.



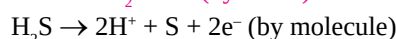
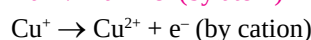
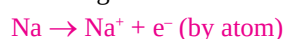
Valency (Fe) = 3, Valency (Fe) = 2

- **Oxidation Number** : Oxidation number is the number of electrons that an atom either gains or loses in order to form a compound or an ion.

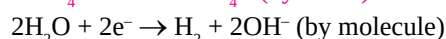
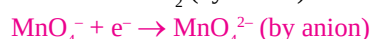
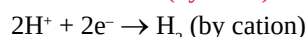
e.g.- Oxidation number of H and O in the molecule of  $H_2SO_4$  is +1 and –2 respectively, then on this basis oxidation number of S is + 6.

### Electronic Concept of Oxidation-Reduction :

- **Oxidation** : When there is a loss of one or more than one electron from an atom, molecule or ion, the process is called **Oxidation** e.g.



- **Reduction** : This is opposite of the oxidation reactions, e.g.



- **Oxidising Agent** : The substance which reduces and oxidises another substance is called Oxidising Agent e.g.  $O_2$ ,  $O_3$ ,  $HNO_3$ ,  $KMnO_4$ ,  $K_2Cr_2O_7$  etc.

- **Reducing Agent** : The substance which gets oxidised, and reduces another reacting substance is called Reducing Agent e.g.  $H_2$ ,  $C_6H_{12}O_6$ , Fe, Mg,  $SO_2$ , C,  $SnCl_2$  etc.

- The substances which behave both as oxidising and reducing agents are – Hydrogen sulfide ( $H_2S$ ), Hydrogen-per-oxide ( $H_2O_2$ ), Sulphur-dioxide ( $SO_2$ ), Nitrus Acid ( $HNO_2$ ) etc.

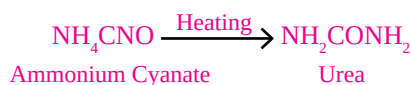
- **Redox Reactions** : Oxidation-Reduction reactions occur simultaneously. These reactions are called Redox Reactions or Oxidation-Reduction reactions.

- Older bonds are broken and new bonds are formed in chemical reactions. Energy is needed for such reactions.

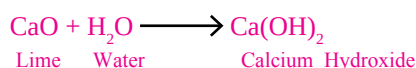


### Major Chemical Reactions :

- **Exothermic Reactions** : Those chemical reactions in which energy is released are called **Exothermic Reactions**, e.g. combustion of 1 mole Charcol-(Carbon). In this process, 395 kilo-joule heat is generated.
- **Endothermic Reaction** : Those chemical reactions in which energy is absorbed are called **Endothermic Reactions**, e.g. when carbon reacts with sulphur, 22 kilo-calorie heat is absorbed.
- **Isomeric Reactions** : Those reactions in which only the rearrangement of atoms takes place are called **Isomeric Reactions**, e.g. formation of urea from ammonium cyanate is an isomeric reaction.



- **Combination Reactions** : When two small atoms combine to form a big molecule, this reaction is called **Combination Reaction**, e.g. Lime (Calcium Oxide) when mixed with water, slacked lime is formed.



- **Electrolytic Reactions** : When the molecule of a substance breaks into small atoms by the passage of electricity, this is called **Electrolytic Reaction**. e.g. on passing an electric current into the water, it decomposes into  $\text{H}_2$  and  $\text{O}_2$



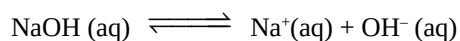
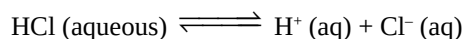
- We observe everyday different types of changes in our surroundings.
  - When ice kept in a tumbler is exposed to the atmosphere, it melts and is converted into water.
  - When the tumbler containing this water is kept in a freezer it is converted again into ice.
  - Thus, this is a temporary change and the substance comes to its original form. Such changes are physical changes.
  - It means we can say that, physical change is a change in which no new substance is formed
  - However, milk once converted into curd, cannot be converted into milk again. Such changes are chemical changes. These changes are of permanent nature.
  - We can say now that a chemical change is a change of materials into another, new materials with different properties and one or more than one new substances are formed.
  - Both physical and chemical changes are integral part of our daily life.

- **Examples of Physical Change** : Melting of ice, boiling of water, the magnetization of iron, heating of Sulphur, heating of iron, Coagulation, Sublimation of iodine and heating of Zinc Oxide etc. are the examples of physical change.
- **Examples of Chemical Change** : Rusting in metals, radioactivity, the formation of curd from the milk, electrolytic decomposition, ripening of fruits, digestion of food, burning of a candle, burning of metal or non-metal, respiration, hardening of cement, the explosion of dynamite etc. are the examples of chemical change.
- **Sublimation** : The reaction in which any solid substance directly converts into gas or vapour without changing into liquid and again changes into solid on cooling is called **sublimation** e.g. Iodine, Camphor and Ammonium Chloride etc.
- **Rancidification** is the process of complete or incomplete oxidation or hydrolysis of fats and oils when exposed to air, light, moisture, or bacterial action that spoils food.

(UPPCS Mains, 2006; SSC CGL 2023 Tier-1)

## 6. Acid and Base

1. **Arrhenius Theory** : Those substances that release hydrogen ion ( $\text{H}^+$ ) in an aqueous solution are called acids and bases are those which release hydroxide ion ( $\text{OH}^-$ ) ion in an aqueous solution e.g.



2. **Bronsted-Lowry Concept** : Acids are those substances that release proton (proton donor) and bases are those substances that absorb protons (proton acceptors).
3. **Lewis Concept** : The substances which absorb electron pairs are acid and the substance which can donate electron pairs is called **base**.
  - By combining all above mentioned three principles, the following definition can be formulated for acid and base.
  - **Acid** : The substances which release hydrogen ion in an aqueous solution or the substance which can release a proton or the substance which can absorb electron pairs are known as acids. Some main acids are as follows –  $\text{HCl}$ ,  $\text{H}_2\text{SO}_4$ ,  $\text{HNO}_3$ ,  $\text{CH}_3\text{COOH}$ , etc.
  - The word acid is derived from the Latin word **asier**, which mean sour.
  - Acid tastes sour.

🔗 **Note** : Aqueous solution of acid turns blue litmus paper into red.

- **Aqua-Regia** : When 3 parts of concentrated hydrochloric acid (HCl) and one part of concentrated nitric acid (HNO<sub>3</sub>) is mixed together, the mixture so formed is called **Aqua-Regia**.

#### Uses of Acids :

- H<sub>2</sub>SO<sub>4</sub> (Sulphuric Acid) and HNO<sub>3</sub> (Nitric Acid) are used to clean iron.
- **Nitric Acid** (HNO<sub>3</sub>) is used to clean silver and gold.
- **Oxalic Acid** (C<sub>2</sub>H<sub>2</sub>O<sub>4</sub>) is used to clean stains on clothes.
- **Hydrochloric acid** (HCl) helps digest the food consumed by animals.
- Various types of acids are used as food items e.g. curd, vinegar, grapes and lime etc.
- **Base** : Compounds that form salt and water on reacting with acids are called **Base**. Bases are of two types A- Base soluble in water and B- Base insoluble in water.

#### A. Bases Soluble in Water :

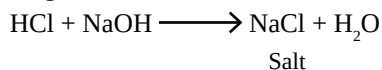
The substances which release hydroxide ion (OH<sup>-</sup>) in aqueous solutions or the substances which can absorb protons or the substances that can release electron pairs are called **bases**. Some main bases are as follows- **NaOH, KOH, Ca(OH)<sub>2</sub>, NH<sub>4</sub>OH** etc.

- Oxides of metals show acidic properties, although they have no hydrogen ions (H<sup>+</sup>) e.g. **SO<sub>2</sub>, CO<sub>2</sub>, SO<sub>3</sub>**, etc.
- Oxides of some metals also show basic properties although they don't possess hydroxide ions (OH<sup>-</sup>), e.g.- **K<sub>2</sub>O, Na<sub>2</sub>O, FeO** etc.

**B. Bases Insoluble in Water** : The compounds which form salt and water on reacting with acids but other properties of alkali are not found in them. e.g- **Cu(OH)<sub>2</sub>, Fe<sub>2</sub>O<sub>3</sub>, ZnO** etc.

🔍 **Note** : A base turns the red litmus paper into blue.

- **Salt** : Salt is formed when there is a substitution of hydrogen from the acid when the reaction between acid and base takes place. e.g.



#### Uses of Bases :

- Bases are used in the manufacturing of paper, soaps and preparing medicines. The strong basic caustic soda (NaOH) is used to clean factories.
- Calcium Hydroxide [Ca(OH)<sub>2</sub>] is used in the formation of soft water, bleaching powder, white washing of homes, cleaning of hairs from the skin of dead animals.

🔍 **Note** : **Magnesium Hydroxide [Mg(OH)<sub>2</sub>]** is used in reducing the acidity in the stomach. Which is also called **milk of magnesia**.

### Main Salts and Chemical Names and Uses

| Salts           | Chemical Names                                                                                                                        | Uses                                                                      |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| 1. Common Salt  | Sodium Chloride (NaCl)                                                                                                                | In preservation of food, pickles, meat and fish                           |
| 2. Washing Soda | Sodium Carbonate (Na <sub>2</sub> CO <sub>3</sub> )                                                                                   | In washing of clothes, in making of caustic soda and detergent powder     |
| 3. Baking Soda  | Sodium Bicarbonate (NaHCO <sub>3</sub> )                                                                                              | Baking powder, fire-extinguisher and in reducing acidity in stomach       |
| 4. Alum         | Potassium Aluminium Sulphate [K <sub>2</sub> SO <sub>4</sub> , Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> , 24 H <sub>2</sub> O] | To stop bleeding from wounds, colouring and for the purification of water |
| 5. Potash       | Potassium Nitrate (KNO <sub>3</sub> )                                                                                                 | In the formation of fertilizer and in making of gunpowder                 |
| 6. Blue Vitriol | Copper Sulphate (CuSO <sub>4</sub> · 5H <sub>2</sub> O)                                                                               | Fungicide, electroplating, colouring and printing                         |

- **pH Scale** : When any acid or base is dissolved in water then the ionic product of the solution remains constant while the concentration of H<sup>+</sup> and OH<sup>-</sup> ions in it change.
- **Sorensen** constructed the pH scale to show the concentration of H<sup>+</sup> or OH<sup>-</sup> ions in any solution. For any acidic or basic solution **pH + pOH = 14**
- In neutral solutions, the value of pH and pOH remains 7.
- In acidic solutions the value of pH is less than 7 and the value of pOH is more than 7.
- In basic solutions value of pH remains more than 7 and the value of pOH remains less than 7.
- **Buffer Solution** :
- A buffer solution is a solution that resists any change in its pH value.
- Buffer solution cancels the effect caused by reaction when any acid or base is poured into it. This is how its pH remains unchanged.
- The buffer solution is widely used in botany and zoology laboratories.
- Blood normally carries slightly the properties of, a base with a normal pH range of about **7.4**.
- The stomach is acidic, which helps food break down properly.

| Some Natural Acids            |                               |
|-------------------------------|-------------------------------|
| Apple                         | Malic acid                    |
| The Sting of ant and Scorpion | Methanoic Acid or Formic acid |
| Vinegar                       | Acetic acid                   |
| Curd (Sour milk)              | Lactic acid                   |
| Grapes and Tamarind           | Tartaric acid                 |
| Orange and Lime               | Citric acid                   |
| Spinach                       | Oxalic acid                   |
| Citrus fruit                  | Ascorbic acid (Vitamin C)     |

## 7. Gaseous State and Nature of Gases

- Gas is the simplest state of matter. The mixture of various gases is present around us in the atmosphere.
- $\text{CO}_2$ ,  $\text{O}_2$ ,  $\text{N}_2$  and water vapour all gases are present in the atmosphere.
- The following are the characteristics of the gaseous state-
  - Gases are highly compressible.
  - Gases release the same pressure in all directions.
  - Density of gases is small in comparison to solids and liquids.
  - Volume and the shape of gases is uncertain.
  - Diffusion of gases takes place rapidly.
- **Boyle's Law** : At constant temperature, the volume of a certain mass of gas is inversely proportional to its pressure. Here, mass means the number of moles in the gas.

$$V \propto \frac{1}{P} \quad (\text{At constant temperature and mass})$$

- **Charles's Law** : At constant pressure, the volume (V) of a certain mass of gas is directly proportional to its absolute temperature (T).

$$(\text{Absolute temperature } T = 273^\circ + t^\circ\text{C})$$

$$V \propto T$$

- **Avogadro Law** : At the constant temperature and pressure number of molecules (moles) in the equal volume of gases is equal.

$$\text{Molar volume of the gas} = \frac{V}{n} = 22.4 \text{ litres (at N.T.P.)}$$

(Here  $n = 1 \text{ mole}$ ) and

Number of molecules in 22.4 litres of gas is

$$= 6.022 \times 10^{23}$$

- $PV = nRT$  is called Ideal Gas Equation.
- Here, R is molar gas constant, its unit is litre atmosphere/Kelvin/mole or erg/Kelvin/mole or Joule/Kelvin/mole or Cubic cm atmosphere/Kelvin/ mole or calorie/Kelvin/mole.
- **Diffusion of Gases** : Diffusion is the process of gases that do not react chemically to form homogeneous mixtures with one another or to spread in homogenous form.

- **Graham's Law of Gaseous Diffusion** : At the constant temperature and pressure, the rate of diffusion of gases is inversely proportional to the square root of their molecular weights or their densities.

$$\text{i.e.} \quad \frac{r_1}{r_2} = \sqrt{\frac{d_2}{d_1}} = \sqrt{\frac{m_2}{m_1}}$$

### Theories of Cooling :

- (i) **Joule-Thomson Effects** : If any gas is allowed to expand from higher pressure to lower pressure, then its temperature gets lowered and cooling takes place.
- (ii) **Evaporation** : Evaporation of liquids also causes cooling because the molecules of the liquid absorb the heat to increase their kinetic energy for evaporation and because of this temperature of the liquid or that surface gets lowered.
- In the 1860s **Thomas Andrews** undertook a thorough investigation of the gas laws expressing the relationships of pressure, temperature and volume in carbon dioxide.

(SSC CSHL 2023 Tier-1)

## 8. Hydrogen and Its Compounds

- Hydrogen is the most abundant element found in the universe.
- Giant planets Jupiter and Saturn are mostly consists of hydrogen gas.
- It is the third most abundant element found on the surface of earth.
- Due to its lightest nature, it is found trace amounts atmosphere. (about 0.15% by mass).
- **Henry Cavendish** discovered it in 1766.
- **Atomic or Active Hydrogen** : Hydrogen molecule ( $\text{H}_2$ ) disintegrates into the hydrogen atoms (H atoms) at low pressure in the presence of tungstens, palladium or platinum heated at very high temperature or by passing electric discharge at low pressure (even lesser than  $\frac{1}{2}$  mm of pressure of mercury) in the hydrogen.
- Hydrogen gas in this state is called **active hydrogen**.
- Active Hydrogen is very reactive and directly combines with Phosphorus and Oxygen at normal temperature.
- **Nascent Hydrogen** : Hydrogen gas immediately released after the chemical reaction is called Nascent Hydrogen.
- Nascent Hydrogen is more reactive than molecular Hydrogen.
- **Ortho Hydrogen** : That molecule of Hydrogen in which the spins of both atoms are parallel is called Ortho Hydrogen.
- **Para Hydrogen** : That molecule of Hydrogen in which both atoms spin in anti-parallel mode is called Para-Hydrogen.
- **Sources of Hydrogen** : Sun is an abundant source of free Hydrogen. Water and Hydrocarbons are the chief sources of Hydrogen upon the Earth.

- **Position in Periodic Table :** Although Hydrogen has similarities with alkali metals and halogens both, yet it has been placed in the first group due to electronic configuration  $1s^1$  of its solitary electron.
- **Isotopes :** Three isotopes of Hydrogen- are Hydrogen ( ${}_1\text{H}^1$ ), heavy Hydrogen ( ${}_1\text{H}^2$ ) and radioactive Hydrogen ( ${}_1\text{H}^3$ ). These isotopes are known as Protium,  ${}^1\text{H}$  or  $\text{H}$  Deuterium  ${}^2_1\text{H}$  or  $\text{D}$  and Tritium  ${}^3_1\text{H}$  or  $\text{T}$  respectively.
- All these isotopes have an atomicity of two.
- Hydrogen and Deuterium are permanent isotopes, while Tritium is radioactive; therefore, unstable.
- Half life-period of Tritium is 12.32 years.
- Deuterium is used for artificial transmutation of elements.
- **Heavy Water :** In 1931, **Urey** and his associates discovered Deuterium and Heavy Water. They informed that in 6000 parts of normal water about 1 part of heavy water is present. It is represented by  $\text{D}_2\text{O}$ .
- The molecular weight of heavy water ( $\text{D}_2\text{O}$ ) is 20.02 g/mol, while ordinary water ( $\text{H}_2\text{O}$ ) weight is 18.015 g/mol.
- Water gas is a combustion fuel containing carbon monoxide ( $\text{CO}$ ) and hydrogen gas ( $\text{H}_2$ ).
- **Interspatial Hydrogen :** Hydrogen present in the space between the atoms of the metals is called **Interspatial Hydrogen**.
- **Uses of Hydrogen :** Hydrogen is an inflammable gas. Therefore, it is used as a gaseous fuel.
- Being a light mixture of Hydrogen and Helium, it is used in balloons.
- Hydrogen gas is used in the production of vegetable ghee, glass industry and in the production of synthetic petrol.
- **Liquid Hydrogen :** Fuel used in a rocket is called Propellant. Liquid Hydrogen and Hydrogen Peroxide ( $\text{H}_2\text{O}_2$ ) are used as rocket propellant.
- It can be used as -
  - (i) Hydrogen Peroxide is used as medicine to wash wounds, cleaning of ears and in the preparation of toothpaste.
  - (ii) Hydrogen Peroxide is used to maintain the quality of milk, wine and other beverages.
  - (iii) Hydrogen Peroxide is used in laboratories as a reducing agent in decolouring of wool, leather, and are used in propellant of rockets.
- **Harold C Urey** was credited with discovering the hydrogen isotope, or heavy hydrogen, for which he later received the 1934 Nobel Prize in Chemistry. (SSC CPO, 2022, 2019)

## 9. Hardness of Water

- Water ( $\text{H}_2\text{O}$ ) has a V like angular shape.
- Molecule of water is partially polar.
- Due to polarity, molecules of water attract mutually and form a hydrogen bond and because of Hydrogen bond, there is molecular multiplication in water.
- The density of water is maximum at **277K ( $4^\circ\text{C}$ )**. The density of ice is less than that of water due to vacant spaces. Therefore, it floats upon water.
- **Hard and Soft Water :** The water that produces lather from soap with difficulty is called **hard water** and the water that easily produces lather from soap is called **soft water**.
- Hardness in water exists because of the presence of soluble salts of Calcium and Magnesium (Bicarbonates, Sulphates, Chloride etc.) The hardness of water is of two types.
  1. **Temporary Hardness :** This type of hardness in water is due to the presence of bicarbonates of Calcium and Magnesium, which can be removed just by boiling the water. On boiling soluble bicarbonates, these change into insoluble Carbonates and it can be removed by filtering the water. Temporary hardness can also be removed by mixing lime water [ $\text{Ca}(\text{OH})_2$ ] into the water and this is known as the **Clark Method**.
  2. **Permanent Hardness :** This hardness of water is caused because of the presence of sulphate and chloride salts of Magnesium and Calcium. This hardness can be removed by mixing the solution of Sodium Carbonate ( $\text{Na}_2\text{CO}_3$ ) into the water. It changes soluble salts of magnesium and calcium into insoluble Carbonates and these can be separated by filtering the water. It is known as **Soda Process**.
- **Distillation Method :** In this method, water is converted into vapour by boiling and then again, it is converted into water by condensing the vapour. Thus Permutit and Calgon's Process is also used to remove the hardness of water.
- **Sterilization** is the process of making the water Potable (removing harmful germs).
- It is done by chlorination, ozonification or ultraviolet rays.

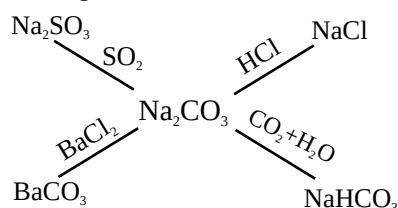
### Comparative Study of Heavy Water and Ordinary Water

| Properties           | $\text{H}_2\text{O}$ | $\text{D}_2\text{O}$    |
|----------------------|----------------------|-------------------------|
| 1. Density at S.T.P. | 0.9982               | 1.1056                  |
| 2. Freezing Point    | $0^\circ\text{C}$    | $3.8^\circ\text{C}$     |
| 3. Boiling Point     | $100^\circ\text{C}$  | $101.42^\circ\text{C}$  |
| 4. Maximum Density   | at $4^\circ\text{C}$ | at $11.6^\circ\text{C}$ |

- Heavy Water is used in Nuclear Reactors and Neutron Decelerators.
- **Hydrogen Peroxide ( $\text{H}_2\text{O}_2$ ) :** Thenard discovered hydrogen peroxide is 1818 AD. Chemical formula of it is  $\text{H}_2\text{O}_2$  and the molecular weight is 34.

## 10. Elements of s-Block

- Those elements in which the ultimate electron (last electron) enters into the s-orbital are called the elements of s-block.
- All these elements, except Hydrogen and Helium, are Alkali Metals (Group-1) or Alkali Earth Metals (Group-2).
- **Availability** : Being very reactive Alkali Metals are not found in nature in a free state, instead, they are found in combined form as compounds.
- **Lithium** is a strong reducing agent among Alkali Metals.
- **Properties of Compounds of Alkali Metals** :
- Stable order of Hydrides :  
 $\text{LiH} > \text{NaH} > \text{KH} > \text{RbH} > \text{CsH}$
- Order of the basic nature of Hydroxides  
 $\text{LiOH} < \text{NaOH} < \text{KOH} < \text{RbOH} < \text{CsOH}$
- Sodium Carbonate ( $\text{Na}_2\text{CO}_3$ ) and its Hydrates called Soda-Ash or Washing Soda.



- Ionisation enthalpy of alkali metals is lower in comparison to other metals.
- The melting point and boiling point of alkali metals are low due to weak metallic bonds.
- **Alkali-Earth Metals** : Radium is the heaviest of alkali earth metals.
- Radium exhibits the property of radioactivity.
- **Atomic Radii** : Ionic radii of alkali metals increases to Ba from Be.

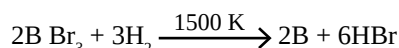


- **Hydrogen-Enthalpy** : Value of Hydration enthalpy declines to  $\text{Ba}^{2+}$  from  $\text{Be}^{2+}$ .
- Only +2 oxidation state is exhibited by the alkali metals.
- Potassium acid salt **Potassium Bitartrate** is obtained as a by-product of alcohol manufacture during the fermentation process. (SSC CSHL 2023 Tier-1)
- **Beryllium** is a silvery-white metal that is used in an alloy with copper or nickel to make gyroscopes, springs, electrical contacts, spot-welding electrodes, and non-sparking equipment. (SSC CSHL 2023 Tier-1)
- **Potassium meta bisulphite** chemical compounds, that is used as a food preservative in some sauces and beverages, retains their natural colour and protects against bacteria. (SSC CSHL 2023 Tier-1)
- **Potassium chloride** potassium salt is a mineral supplement used to treat or prevent low levels of potassium in the blood.

(Selection Post Phase XI)

## 11. Boron and Carbon

- **Boron** : Boron is a strong reducing agent.
- It reacts with acids, bases and halogens.
- Upon reacting with metals, it oxidizes and thus metallic bonds are formed.
- Boron is not found in a free state in nature. It is found in combined state as compounds, e.g. Boric Acid, Borax, Colemanite, Boronite, etc.
- Borax Mineral is the chief source of Boron.
- Pure Crystalline Boron is obtained by heating the mixture of **Boron Tribromide** and  $\text{H}_2$  and then by passing it through the heating filament of Tungsten.



- **Allotropes of Boron** : There are two allotropes of Boron. (i) Crystalline and (ii) Amorphous
- The crystalline form of Boron is in the form of brown powder.
- An amorphous form of Boron is colourless or brown.

### Uses of Boron :

- Major uses of Boron are as input in making enamel and glass.
- Boron is used as a neutron absorber in nuclear reactors.
- Boron is used for the hardening of steel.
- Borax, boric Acid, Boron Hydride are important compounds of Boron.
- **Carbon** : Carbon is a non-metal, which can exist in different forms. Each form is called its allotrope. Carbon in nature is found in standalone as well as a combined state.
- The pure form of carbon is diamond and graphites are found in standalone state.
- In a combination state, carbon is found in natural gas, petroleum, atmosphere and in all animals.
- There are two allotropes of carbon- (i) Diamond and (ii) Graphite
- **Diamond** : Diamond is a very hard substance.
- Refractive index of diamond is 2.4175 because of this it has a **total internal reflection**.
- Glare in the diamond is due to total internal reflection.
- Diamond is an insulator of electricity.
- The pure diamond is transparent and colourless.
- Black or non-gemstone quality diamonds are called **Boart**.
- Boart is used to cut the glass.
- Any type of liquid, acid or base does not affect diamond.
- **Graphite** : There is  $\text{sp}^2$  hybridization of carbon atom in the graphite, it remains arranged in the form of layers.
- Graphite is also called **Black Glass**.
- Graphite is a good conductor of electricity.
- Graphite is used in atomic reactors as electrodes and on the tips of pencils, etc.



- **Fullerene** : Fullerene is the third crystalline form of carbon.
- In one molecule of fullerene there may be 20, 60, 70 or more carbon atoms.
- **HC Brown** discovered that diborane reacts with aldehydes and ketones to produce **dialkoxaboranes**, Which are hydrolysed by water to produce alcohols.

(SSC CGL 2023 Tier-1)

## 12. Elements of Groups 15, 16, 17 and 18

### Elements of Group 15 :

- Ionisation energy of nitrogen is very high due to half-filled orbitals.
  - Nitrogen forms Hydrazine ( $\text{NH}_2\text{-NH}_2$ ) and Hydrozoic Acid including  $\text{NH}_3$ .
  - Among the hydrides of group 15.
    - Stability reduces from  $\text{NH}_3$  to  $\text{BiH}_3$   
 $\text{NH}_3 > \text{PH}_3 > \text{AsH}_3 > \text{SbH}_3 > \text{BiH}_3$
    - Reducing property increases from  $\text{NH}_3$  to  $\text{BiH}_3$   
 $\text{NH}_3 < \text{PH}_3 < \text{AsH}_3 < \text{SbH}_3 < \text{BiH}_3$
    - Bond-angle declines from  $\text{NH}_3$  to  $\text{BiH}_3$   
 $\text{NH}_3 > \text{PH}_3 > \text{AsH}_3 > \text{SbH}_3 > \text{BiH}_3$
  - Among the oxides of group-15-
    - Acidic nature of  $\text{M}_2\text{O}_3$  type of oxides declines from  $\text{N}_2\text{O}_3$  to  $\text{Bi}_2\text{O}_3$ .  
 $\text{N}_2\text{O}_3 > \text{P}_2\text{O}_3 > \text{As}_2\text{O}_3 > \text{Sb}_2\text{O}_3 > \text{Bi}_2\text{O}_3$
    - $\text{NO}$  and  $\text{NO}_2$  are paramagnetic.
    - $\text{HNO}_2$  has oxidising, reducing and hybrid formation properties.
    - Red Phosphorus or Phosphorus Trisulphide is used in the making of a matchbox.
- **Zeolite** : It is an aluminosilicate mineral.

### Elements of Group-16 :

- Elements of group 16 are collectively called **Chalcogen** or the makers of ore.
  - Polonium is a radioactive element. It was discovered by **Madam Curie** and **Pyre Curie** from Pitch-blende.
  - All elements of group-16 exhibit allotropy and polymorphism.
  - Descending order of the boiling points of group-16 elements is-  
 $\text{H}_2\text{O} > \text{H}_2\text{Te} > \text{H}_2\text{Se} > \text{H}_2\text{S}$
  - Descending order of reducing property of hybrids of group-16 elements is-  
 $\text{H}_2\text{Te} > \text{H}_2\text{Se} > \text{H}_2\text{S} > \text{H}_2\text{O}$
  - Oxygen has paramagnetic nature.
  - Ozone is found in the stratosphere and absorbs the ultraviolet radiations from the sun.
- **Peroxy monosulphuric Acid ( $\text{H}_2\text{SO}_5$ )** : This acid is also called Kero-Acid.

- **Peroxidisulphuric Acid ( $\text{H}_2\text{S}_2\text{O}_8$ )** : This acid is also known as Marshal Acid.

### Elements of Group-17 :

- Ascending order of the size of Halogen atom is-  
 $\text{F} < \text{Cl} < \text{Br} < \text{I} < \text{At}$
- Iodine sublimates on heating.
- Volatile nature of Halogen decreases from  $\text{F}_2$  to  $\text{I}_2$
- Descending order of ionisation enthalpy of Halogens is  $-\text{F} > \text{Cl} > \text{Br} > \text{I}$
- Descending order of electron affinity is  
 $\text{Cl} > \text{F} > \text{Br} > \text{I}$
- Descending order of bond-energy is-  
 $\text{Cl}_2 > \text{Br}_2 > \text{F}_2 > \text{I}_2$
- Descending order of oxidising power is-  
 $\text{F}_2 > \text{Cl}_2 > \text{Br}_2 > \text{I}_2$
- Fluorine is formed by the electrolytic dissociation of dehydrated Potassium-Hydrogen Fluoride ( $\text{KHF}_2$ ). Hydrogen is obtained at the cathode while Fluorine is at the anode.
- Chlorine is used for the formation of **toxic gases** used during chemical warfare, e.g. Phosgene ( $\text{COCl}_2$ ), Chloropicrine gas as tear-gas ( $\text{CCl}_3\text{NO}_2$ ), Mustard Gas ( $\text{C}_2\text{H}_4\text{Cl-S-C}_2\text{H}_4\text{Cl}$ ).
- Iodine is not easily soluble in water but immediately soluble in sodium or Potassium Iodide due to formation of Tri-Iodide.
- $\text{HF}$  and  $\text{HCl}$  are formed by heating their salts with concentrated  $\text{H}_2\text{SO}_4$ , but  $\text{HBr}$  and  $\text{HI}$  cannot be formed by this method due to their reducing properties ( $\text{HBr}$  and  $\text{NI}$  oxidized into  $\text{Br}_2$  and  $\text{I}_2$  by the concentrated  $\text{H}_2\text{SO}_4$ ).

### Hydrogen Halides of Group-17 Elements :

- Descending order of boiling points-  
 $\text{HF} > \text{HI} > \text{HBr} > \text{HCl}$   
 (the least volatile) (the most volatile)
- Descending order of acidity-  
 $\text{HI} > \text{HBr} > \text{HCl} > \text{HF}$
- Descending order of Bond polarity-  
 $\text{HF} > \text{HCl} > \text{HBr} > \text{HI}$
- Descending order of dipole moment-  
 $\text{HF} > \text{HCl} > \text{HBr} > \text{HI}$
- Oxidation efficiency of oxyacids reduces as the ratio of chlorine to oxyacids increases, while strength and durability are enhanced.
- Halogen compounds of two or more halogens are called **Interhalogen Compounds**. Their general formula is  $\text{XY}_n$  (Where  $n = 1, 3, 5$  or  $7$ ) and  $\text{X}$  is low electromagnetic between the two halogens.

## Elements of d and f-Blocks

- **Elements of d-block :** Those elements in which the last electron is filled into the (n-1)d orbitals are called d-block elements. Elements of groups 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 are related to this block.
- **Transition Elements :** Elements exhibiting properties between s and p blocks are called transition elements. Generally, elements of d-block are transition elements because their d-orbital is partially filled. General electronic configuration of transition elements is (n-1)  $d^{1-10}$ ,  $ns^{1-2}$ .
- **Elements of f-Block :** Those elements in which the last electron is filled in the (n-2)f orbitals are called f-block elements. Elements of Lanthanide and Actinide series are related to this block. Electronic configuration of these elements is (n-2)  $f^{1-14}$ , (n-1)  $d^{0-1}$ ,  $ns^2$ .
- Transition metals form paramagnetic and coloured compounds due to the presence of pairless electrons.
- Transition elements show various oxidation states due to the marginal difference in the energies of (n-1)d and ns orbitals. Mn is the transition element that shows the **maximum number of oxidation states**.
- Transition elements are hard due to metallic bonds and exhibit the properties of high density, high melting points and high boiling points.
- Actinides have a greater tendency to form complex-compounds compared to lanthanides.
- Potassium Dichromate ( $K_2Cr_2O_7$ ) at pH < 7 gives orange colour to the solution but in basic medium (pH > 7) gives yellow colour because  $K_2Cr_2O_7$  converted into  $K_2Cr_2O_4$ .
- Potassium Permanganate ( $KMnO_4$ ) works as the oxidising agent in all the three acidic, alkaline and neutral mediums but its equivalent weights are different in all these mediums.
- There is  $sd^3$  hybridisation of Mn and Cr in  $KMnO_4$  and  $K_2Cr_2O_7$ .

### Elements of Group 18 :

- There are 6 elements of zero group in the periodic table- Helium, Neon, Argon, Krypton, Xenon and Radon. These elements at normal temperature are gases and generally dormant, that is why they are called **Inert or Noble Gases**.
- Noble Gases or Rare Gases are the elements of zero or the 18<sup>th</sup> group.
- Noble Gases are monoatomic. They form 1% of the whole atmosphere.
- All inert gases except Helium, have a complete octet ( $ns^2$ ,  $np^6$ ) of electrons.
- The first noble gas discovered is Argon.

- Radon is a radioactive element.
- Atomic radii in noble gases are Van-der Waals radii. Therefore, the atomic size of noble gases is greater than the consecutive Halogen atoms.
- Ionization potential of Helium is the highest.

✎ **Note :** Helium and Argon are soluble in water, therefore they are also found in rivers, oceans and in the rain water in small quantities.

### Helium (He) :

- Helium being a light gas is used for filling in the tyres of aeroplanes and in meteorological balloons.
- Mixture of Helium and Oxygen is given to sea divers and asthma patients.
- Helium is also used in compass, navigation instruments, welding and other works.

### Xenon (Xe) :

- Xenon is a chemical element, a heavy and extremely rare gas of Group 18 (noble gases) of the periodic table.
- This gas was the first noble gas found to form true chemical compounds.
- It is more than 4.5 times heavier than air, xenon is colourless, odourless, and tasteless.

### Neon (Ne) :

- The name neon comes from the Greek word "neos" which means "new".
- Neon gas is used in liquid bulbs used for sending light signals to aeroplane pilots.
- Neon gas is used to produce light in different colours in advertisement for hoardings.

### Argon (Ar) :

- Argon is called **lazy gas**.
- Argon is filled in the gas-electric bulb; the lifetime of the filament increases due to its presence.

### Radon (Rn) :

- Radon is a radioactive noble gas.
- Radon gas is not found in the atmosphere.
- Radon is used in the radioactive treatment of cancer.

✎ **Note :** Use of Cobalt-60 (Co-60) is prevalent for the radioactive treatment of cancer. Gamma ( $\gamma$ ) rays are produced by it which destroy the cancerous cells.

### Krypton (Kr) :

- Krypton gas is used in fluorescent discharge lamps and the ionised chamber for the measurement of cosmic radiation.
- Mixing Xenon with Krypton Neon light enhances the longevity of bulb.
- Scientist **Lord Rayleigh** with William Ramsay showed in 1894 that air also contained an element unknown until then, which was named argon. (SSC CSHL 2023 Tier-1)

- d-block element **Actinium** in the periodic table is represented by the Greek symbol 'alpha' and the metallic 'rays'. (SSC CSHL 2023 Tier-1)
- **Praseodymium** is the soft, malleable, and silvery-yellow metal with atomic number 59 in the lanthanide series. (SSC CSHL 2023 Tier-1)
- Nihonium element of group 13 has the atomic number 113 and its electronic configuration in  $[Rn] 5f^{14} 6d^{10} 7s^2 7p^1$ .
- **Seaborgium** is transuranium element with atomic number 106, created by bombarding californium - 249 with oxygen - 18 nuclei. (SSC CSHL 2023 Tier-1)
- **Plutonium** actinide, discovered by Glenn T Seaborg in 1940, is used as a heat source for sensitive electrical components in satellites as well as a power source for satellites. (SSC CGL 2023 Tier-1)
- What is the colour of the flame is **White** when magnesium burns in the presence of oxygen. (SSC GD, 2022)

### 13. Some Important Non-Metals and Their Uses

#### Nitrogen :

- Nitrogen has a 78% share among gases present in the atmosphere.
- 0.01% of Nitrogen is present in whole of the earth, including the atmosphere.
- If there was no Nitrogen, the whole of the earth would be burnt to ashes by the presence of oxygen.
- Nitrogen is used to create an inert or incombustible atmosphere inside industrial plants.
- Ammonia or Chlorofluorocarbon (any one) is used in refrigerators and other cooling plants.
- **Nitrous Oxide** : Nitrous oxide ( $N_2O$ ) is also called **Laughing Gas**. This is also an anaesthetic (Chloroform is also used as anesthetics).
- The main compound of nitrogen is ammonia.
- Ammonia gas is formed by the Haber Process.
- Ammonia is used in the formation of fertilizers like Ammonium Sulphate, Urea, ice and the compounds like Sodium Bicarbonate, Sodium Carbonate and Ammonium Salts.
- Other uses of Ammonia are in the making of explosives and artificial silk.
- Nitrogen gas is used to fill the tires of aircraft.
- Some **nitrogen fixing bacteria** are found in the soil, they convert atmospheric nitrogen into nitrate. These bacteria are – **Rhizobium**, **Nitrosomonas** and **Nitrobacter** etc.
- The nitrogen cycle matters because nitrogen is an essential nutrient for sustaining life on Earth.

- Nitrogen is a core component of amino acids, which are the building blocks of proteins, and of nucleic acids, which are the building blocks of genetic material (RNA and DNA).

#### Phosphorus :

- There are 5 Allotropes of Phosphorus - Yellow Phosphorus, Red Phosphorus, White Phosphorus, Violet Phosphorus and Black Phosphorus.
- Red Phosphorus and Phosphorus Trisulphide are used in the making of matchstick.
- White Phosphorus is used in making rat poison, explosives, crackers and fireworks. [ $KMnO_4$  (Potassium Permanganate) is used in fireworks to produce different colours].
- Phosphine ( $PH_3$ ) is used for signalling by the ships during the voyage.

#### Sulphur :

- Sulphur dioxide gas ( $SO_2$ ) emits from petroleum refining plants and vehicles causing pollution.
- Sulphur dioxide and the oxides of Nitrogen on reacting with water vapour present in the atmosphere from Sulphuric and Nitric Acids which reach the top soil with rain and make it acidic, is called **acid rain**.

✎ **Note** : Corrosion of Taj-Mahal is taking place due to the sulphur dioxide being emitted from the Mathura oil refinery.

- Sulphuric acid is used in petroleum refining in manufacturing paint and colours. Ammonium sulphate is used in detergent making and superphosphate fertilizer manufacturing etc.
- Organic substances are abundant in domestic wastewater, including soaps, detergents, fats, pharmaceuticals, and different products of human activity, such as urine and fecal materials.

#### Halogens :

- Halogen elements are placed in group 7A (or 17) of the periodic table.
- Bromine is used in the formation of silver bromide.
- **Silver Bromide** is used in the making of photographic plates.
- Bromine is used in the synthesis of ethylene bromide.
- Chlorine is used in the synthesis of herbicide and pesticides, organic compounds and medicines.
- Fluorine is used in the formation of Uranium Hexafluoride ( $UF_6$ ).
- Uranium Hexafluoride is used in the generation of atomic energy.
- Fluorine is also used in the formation of Sulphur-hexafluoride ( $SF_6$ ).
- Sulphur-hexafluoride is used in parasitology.
- Hydrogen fluoride is used in the synthesis of chlorofluorocarbons (CFC) compounds and polytetrafluoroethylene (Teflon).

- Chlorofluorocarbon is also called **Freon**.
- Chlorofluorocarbon (CFC) is used in refrigerators and air-conditionors (A.C.) as coolant.
- Teflon ( $C_2F_4$ )<sub>n</sub> is used for making the upper layer of **non-stick** utensils.

## 14. Some Important Metals and Their Uses

### Sodium :

- Molten Sodium is used as a coolant in **nuclear reactors**.
- Sodium vapour is used in sodium lamps.
- Sodium chloride (NaCl) is used as edible salt.

 **Note :** Excess Sodium in food increases blood pressure.

### Potassium :

- Potassium Nitrate ( $KNO_3$ ) is called nitre or **gunpowder**. It is used in making explosives.
- $K^+$  ion is present in food or body and controls the heartbeat rate.
- Different compounds of Potassium are used as fertilizers in the form of Potash. e.g.- Potassium Chloride (KCl), Potassium Sulphate ( $K_2SO_4$ ), Potassium Carbonate ( $K_2CO_3$ ), Potassium Nitrate ( $KNO_3$ ).

### Calcium :

- Calcium and Phosphorus are the main constituent elements of bones and teeth.
- Calcium Carbonate ( $CaCO_3$ ) is used in making toothpaste and toothpowder.
- Plaster of Paris [Chemical name- Hemihydrate Calcium Sulphate ( $CaSO_4 \cdot \frac{1}{2} H_2O$ )] upon reacting with water turns into solid.
- Plaster of Paris is used in plastering the fractured bone, making idols and toys.

### Copper :

- Being a good conductor of electricity, copper is used in the making of wires and electric appliances.
- Utensils, coins and alloys etc. are made of Copper.
- Copper Sulphate ( $CuSO_4$ ) and Copper Oxide are used in the making of **pesticides** and **analgesis**.

### Magnesium :

- Magnesium is present in the **Chlorophyll** of plants.
- **Magnesium Elba** [ $Mg(OH)_2$ ;  $MgCO_3 \cdot 3H_2O$ ] is an anti-acid (removes acidity of stomach).
- Magnesium Elba is sold in the market as **ENO**.

### Zinc :

- Zinc Oxide (ZnO) is used in making **lotion and face cream**.
- Zinc Oxide (ZnO) is used in making white paint.
- Zinc is used in the galvanization of iron sheets.

### Gold :

- Gold is a very soft metal; therefore other metals are mixed with it to make it durable.

- Gold used in making ornaments is mixed with **Copper**. The amount of gold present in alloys is generally expressed in **Carat**.
- Pure gold (100% gold) is **24 carats**, 50% pure gold is 12 carats. This means that 4% of gold is present in one carat gold (Alloy).

### Silver :

- Silver is a good conductor of heat and electricity.
- Silver is one of the most corrosionless metals.
- **Silver Amalgam** (an alloy of Silver and Mercury) is filled in the cavities of teeth.
- Silver nitrate is used in making mirrors.
- Owing to the photosensitivity of silver-bromide, silver-chloride and silver-iodide, they are used in making **photographic plates**.
- Silver iodide is used in creating **artificial rain**.

### Mercury (Hg)

- Mercury vapour is filled in tube-lights.
- Alloys formed by mixing Mercury with other metals are called **Amalgam**.
- **Cr** metal ion released from tannery industry causes acute water pollution. (SSC CSHL 2023 Tier-1)
- **Philosopher's stone** convert all baser metals like iron into gold. (Selection Post Phase XI)

## 15. Methods of Extraction of Elements and Processes

- **Presence in Nature :** Metals in nature are found both in separate and combined states. Gold, Platinum and Silver are the metals found generally in a separate state.
- **Minerals :** Different compounds extracted from the mines and rocks are called **minerals**.
- **Ores :** Minerals from which metals can be obtained are called **ores**.
- **Classification of Ores :** The ores of metals are mainly classified into many types based on the way they are extracted from mines.  
Oxide, Sulphide, Carbonate, Sulphate, Phosphate Halide and Silicate ores.
- **Metallurgy :** The process of obtaining pure metal from the ore is called metallurgy.
- **Concentration :** The process of separating the particles of impurities from the ore is called **concentration**.
- **Gangue :** Impurities such as soil, sand and pebbles etc. are called **gangue**.
- **Flux :** External substances mixed with the ore used to remove impure matters are called **Flux**.
- **Concentration of Ore :** The processes like gravity separation, froth floatation, electro-magnetic separation is used for the concentration of ore.

- **Separation Using Gravity :** This method of concentration of ores is based upon the differences in the density of pure ore and the gangue.
- **Froth Floatation Method :** Concentrated Sulphide Ores is done by the flow of air in water mixed with oil. Pine and Eucalyptus oil generate froth while Sodium and Potassium Ethyl Xanthate cause floatation.
- **Electromagnetic Separation :** If there is magnetic property either in the ore or in impurity, this method is useful.
- **Chemical Method :** If the ore is of very impure form e.g. bauxite, then this method is used.
- **Calcination :** In the process of calcination, an ore is heated below its melting point in the absence of air.
- **Roasting :** In the process of roasting, an ore is heated to below its melting point in excess of air.
- **Smelting :** Obtaining metal by heating metallic oxides with a suitable reducing agent in the presence of flux is called **smelting**.
- **Slag :** Flux and gangue combine to form molten material is called **slag**.
- **Aluminothermic Process :** Extraction of metal from the metallic oxides by using Aluminium powder as a reducing agent is called Aluminothermic Process.
- **Metal Refining :** Obtaining pure metal from raw or impure metal is called Metal Refining, Distillation, liquefaction, zone-refinement and are physical methods for metal refining while oxidation process for metal refining is Mond-method, electrolytic dissociation method and Van Arkel process are chemical methods.
- The main ore of aluminium is bauxite. Its purification is done by Hall, Bayer and Serpek processes.
- Main ore of copper is copper-pyrite.
- Main ores of zinc are sphalerite and zinc-blende.
- Main ores of iron are magnetite and haematite.

| Metals        | Ores                                                                 |
|---------------|----------------------------------------------------------------------|
| Bismuth (Bi)  | Bismuthinite                                                         |
| Copper (Cu)   | Azurite<br>Copper Pyrite<br>Chalcopyrite<br>Chalcocite<br>Cuprite    |
| Calcium (Ca)  | Calcium Carbonate (Lime-stone)<br>Gypsum<br>Fluorspar<br>Phosphorite |
| Cadmium (Cd)  | Greenockite                                                          |
| Antimony (Sb) | Stibnite                                                             |

|                |                                                                               |
|----------------|-------------------------------------------------------------------------------|
| Cobalt (Co)    | Smeltite                                                                      |
| Chromium (Cr)  | Chromaite                                                                     |
| Aluminium (Al) | Bauxite<br>Cryolite<br>Corundum<br>Diaspore                                   |
| Sodium (Na)    | Sodium Chloride<br>Sodium Carbonate<br>Sodium Nitrate<br>Borax                |
| Tin (Sn)       | Cassiterite                                                                   |
| Gold (Au)      | Silvenite<br>Calaverite                                                       |
| Silver (Ag)    | Native Silver<br>Argentite<br>Chlorargyrite                                   |
| Zinc (Zn)      | Sphalerite<br>Zinc Blende<br>Franklinite<br>Calamine<br>Zincite               |
| Nickel (Ni)    | Millerite                                                                     |
| Potassium (K)  | Potassium Chloride<br>Potassium Carbonate<br>Potassium Nitrate                |
| Barium (Ba)    | Baryte                                                                        |
| Magnesium (Mg) | Magnesite<br>Dolomite<br>Carnallite<br>Epsom Salt                             |
| Mercury (Hg)   | Cinnabar                                                                      |
| Manganese (Mn) | Pyrolusite                                                                    |
| Iron (Fe)      | Magnetite<br>Haematite<br>Limonite<br>Siderite<br>Iron Pyrite<br>Chalcopyrite |
| Uranium (U)    | Pitch-blende (Uraninite)<br>Carnotite                                         |
| Lead (Pb)      | Galena                                                                        |

### SI Fundamental Quantities and Their Units

| Sl. No. | Alloys          | Composition                                            |
|---------|-----------------|--------------------------------------------------------|
| 1.      | Brass           | Copper 70%, Zinc 30%                                   |
| 2.      | Gun-metal       | Copper 88%, Zinc 2%, Tin 10%                           |
| 3.      | Stainless Steel | Iron 89.4%, Chromium 10%, Manganese 0.35%, Carbon 2.5% |



|     |               |                                                          |
|-----|---------------|----------------------------------------------------------|
| 4.  | Muntz-Metal   | Copper 60% and Zinc 40%                                  |
| 5.  | Dutch Metal   | Copper 80% and Zinc 20%                                  |
| 6.  | German Silver | Copper 51%, Nickel 19%, Zinc 30%                         |
| 7.  | Bronze        | Copper 88%, Tin 12%                                      |
| 8.  | Magnelium     | Aluminium 95%, Magnesium 5%                              |
| 9.  | Duraluminium  | Aluminium 95%, Copper 4%, Manganese 0.5%, Magnesium 0.5% |
| 10. | Nichrome      | Nickel, Iron, Chromium and Manganese                     |
| 11. | Solder        | Lead 63%, Tin 37%                                        |
| 12. | Type Metal    | Lead 81%, Antimony 16%, Tin 3%                           |

### Metals and Uses of Their Compounds

| Sl. No. | Compounds                                                            | Uses                                                                          |
|---------|----------------------------------------------------------------------|-------------------------------------------------------------------------------|
| 1.      | Mercury (Hg)                                                         | In making Thermometer, Amalgam and Vermilion                                  |
| 2.      | Mercuric-Chloride (HgCl <sub>2</sub> )                               | In making wood preservative and Pesticides                                    |
| 3.      | Sodium-Bicarbonate                                                   | Fire extinguishing instrument, Bakery, industry and in the form of repulsive. |
| 4.      | Magnesium (Mg)                                                       | In making flash bulbs and metal alloys                                        |
| 5.      | Magnesium-Carbonate [MgCO <sub>3</sub> ]                             | In making Toothpaste, medicine and Gypsum salt                                |
| 6.      | Magnesium Hydroxide [Mg(OH) <sub>2</sub> ]                           | Making sugar from molasses in the sugar industry                              |
| 7.      | Magnesium-Chloride [MgCl <sub>2</sub> ]                              | In decorating cotton                                                          |
| 8.      | Calcium (Ca)                                                         | Used to remove Sulphur from the petroleum and as reagent.                     |
| 9.      | Calcium Oxide (CaO)                                                  | In making bleaching powder and in the form of slurry                          |
| 10.     | Calcium Carbonate [CaCO <sub>3</sub> ]                               | Toothpaste, Lime, in making Carbondioxide                                     |
| 11.     | Gypsum [CaSO <sub>4</sub> ·2H <sub>2</sub> O]                        | In making-Ammonium Sulphate Plaster of Paris and in Cement industry           |
| 12.     | Plaster of Paris (CaSO <sub>4</sub> ) $\frac{1}{2}$ H <sub>2</sub> O | In making Idols, Bone-treatment and tying-bandage                             |

|     |                                                                        |                                                                                                                   |
|-----|------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| 13. | Bleaching Powder [CaOCl <sub>2</sub> ]                                 | Used as a germicide and for discolouring paper and clothes                                                        |
| 14. | Copper (Cu)                                                            | In making brass and electric wire                                                                                 |
| 15. | Copper Sulphate or Blue Vitriol [CuSO <sub>4</sub> ·5H <sub>2</sub> O] | In the construction of electric cell, making germicides, purification of copper in making color                   |
| 16. | Cupric Oxide (CuO)                                                     | In purification of petroleum and in the construction of blue & green glass                                        |
| 17. | Cuprous Oxide (Cu <sub>2</sub> O)                                      | In the formation of red glass and pesticides                                                                      |
| 18. | Chlorine (Cl)                                                          | Mustard Gas, Tincher, in making bleaching powder                                                                  |
| 19. | Bromine (Br)                                                           | In making medicine, Tincher, Colour industry and as repulsive                                                     |
| 20. | Iodine (I)                                                             | In colour industry pesticide and in making Tincher-iodine                                                         |
| 21. | Sulphur (S)                                                            | Medicine, Pesticides and in making of gunpowder                                                                   |
| 22. | Phosphorous (P)                                                        | White phosphorous is used to kill rats, red phosphorous used in matches and in making phosphorous-bronz           |
| 23. | Hydrogen (H <sub>2</sub> )                                             | In the production of Ammonia, formation of organic compounds                                                      |
| 24. | Liquid Hydrogen                                                        | Used as rocket fuel                                                                                               |
| 25. | Heavy Water (D <sub>2</sub> O)                                         | In nuclear-reactions, Deuterated compounds and as neutron retarder                                                |
| 26. | Hydrochloric Acid                                                      | Aqua-R, Chlorine, Colour, (HCl) Chloride salts formation                                                          |
| 27. | Sulphuric Acid (H <sub>2</sub> SO <sub>4</sub> )                       | Storage, Battery, Fertilization production, purification of petroleum, color making and as reagent in laboratory. |
| 28. | Ammonia (NH <sub>3</sub> )                                             | In making rayon, as reagent and in ice-factory                                                                    |
| 29. | Nitrous Oxide (N <sub>2</sub> O)                                       | Before surgery as an anaesthesia                                                                                  |
| 30. | Producer Gas (CO + N <sub>2</sub> )                                    | In heating furnace, as cheap fuel, in the extraction of metal.                                                    |

|     |                                                                                                            |                                                                                            |
|-----|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| 31. | Water Gas (CO + H <sub>2</sub> )                                                                           | In creating inert atmosphere, in the work of welding.                                      |
| 32. | Alum [K <sub>2</sub> SO <sub>4</sub> ·Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> ·24H <sub>2</sub> O] | In medicine making, leather industry in the purification of water, in colouring of clothes |
| 33. | Zinc (Zn)                                                                                                  | In making a battery, in the formation Hydrogen.                                            |
| 34. | Zinc Oxide (ZnO)                                                                                           | To make ointments and to make porcelain shine                                              |
| 35. | Zinc Sulphide (ZnS)                                                                                        | In the form of white pigment                                                               |
| 36. | Ferrous Oxide (FeO)                                                                                        | In the formation of Ferrous salts and in making of green glass                             |
| 37. | Ferric Oxide                                                                                               | In the formation of ferric salts, in making the polish for ornaments                       |
| 38. | Potassium Bromide                                                                                          | Photography                                                                                |
| 39. | Potassium Nitrate                                                                                          | Gunpowder                                                                                  |
| 40. | Potassium Sulphate                                                                                         | Fertilizer                                                                                 |
| 41. | Monopotassium Tartrate                                                                                     | Bakery                                                                                     |

## 16. Polymer

- A substance with a large molecule in which a particular unit of a molecule reproduce itself to form a giant molecule is called Polymer. The single unit of a chemical substance called Isoprene in rubber, is an example that enables itself into a large molecule.
- Starch and cellulose are also natural polymers that are obtained from plants.
- Starch and Cellulose are formed by a single unit of polymer glucose. Cotton, Jute, Flax are all cellulose (a polymer of glucose).
- Proteins are polymers formed by single units of amino acids.
- Plastic is also a polymer. Plastics are of two types–
  - Natural Plastic e.g. Lac
  - Synthetic Plastic e.g. Nylon, Polythene etc.

### Polymerisation :

- When a large number of molecules of a single compound combine to form a large molecule structure, it is called **Polymerisation**.
- The molecule which takes part in polymerisation action is called a **monomer**.

### ➤ Properties of Polymerisation :

- In the polymerisation process molecules of a single compound only combine.
  - There is no extraction of any molecule in polymerisation process.
  - Molecular weight of the polymer in a polymerisation process is the multiple of molecular weight of the compound.
- Polythene or Polyethylene is obtained by polymerisation of ethylene (C<sub>2</sub>H<sub>4</sub>) at high temperature.
  - Polystyrene is also a polymer, which is obtained by polymerisation of phenyl ethylene.

### Plastics :

- Plastics are compounds of large molecules.
- Plastics are generally prepared by the polymerisation of unsaturated hydrocarbons.
- **Cellulose** is a natural molecule of large size and it is used in the manufacture of plastics.
- Plastics are obtained from the substances found in nature e.g. natural gas, oil, coal and plants.
- Plastics are mostly obtained from hydrocarbons.
- Plastics are of two types natural and synthetic.
- Lac is a natural plastic, which is only a chemical polymer like synthetic polymers.
- Lac is secreted by the female lac insect.
- Plastics are mainly manufactured by chemical or synthetic methods. These are divided into two types–

#### (i) Thermoplastics (ii) Thermosetting Plastics

- **Thermoplastics** : These are the plastics that get soft on heating and when cooled they become hard.
- Thermoplastics have low melting points manufactured through polymerisation of organic compounds, e.g. Teflon, Polystyrene, Nylon, Polyvinylchloride and Polythene etc.
- **Polythene** : Ethylene (C<sub>2</sub>H<sub>4</sub>) on polymerisation at high temperature and pressure generates polythene.
- It is used in the making of packing bags and insulation cover of electrical wires.
- **Polyvinyl Chloride** : Polyvinyl chloride is formed by the polymerisation of vinyl chloride. It is used in making thin sheets of plastic and film etc.
- **Polystyrene** : Polystyrene is formed by the polymerisation of phenyl ethylene. It is used in making bottles for acids and the covers of batteries.
- **Thermosetting Plastics** : These are the plastics made through crosslinking process promoting chemical bonding between macromolecular chains and creating a three-dimensional (3D) network.
- Through the effect of heat and pressure molecules of this plastic add up a number of turns it hard chains and

which can initially be moulded into any shape. Once they become hard or they can't be liquefied again in any case, e.g. Bakelite, Urea-formaldehyde, plastic etc.

- **Bakelite** : Bakelite is formed when phenol is heated with sodium hydroxide and formaldehyde. Bakelite is used in making plastic goods e.g. Bucket, Table, Chair and other items.

#### Synthetic Fibres :

- Synthetic fibres are made by the synthesis of chemical substances.
- Fibres available in nature are converted into synthetic fibres by the chemical reaction, these are called **rayon**.
- Cellulose nitrate had its first industrial use in 1885 in making synthetic fibres.
- The synthetic fibres which are used in making other products except fabric are— acetate fibres and polyester-fibres etc.
- Synthetic fibres are generally of two types-  
(i) Transformed fibres of cotton e.g. Viscose Rayon and Acetate Rayon.  
(ii) Chemical synthetic fibres e.g. Nylon is a polyamide fibre.
- **Nylon** : Nylon is the first completely synthetic fibre synthesized by man.
- Nylon is an artificial substance that is formed by the polymerisation of small organic molecules. It is used in the production of tyres, nets, ropes etc.
- **Rayon** : Synthetic fibre made by cellulose is called Rayon. It is used in making cloth mixed with cotton, making carpets, mesh gauze and bandage for wounds.
- **Rexine** : It is an **artificial** leather. It is formed from cellulose or plants. It is used in making jacket, canvas, shoes, slippers etc.

🔗 **Note** : Paper is formed by pure cellulose.

### 17. Chemistry : Important Facts

- Hydrogen is the **lightest element**.
- Osmium (Os) and Iridium (Ir) are the **heaviest elements**.
- Lithium (Li) is the **lightest metallic element**.
- Oxygen (O<sub>2</sub>) is the element found in abundantly the earth's crust.
- Astatine (At) is the **rarest** element in the earth's crust.
- Diamond is the **hardest substance** found in nature.
- Nitrogen (N<sub>2</sub>) (78%) is an element found in the largest amount in the atmosphere.
- Bromine (Br) is the only non-metal, which remains in liquid form at normal temperature and pressure.
- Silver (Ag) metal has the **highest electrical conductivity**.

- Graphite is a non-metal with the **highest electrical conductivity**.
- Carbon (C) is an element with the greatest chain-forming property.
- Carbon (C) is the largest compound (Chemical substance) forming element in nature (about 10 lakh compounds).
- Francium (Fr) is the **largest electropositive element**.
- Fluorine (F) is the **largest electronegative element**.
- Chlorine (Cl) is the element with the highest electron affinity.

#### Formulas, Chemical and Commercial Names of Chemical Compounds

| Commercial Name          | Chemical Name                | Formula                                                                                            |
|--------------------------|------------------------------|----------------------------------------------------------------------------------------------------|
| Washing Soda             | Sodium Carbonate             | Na <sub>2</sub> CO <sub>3</sub>                                                                    |
| Baking Soda              | Sodium Bicarbonate           | NaHCO <sub>3</sub>                                                                                 |
| Caustic Soda             | Sodium Hydroxide             | NaOH                                                                                               |
| Common Salt              | Sodium Chloride              | NaCl                                                                                               |
| Bleaching Powder         | Calcium Oxychloride          | Ca(OCl)Cl or CaOCl <sub>2</sub>                                                                    |
| Alum                     | Potassium Aluminium Sulphate | K <sub>2</sub> SO <sub>4</sub> Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> ·24H <sub>2</sub> O |
| Dry Ice                  | Solid Carbon dioxide         | CO <sub>2</sub> (Solid)                                                                            |
| Marsh Gas (Gobar Gas)    | Methane                      | CH <sub>4</sub>                                                                                    |
| Fools Gold               | Iron Pyrite                  | FeS                                                                                                |
| Red Lead                 | Tri-Plumbic Tetraoxide       | Pb <sub>3</sub> O <sub>4</sub>                                                                     |
| Lime Water (Slaked Lime) | Calcium Hydroxide            | Ca(OH) <sub>2</sub>                                                                                |
| Quick Lime               | Calcium Oxide                | CaO                                                                                                |
| Gypsum                   | Calcium Sulphate             | CaSO <sub>4</sub> ·2H <sub>2</sub> O                                                               |
| Lime Stone (Chalk)       | Calcium Carbonate            | CaCO <sub>3</sub>                                                                                  |
| Green Vitriol            | Ferrous Sulphate             | FeSO <sub>4</sub> ·7H <sub>2</sub> O                                                               |
| Blue Vitriol             | Copper Sulphate              | CuSO <sub>4</sub> ·5H <sub>2</sub> O                                                               |
| Vermilion                | Borax                        | Na <sub>2</sub> B <sub>4</sub> O <sub>7</sub> ·10H <sub>2</sub> O                                  |
| Sal ammoniac             | Ammonium Chloride            | NH <sub>4</sub> Cl                                                                                 |

- Nitrogen and Oxygen present in the atmosphere together convert into Nitrogen Oxide during lightning.
- Oxygen and Helium mixture filled into the cylinders is used in hospitals for helping patients to breathe.

- Chloroform when left open in the sunlight converts into toxic Phosgene Gas.
  - Crude petroleum is purified by the process of fractional distillation.
  - The residue product obtained after the refining of petroleum is paraffin.
  - Dry ice (Solid Carbon-dioxide) on heating directly converts into gas.
  - On separating cream the density of milk increases.
  - Nitrous oxide ( $N_2O$ ) is also called **Laughing Gas**.
  - Fluorine (F) is a strong oxidising agent.
  - The density of gold is higher than the density of mercury and the density of mercury is higher than the density of steel, that is why gold sinks into the mercury, but steel floats on it.
  - **Gallium arsenide** is also used in computer as chips, while generally silicon chips were used earlier.
  - Sodium being highly inflammable is placed in kerosene.
  - Methane ( $CH_4$ ) is called **Marsh Gas** (as it is generally found in marshy land).
  - The major constituent of **Gobar-Gas** (Bio-gas) is methane ( $CH_4$ ). Methane gas is produced by the rotting of large amount of leaves which fall on the ground in forests.
  - The cause of fire and explosion in the mines is due to methane gas.
  - **Oxy-acetylene gas** is also called flame gas. It is used in the cutting and welding of metals.
  - Solid Carbon dioxide ( $CO_2$ ) is called **dry ice** (sublimation temperature- $-78.5^\circ C$ ).
  - **Methyl Isocyanate** ( $MIC-C_2H_3NO$ ) is a toxic gas. It is used in the making of pesticides.
- 🔍 **Note :** The same gas had leaked from the Union Carbide factory in Bhopal when the gas tragedy occurred in 1984.
- Ethylene gas is used for ripening of fruits.
  - Presence of Carbon dioxide gas in the atmosphere is the cause of the **Greenhouse Effect**.
  - The liquefied gas used in domestic cooking is called L.P.G. (Liquefied Petroleum Gas).
  - L.P.G. is mainly the mixture of **Butane** and **Propane**.
  - Carbon dioxide ( $CO_2$ ) is used in fire-extinguishing equipment.
  - **Kaolinite** is the product as a result of the process of hydrolysis of orthoclase. (SSC CSHL 2023 Tier-1)
  - **Calomel** is the popular name for mercury(I) chloride which is used as a laboratory reagent and as a depolarizer in dry batteries. (SSC CSHL 2023 Tier-1)
  - **Rice** grains contains oryzenin. (SSC CSHL 2023 Tier-1)
  - **Erucic acid** is found in Mustard oil. (SSC MTS 2022)
  - In Year **1787** Antoine Lavoisier publish 'Methods of Chemical Nomenclature', which included the rules for naming chemical compounds that are still in use today. (SSC CGL 2023 Tier-1)
  - **Pectin** the soluble fibers found in fruits is used as a thickener in cooking and baking. (SSC CGL 2023 Tier-1)
  - **Oleic acid** makes up 55-80% of olive oil, making it a good choice for most cooking methods. (SSC CGL 2023 Tier-1)
  - Pectin, which is responsible for the firmness and softness of fruits is mainly composed of **Galacturonic Acid**. (SSC CGL 2023 Tier-1)
  - Low-calorie sweetener has the chemical formula  $C_{14}H_{18}N_2O_5$  that is two hundred times sweeter than sugar is **Aspartame**. (SSC CGL 2022 Tier-1)
  - **Curcumin** chemical compounds is a naturally occurring orange/yellow pigment extracted from turmeric, which is used as a spice, in food colouring and as a traditional herbal medicine. (SSC Selection Phase X, 2022)
  - **Butylated hydroxyanisole** chemical compound is used as a yeast de-foaming agent, commonly found in butter, meat, cereals, chewing gum, baked goods, snack foods, dehydrated potatoes and beer.

## 18. General Chemistry

- Coil of the heater is made of **nichrome** alloy.
- Vessels to place acids are formed by **monel alloy**.
- Composition of various gases in the atmosphere (dry air) is as follows— Nitrogen (78.09%), Oxygen (20.95%), Water vapour (0.4%), Argon (0.03%), Carbon-dioxide (0.04%).
- **Alcohol** and **Glycerine** are mixed to avoid the freezing of water in radiators of vehicles in colder regions.
- Petrol is also called gasoline, when 10–20% ethyl alcohol is mixed with petrol and the mixture is known as **Gasohol**.
- **Saccharin** is 300–400 times sweeter than sugar, but its food value is zero. It is used by diabetic patients.
- For the checking of stomach, Barium Sulphate solution is given to drink to the patient, as this solution is transparent for the X-rays.
- Strongly explosive dynamite is a chemical compound known as **Nitroglycerine**. It was discovered by **Alfred Nobel** (after whose name Nobel Prize is named).

### Chemical Substances and Their Sources

| Chemical Substances | Sources      |
|---------------------|--------------|
| Protein Casein      | Milk, Paneer |

|             |                     |
|-------------|---------------------|
| Nicotine    | Tobacco             |
| Caffeine    | Tea, Coffee, Cocoa  |
| Formic Acid | Ant, Scorpion sting |

- Carbon dating (carbon-14 dating) is a method to find the age of fossils, rocks etc.
- Carbon dioxide ( $\text{CO}_2$ ) and carbon-tetrachloride ( $\text{CCl}_4$ ) are used in **fire-extinguishers**.
- Carburettor in a petrol engine mixes air with petrol, which helps it in ignition.
- Celluloid is a man-made plastic liquid, which is used in making the reels of photographic films.
- In the night, the light emitted by the fire fly is due to the oxidation of a chemical called **Luciferin**.
- Formaldehyde (23–40%) dilute solution in water is called **formalin**. It is used in the preservation of dead animals.
- Methane is the simplest hydrocarbon.
- Acidity is the property of chlorinated water.
- Kajal (lampblack) is the purest form of carbon.
- Glass melts in the form of hydrochloric acid.
- Hydrometer is an instrument to measure the relative density of the liquids.
- Rusting of iron is a chemical change.
- Alloy of copper and tin is called **Bronze**.
- Oxygen and acetylene gas are used for welding.
- **Wohler** prepared urea in a laboratory.
- Silver reacts with oxygen; it starts getting black.
- Ultra-violet and antibiotics are used for the preservation of food and meat.
- Lactitol is derived through the hydrogenation of: **Lactose**.  
(SSC CSHL 2023 Tier-1)
- **Ficus benghalensis** is the scientific name of the banyan tree, a large evergreen tree of Asia characterized by its trunk-like aerial roots.  
(SSC CSHL 2023 Tier-1)
- **Caramelisation** is a cooking procedure in which the sugar in the food gets oxidized, turning into a brown color.  
(SSC MTS 2022)
- In **Spit-roasting** method of cooking is food heated slowly over a source of heat and cooked by high heat and air convection depending on the position of the food in relation to the fire.  
(SSC CGL 2023 Tier-1)
- **Disorder**                      **Enzyme**
  - i. Gaucher disease        - Glucocerebrosidase
  - ii. Hunter syndrome    - Iduronate-2-Sulfatase
  - iii. Tay-Sachs disease   - Hexosaminidase A
  - iv. Phenylketonuria      - Phenylalanine hydroxylase

(SSC CGL 2023 Tier-1)

- The substance piperine is found in **Black pepper**.  
(CRPF Tradesman 2023)
- In 1879, an artificial, or non-nutritive, sweetener that is approximately 300-400 times sweeter than sucrose was discovered. The name of the sweetener is **Saccharin**.

(CRPF Tradesman 2023)

## 19. Hydrocarbons

- Compounds of Carbon and Hydrogen are called Hydrocarbons.
- Hydrocarbons are of three types– Saturated Hydrocarbons, Unsaturated Hydrocarbons and Aromatic Hydrocarbons.
- (1) **Saturated Hydrocarbons** : Saturated Hydrocarbons are also known as Alkanes. Their general formula is  $\text{C}_n\text{H}_{2n+2}$ .
- In saturated Hydrocarbons, all four valencies of the carbon atom are in a stable state by making covalent bonds.
- Organic compounds like Methane, Ethane, Propane and Butane are obtained by substituting the values of  $n = 1, 2, 3, 4, \dots$  in the general formula  $\text{C}_n\text{H}_{2n+2}$  of alkane series.
- (2) **Unsaturated Hydrocarbons** : Unsaturated hydrocarbons are also called **Alkenes** and **Alkynes**.
- In Alkanes ( $\text{C}_n\text{H}_{2n}$ ) hydrocarbon compounds carbon atoms are mutually combined through the double bonds in the form of covalent bonds. Ethylene or Ethane ( $\text{C}_2\text{H}_4$ ) is such a kind of compound. In Alkyne ( $\text{C}_n\text{H}_{2n-2}$ ) Hydrocarbon compounds, Carbon atoms are mutually combined with triple bonds e.g. Acetylene ( $\text{C}_2\text{H}_2$ ).
- (3) **Aromatic Hydrocarbons** : Compounds derived from Benzene ( $\text{C}_6\text{H}_6$ ) are called **Aromatic Compounds**. There is at least one aromatic ring or cycle in their structure.
- The name of aromatic compounds is given after the specific smell (aroma) of these compounds.
- **Isomerism** : Compounds with similar atomic but different properties are called Isomeric Compounds and this property is called Isomerism.
- There are two types of Isomerism :
- (i) **Structural Isomerism** : Molecules that have the same molecular formula, but have a different arrangement of atoms in space.
- (ii) **Stereo Isomerism** : Isomers that have the same structural formula but have different relative arrangements of atoms or groups in space are called Stereoisomers and the phenomenon is called Stereoisomerism.
- **Petroleum** : Petroleum (Crude Oil) is a natural source of Hydrocarbons.
- Petroleum is accumulated by nature in deposits made between certain types of Sedimentary rocks on earth.



### Uses of Petroleum :

- Petroleum is a mixture of many Hydrocarbons.
- Petrol is also known as mineral oil is found beneath the earth.
- Fractional distillation process is used for petroleum refining.
- Components of different boiling points constituting crude oil gets separated by fractional distillation, which is called Fractions- e.g. Asphalt (Damar), Paraffin wax, Lubricant Oil, Fuel Oil, Diesel, Kerosene, Petrol and Petroleum Gas.
- **Acrolein** is the name of the chemical compound having the molecular formula  $C_3H_4O$  which is mostly used for the production of acrylic acid and acrylate ester.

(SSC CSHL 2023 Tier-1)

- In 1937, **Edward Davies Hughes** along with Sir Christopher Ingold proposed nucleophilic substitution reactions of alkyl halides and related compounds.

(SSC CSHL 2023 Tier-1)

- Oxolane is a synonym of **Tetrahydrofuran** compound having the molecular formula  $(CH_2)_3CH_2O$ .

(SSC CSHL 2023 Tier-1)

- Organic chemical compound **Aniline** is reacted with nitrous acid at 273-278K to prepare benzenediazonium chloride.

(SSC CSHL 2023 Tier-1)

- **2-Propen-1-amine** is the IUPAC name of allylamine, which is used to make pharmaceuticals and other chemicals.

(SSC CSHL 2023 Tier-1)

- In **Phthalaldehyde** di-aldehyde are two formyl groups attached to adjacent carbon centres on a benzene ring and form fluorescent conjugation products with primary amines.

(SSC CSHL 2023 Tier-1)

- **Anthocyanins** is natural bioactive water-soluble phenolic compound is present in fruits, vegetables, and grains with red, purple, blue, or black hues.

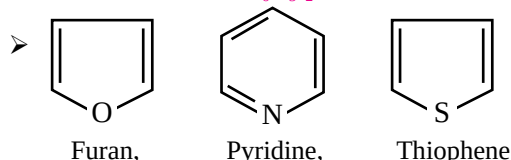
(SSC CSHL 2023 Tier-1)

- **Ethynyl** compounds having the molecular formula  $C_2H$  is derived from the hydride of acetylene.

(SSC CSHL 2023 Tier-1)

- **Benzophenone** is a naturally occurring organic compound with the formula  $(C_6H_5)_2CO$ .

(SSC CGL 2023 Tier-1)



(SSC CGL 2023 Tier-1)

- A rise in the number of OH-groups associated with anthocyanin **increases the bluish colour** of the anthocyanin.

(CRPF Tradesman 2023)

- **Cumene** is an alkylbenzene widely used as a chemical intermediate in the production of phenol.

(SSC CGL 2022 Tier-1)

- In Kolbe's reaction **Ortho-hydroxybenzoic acid** chemical compound is formed as the primary product by heating sodium phenoxide at  $125^\circ C$  in the presence of carbon dioxide gas under a pressure of about 100 atm.

(SSC Scientific Assistant IMD Recruitment 2022)

## 20. Artificial Substances

### A. Soaps

- Generally, soaps are salt of higher fatty acids.
- Washing soaps contain high Sodium salts.
- Bathing soaps contain Potassium salts of high fatty acids.
- Saponification is a process involving the hydrolysis of fats on its reaction with alkali, thereby leading to the formation of salts of fatty acids and glycerol.

### B. Detergents :

- Detergents are those chemical substances that remove the dirt from clothes and clean them. These detergents have soap-like properties and are not affected by the hardness of water.
- Detergents are synthetic organic compounds and they have better moisturising properties in comparison to soaps.

### C. Explosives :

Types of Explosives :

Explosives are divided into three categories :

- (i) Composite Explosives
- (ii) Aliphatic nitro Explosives
- (iii) Aromatic nitro Explosives

#### (i) Composite Explosives :

Composite explosives are formed by mixing two or more compounds, for example-

- (a) **Gunpowder** : It is formed by mixing Potassium Nitrate, Sulphur and Charcoal.
- (b) **Dynamite** : Dynamite was invented by Alfred Nobel. Nobel made dynamite by absorbing Nitroglycerine in Kieselguhr.

- Dynamite is used for digging oil wells, making roads in hilly areas, laying tunnels and breaking the rocks.

#### (ii) Aliphatic Nitro Explosives :

There are following explosives used as aliphatic nitro explosives- Acetilide, Nitromethane etc.

- (iii) **Aromatic Nitro Explosives** : Following explosives come are aromatic nitro explosives – Tri-nitro- toluene, Toluene, Picric Acid etc.

### D. Glass :

- Glass is an amorphous mixture of metallic silicates.
- Soda glass is the cheapest and common glass.
- Soda glass is used in making the utensils of daily use, tube-light, and laboratory instruments.

- **Xena Glass** is the best quality glass.
- Xena glass is used in making scientific instruments and chemical pots.
- **Flint Glass** is used in making electric bulbs, lenses for cameras and telescopes.
- **Crook's Glass** is used in making sunglasses.
- **Crown Glass** is used in making lenses for other glasses.
- **Pyrex Glass** is used in making laboratory instruments.
- **Photochromatic Glass** : This is a special type of glass, which becomes dark in intense light. This property in it is due to the presence of **Silver Chloride**.
- Potassium Chloride is used for making the glass hard.
- A small amount of metallic compounds is mixed for making the coloured glass.

| Colour of the Glass and Metallic Compounds |                    |
|--------------------------------------------|--------------------|
| Colour of Glasses                          | Metallic Compounds |
| Dark Blue                                  | Cobalt Oxide       |
| Dark Red                                   | Cuprous Oxide      |
| Orange                                     | Selenium Oxide     |
| Yellow                                     | Cadmium Sulphide   |
| Brown                                      | Ferric Oxide       |
| Green                                      | Ferrous Oxide      |

#### E. Cement :

- Cement is the mixture of Calcium Silicate and Aluminium Silicate.
- Due to Calcium Silicate and Aluminium Silicate hydration, cement has a solidifying property.
- Gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) is mixed with cement for slowing down the solidification process.

#### F. Fertilizers :

- Fertilizers are manufactured mixtures of chemical products that contain N, P, K and other necessary nutrients.
  - They are spread over the soil to re-supply the soil with the proper amount of these nutrients.
  - The three numbers on the front of the fertilizer bag represent the percentage by weight of nitrogen, phosphorus, and potassium in that particular mixture.
- Chemical Fertilizers are mainly of three types– Nitrogen, Phosphorous and Potassium Fertilizers.

**A. Nitrogen Fertilizers :** The fertilizers which contain a large amount of nitrogen are called Nitrogen Fertilizers. Urea, Ammonium Sulphate, Calcium Cyanamide and Calcium Nitrate, are the main Nitrogen Fertilizers.

- Urea has 46% of Nitrogen.

**B. Phosphorous Fertilizers :** Fertilizers with a large amount of phosphorous are called phosphorous fertilizers. phosphoric

slag, super phosphate of lime, etc. are the main phosphorus fertilizers.

- C. Potassium Fertilizers :** Fertilizers with Potassium as their chief constituent is called Potassium fertilizers. Potassium Nitrate, Potassium Chloride and Potassium Sulphate are main Potassium fertilizers.
- **Biofertilizers** are biological preparations of efficient microorganisms that promote plant growth by improving nutrient acquisition.
- They enhance soil productivity by fixing atmospheric nitrogen, solubilizing soil phosphorus, and stimulating plant growth.

## 21. Fuel

#### Fuel :

- The substances which produce heat on burning are called fuels, e.g. coal, wood and kerosene, etc.
- On the basis of form, fuels are divided into two categories–
  - (1) Primary Fuel – Coal, Wood, Petrol
  - (2) Secondary Fuel : **Water Gas** ( $\text{CO} + \text{H}_2$ ), **Producer Gas** ( $\text{CO} + \text{N}_2$ )
- Types of fuel on the basis of physical state–
  - (i) Solid Fuel – Wood, Coal, Charcol and Coke.
  - (ii) Liquid Fuel – Petrol, Diesel, Kerosene.
  - (iii) Gaseous Fuel – CNG, Biogas, Natural Gas.
- **Bio-Gas** : Biogas is a gaseous fuel, which is prepared by the excretory products of humans, animals and the remains of plants.
- Biogas is a mixture of various constituents.
- Names of the constituents of gases are- methane, Hydrogen, Carbon dioxide, Nitrogen and Hydrogen Sulphide.
- **Methane** ( $\text{CH}_4$ ) is found in the largest amount (50-75%) in the biogas.
- **Liquefied Petroleum Gas (L.P.G.)**
- L.P.G. is majorly the mixture of **Butane** and **Propane**.
- The main ingredient of L.P.G. is Butane which burns easily and provides an excessive amount of heat.
- To find out the leakage of gas, a compound with a sharp smell, **Ethyl Mercaptan** is mixed with it in very small quantity.

#### Natural Gas :

- Natural gas mainly contains Methane gas.
- Natural Gas is considered clean and pollution-free fuel.

#### Petrol :

- Petrol is a fossil fuel that is used in cars, motorcycles, etc.
- Air and Petrol are mixed through the carburettor in the petrol engine.

#### Diesel :

- Diesel is generally used for heavy vehicles and running generators.

- Biology is the science of life. The term 'Biology' is derived from two words 'Bios' (life) and 'Logos' (study).
- Biology is the branch of science that focuses on the study of living beings.
- Plants and animals (both are living organism) come under living beings.
- **Zoology** (Zoion = an animal, logos study) is the study of all animals where **Botany** (Botane = herb or plant) is the study of **plants**.
- Zoion and botane are Greek words.
- The term 'Biology' was first used by scientists, **Lamarck** and **Treviranus in 1802 AD**.
- Aristotle is called the **Father of Biology** and Zoology.
- Scientists **George Emil Palade** is considered the Father of Modern Cell Biology (1912-2008).

(CRPF Tradesman 2023)

- It is difficult to give a definition of life, but all living beings have some special characteristics, on the basis of that, they can be separated from non-living things. These characteristics are as follow –
 

|                                     |                 |
|-------------------------------------|-----------------|
| (i) Life cycle                      | (ii) Protoplasm |
| (iii) Cell structure                | (iv) Metabolism |
| (v) Respiration                     | (vi) Nutrition  |
| (viii) Sensibility and Adaptability |                 |
| (ix) Growth and Movement            |                 |
| (x) Excretion                       |                 |

### 1. Taxonomy

- Taxonomy is the science of naming, describing and classifying Organisms and includes all plants, animals and micro organisms of the world.
- The term Taxonomy was coined by **AP De Candolle**.
- **Carolus Linnaeus** classified plants and animals in his book '**Systema Naturae**'.
- Carolus Linnaeus is called the father of modern taxonomy. Binomial nomenclature was proposed by him for living organisms.
- According to Binomial Nomenclature, the name of every living organism is derived from two Latin words, former is the name of genus and the latter is the name of species.
- In 1969, **Robert H. Whittaker** proposed five kingdom systems for classification. All living beings are classified into five kingdoms which are as follows:

- 1. Kingdom Monera** : It includes all prokaryotic living organisms like bacteria, Mycoplasma Blue-green algae (cyanobacteria), etc.
  - **Mycoplasma pneumoniae** are bacteria that can cause illness by damaging the lining of the respiratory system (throat,

lungs, windpipe). People can have bacteria in their noses or throats at one time or another without being ill.

- **It is important to indicate that Bacteria are prokaryotes.**
  - Bacteria can be both autotrophic and heterotrophic. Autotrophic bacteria such as Cyanobacteria and Rhodospirillum contain pigment-containing vesicles called '**chromatophores**'.
- 2. Kingdom Protista** : It consists of unicellular, eukaryotic living organisms like Protozoa and algae.
    - Algae are a diverse group of aquatic organisms.
    - They have the ability to conduct photosynthesis.
    - Certain algae are familiar to most people; for instance, seaweeds (such as kelp or phytoplankton), pond scum or the algal blooms in lakes.
    - Notably, algae are capable of photosynthesis and produce their own nourishment by using light energy from the sun and carbon dioxide in order to generate carbohydrates and oxygen.
    - Thus most algae are autotrophs or more specifically, photoautotrophs (reflecting their use of light energy to generate nutrients).
    - Plastics contain three types of pigments in algae. These are –
 

|                   |                                    |
|-------------------|------------------------------------|
| (i) Chlorophyceae | - Green algae (with green pigment) |
| (ii) Rhodophyceae | - Red algae (with red pigment)     |
| (iii) Pheophyceae | - Brown algae (with brown pigment) |
  - 3. Kingdom Fungi** : It consists of eukaryotic and heterotrophic organisms with absorptive nutrition. They are parasitic or saprotrophic and their cell wall is made of complex sugar named chitin. **Ex- mushrooms, yeast, etc.**
    - Mycorrhizae are a symbiotic association between plant roots and fungi. Their major role is to enhance nutrient and water uptake by the host plant by exploiting a larger volume of soil than roots alone can do.
  - 4. Kingdom Plantae** : All multicellular, photosynthetic producing organisms are included in this kingdom. They are green plants, **Angiosperms, Gymnosperms, Thallophytes, Bryophytes** and **Pteridophytes**.
  - 5. Kingdom Animalia** : This kingdom consists of all multicellular Holozoic, the eukaryotic consumer. They directly or indirectly depend on plants for food. This group is also called Metazoa. These are **Phylum Porifera, Coelenterata, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca** and **Echinodermata** and fishes, Reptiles, Amphibians, Birds, Mammals.
    - **Kingdom, Phylum, Class, Order, Family, Genus** and **Species** are the categories or groups of animals and plants. A category is used as a division at the place of phylum for plants. In contrast, the terms of the remaining categories remain the same. The lowest category is species and the highest is the **kingdom**.

## 2. Cytology

- Cytology is a branch of Biology that studies cell structure, life-cycle, division, cell organelles, etc. It is studied at a micro and molecular level.
- **Robert Hooke** used the term 'Cell' for the first time.
- The first time the word cell was used to refer to these tiny units of life was in 1665 by a British scientist named Robert Hooke. Hooke was one of the earliest scientists to study living things under a microscope.
- In 1574 AD. Leauwenhoek studied the living cell for the first time.
- The cell has specific components called **Cell Organelles**. Every cell organelle performs a specific function.
- Cells are formed essentially from a living substance, the **Protoplasm**. It contains a number of chemical substances. It performs all the biological actions. It is called the **Physical Basis of Life**.
- **1855** Rudolf Ludwig Karl Virchow formulated his famous aphorism 'Omnis cellula-e cellula' which became a part of the foundation of cell theory. (SSC CHSL 2023 Tier-1)

### Sub-Divisions of Biology

|              |                                                                                                                            |
|--------------|----------------------------------------------------------------------------------------------------------------------------|
| Gerontology  | Study and causes of ageing of Humans                                                                                       |
| Pedology     | Study of soil, soil formation, etc.                                                                                        |
| Lithotripsy  | Study of medical procedure to break stones in Kidney, Pancreas, Gall-bladder                                               |
| Agrostology  | Study of Grasses                                                                                                           |
| Biometry     | Study of biology by Mathematical and Statistical methods                                                                   |
| Bionics      | Study and design of engineering system and modern technology by the application of biological and system present in nature |
| Bionomics    | Study of the relations of living beings with environment                                                                   |
| Conchology   | Study of shells of Molluscs                                                                                                |
| Genetics     | Study of genetic characteristics and heredity of living beings                                                             |
| Ethology     | Study of all animals' behaviour including humans'                                                                          |
| Ichthyology  | Study of the science of Fish                                                                                               |
| Palynology   | Study of different types of pollen grains                                                                                  |
| Parasitology | Study of Parasites                                                                                                         |
| Entomology   | Study of Insects                                                                                                           |
| Phrenology   | Study of the functioning and insanity of various parts of the brain, based on tructure of the cranial cavity               |

|              |                                                     |
|--------------|-----------------------------------------------------|
| Sericulture  | Rearing of silkworms for the production of raw silk |
| Pisciculture | Rearing of Fish                                     |
| Malacology   | Study of Mollusca                                   |
| Oncology     | Study of Cancer                                     |
| Teratology   | Study of abnormalities in physiological development |
| Osteology    | Study of Bones                                      |
| Serology     | Study of Blood Serum                                |
| Ornithology  | Study of Birds                                      |

- **Purkinje** coined the name, protoplasm.
- The protoplasm consists of two constituents, the **Cytoplasm** and the **Nucleus** (nucleoplasm).
- A. Cytoplasm:** It surrounds the nucleus and is surrounded by a cell membrane or cell wall itself.
- **Cytokinesis** is the division of the cytoplasm of one eukaryotic cell into two daughter cells. (SSC MTS, 2022)
- B. Nucleus:** It is the specific part of protoplasm located in the cytoplasm. It was discovered by **Robert Brown**.
- About 80% of protoplasm is water.
- 99% of protoplasm contains four substances- Oxygen (76%), Carbon (10.5%), Hydrogen (10%) and Nitrogen (2.5%).
- The ratio of organic and inorganic compounds in protoplasm is 19:81.

### Cell :

- A cell is the smallest functional unit of structure and vital activities of a living being.
- Cells often regenerate themselves spontaneously.

### Difference Between Plant and Animal Cells

| Plant Cell                                                                   | Animal Cell                                                                            |
|------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 1. Cell wall is present.                                                     | 1. Cell wall is absent.                                                                |
| 2. Chloroplast is present.                                                   | 2. Chloroplast is absent.                                                              |
| 3. Centrosome is absent (Centrosome is found in Algae and Fungi only).       | 3. Centrosome is present. It helps in cell division.                                   |
| 4. There is usually a large vacuole in the centre of a fully developed cell. | 4. Vacuole is either absent or very small.                                             |
| 5. In cell division, a plate is formed at the centre of the cell.            | 5. In cell division, cell divides into two parts by invagination of the cell membrane. |

- A Plant cell has a big central **Vacuole** unlike a number of small **vacuoles** in animal cells. (SSC MTS, 2022)



- sporophyte stage is dominant in **Vascular plants** plant group. (SSC CGL, 2023 Tier-1)
- **Cell Theory : Schleiden and Schwann** propounded the cell Theory. Important features of cell theory are as follows:
  1. All organisms consist of one or more cells.
  2. Cells are the basic living units within organisms and all functions or activities occur in cells.
  3. All cells engender from existing living cells.
- Two types of cells are found in living beings–
  1. Prokaryotic Cells
  2. Eukaryotic Cells

### Difference Between Prokaryotic and Eukaryotic Cells

| Prokaryotic Cell                                   | Eukaryotic Cell                                                                                                         |
|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| 1. Cells are often small in size.                  | 1. Cells are often big in size.                                                                                         |
| 2. Incipient Nucleus.                              | 2. Fully developed Nucleus.                                                                                             |
| 3. Nuclear membrane and nucleolus are absent.      | 3. Nuclear membrane and nucleolus present.                                                                              |
| 4. Histone proteins are not associated with DNA.   | 4. Histone proteins are associated with DNA.                                                                            |
| 5. Cell organelles are present without membrane.   | 5. Cell organelles like golgi body, endoplasmic reticulum, chloroplast and mitochondria are present with cell membrane. |
| 6. Cellular respiration occurs in plasma membrane. | 6. Cellular respiration occurs in mitochondria.                                                                         |
| 7. All cells have 70S type of ribosomes.           | 7. All cells have 70S and 80S ribosomes.                                                                                |

- **Theodor Schwann** presented the Classical Cell Hypothesis in 1839. (CRPF Tradesman 2023)

### Prominent Cell Organelles and Other Parts

#### (A) Cell Membrane :

- Cells are surrounded by a thin semi-permeable membrane called the **cell membrane**.
- It maintains the shape of the cell and protects it from external shocks.
- The function of the cell membrane is to determine the substances moving in and out of the cell.
- The synthesis of specific molecular components and their assembly into cellular membranes is called : **Membrane Biogenesis**. (CRPF Tradesman 2023)

### Fluid mosaic model

- Biological membranes are known to exist in different structures and phases, such as bilayers, micelles, hexagonal, and cubic phases.

- However, the most common structure of membranes is described in the fluid mosaic model. This model was put forth by SJ Singer and GL Nicolson in 1972.
- According to this model, membranes are depicted as two-dimensional fluids made up of lipid bilayers that are interspersed with proteins in a mosaic-like fashion.

#### (B) Cell Wall :

- It is the outer covering of the cell membrane.
- It is found only in cells of plants, fungi and bacteria.
- It consists of cellulose in plants.
- The cell wall of bacteria is made of peptidoglycan.
- It is made of chitin in fungi.
- It maintains the shape of cells.

#### (C) Mitochondria :

- **Kolliker** first discovered mitochondria in the striated muscles of organisms.
- **Richard Altman** discovered mitochondria in cells but named them bioplast in 1890.
- **Carl Benda** renamed it as mitochondria for the first time.
- Mitochondria are membrane-bound cell organelles (mitochondrion, singular) that generate most of the chemical energy needed to power the cell's biochemical reactions.
- Mitochondria is the site of respiration within cells.
- It is also called as '**Power House of the Cell**'.
- It is known as a prokaryotic cell within a eukaryotic cell.

✍ **Note :** Besides nucleus and Chloroplast, DNA is found in mitochondria also.

- 70S ribosome is found in mitochondria and chloroplast.
- $F_1$  particles are present in Mitochondria.
- **Mitochondria** convert nutrients into energy. (SSC CHSL 2023 Tier-1)
- **Mitochondria** can make copies of themselves. (SSC CHSL 2023 Tier-1)

#### (D) Endoplasmic Reticulum (ER) :

- **K.R. Porter** discovered it in 1945.
- It is associated with the nuclear membrane on one side and cell wall on the other.
- It is the largest membrane found in the eukaryotic cell.
- There are two types of endoplasmic reticulum: Rough Endoplasmic Reticulum (rough ER) and smooth Endoplasmic Reticulum (smooth ER). Both types are present in plant and animal cells.
  - **Rough Endoplasmic Reticulum** is an extensive organelle composed of greatly convoluted but flattish sealed sacs, contiguous with the nuclear membrane. It is called 'rough' endoplasmic reticulum because it is studded on its outer surface (the surface in contact with the cytosol) with ribosomes.



- **Smooth Endoplasmic Reticulum** is more tubular than rough ER and forms an interconnecting network sub-compartment of ER. It is found fairly evenly distributed throughout the cytoplasm.

- The main function of endoplasmic reticulum is the transportation of constructive fats and proteins for different membranes, like cell membrane, nucleus membrane detoxification and inter cellular transport etc.
- Cytologist **George E Palade** demonstrated the role of the endoplasmic reticulum (ER) in protein processing and sorting in a variety of cells in the 1960s. (SSC CHSL 2023 Tier-1)

#### (E) Ribosomes:

- Ribosomes are a membrane-less small particles with a diameter of 150-250 Å.
- George E. Palade for the first time witnessed dense granular structure of the ribosomes in 1953.
- Ribonucleic Acid (RNA) and ribonucleoprotein are found equal measure in ribosomes.
- It is the site of protein synthesis. It is also known as a **protein factory**.
- A Ribosome is of two types based on the size and sedimentation coefficient- (i) 70S Ribosome and (ii) 80S Ribosome.
- 70S Ribosomes are found in Bacterial cell, Chloroplast and Mitochondria.
- During protein synthesis many ribosomes are assembled on a single m-RNA, at this time they are called Polysome-ergosome or Polyribosome.
- A group of ribosomes attached to mRNA is known as : **polysomes**. (SSC CGL 2022 Tier-1)
- **Equisetum** is the only living representative of Sphenopsida with an underground, creeping and perennial rhizome that gives off aerial and underground branches. (SSC CGL, 2023 Tier-1)

#### (F) Golgi Complex :

- Golgi Complex is also known as the **Golgi Body**.
- It was discovered by **Camillo Golgi** in an animal cell in 1898.
- Golgi complex, functional unit is called Cisternae
- In plants, they are called dictyosomes.
- It is absent in bacteria and blue-green algae.
- It forms the cell wall and lysosome.
- It is called the **Traffic Police of the Cell**, because it sorts-out the proteins and other components including enzymes, of the cell membrane in the same or modified form.
- It is formed by different types of vesicles and microtubule clusters.
- **Golgi apparatus** is known as the cell's post office.

(SSC CHSL 2023 Tier-1)

- **Golgi Apparatus** is a component of the cell organelles that principally performs the function of packaging materials, to be delivered either to the intra-cellular targets or secreted outside the cell. (SSC MTS, 2022)

- In the Golgi apparatus, the maturing face is : **Convex**. (SSC CGL 2022 Tier-1)

#### (G) Lysosome:

- Lysosome was discovered by **Christian Rene de Duve** in 1955.
- Its main function is to devour and digest outer substances.
- It is a pouch-like structure surrounded by a single-layer membrane.
- It contains various types of hydrolytic enzymes.
- The activities of all enzymes present in it are high at acidic pH.
- It is also called **Suicide Bag**.

#### (H) Centrosome:

- Centrosome was discovered by **Edouard Van Beneden** in 1883 and was named in 1888 by **Theodor Boveri**.
- It contains two cylindrical structures called **Centrioles**.
- It is found **only in animal cells**.
- It causes cell division.
- **Centrosome** is the major microtubule-organising centre (MTOC) in eukaryotic cells involved in various cellular processes, including sensory reception, locomotion, and embryogenesis. (SSC CHSL 2021)

#### (I) Plastid:

- Plastid was discovered by **Ernst Haeckel**.
- It is often found in plant cells.
- Three types of plastids are found - (i) Chloroplast, (ii) Chromoplast and (iii) Leucoplast

#### I. Chloroplast:

- Chloroplast contains a green-coloured pigment known as **chlorophyll**.
- Leaves and some parts of plants appear green due to chlorophyll.
- Plant photosynthesize with the help of chlorophyll and make their own food.
- A chloroplast is also known as the **kitchen of the cells**.
- The first-ever terrestrial plants to possess vascular tissues were : **Pteridophyta** (SSC CHSL 2023 Tier-1)
- Most of the Chlorophyceae have one or more storage bodies called **Pyrenoids** located in the chloroplasts. (SSC CGL 2022 Tier-1)

#### II. Chromoplast:

- Chromoplast has many colours like red, yellow, orange, etc. except green.
- It is found in coloured parts of a plant like a flower, pericarp, seeds etc.
- **Phaeoplast** is responsible for the brown colour and **Rhodoplast** for the red colour in algae.

- **Xanthophyll pigment** is responsible for yellow colour.
- The red colour of tomato and chilly is due to **lycopene** in the chloroplast.

### III. Leucoplast:

- Leucoplast is colourless. It is found in that part of a plant which fails to receive sunlight.
- It is mostly found in roots and underground stems.
- It stores starch, oil and protein molecules like edible substances.
- **Elaiooplasts** is a form of leucoplast specialises in oil synthesis and storage and is mainly found in the layer of cells in pollen grains that develop pollen grains.

(SSC CGL, 2023 Tier-1)

- **Elaiooplasts** are leucoplasts that store oil and fat.

(SSC CHSL 2021)

**(J) Nucleus:** Nucleus was discovered by Robert Brown in 1831 AD. It is an important part of the cell. It acts as the controlling centre for the activities of the cell.

- The most important function of Nucleus is to transmit the parental characters of the organisms to the new generation.
- The nucleus is divided into four parts-nuclear membrane, nucleoplasm, nucleolus and chromatin threads.
- The plasma of the nucleus is called **Nucleoplasm** and it is surrounded by a two-layered nuclear membrane.
- The round part located in the middle of the nucleus is called Nucleolus.
- Nucleolus was **discovered by Felice Fontana** and **named by Bowman**.
- Nucleolus contains DNA, RNA and Protein.
- A thread-like structure located in nucleoplasm is called **Chromatin**.
- Chromatin was coined by Flemming.
- Chromatin is a nucleoprotein that is made by a mixture of nucleic acids and basic protein (Histone).
- Notably, Chromosomes are threadlike structures made of protein and a single molecule of DNA that serve to carry the genomic information from cell to cell.
- While occurring about plants and animals (including humans), chromosomes reside in the nucleus of cells.
- Nucleic acid is very complex organic acid.
- Nucleic acid consists of pentose sugar, phosphate and a nitrogenous base.
- It is of two types - (i) Deoxyribonucleic acid (DNA) and (ii) Ribonucleic acid (RNA).

### Cell Division:

- The process by which a cell is divided into two or more parts is called **cell division**.
- The cell that is divided is called **mother cell** and cells formed after division are called **daughter cells**.

- Cell division occurs mainly in three forms- (1) Amitosis, (2) Mitosis, (3) Meiosis

- (1) **Amitosis** : This type of cell division takes place often in bacteria, fungi, some of algae and protozoans.
- (2) **Mitosis** : It occurs in somatic cells. Walther Flemming coined this name.
- (3) **Meiosis** : It occurs only in germ cells. The name 'meiosis' was given by **Farmer and Moore** in 1905.

### Difference Between Mitosis and Meiosis

| Mitosis                                                                                                      | Meiosis                                                                                            |
|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| 1. It occurs in somatic cells and as a result of this division, somatic growth and tissue growth take place. | 1. It occurs in reproductive cells and as a result of this division. Gametes formation take place. |
| 2. It takes less time in division.                                                                           | 2. It takes more time in division.                                                                 |
| 3. Chromosome pairs are not formed in it.                                                                    | 3. It forms chromosome pairs.                                                                      |
| 4. Exchange of genetic materials among chromosomes does not take place in it.                                | 4. Exchange of genetic materials among chromosomes takes place in it.                              |
| 5. Daughter cells have the same number of chromosomes as mother cell.                                        | 5. Daughter cells have half the number of chromosomes as mother cells.                             |
| 6. One mother cell forms two daughter cells.                                                                 | 6. One mother cell forms four daughter cells.                                                      |

- In the 1920s, Alexander Oparin and J. B. S. Haldane independently proposed nearly identical hypotheses for how life originated on Earth. Their hypothesis is now called the Oparin-Haldane hypothesis.
- The Oparin-Haldane hypothesis suggests that life arose gradually from inorganic molecules, with "building blocks" like amino acids forming first and then combining to make complex polymers.
- In the 1920s, **Alexander Oparin** and **J. B. S. Haldane** independently proposed nearly identical hypotheses for how life originated on Earth. Their hypothesis is now called the Oparin-Haldane hypothesis, and the key steps are:
  - Formation of organic molecules, the building blocks of cells (**e.g., amino acids, nucleotides, simple sugars**)
  - Formation of polymers (longer chains) of organic molecules, that can function as enzymes to carry out metabolic reactions, encode hereditary information, and possibly replicate (**e.g., proteins, RNA strands**),
  - Formation of protocells; concentrations of organic molecules and polymers that carry out metabolic reactions within an enclosed system, separated from the environment by a semi-permeable membrane, such as a lipid bilayer membrane.

- Cell analysis technique **Flow cytometry** is used to rapidly analyze single cells or particles as they flow through single or multiple lasers while suspended in a buffered salt-based solution. (SSC CHSL 2023 Tier-1)
- Year **1925** E Gorter and F Grendel made a breakthrough by examining the surface area of lipids and concluded that the lipid surface surrounding cells must be of two layers. (SSC CGL, 2023 Tier-1)
- In a plant, **Pectin** is present in the middle lamella, primary cell and secondary walls and accumulates in the initial stages of development during cell expansion. (SSC CGL, 2023 Tier-1)

### 3. Organic Evolution

- It appears that life first emerged at least 4 billion years ago after the Earth was formed almost 4.6 billion years ago.
- Various theories/hypothesis have been presented by many scientists regarding to the origin of life on earth. in which "Chemical evolution as a result of origin of life" is the most modern one.
- A detailed and well-known hypothesis related to this was given by the Russian biochemist **A.I. Oparin** presented '**Materialistic Theory**', which appeared in his book '**Origin of life**'.
- Basis hypothesis of Evolution - "Descent with change or modification" means the process of continuous change of primary, simple and micro-organisms into a complex and developed one is called **organic evolution**.
- Organic evolution is the theory, according to that more recent types of plants and animals have their origins in other pre-existing forms and the distinguishable differences between ancestors and descendants are due to modification in successive generations.
- Lamarck, Darwin, Hugo de Vries and others propounded their theories in the context of organic evolution and imperial evidence was given by them to prove their assumptions are as follows–
  1. Evidence from Taxonomy
  2. Evidence from Comparative Structure
  3. Evidence from common Descent
  4. Evidence from Comparative Embryology
  5. Evidence from Comparative Physiology
  6. Evidence from Genetics
  7. Evidence from Geographical Distribution
  8. Evidence from Analogy
  9. Evidence from Connective Organisms
  10. Evidence from Fossils
- **Homologous Organs:** Organs of different animals which have similar basic structures but different functions. For example- hands of human beings, wings of bats and

birds, fins of whales and seals and forearms of tetrapod vertebrates. These are similar in fundamental structure and organic growth but have different basic functions. Human hands are used to hold objects, havel and seal flipper to swim and the forearms of quadrupedal vertebrates to run.

- **Analogous Organs:** Analogous organs have a different basic structure and organic growth but perform the same function. Example - wings of the butterflies, bats and birds; wings of Draco (gliding lizard) birds and insects, stings of bees and scorpions.
- **Vestigial Organs:** Vestigial organs are such organs, where tissues or cells are no more functional the way they were in their initial form. Such structures can be formed due to changes in environmental conditions, gene mutation. Example- plica semilunaris of the human eyes, ear pinna, skin hairs, vermiform appendix, coccyx (tailbone), etc.

✎ **Note :** More than 100 vestigial organs are found in the human body.

- **Palaeontology:** Study of plant and animal fossils including those of microscopic size, preserved on rocks and surface of the earth is called Palaeontology.
- **Connecting Links or Intergrading Species:** An organism or species having characteristics of two different groups of organisms is known as Connecting Links or Intergrading Species. Example- Euglena is connecting link between plant and animal, archaeopteryx is connecting link between birds and reptiles. Prototheria is connecting link between reptiles and mammals. Neopilina is connecting link between Annelida and Mollusca. Peripatus is connecting link between phylum Annelida and Arthropoda.

✎ **Note :** Virus is the link between living and non-living organisms.

#### Theory of Organic Evolution

- Some important theories of organic evolution propounded by various biologists are as follows :
- **Lamarckism:** First-ever logical theory on organic evolution was presented by the French biologist Jean-Baptiste Lamarck in his book '**Philosophie Zoologique**' published in 1809. This theory is called Lamarckism or the theory of Inheritance of Acquired Characteristics.
  1. There is a natural tendency in an animal's body and its organs to grow continuously.
  2. Environmental conditions affect these animals directly, so it becomes necessary to use some organs more frequently and some less frequently.
  3. Organs that are highly used and developed and the organs used occasionally remain underdeveloped. Therefore,

Lamarckism is also called the "principle of use and disuse of organs".

4. In this way, any change in the animal's body is called **Acquired Characteristics**. They are hereditary, as a result of which a new class of species are formed, for example, the long neck of a giraffe, extinct legs of a snake.

- **Darwinism**: The second principle on organic evolution is known as Darwinism. Charles Darwin had the opportunity to work as a natural-scientist on a world survey ship named **HMS Beagle** in 1831. Before the trip, he believed in specific creationism but during the journey, he started to believe in the concept of organic evolution, as a result of that he propounded Darwinism. Darwinism is also called '**Theory of Natural Selection**'. The detailed explanation of Darwinism was published in his book '**On the Origin of Species**' in 1859. Darwinism is based on the following facts—

1. Abundant capacity of reproduction in animals
2. Struggle for existence
3. Variation and their inheritance
4. Survival of the fittest or Natural Selection

- **Neo-Darwinism**: After Darwinism, neo-Darwinism emerged through the incorporation of Mendel's Genetic Principles and Darwin's theories by evolutionary scientists.
- According to this theory, various factors affect species as mutation, nature, diversity and reproduction, and due to these effects, new species of organisms are formed.
- **Mutation Theory**: Hugo De Vries propounded the Theory of mutation. According to this theory :

1. The creation of new species does not occur as a result of accumulation and gradual development from generation to generation by natural selection of small and unstable variations in characteristics, but it appears as a result of sudden and occasional permanent changes.
  2. The first member of the species thus produced, which show the sign of mutation are called **Mutant** and it is a pure breed for mutated traits.
  3. Mutations are often uncertain. Mutation can occur in a specific organ or various organs. These mutants may be beneficial, useless or harmful.
  4. All organisms have a natural quality of mutation.
  5. Different types of mutations can occur in different members of any species. Therefore a new similar species may originate from a parent or ancestral species at the same time.
- Danish Botanist Johannsen (1905) supported the **Mutation Theory** by experimenting on garden bean plants like De Breeze.

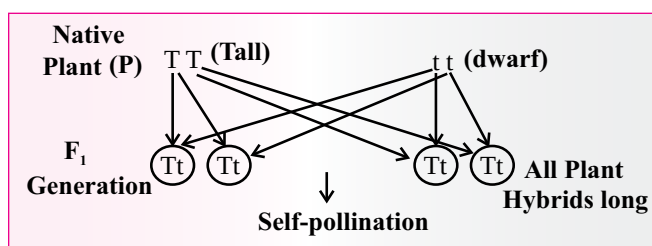
- **Modern Synthetic Theory of Evolution** - Neo-Darwinism emerged as the "modern synthetic theory of evolution".
- This Theory originated from the book 'Genetics and the Origin of Species' by **Dobzhansky** (1937) and was named by **Julian Huxley** (1942).
- In Modern Synthetic Theory, the mechanism of biological evolution has been explained in terms of genetics of population of species.

## 4. Genetics

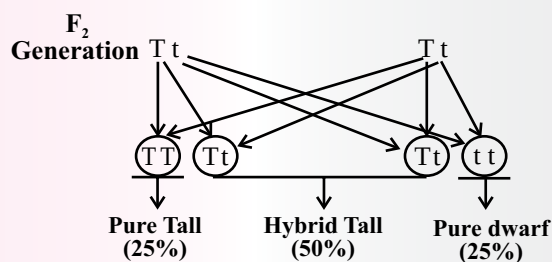
- The process of transmission of genetic traits from one generation to another is called heredity. It is a major factor responsible for variations in the characteristics of individuals.
- A Catholic priest in Brunn, the city of Austria Gregor Johann Mendel is credited with the theory of modern genetics by formulating the basic rules of modern inheritance in 1865.
- Gregor Johann Mendel is called the **father of genetics**.
- Mendel chose the garden pea '**Pisum Sativum**' for his hybridization experiments.
- He selected the following seven lineage traditional genetic traits, with comparative variations or contrasting expressions of peas for these experiments—

| S. No. | Characters/Traits       | Strong Contracting Expression | Stagnant Expression         |
|--------|-------------------------|-------------------------------|-----------------------------|
| 1.     | Colour of flowers       | Purple                        | White                       |
| 2.     | Position of flowers     | Axillary                      | Terminal                    |
| 3.     | Length of stem          | Tall                          | Dwarf                       |
| 4.     | Colour of unripened pod | Green                         | Yellow                      |
| 5.     | Shape of Ripened pod    | Inflated                      | (Constricted between seeds) |
| 6.     | Shape of Seed           | Round                         | Wrinkled                    |
| 7.     | Colour of Cotyledons    | Yellow                        | Green                       |

- Mendel first studied the inheritance of one pair of contrasting characters (mono-hybrid cross) and later on the inheritance of two pairs of contrasting characters (dihybrid cross).
- **Monohybrid Cross**: Mendel made a cross between tall (TT) and dwarf (tt) plants for monohybrid cross, with following results-

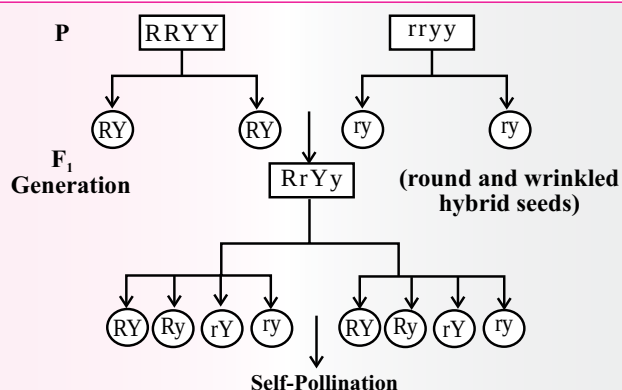






**Conclusion :** Phenotype ratio F<sub>2</sub> generation plants = 3 : 1  
Genotype ratio F<sub>2</sub> generation plants = 1 : 2 : 1

- Tall plant of the pea is dominant and dwarf plant of pea is recessive character.
- **Dihybrid Cross:** Mendel made a cross between the plants produced from round and yellow seeds (RRYY) and green and wrinkled seeds (rryy) for dihybrid cross which gave the following results :



|    | RY                              | Ry                              | rY                                 | ry                                 |
|----|---------------------------------|---------------------------------|------------------------------------|------------------------------------|
| RY | RRYY<br>Pure Round and yellow   | RRYy<br>Impure round and yellow | RrYY<br>Impure round and yellow    | RrYy<br>Impure round and yellow    |
| Ry | RRYy<br>Impure Round and yellow | RRyy<br>Pure round and green    | RrYy<br>Impure round and yellow    | Rryy<br>Impure round and green     |
| rY | RrYY<br>Impure round and yellow | RrYy<br>Impure round and yellow | rrYY<br>Pure wrinkled and yellow   | rrYy<br>Impure wrinkled and yellow |
| ry | RrYy<br>Impure Round and yellow | Rryy<br>Impure round and green  | rrYy<br>Impure wrinkled and yellow | rryy<br>Pure wrinkled and green    |

**Conclusion :** Phenotype ratio of F<sub>2</sub> generation plants = 9 : 3 : 3 : 1  
Genotype ratio of F<sub>2</sub> generation plants = 1 : 2 : 1 : 2 : 4 : 2 : 1 : 2 : 1

- Mendel proposed some heredity rules based on his experiments are known as **Mendel's Law of Inheritance**.
- Mendel's Law:**
- Mendel proposed the following laws of inheritance based on monohybrid and dihybrid cross –

- **Law of Dominance:** According to this rule, hybridization in plants with a pair of contrasting traits reveals dominant traits in first generation while recessive traits are hidden. These recessive traits appear in the second generation.
- **Law of Segregation:** Variations of Genetic Trait, i.e. factors of comparative forms remain unchanged even when they remain together for a long time which results in the factors going into gamete remaining pure. It is called the law of purity of gametes. It is a universally accepted law of inheritance.

- **Law of Independent Assortment:** When hybridization is made between plants with two different traits, the segregation of both traits is independent and the inheritance of one trait does not affect the other.

#### Human Genetics:

- **William Bateson** first used the term '**Genetics**' in 1905.
- **Johanssen** first used the term '**Gene**'.
- **Waldeyer** coined the term '**Chromosome**' in 1888.
- Chromosomes are thread-like structures found in cells of all organisms.
- Chromosomes determine and transmit all genetic properties. Each living being has a definite number of chromosomes.
- **Genome:** A complete set of DNA of an organism including all of its genes is called Genome.
- **Karyotype:** Complete morphology of a set of chromosomes is called Karyotype.
- **Idiogram:** Idiogram is the diagrammatic representation of Karyotype showing all the morphological features of a set of chromosomes.
- **Phenotype:** Observable physical properties of an organism are called Phenotypes.
- **Genotype:** Genotype is the genetic constitution of an organism. It is a complete set of inherited genes that can be passed from parents down to generations.
- **Allele:** An allele is a variant of a gene. Allele is any one of two or more genes that may occur alternatively at a given site (locus) on a chromosome. It may occur in pairs or there may be multiple alleles.
- **S. Benzer:** first called the unit of function of a gene as **Cistron**, a unit of mutation as Muton and a unit of recombination as **Recon**.
- **Arthur Kornberg** discovered an enzyme named DNA polymerase, which helps in DNA synthesis.
- **James D. Watson** and **Francis H.C. Crick** proposed a three-dimensional model of **a double helix of DNA** molecule in 1953.
- The stability of DNA helix is mainly due to hydrogen bonds.
- DNA is the genetic material in cells.
- **Friedrich Miescher** discovered DNA in 1869. He called it '**Nuclein**'.



- DNA contains Five carbon sugar 'deoxyribose'.
- DNA molecules contain nitrogenous bases called Adenine, Guanine, Cytosine and Thymine.
- DNA conducts all genetic processes.
- DNA regulates protein synthesis.
- The fundamental physical and functional unit of genetics is a gene.
- Genes are constituted by DNA.
- **RNA:** Full form of RNA is Ribonucleic Acid. The synthesis of RNA from DNA is called **Transcription**.
- The five-carbon sugars in the RNA molecules are ribose instead of deoxyribose.
- RNA contains nitrogenous base **uracil** instead of **thymine**.
- A molecule of RNA is of three types – rRNA, mRNA and tRNA.
- 1. **r-RNA (Ribosomal RNA):** These molecules are components of ribosomes that help in protein synthesis.
- 2. **m-RNA (Messenger RNA):** It helps in the selection of amino acids outside the nucleus by receiving different orders.
- 3. **t-RNA (Transfer RNA):** It brings various types of amino acids to be collected at the ribosome for protein synthesis where the protein is produced.
- Human species has a total of 23 pairs or a total of 46 chromosomes.

#### Main differences between DNA and RNA

| DNA                                                      | RNA                                          |
|----------------------------------------------------------|----------------------------------------------|
| 1. It contains deoxyribose sugar.                        | 1. It contains ribose sugar.                 |
| 2. Its bases are adenine, guanine, cytosine and thymine. | 2. It has a uracil base of thymine.          |
| 3. It is mainly present in nucleus.                      | 3. It is found in the nucleus and cytoplasm. |

- 22 pairs of chromosomes are homologous in females and males. They are called **Autosomes**.
- One pair (23<sup>rd</sup>) of a chromosome is not homologous in males and females. It is called **Heterosomes** or **Allosomes**.
- 23<sup>rd</sup> pair of chromosomes in females is XX and the entire set of chromosomes are represented as **44A+XX**.
- 23<sup>rd</sup> pair of chromosomes in males is XY and the entire set of chromosomes are represented as **44A + XY**.
- G1 - First gap phase, the cell grows physically larger
- S - Cell synthesises a complete copy of the DNA
- G2 - Cell begins to recognise its contents in preparation for mitosis
- M - The Cell divides its copied DNA and cytoplasm to make two new cells.

(SSC CGL 2022 Tier-1)

- In **1956** an American cytogeneticist, named Joe Hin Tjio published a research finding that defined  $2n = 46$  as the exact number of human chromosomes.

(SSC CGL, 2023 Tier-1)

#### Genetic Engineering and Biotechnology

- Scientists can modify the DNA of bacteria, plants and animals to add genetic information (and the associated characteristics) from a different organism. This process has previously been called genetic engineering but more recently is referred to as recombinant DNA technology or genetic modification.
- Genetic engineering is accomplished in three basic steps. These are- (1) The isolation of DNA fragments from a donor organism; (2) The insertion of an isolated donor DNA fragment into a vector genome and (3) The growth of a recombinant vector in an appropriate host.
- Reproduction by somatic parts of plants such as root, stem and leaf is called vegetative propagation.
- Offsprings produced by vegetative propagation are similar to the parental one.
- In species of Eudorina, the fusion of two different sized gametes is called **Anisogamous**.
- Clone of sheep Dolly was the first clone of a mammal in the world.
- It was produced on **5 July, 1996** at the Roslin Institute in Scotland by the efforts of Ian Wilmut, Keith Campbell and their colleagues.
- It was developed by the traditional **cloning technique**.
- The world's first female cloned camel was developed in **2009** at the Camel Breeding Centre in Dubai.
- This clone was named '**Injaz**'.
- **Triticale** is a hybrid of wheat (**Triticum**) and rye (**Secale**) first bred in laboratories during the late **19<sup>th</sup> century** in Scotland and Sweden.
- Samrupa is the world's first cloned buffalo calf. Samrupa was born in February 2009.
- However, Sampura was infected with a lung infection after within 7 days of its birth and died.
- Subsequently, the second cloned calf "**GARIMA**" was born on 6th June, 2009 with the birth weight of 43 kg.
- Two monkeys have been cloned using the technique that produced Dolly the sheep. Identical long-tailed macaques Zhong Zhong and Hua Hua were born several weeks ago at a laboratory in China.
- **Stem cells** have the ability to develop any part of the body as a cell. That means stem cell is an immature cell that has the ability to grow and gain speciality of a mature cell.
- Based on their source, stem cell can be classified into embryo, adult and cord-blood.
- Stem cells are mostly derived from embryos.

- The Umbilical cord, blood, teeth, bone marrow, etc. are the uncontroversial sources of stem cells.
- Stem cells help to treat corneal transplant, damaged muscles due to cardiac attacks and many other diseases.
- Insect-resistant transgenic cotton is produced by genetic engineering by inserting a gene.
- It is prepared by *Bacillus Thuringiensis*.
- It is also called Bt cotton.

### Genetic Diseases and Affected Organs

| Disease                         | Impact                                                                  | Carrier |
|---------------------------------|-------------------------------------------------------------------------|---------|
| Colour-blindness                | Red and green colour cannot be recognized                               | Women   |
| Haemophilia                     | Blood clotting does not occur                                           | Women   |
| Turner Syndrome (mainly female) | Infertility (women)                                                     | —       |
| Klinefelter Syndrome            | Infertility (men)                                                       | —       |
| Down Syndrome (mainly child)    | Feeble minded, slanting eyes, protruding tongue, unusual body structure | —       |

- Golden rice is an achievement of biotechnology.
- Prof. Ingo Potrikus and Dr Peter Beyer were the **Father of golden rice**.
- It contains beta carotene forming gene which converts into vitamin 'A' when it reaches human body.
- **Amniocentesis** is a pre-delivery examination conducted on a pregnant woman.
- In this process, a small amount of **amniotic fluid** from the amniotic sac surrounding a developing fetus is sampled and analyzed.
- Various types of birth defects such as down syndrome, chromosomal abnormality. **Sex determination** can be examined through it.
- **DNA fingerprinting technology** is used in establishing the paternity of a child, identification of genetic diseases, establishing the pedigree of animals.
- This technique was invented in year 1984 AD by Sir Alec Jeffreys.
- Indian Scientist Dr. Lalji Singh is called the **Father of Indian DNA fingerprinting Technology**.
- **Hair, Saliva, Blood Cells, Bone Cells, Dry Semen**, of the accused are sufficient evidence for its analysis.
- Spreading of cancer cells from one organ to another nearest organ of a body is called Metastasis.
- "A procedure that involves the transplantation, implantation or infusion into a human recipient of either (a) live cells, tissues, or organs from a nonhuman animal source, or (b) human body fluids, cells, tissues or organs that have had

ex vivo contact with live non-human animal cells, tissues or organs" is called what **Xenotransplantation**.

(SSC Head constable Ministerial)

### Important Animals and Their Conception Period

| Animal     | Conception Period (Near about in days) |
|------------|----------------------------------------|
| Human      | 270                                    |
| Cow        | 280                                    |
| Buffalo    | 310                                    |
| Elephant   | 620                                    |
| Goat       | 150                                    |
| Sheep      | 150                                    |
| Pig        | 115                                    |
| Dog        | 61                                     |
| Rabbit     | 31                                     |
| Horse      | 340                                    |
| Mouse      | 21                                     |
| Lion       | 110                                    |
| Blue Whale | 360                                    |

- **Clone means Model.**
- Creation of the same form and breed without tempering with genes occurs in cloning.
- They are produced asexually, often identical to their Parent.
- The process of generating a genetically identical copy of a cell or an organism is called **cloning**.
- **While genes are transferred and replicated in transgenic.**
- **Human Genome Project** : The 'Human Genome Project' was a landmark global scientific effort whose signature goal was to generate the first sequence of the human genome.
- Scientists under the Human Genome Project have estimated that the human genome contains about **30,000 genes**.
- This will help humans to get rid of serious **genetic diseases** and **premature deaths**.
- The transformation of the larva into an adult through drastic change is called **Metamorphosis**. (SSC MTS, 2022)
- **Obelia** is an organism that exhibits metagenesis.

(SSC CGL, 2023 Tier-1)

## C1 Botany

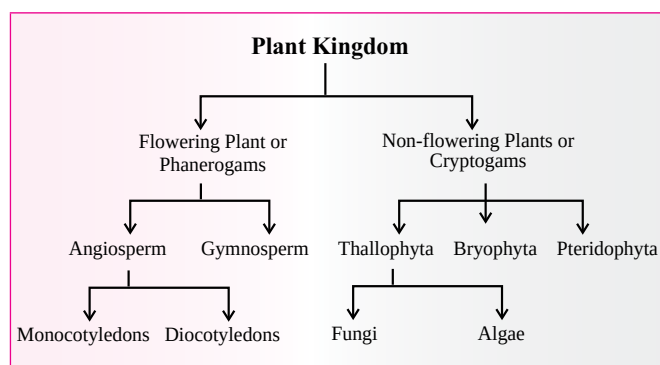
### 5. Plant

- Study of different types of plants and their activity is called Botany.
- **Theophrastus** is known as the father of botany.
- Plants differ from animals in following ways—
- 1. Each plant cell is surrounded by a dead wall that is called cell wall, while animals do not have a cell wall.

- Plants prepare food by photosynthesis in the presence of chlorophyll, so plants are called **Autotrophs**. Animals depend on plants for food, so animals are called **Heterotrophs**. Chlorophyll is absent in animals.
- Growth in plants occurs through special cells that are located in particular positions. The division of apical meristem at the apex of the roots and stems and the intercalary meristem leads to the increase in height while the lateral meristem makes the stem of the plant thicker. Growth in animals occur not at particular parts but all over the body.
- Plants continue growing and forming new parts throughout life and keep generating branches while in animals, the growth of the body continues only up to a certain age.
- Fully developed plant cells often have a large vacuole but animal cells do not have anything like that.

### Classification of Plants:

- Plant Taxonomy includes the identification of plants found on earth and their classification on the basis of similarities.
- According to the old method, a scientist named **Eichler** classified the plant kingdom in following way–



### Cryptogams:

- Cryptogams are plants that are without flowers and seeds. Thallophyta, Bryophyta and Pteridophyta fall in this category cryptogams.
- Thallophyta is the **largest group of plant kingdoms**. These are simple and primitive plants. In these, the plant body is in the form of Thallus, that is, the plant is **not divided into root, stem and leaf**. Embryo and vascular tissues are also not found in them. It includes **algae and fungi**.
- Pteridophyta** are cryptogam. (SSC CHSL 2023 Tier-1)

### Algae:

- Study of Algae is called **Algology or Phycology**.
- Algae are often Autotrophic containing chlorophyll and without vascular tissues.
- In algae, an embryo is not formed after reproduction.
- The member of the **Rhodophyceae** are commonly called red algae. (SSC MTS, 2022)
- The **Phaeophyceae** class of algae is widely known as brown algae. (SSC MTS, 2022)

- Chlorophyceae** class of algae is widely known as green algae. (SSC MTS, 2022)
- Eudorina** is an algae that undergoes anisogamous fusion of gametes. (Selection Post Phase XI)
- Ulothrix** algae are gametes flagellated and similar in size. (SSC Stenographer 2022)
- Gracilaria** algae produces agar. (SSC CHSL 2021)

### Beneficial Algae:

- Algae that are used as food** : Laminaria, Porphyra, Ulva, Sargassum, Alaria, etc. are the algae that are used as food.
- Use of algae in manufacturing of medicine** : Antibiotic medicine chlorella is produced from chlorella that protects us from bacteria.
- Use of algae as fertilizers in agriculture**: Some Sea algae are used as fertilizers. Nostoc and Anabaena cause nitrogen fixation.
- Algae used in the production of Iodine**: Brown algae named laminaria contains iodine.
- Use in Research**: Chlorella, Acetabularia, Valonia algae are used in research. Modern knowledge of the process of the photosynthesis is based on experiment and research conducted on chlorella.
- Agar**: Agar substance is obtained from red algae-Gelidium, Gracilaria, are used to produce jelly and ice-cream.
- Golgi apparatus** is known as the cell's post office. (SSC CHSL 2023 Tier-1)
- Food is stored in brown algae in the form of a complex carbohydrates that may be in the form of laminarin or mannitol. (SSC CHSL 2021)

### Harmful Algae:

- Microcystis, Chroococcus, Oscillatoria, Anabaena, and other algae cause 'Water Blooms' in the water reservoir emitting smell. This process causes water to degrade and kills fish besides water becomes unsuitable for drinking.
- Algae named Celphaleurous is the cause of red rust in tea. Sometimes it causes extensive damage to the tea crop.

### Diseases in Plants Due to Lack of Elements

| Disease                                    | Elements   |
|--------------------------------------------|------------|
| Heart rot of sugar beets                   | Boron      |
| Internal cork of Apple                     | Boron      |
| Dieback disease of Citrus                  | Copper     |
| Whiptail disease of Cabbage                | Molybdenum |
| Little leaf disease of Citrus              | Zinc       |
| Khaira disease of Paddy Rice               | Zinc       |
| Browning disease of Cauliflower            | Boron      |
| Reclamation disease in cereals and legumes | Copper     |

### Some Important Facts Related to Botany

|                                                    |                               |
|----------------------------------------------------|-------------------------------|
| Tallest angiosperm plant in the world              | Eucalyptus                    |
| Tallest tree in the world                          | Sequoia (Gymnosperm)          |
| Smallest (shape) angiosperm plant                  | Wolffia Globosa               |
| Plant having the largest leaf                      | Victoria                      |
| Biggest seed                                       | Lodoicea                      |
| Largest flower                                     | Rafflesia Arnoldii            |
| Biggest antherozoid                                | Cycas                         |
| Biggest ovule                                      | Cycas                         |
| Smallest seed                                      | Orchid                        |
| Smallest cell                                      | Mycoplasma                    |
| Angiosperm plant having minimum chromosome numbers | Haplopappus Gracilis (2n = 4) |
| Angiosperm plant having maximum chromosome numbers | Ophioglossum (2n = 1266)      |
| Smallest gymnosperm                                | Zamia Pygmaea                 |
| Smallest pteridophyte                              | Azolla                        |
| Smallest bryophyte                                 | Zoopsis                       |
| Largest bryophyte                                  | Dawsonia                      |
| Coffee producing plant                             | Coffea arabica                |
| Opium producing plant                              | Papaver Somniferum            |

#### Virus:

- Viruses are acellular microscopic organisms that replicate inside the living cells.
- **Ivanovsky** discovered the virus in **1892**.
- Its nature is both living and non-living, that is why it is called a connecting link between living and non-living.
- A virus can be made as a crystal and kept for a long period of time as non-living matter.
- Significantly, viruses are non-cellular organisms that are characterized by having an inert crystalline structure outside the living cell.
- Viruses are an obligate parasites. Once they infect a cell, they take over the mechanism of the host cell to replicate themselves, killing the host.
- Viruses can be classified into three types based on the host range-
  1. Animal Viruses- Animal virus infect the cells of animals, including humans. The prominent examples of animal viruses are influenza, mumps, etc. These viruses consist of genetic material usually DNA or sometimes RNA.
  2. Plant Viruses - These viruses infect plants by invading the plant cells the genetic material in these viruses is usually RNA or rarely DNA.

3. Bacteriophage - The virus which infects bacterial cells is known as bacteriophage.

✖ **Note :** The term 'retrovirus' means it behaves backwards from the original way that we all think about genetics which is that 'DNA makes RNA' and RNA makes protein. Reverse transcriptase is an enzyme found in retrovirus.

#### Fungi :

- The word fungi is derived from the Latin word fungus, which literally means Mushroom.
- Mycology is the branch of biology concerned with the study of fungi.
- Fungi are often found everywhere. These are achlorophyllous, eukaryotic, vascular tissueless thallophytes.
- They are found on other plants in parasitic or symbiotic form or on rotten substances in parasitic form.
- Fungi are never autotrophic, usually they are heterophytes.
- Their cell wall consists of chitin or cellulose.
- Food stored in fungi remains in the form of glycogen or drops of oil.

#### Benefits of fungi:

1. Fungi increase soil fertility by decomposing rotten substances.
2. Many fungi like mushrooms etc. are edible.
3. A variety of antibiotics are obtained from fungi such as Penicillium Notatum and Penicillium Chrysogenum, which yield antibiotics called **Penicillin**.
4. Yeast and some fungi are used in bakeries and distilleries to prepare wine by fermentation.
5. Lysergic Acid Diethyl Amide (LSD) is a hallucinogenic substance, made from a fungus 'Claviceps'.
6. Plant hormone called Gibberellin, necessary for increasing plant length, is produced from a fungus called '**Fusarium Moniliforme**'.
7. Neurospora, Yeast, Ascobolus, and other fungi have long been used in genetics, cytology and metabolic discoveries.

#### Major Diseases caused by Fungi in Plants

| Disease                    | Fungi                    |
|----------------------------|--------------------------|
| Late blight of Potato      | Phytophthora infestans   |
| Wart disease of Potato     | Synchytrium endobioticum |
| Early blight of Potato     | Alternaria Solani        |
| White rust of Crucifer     | Albugo Candida           |
| Loose smut of wheat        | Ustilago Triticis        |
| Red rot of Sugarcane       | Colletotrichum Falcatum  |
| Tikka disease of Groundnut | Cercospora Personata     |
| Wilt of Arhar              | Fusarium Udim            |
| Loose smut of Barley       | Ustilago Nuda            |

- Some species of aspergillus cause a disease called aspergillosis in the lungs of humans.
- Fungi such as Rhizopus, Mucor, Aspergillus, etc. destroy food products.
- Aspergillus Flavus and Aspergillus Parasiticum produce a toxic substance called aflatoxin, which is generally harmful to pets.

#### Lichens:

- A lichen is not a single organism; it is a stable symbiotic association between a fungus and algae.
- The algae component in lichen produces carbohydrates through photosynthesis which is used as food by both algae and fungi. Instead of food, fungi release water and minerals to the hanging algae.
- Morphologically, there are mainly three types of lichens (I) Crustose (II) Foliose and (III) Fruticose.
- The fungal partner is involved in sexual reproduction with the help of reproductive structures called apothecia.
- Lichens such as Lichenora, Parmelia, Umbilicaria etc. are used as food in different parts of the world.
- Use of Parmelia Sexatilis is beneficial for the treatment of epilepsy.
- Erythrin obtained from Rocella Montagnei is used to cure Angina.

#### Bacteria:

- The branch of science that deals with the study of bacteria, is called Bacteriology.
- Bacteria are the simplest microbial and unicellular proto organisms.
- These are ubiquitous and found in water, land or air and also in living and non-living plants and animals.
- Antonie Van Leeuwenhoek, a resident of Holland, first discovered it in 1683. He is called the father of bacteriology.
- Ehrenberg coined the term 'Bacteria' in 1829.
- **Robert Koch** discovered bacteria of cholera and tuberculosis.
- **Louis Pasteur** discovered rabies vaccines, pasteurization and fermentation. Plasmids are the genetic material found in bacteria other than chromosomes.
- Bacterias, depending on their different shapes, can be classified into the following.

(I) **Spherical or Coccus:** These bacterias are spherical, such as Micrococcus, Diplococcus Pneumoniae.

(II) **Rod-shaped or Bacillus:** These are rod-shaped, tubular or cylindrical. Such as Lactobacillus.

(III) **Comma shaped or Vibrio:** These are bacteria with a comma (,) like structure, such as Vibrio Coliery, etc.

(IV) **Spiral or Spirilli:** These are coiled or spring shaped, such as Spirillum Rubrum.

- Often plants absorb nitrogen in the form of nitrates. The conversion of nitrogen into nitrates, that is, nitrogen fixation occurs through bacteria. These bacterias as exist on Earth as independent or in symbiotic relationship. Bacterias such as Azotobacter and Clostridium are found as separately-living on Earth. These stabilize the nitrogen of air between the soil particles.
- Some Cyanobacteria such as Anabaena, Nostoc also fix atmospheric nitrogen (N).
- Species of bacteria like Rhizobium and Bradyrhizobium live in symbiotic relationship in the roots of Leguminosae (pea family) plant and fix atmospheric nitrogen.
- Frankia and Aerorhizobium are other examples of bacteria fixing nitrogen symbiotically.
- Nitrosococcus and Nitrosomonas convert Ammonia into Nitrite, while Nitrobacter converts Nitrite to Nitrate. These are called Nitrifying Bacteria.
- To pressure milk for a long time, it can be pasteurized in the following ways –  
(I) Heat the milk at 62.8 °C (145 °F) for 30 minutes, Or  
(II) Heat the milk at 71.7 °C (161 °F) for 15 minutes or  
(III) Heat the milk at 88.3 °C (191 °F) for 1 minute.
- Curing is done by the fermentation process of the tea leaves by Micrococcus candidans, giving a special flavour to the tea leaves.
- Bacteria are also used in tanning and fibre rating.
- Streptococcus Lactis and Lactobacillus Lactis are used to make dairy products.
- The major bacteria and their antibiotics are as follows:

| Antibiotic    | Bacteria                |
|---------------|-------------------------|
| Streptomycin  | Streptomyces Griseus    |
| Chloromycetin | Streptomyces Venezuelae |
| Terramycin    | Streptomyces Rimosus    |

- The main diseases caused by bacteria in plants are:

| Bacteria                  | Disease              |
|---------------------------|----------------------|
| Pseudomonas Solanacearum  | Potato Wilt          |
| Agrobacterium Tumifaciens | Crown Gall           |
| Xanthomonas Campestris    | Black Rot of Cabbage |
| Xanthomonas Citri         | Citrus Canker        |

- Glycocalyx is called the slime layer when it is like a loose sheath in the cell envelope of bacteria. (SSC CGL, 2023 Tier-1)
- **Lactobacillus Acidophilus** is type of bacteria used in the manufacture of fermented dairy, sourdough, meat and vegetable food. (CRPF Tradesman 2023)

#### Bryophyta:

- Bryophyta is the simplest and primitive group of an embryo-forming plant (Embryophyta).



- The Bryophyta is also called the Amphibia class of the Plant Kingdom.
- There is a complete lack of vascular tissue (xylem and phloem) in Bryophyta class plants.
- Plants of Bryophyta are more developed than Thalophyta are.
- The main plant of Bryophyta is gametophyte.
- Professor **S.R. Kashyap** is called the Father of Indian Bryology.
- Due to high water absorption in Sphagnum, a plant of Bryophyta is used in wrapping and shipping other living plants from one place to another.
- Sphagnum is also used to clean wounds and in dressing.
- Sphagnum is also used as fuel.
- Bryophytes grow in dense form, it binds the soil and thus prevents erosion of soil caused by rainwater.
- **Marchantia** is not an example of thallophyta.

(SSC MTS, 2022)

- **Marchantia** is a common type of Bryophyta.

(SSC CHSL 2022 Tier-1)

### Pteridophyta:

- Pteridophytes are vascular cryptogams, i.e., plants of this group lack flowers but possess vascular tissue.
- Plants of this group are often terrestrial, which grow in moist and shady places. Some of its species are aquatic, such as Salvinia, Azolla etc.
- Except for a few woody ferns, most of the pteridophytes are herbaceous.
- Pteridophytes are also called botanical snake.
- Vascular tissues in this group of plants are fully developed but Xylem lacks Vessels and Phloem lacks companion cells.
- Pteridophyta group includes the most primitive living and fossil vascular plants.
- The main plant of this group is the sporophyte, which often has roots, stems and leaves.
- The Azolla is used as fertilizer. Application of it in rice paddy fields by rice farmers increases the productivity of rice by more than 50% thereby it is used as a nitrogen-rich biofertilizer and weed suppressant.
- **Chlamydomonas** is a type of haploid unicellular eukaryote cell that has a diameter of  $\sim 10 \mu\text{m}$ , and about half of its volume is occupied by cup-shaped chloroplasts.

(SSC CHSL 2023 Tier-1)

- Ferns, horsetails and lycophytes belong to **Pteridophyta** groups.

(SSC CGL, 2023 Tier-1)

### Flowering Plant:

- Phanerogams or flowering plants include plant groups, which have flowers and seeds.

### Gymnosperm:

- It is a group that falls between the categories of Pteridophytes and angiosperms.

- This group consists of plants in which seeds are formed, but they remain without cover. The ovules or seeds developing out of them are not embedded in any shell, wall or fruit.
- They lack an ovary.
- Plants of this group are usually perennial and wood like.
- Gymnosperms are xerophytes in nature.
- The world's tallest plant, Sequoia Sempervirens which is found in Redwood Park, California, belongs to this group.
- Zamia pigmaea is the smallest gymnosperm.
- Cycas, Ginkgo biloba and Metasequoia are called living fossils because these plants are found in small numbers and their fossils are also found.
- Ginkgo biloba is also known as Maidenhair tree.
- The ovules and antherozoids of the cycas are the largest in the entire plant world.
- All gymnosperms are wind-pollinated (Anemophilous).
- In these, embryos develop before fertilization. There is no double fertilization and triple fusion, so the embryos are haploid.
- Polyembryony is a significant characteristic of this group. More than one embryo develops in each gametophyte.

### Economic Importance of Gymnosperm:

- Woods of Pine, Sequoia, Juniperus, Cedar, etc. are used to make furniture.
- Cycas is also called Sago palm. Sago is obtained from it.
- Match sticks are made from pine wood.
- Chilgoza is a type of edible seed, obtained from a plant called Pinus Girardiana.
- Broom and baskets are made from different types of leaves of Cycas.
- Turpentine oil is obtained from pinus (pine).
- Resins are extracted from some plants which are used in making varnishes, polishes, paints etc.
- A substance called tannin is extracted from the bark of Tsuga or Hemlock, from which the ink is made and is also used as a medicine.
- Cycas Rumphii produces a type of gum that is used to treat malignant tumours.

✎ **Note :** A drug called ephedrine is obtained from the ephedra plant which is used as a medicine for cough and cold.

- **Calotropis** plant is considered a noxious weed that has a chemical defense mechanism to protect it from predators.

(SSC CGL, 2023 Tier-1)

### Angiosperm:

- In this group of plants, the seeds are embedded in the fruit and thus it is different from gymnosperm.
- In this group of plants, the roots, stems, leaves, fruit, flowers and seeds are all fully grown.

- The presence of flowers and double fertilization is a unique feature of these plants.
- **Tomato** is an example of Angiosperm in Plant Kingdom. (SSC MTS, 2022)
- The seeds of these plants contain cotyledons, based on which this group is divided into (I) Monocotyledon plants and (II) Dicotyledon plants.

**I. Monocotyledon Plants:** Monocot is a group of flowering plants that have only one Cotyledon in their seeds.

- Following are the names of their main families and related plants.

| Family      | Major Plants                                                |
|-------------|-------------------------------------------------------------|
| Orchidaceae | Orchid, Habenaria, Vanda,                                   |
| Liliaceae   | Garlic, Onion, Aloe Vera                                    |
| Palmae      | Betel nut, Coconut, Date Palm, Palm                         |
| Gramineae   | Wheat, Maize, Rice, Sorghum, Millet, Sugarcane, Bamboo etc. |

## II. Dicotyledon Plants:

- Their seeds have two cotyledons.
- Following are the names of their major families and related plants.

| Family                   | Major Plants                                                                                                                                                       |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cruciferae               | Mustard, Radish, Turnip                                                                                                                                            |
| Malvaceae                | Ladyfinger, Hibiscus (Shoe flower), Cotton, Jute                                                                                                                   |
| Leguminosae              | Rosewood, Acacia, Catechu, Ashok, Gulmohar, Kachnar, Shameplant, Shikakai, Fenugreek, Sanai, Tamarind and all Pulse crops.                                         |
| Asteraceae or Compositae | Sunflower, Bhiringraj, Chry-santhemum, Marigold, Kusum, Dahlia, Kush etc.                                                                                          |
| Cucurbitaceae            | Pumpkin, Kheera, Water melon, Cucumis melo (Kharbooza), Lagenaria Siceraria (Lauki), Trichosanthesanguina (Chachinda), Momordica Charantia (Karela), Cucumber etc. |
| Rosaceae                 | Apples, Almonds, Pears, Strawberries                                                                                                                               |
| Rutaceae                 | Lemon, Orange, Sweet Lemon, Wood apple                                                                                                                             |
| Solanaceae               | Datura, Potato, Eggplant, Raspberry, Chilli, Tomato, Tobacco, Queen of the night, Ashwagandha, Atropa Belladonna                                                   |

## Plant Morphology:

- Study of the form, shape and characteristics of various plant organs such as root, stem, leaf, flower, fruit, etc. is called plant morphology.
- Plants are annual, biennial or perennial and show the nature of herbs, shrubs or trees.

## Root:

- Roots are the lower descending part of plants. They develop from radicles.

- In contrast to the stem, roots show positive geotropism and negative phototropism. There is a lack of nodes, internodes, leaves, fruits and flowers.

- There are mainly two types of roots (i) Taproots and (ii) Adventitious Roots.

**(i) Taproots :** At the time of germination of seeds, main root (radicle) grows and forms the primary root, from which many secondary and tertiary roots emerge. Such roots are called taproots, such as gram, pea and carrot.

- Pneumatophores are specialised aerial roots that protrude from the trunk and branches of mangrove trees. Significantly, they are used for breathing in air and extracting nutrients from the water.

**(ii) Adventitious Roots:** Roots originating from any part of the plant other than main root (radicle) are called adventitious roots. Example - pillar roots of banyan, roots of maize and sugarcane plant.

- In some plants, roots are modified by hard pointed thorn-like structures called root thorns. e.g. Pothos armatus and Acanthorrhiza.

- These are called thorn root.

- **Shrub or Fibrous Root:** In monocot plants, the radicle, becomes dormant shortly after germination which prevents its growth resulting in many thread-like structures from the base of the stem surrounding the radicle called fibrous roots. Example - paddy and wheat roots.

- The roots of some plants are green, in which food is formed by the action of photosynthesis. Example - roots of gurcha and water chestnut.

- The roots that move towards the ground to support the banyan are called pillar roots.

- Carrot, Radish, Turnip are the modification of roots, in which the roots act as food storage.

- Stabilization, absorption, conduction and accumulation of food are the main functions of the root.

- The carrot has a conical shape, the turnip and beet have a napiform and the radish has a fusiform root.

## Stem:

- The stem develops from the plumule and forms the shooting mechanism of the plant.

- This part of the plant grows towards the light.

- Stems have negative geotropism and positive phototropism.

- Leaves are decorated on its internodes.

- Stems have buds. Branches and flowers are formed on the buds.

- Potato, ginger, mistletoe, yam, turmeric, garlic, lily and onion all are the modification of stems.

- In some weak plants, with weak stems, axillary or terminal buds are modified into tendrils for climbing.

| Modification of Stem |                    |
|----------------------|--------------------|
| Underground Stem     | Examples           |
| Rhizome              | Turmeric, Ginger   |
| Tuber                | Potato             |
| Corm                 | Mistletoe, Saffron |
| Bulb                 | Onion              |

#### Leaf:

- It is usually green.
- Its main function is to prepare food through photosynthesis.
- The leaves which pass through petiole are called **Petiolate** and where the petiole is absent, are called **Sessile**.
- Shape of the leaves is different in varied plants. It helps in identifying the plants.
- The broad, green part of the leaf is called **Lamina**.  
(SSC MTS, 2022)
- The leaves of some plants get coiled like the spring of a clock. It is called leaf tendril. Example- Wild pea.
- Leaves of some plants are modified into thorns, they are called leaf-spine. Example- Opuntia, acacia etc.
- The leave of some insectivorous plants take the form of a vase or pitcher to catch insects, such as Nepenthus.

#### Inflorescence:

- The inflorescence has special significance for the taxonomic identification of the plants.
- The reproductive branch on which many flowers are positioned in a specific sequence is called an inflorescence.
- The main branch of the inflorescence is called the **Peduncle**.
- Many plants have solitary flowers on the branches. These are called solitary flowers.
- The primary inflorescence is of the following type:  
(I) **Racemose**  
(II) **Cymose**  
(III) **Special**  
(IV) **Compound**

#### Flower:

- It is the reproductive organ of the plant.
- The flower which contains Calyx, Corolla, Androecium and Gynoecium is called a **complete flower**. But if any of these is absent, it is called an **Incomplete Flower**.
- The androecium is the male reproductive organ and the gynoecium is the female reproductive organ.
- The flower that has both male and female reproductive organs is called a Bisexual or Hermaphrodite flower.
- A flower is called unisexual when only the male or female organ is present.

- **Androecium:** They contain one or more stamens. The pollen grain is found in stamens.
- **Gynoecium:** Carpels are present in it. Carpel has three parts (i) **Stigma**, (ii) **Style** and (iii) **Ovary**.
- **Pistil** is a part of the flower that contains a single carpel or group of fused carpels that are usually differentiated into ovary, style and stigma and help in the process of receiving pollen and fertilization.  
(CRPF Tradesman 2023)

#### Pollination:

- The process of transfer of pollen grains from the Anther to the stigma of the carpel is called Pollination. Pollination is of two types - (i) **Self-Pollination** and (ii) **Cross-Pollination**.
- When the pollen of a flower reaches the stigma of another plant of the same species, this process is called **Cross-Pollination**.
- When the pollen of a flower reaches the stigma of the same flower or the stigma of another flower of the same plant, it is called self-pollination. The plants produced by this method are less differentiated and new species are not found. This maintains the purity of the species.
- Cross-pollination is more prevalent in nature.
- Pollination occurs mainly through water, air and insects.

#### Fertilization:

- The cross of male and female reproductive organs is called fertilization. In angiosperm, this action occurs by a combination of a male gamete made from the nucleus of the pollen grain and an egg cell embedded in the ovule. The fertilized egg is called Zygote.
- In Angiosperm, triple fusion occurs while other groups of plants have double fusion.

#### Parthenocarp:

- In some plants, the ovary forms fruit without fertilization. Thus, the development of fruit without fertilization is called Parthenocarp. Often these types of fruits are seedless. eg. **Grapes, Banana, Pineapple, Orange etc.**
- Now-a-days, seedless fruits are obtained by spraying a solution of suitable concentration of auxin and gibberellin over the flowers and plant tissue.

#### Fruits:

- The mature ovary is called fruits, i.e. fruits are formed from the ovary.
- If the fruit is formed by the participation of the ovary only, it is called true Fruit. e.g. Peas, Mangoes etc.
- Apart from the ovary, if other parts of the flower-like thalamus, sepals, etc. also participate in the formation of the fruit, such fruits are called **Pseudo Fruit or False Fruit**.  
Ex. **Apple, Pear etc.**
- There are mainly three types of fruits.

1. **Simple Fruit:** Such as Litchi, Water Chestnut, Cashew Nut, Guava, Banana, Papaya, Mango, Almond, Walnut etc.
2. **Aggregate Fruit:** Such as Custard Apple, Calotrope, Raspberry, Strawberry etc.
3. **Composite Fruit:** Such as Figs, Jackfruit, Mulberry etc.

**Some fruits and its edible parts are as follows –**

| Fruits         | Edible Parts                        |
|----------------|-------------------------------------|
| Mango          | Fleshy Mesocarp                     |
| Guava          | Pericarp and Placenta               |
| Grape          | Pericarpant Placenta                |
| Tomato         | Pericarpant Placenta                |
| Apple          | Fleshy Thalamus                     |
| Pear           | Fleshy Thalamus                     |
| Banana         | Mesocarps and Endocarp              |
| Muskmelon      | Mesocarp and Endocarp               |
| Coconut        | Endosperm & Embryo (entire seed)    |
| Wheat          | Endosperm and Embryo (entire seed)  |
| Maize          | Endosperm and Embryo (entire fruit) |
| Cashew nut     | Cotyledons and fleshy pedicel       |
| Litchi         | Aril                                |
| Groundnut      | Seed                                |
| Mulberry       | Perianth                            |
| Jackfruit      | Perianth and Seed                   |
| Pineapple      | Perianth                            |
| Lemon          | Endocarpic Juicy Hair               |
| Orange         | Endocarpic Juicy Hair               |
| Tamarind       | Mesocarp                            |
| Water chestnut | Cotyledons and Aril                 |
| Pomegranate    | Juicy Testa                         |

#### Plant Tissue:

- **Tissue:** A group of cells that have a similar origin and function is called Tissue.
- Tissues are divided into the following two categories based on origin and development - 1. **Meristematic Tissue** and 2. **Permanent Tissue**.

**(1) Meristematic Tissues:** These tissues are found in growing regions of plants. It is only due to their continuous regeneration that plants grow. Specific characteristics are as follows -

- A. All the cells in these tissues are living and have a thin cell wall.
- B. These cells are round, oval or polygonal in shape.
- C. The Protoplasm is dense, the nucleus is large and the vacuole is small.

D. There is no intercellular space among cells.

- The meristematic tissues are divided into following three categories based on the position of presence in plants-

(i) **Apical Meristem**, (ii) **Lateral Meristem** and (iii) **Intercalary Meristem**

(I) **Apical Meristem:** These tissues are found on the apical ends or apex of the stems and roots. They increase the length of root and height of the stem.

(II) **Lateral Meristem:** These tissues are embedded in the lateral directions of the stems and roots. The division takes place only in the radial direction in them. Their division leads to secondary growth, whereby roots and stems increase in thickness.

(III) **Intercalary Meristem:** It is a part of the apical meristem, which separates from the roots and stems as they grow in length and height respectively and does not turn into permanent tissue. This part falls between the permanent tissues. Plant and its organs also increase in size due to their activity.

**(2) Permanent Tissue:** These tissues are formed as a result of division and differentiation in meristematic tissues. Cells of these tissues are either living or dead, thin-walled or thick-walled.

- There are three types of permanent tissues (i) Simple tissue, (ii) Complex tissue and (iii) Specific tissue.

**(i) Simple Tissue:** These tissues are made up of the same type of cells i.e, a collection of structurally similar cells that perform a common function. They are of three types - Parenchymal, Collenchyma, and Sclerenchyma.

**(ii) Complex Tissue:** Complex tissue is a group of cells that contains more than one type of cells and all together function as a unit. E.g. Xylem and Phloem.

- **Xylem:** It is also called '**water conductive tissue**'. Its main function is to transport water and mineral salts absorbed by the roots to different parts of the plant.

- It is made up of four types of cells namely. Tracheids vessels, wood parenchyma and wood fibre.

- Part of xylem tissue in plants stores food : Xylem parenchyma. (SSC CGL 2022 Tier-1)

✎ **Note :** The age of the plant is calculated by counting the annual rings produced by xylem tissue. This method of determining the age of plants is called **Dendrochronology**.

- **Phloem:** The primary function of phloem is to **transfer food** produced in green parts of the plant to other parts.

- It is a vascular tissue.

**(iii) Special Tissue:** This type of tissue performs a special type of function in plants. Such as gum, resins, oil and latex secretions.

These tissues are of two types -

**a. Glandular Tissue, b. Laticiferous Tissue**

| The Diploid Number of Chromosomes in Some Plants |                    |                 |
|--------------------------------------------------|--------------------|-----------------|
| Plant                                            | Botanical Name     | Chromosome – 2n |
| 1. Garden Peas                                   | Pisum Sativa       | 14              |
| 2. Sweet Peas                                    | Lathyrus odoratus  | 14              |
| 3. Wheat                                         | Triticum Aestivum  | 42              |
| 4. Rice                                          | Oryza Sativa       | 24              |
| 5. Barley                                        | Hordeum Vulgare    | 14              |
| 6. Onion                                         | Allium Cepa        | 16              |
| 7. Maize                                         | Zea Mays           | 20              |
| 8. Radish                                        | Raphanus Sativus   | 18              |
| 9. Cabbage                                       | Brassica Oleracea  | 18              |
| 10. Cotton                                       | Gossypium Hirsutum | 52              |
| 11. Tobacco                                      | Nicotiana Tabacum  | 48              |

- Husk of a coconut is made of **Sclerenchyma** tissue.  
(SSC CGL 2022 Tier-1)
- Cells of meristematic tissue lack **Vacuoles**.  
(SSC CGL 2022 Tier-1)

### Life Process in Plants

#### (I) Nutrition:

- Water and inorganic elements are obtained from the soil by plants and inorganic elements are in the form of minerals in the soil.
- These are called nutrient elements and their nutrition is called mineral nutrition.
- It is important to mention here that Plants complete their life cycle regularly.
- The 17 Essential Plant Elements include nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, boron, chlorine, iron, manganese, zinc, copper, molybdenum, and nickel. The non-mineral essential plant elements include hydrogen, oxygen, and carbon. These are either taken up as a gas or water.
- Plants are divided into two groups on the basis of nutrition.

**A. Autotrophic Plants:** Such plants that make organic food.

- Some bacteria make organic food from energy obtained by biological oxidation (**support from oxygen**) of organic matter, such as Nitrosomonas and Nitrobacter bacteria. Such organisms are called chemo-autotrophs.
- Some plants make organic food products (**glucose**) from simple inorganic materials (**carbon dioxide and water**) using sunlight energy with the help of chlorophyll

(foliage). Such plants are called 'photo-autotrophs'. The above-mentioned process is called photosynthesis.

**B. Miscellaneous or Leguminous Plants :** Plants that cannot prepare food without Chlorophyll, Bacteria, Fungi, etc. are of the following types.

**(i) Parasites:** These organisms get their food from other living plants or animals. Such as Bacteria, Fungi and Cuscuta.

✎ **Note :** Cuscuta reflexa is a parasitic plant which belongs to family Convolvulaceae. It is commonly known as dodder plant, amarbel, akashabela. Traditionally it is called miracle plant. It is rootless, perennial, leafless climbing parasitic.

**(ii) Saprophytes:** Organisms that live on dead organic matter. e.g. types of fungi.

**(iii) Symbiotic:** Those organisms which sustain by drawing life from one another being in symbiotic relationship. This is an example of the symbiosis of Algae and Fungi.

**(iv) Insectivores:** Plants that feed on pests to meet their nitrogen requirement. Example- Drosera, Dionia and Nepenthes.

#### (2) Respiration:

- Respiration can be defined as a catabolic process in which the absorbed oxygen is used in the oxidation of food resulting in the release of energy. The specific organelles in a cell where most respiration occurs are called mitochondria. The oxygen required for this oxidation reaches the cell from the atmosphere.
- Cellular respiration is of two types -
- (i) Aerobic Respiration:** When the degradation of food occurs with oxygen, excessive energy is released.
- (ii) Anaerobic Respiration:** The degradation of food occurs without oxygen. In such a situation, there is an incomplete degradation of glucose (food).
- The respiratory quotient (**RQ**) is the ratio of **CO<sub>2</sub>** produced to that of the **O<sub>2</sub>** consumed while food is being metabolized.

#### (3) Emission or Excretion:

- Some excretory substances are formed in the body after metabolic activities. The action of excreting them out of the body is called Emission. The main emitting substances of plants are - oxygen, carbon dioxide and water vapour.
- Carbon dioxide and water vapour are always emitted by plants, whereas oxygen is emitted only during the day (**in the presence of light**). All these excretory substances are exchanged in plants through the foliage. Some useful excretory substances are catechu, gum, tannin and resins.



#### (4) Reproduction:

- Each organism has the ability to produce its progeny. This process is called reproduction. It has mainly three methods (i) Sexual and (ii) Asexual.
- In sexual reproduction, male and female cells are differentiated, while in asexual both cells are similar.
- When a new plant is born from an organ of the plant (e.g., root, stem, leaf or bud), it is called Vegetative Propagation. Such as Ginger, Turmeric, Potato and Onion stems. From the leaves of Bryophyllum and Begonia, Vegetative Propagation is used in methods such as grafting and layering.
- Vegetative Propagation is an asexual method of reproduction.
- In bacteria, fungi and algae vegetative reproduction occurs by budding and fission.
- The stem of sugarcane is solid and jointed in which nodes and internodes are found. It usually consists of vegetative propagation by stems cutting or stem cutting method.
- The characteristic of seed plants in which one sperm nucleus fuses with the egg nucleus to form an embryo and another fuse with polar nuclei to form an endosperm is called : **double fertilization.** (CRPF Tradesman 2023)

#### Photosynthesis:

- In the process of photosynthesis, green parts of plants absorb solar energy and carbon dioxide (CO<sub>2</sub>) from the air and form carbohydrates by absorbing water (H<sub>2</sub>O) from the soil and releasing oxygen as a by-product.



- Terrestrial plants absorb carbon dioxide from the atmosphere while aquatic plants absorb dissolved carbon dioxide in the water.
- In the process of photosynthesis, light absorption is followed by excitation of chlorophyll molecules by photons of light.
- The water required for photosynthesis is absorbed by the roots of plants and during photosynthesis, oxygen is released as a result of decomposition of water.
- The correct sequence of processes that occur during photosynthesis is as follows:
  - (i) Light absorption
  - (ii) Excitation of chlorophyll molecules
  - (iii) Transfer of electron
  - (iv) Synthesis of energy (ATP)
- Chlorophyll is a green pigment in leaves. This is the centre of photosynthesis.
- **Anthocyanins** is a water-soluble pigment belonging to a phenolic group that is present in pomegranate, eggplant, black carrots and red cabbage. (SSC CGL, 2023 Tier-1)

- The amount of chlorophyll in the cell is closely related to photosynthesis. Photosynthesis increases with the amount of chlorophyll.
- There is one atom of magnesium in the centre of chlorophyll.
- Photosynthesis takes place only in the visible light part of the light spectrum, that is, rays from 3800 Å to 7600 Å wavelengths. This action is most excellent in red light and less efficient with blue light and least or negligible in green light.
- The process of photosynthesis is a reaction of oxidation. In this, water is oxidized to become oxygen and carbon dioxide is reduced to form carbohydrates.
- Photosynthesis consists of the following two major processes –
  - (i) Photochemical Reaction
  - (ii) Dark Chemical Reaction
- **Photochemical Reaction:** This process takes place in the grana part of chlorophyll. It is also called **Hill Reaction**. Hill reaction shows that (i) oxygen is generated from water in the photosynthesis process and (ii) electron is obtained from water for the reduction of CO<sub>2</sub>.
- Energy for the decomposition of water comes from light.
- At the end of the process, ATP and NADPH are released as energy, which help to conduct a dark chemical reaction.
- This is called Hill cycle.
- **Dark Chemical Reaction:** This process takes place in the stroma part of chlorophyll.
- This results in the reduction of carbon dioxide to form sugar and starch.

✎ **Note :** **Amylum** is another name for Starch found mainly in the pulp of seeds, fruits, tubers, roots and stems of plants, especially in corn, potatoes, wheat and rice.

(SSC CGL, 2023 Tier-1)

- This is called PCR cycle or Calvin cycle.
- Plants that are adapted to live under plenty of sunlight are called : heliophyt. (Selection Post Phase XI)
- Plants that are grown under shade are known as : Sciophytes. (Selection Post Phase XI)

#### Plant Hormones:

- Plant hormones are also called phytohormones.
- Plant hormones are special organic compounds produced naturally in plants, which after transport reach other organs in very small amounts, and affect and regulate the growth of many metabolic activities.
- **Auxin, Gibberellin** and **Cytokinin** are **growth promoters** while **abscisic acid** and **ethylene** are **growth inhibitors**.
- Following are the major plant hormones.

### A. Auxin :

- The first plant hormone discovered was Auxin.
- The principal scientists related to the discovery of Auxin were **Charles Darwin** and **F. W. Went**.
- Auxin formation occurs in the apical parts of the plant.
- The effect of Auxin leads to **apical dominance** in plants and suppress the growth of the lateral buds. It prevents the abscission of leaves.

### B. Gibberellin:

- Gibberellin was discovered by Japanese Scientist **Kurosawa in 1926**.

### Key Terms and Related Products

|                        |                                                                                                                            |
|------------------------|----------------------------------------------------------------------------------------------------------------------------|
| <b>Apiculture</b>      | The raising and care of bees for commercial (honey production) and agricultural purposes (Crop pollination)                |
| <b>Aviculture</b>      | The breeding and rearing of birds                                                                                          |
| <b>Aquaculture</b>     | The rearing of aquatic animals or cultivation of aquatic plants for food.                                                  |
| <b>Agriculture</b>     | The science, art or occupation concerned with cultivating land, raising crops and feeding, breeding and raising livestock. |
| <b>Algaculture</b>     | A type of aquaculture under which algae are cultivated                                                                     |
| <b>Sericulture</b>     | It is a process of cultivating Silkworm for the production of raw silk.                                                    |
| <b>Silviculture</b>    | The cultivation of forest tree                                                                                             |
| <b>Spongingculture</b> | Cultivation of sponges                                                                                                     |
| <b>Caniculture</b>     | The breeding and rearing of dogs                                                                                           |
| <b>Floriculture</b>    | Cultivation of flowers                                                                                                     |
| <b>Olericulture</b>    | Cultivation of vegetable                                                                                                   |
| <b>Arboriculture</b>   | The cultivation of trees and shrubs                                                                                        |
| <b>Oligoculture</b>    | The cultivation of a few crops or species.                                                                                 |
| <b>Horticulture</b>    | The cultivation of flowers, fruits, vegetables and spices                                                                  |
| <b>Osterculture</b>    | The artificial breeding of oysters for the market                                                                          |
| <b>Oleiculture</b>     | Production, processing, and marketing of olives.                                                                           |
| <b>Heliculture</b>     | The farming and rearing of snails                                                                                          |
| <b>Vermiculture</b>    | Rearing of earthworms for increasing agriculture production                                                                |
| <b>Viticulture</b>     | Cultivation of grapevines                                                                                                  |

|                                                 |                                                                                                                     |
|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>Mariculture</b>                              | Cultivation of marine organisms (flora and fauna) for food and other products                                       |
| <b>Moriculture</b>                              | Cultivation of mulberry                                                                                             |
| <b>Citriculture</b>                             | Cultivation of citrus fruits or products                                                                            |
| <b>Pomology</b>                                 | The science of fruit-growing                                                                                        |
| <b>Hydroponics or Aeroponics or Aeroculture</b> | The growing of plants without soil                                                                                  |
| <b>Vegeticulture</b>                            | The cultivation of vegetables and the cultivation of plants (especially root crops, propagated by vegetative means) |

- Gibberellin is helpful in elongating the dwarf plant.
- Gibberellin is useful in the breaking of dormancy and the promotion of germination of seeds.
- By spraying, it increases the size of the flowers and fruits of the plants.

### C. Cytokinin:

- Naturally, it works together with Auxin.
- In the presence of Auxin, it helps in cell division and growth.
- Cytokinin is helpful in the production of protein and RNA.

### D. Absciscic Acid:

- Absciscic acid was discovered by **W.C. Lew and H.R. Cairns**.
- Absciscic acid is a growth hormone.
- Absciscic acid is helpful in keeping seeds in dormancy.
- Absciscic acid plays a crucial role in the abscission of leaves.

### E. Ethylene:

- Ethylene is the only hormone found in the gaseous state.
- Ethylene helps in the ripening of fruits and increases the number of flowers.

✎ **Note :** Fluorescence is called flowering hormones. They are formed in the leaf, but help in blooming of a flower.

## 6. Ecosystem

- **Ecology:** It is the branch of biology which studies the interactions between organisms and their environments.
- The word ecology is believed to have been invented by Ernst Haeckel (1869) though its first authentic usage was made by Reiter (1885).
- Ecologist **Henry Chandler Cowles** is famous for studying plant life in the Indiana Dunes in 1896.

(SSC CGL, 2023 Tier-1)

- An ecosystem is an open system because an open system is a system in which energy and nutrients are exchanged between the physical environment and living organisms.
- **Autecology:** Autecology is concerned with the study of an individual plant or individual plant species in relation to the environment.

 **Note :** Ocean is the most sustainable ecosystem.

- **Synecology :** It is the study of the plant community and its relationship with the environment.
- World Environment Day is celebrated on **5<sup>th</sup> June**.
- Different populations living in a specific geographical area or habitat are called **Biotic Community**.
- In terms of composition and function, the combined units of different organisms and environments are called **Ecosystem**.
- The term Ecosystem was first used by a scientist, named **A.G. Tansley**.
- The ecosystem consists of two components (a) Biotic components (b) Abiotic components
- A. Biotic Components** are divided into three parts - 1. Producer, 2. Consumer, and 3. Decomposer
- 1. Producer:** Those components that make their own food are called producers such as green plants.
- 2. Consumer:** Consumer mainly consumes food produced by the producer. There are three types of consumers - (i) Primary Consumer, (ii) Secondary Consumer and (ii) Tertiary Consumer.
- (i) Primary Consumer:** It includes herbivorous animals, who depend on plants for food, such as cows, goats, rabbits etc.
- (ii) Secondary Consumer:** Under this category those animals come, which consume herbivorous animals i.e, primary consumers as their food, such as Frogs, Foxes, Wolves etc.
- (ii) Tertiary Consumers:** It includes lower organisms that use primary and secondary consumers as their food, such as Snakes, Lions, Cheetahs etc.
- 3. Decomposer:** This includes those lower organisms which decompose (rotten) dead producers and consumers, such as Bacteria, Fungi etc.
- B. Abiotic Component:** It can be divided into the following three parts –
- 1. Climatic Components:** like heat, water and air, etc.
- 2. Inorganic Substances:** such as nitrogen, carbon, calcium, sulphur, phosphorus and water etc.
- 3. Organic Substances:** including proteins, carbohydrates and lipids etc.
- The ultimate source of energy in any ecosystem is the Sun.

- The entire dry mass per unit area of living beings in an ecosystem is called its Biomass.
- The biomass of the primary producer of terrestrial ecosystems is more than each stage of consumers of the food chain.
- In the terrestrial ecosystem, the pyramid of biomass is up-right.
- The pyramid of the biomass in the grassland is up-right.
- The pyramid of the biomass of aquatic ecosystem (pond) is inverted in shape.
- Energy flow webs quantify energy flow from one species to another. Thickness of an arrow reflects the strength of the relationship.
- At each level of the food chain, the consumer converts only **10 per cent** of the accumulated energy into his body weight.
- Hyenas and Vultures are scavengers in the food web.
- The transfer of energy in any ecosystem is unidirectional.
- The entire process of energy flow is summarized in following points;
  - The flow of energy in an ecosystem is always linear i.e uni-direction
  - At each energy step in food chain, the energy received by the organisms is used for its own metabolism and maintenance.
  - Flow of energy follows the ecological rule of 10%.
- Ten per cent law related to the transfer of energy in ecosystems has been given by **Lindeman** (1942).
- Primary producers of any ecosystem get the highest amount of energy. The primary consumer gets less energy than the producer while the final consumer gets the least energy.
- Pyramid of Energy is always up-right.
- Often there are a large number of primary producers in a food chain.
- Microorganisms in the aquatic environment are called plankton.
- Continuous energy is required in an ecosystem.
- According to the National forest Policy, the forest cover should be 33 percent in plain area and 67 percent in the hill area.
- There are 18 biosphere reserves in India.
- The United Nations Conference on the Human Environment (**also known as the Stockholm Conference**) was an international conference convened under United Nations auspices held in Stockholm, Sweden from June 5-16, 1972.
- Biogeochemical cycles ensure the flow of the nutrients in the ecosystem.

- The IUCN Red List is a critical indicator of the health of the world's biodiversity.
- The book is compiled and published by the International Union for Conservation of Nature (IUCN). The first edition of the book was published in 1964 and the latest edition was published in 2018.
- The optimum pH of fertile soil is 6.5 - 7.
- Forest Research Institute (FRI) is located in Dehra Dun.
  - Initially named as Imperial Forest Research Institute, FRI came into being in 1906.
  - After reorganization of Forestry Research in the country and creation of Indian Council of Forestry Research and Education (ICFRE) in 1988, the training and research centres were given an independent status of institutes.
- The central National Botanical Museum is located in Kolkata (West Bengal).
- Agenda 21 is a comprehensive plan of action to be taken globally, nationally and locally by organizations of the United Nations System, Governments, and Major Groups in every area in which human impacts on the environment.
- The United Nations Environment Programme (UNEP) is the leading global authority on the environment.
  - UNEP's mission is to inspire, inform, and enable nations and peoples to improve their quality of life without compromising that of future generations.
  - UNEP was founded in 1972 after a UN General Assembly resolution (2997 XXVII).
  - It is headquartered in Nairobi (Kenya).
- Greenpeace is a global network of independent national and regional Greenpeace organizations (NROs) and Greenpeace International as a coordinating organization.
  - It is headquartered at Amsterdam, Netherlands.
- The Environment (Protection) Act was enacted in 1986 with the objective of providing for the protection and improvement of the environment.
  - Environment Protection act, 1986 is known as 'Umbrella Legislation' in India.
- The National Environmental Engineering Research Institute (NEERI) is located in Nagpur.
  - It is dedicated to environmental science and engineering research as well as solving a variety of challenges faced by businesses, government, and the general public.
  - The National Environmental Engineering Research Institute (NEERI), Nagpur was established in 1958 as Central Public Health Engineering Research Institute (CPHERI).
- The National Green Tribunal (NGT) was established by the Government of India on October 18, 2010 under the National Green Tribunal Act, 2010.
  - It deals with matters related to environmental protection, forests and other natural resources.
- Chipko movement was a non-violent movement which came into existence in 1970's to protect trees from cutting down.
  - It was initiated by the women in Uttar Pradesh's Chamoli district (now is a part of Uttarakhand, India) for the conservation of forests to maintain ecological balance in the environment.
- The Appiko movement took place in Uttara Kannada district of Karnataka in the Western Ghats. The movement created awareness among the villagers throughout the Western Ghats about the ecological danger.
  - The Appiko Movement uses various techniques to raise awareness: foot marches in the interior forests, slide shows, folk dances, street plays and so on.
- The Ramsar Convention was signed in 1971 at the small Iranian town of Ramsar. Since then, the Convention on Wetlands has been known as the Ramsar Convention.
  - The Convention on Wetlands is the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources.
- World Wetlands Day, celebrated annually on 2 February, aims to raise global awareness about the vital role of wetlands for people and planet.
  - This day also marks the date of the adoption of the Convention on Wetlands on 2 February 1971, in the Iranian city of Ramsar.
  - Presently 82 Ramsar sites are located in India.
- Giant Salvinia floating fern damages aquatic ecosystems by outgrowing and replacing native plants that provide food and habitat for native animals and waterflow.

(SSC Selection Phase X 2022)

## 7. Pollution

- Pollution is the undesirable change in the physical, chemical and biological characteristics of air, water and land, which in any way damages the substances required for living organisms. Pollution is mainly of the following types -
  1. Air Pollution
  2. Water Pollution
  3. Soil Pollution
  4. Radioactive or Nuclear Pollution
  5. Noise Pollution
  6. Electronic Pollution

- Substances that cause pollution are called pollutants.
  - Word “anthropogenic” is used by scientists in referring to environmental change caused or influenced by people, either directly or indirectly.

#### A. Air Pollution:

- Mixing of some undesirable and environmentally dangerous elements in the air causes toxic changes in the physical, chemical and biological properties of the air, which is called Air pollution.
- Carbon monoxide (CO), Sulfur Dioxide (SO<sub>2</sub>), Hydrogen Fluoride (HF), Nitric Oxide (NO), Nitrogen Dioxide (NO<sub>2</sub>), Ozone(O<sub>3</sub>), dust and smoke particles, are the major air pollutants.
- Particles of **Lead (Pb)** specifically cause diseases of the nervous system.
- Cadmium acts as a respiratory toxin and causes many cardiovascular diseases by increasing blood pressure.
- Ozone causes eye diseases, cough and chest pain.
- If silica dust is found in the iron ore dust, then those working in the mines contract **Cytosilicosis** disease.
- It is easier for Carbon Monoxide to react with haemoglobin in human blood about 240 to 300 times more than oxygen.
- Air with high carbon monoxide cause difficulty in breathing and eventually, death can also occur due to asphyxia.
- Fly ash is the finely divided residue that results from the combustion of pulverized coal and is transported from the combustion chamber by exhaust gases.
- Sulfur dioxide (SO<sub>2</sub>) and nitrogen dioxide (NO<sub>2</sub>) gases react with atmospheric water to form sulphuric acid and nitric acid respectively. When it rains on the Earth mixed with rainwater, it is called **Acid Rain**. Acid rain is harmful to plants, animals and buildings.
- When the pH of the rain water drops below 5.6, it is called acid rain. Acid rain refers to the ways in which acid from the atmosphere is deposited on the earth's surface.
  - Oxides of nitrogen and sulphur which are acidic in nature can be blown by wind along with solid particles in the atmosphere and finally settle down either on the ground as dry deposition or in water, fog and snow as wet deposition
- **On 3<sup>rd</sup> December, 1984**, there was an accident at the Union Carbide, India Limited factory at Bhopal due to leakage of **methyl isocyanate (MIC)** [C<sub>2</sub>H<sub>3</sub>NO]. This incident is known as the **Bhopal Gas Tragedy**.
- About 12-50 km above the surface of the Earth in the stratosphere lies the ozone shield, which absorbs the ultraviolet rays radiated by the sun.
- Ozone layer decays due to pollution from Chlorofluorocarbons and Freon.

- In the absence of ozone shield, ultraviolet rays may severely affect the health of the Earth's organisms, causing diseases such as mutations, skin cancers, reduced immunity and cataracts.
- The unit of measurement of ozone layer is Dobson.
  - It is worth mentioning that like other countries, the Air Quality Index in India is prepared on the basis of eight main pollutants.
    - (a) Particulate matter of < 10 micrometer size (or **PM10**)
    - (b) Particulate matter < 2.5 micrometer in size (or **PM2.5**)
    - (c) Nitrogen dioxide (**NO2**)
    - (d) Carbon monoxide (**CO**)
    - (e) Ozone (**O3**)
    - (f) Sulphur dioxide (**SO2**)
    - (g) Ammonia (**NH3**)
    - (h) Lead (**Pb**)
- Ministry of Environment, Forest and Climate Change (MoEFCC) launched National Clean Air Programme (NCAP) in January, 2019 with an aim to improve air quality in 131 cities (non-attainment cities and Million Plus Cities) in 24 States/UTs by engaging all stakeholders.

#### B. Water Pollution:

- The presence of undesirable and harmful substances or factors in water is called water pollution.
- Water pollution can occur in many ways. The causes of pollution of drinking water are diseases causing bacteria, viruses, household detergents, toxic untreated substances from industries, weedicides, disinfectants and chemical fertilizers, etc.
- Oil leaked from oil tankers quickly spreads to the surface of ocean water. In this way, oil spread on the aqueous surface is called **Oil Spills**.
- Drinking water with an excess of fluoride for a long time causes a disease called **Fluorosis**. This causes rapid calcification of bones and teeth.
- Consumption of water containing asbestos fibres causes a disease called **Asbestosis**.
- **Minamata** disease is caused by mercury or drinking water containing mercury.
- Eutrophication is characterized by excessive plant and algal growth due to the increased availability of one or more limiting growth factors needed for photosynthesis (Schindler 2006), such as sunlight, carbon dioxide, and nutrient fertilizers.
  - Algal blooms are dense layers of tiny green plants that occur on the surface of lakes and other bodies of water when there is an overabundance of nutrients (primarily phosphorus) on which algae depend.



- Biological Oxygen Demand (BOD) test is conducted to measure water pollution.

✎ **Note :** Water pollution of rivers is measured by dissolved oxygen.

### C. Soil Pollution:

- Any unwanted change in the physical, chemical or biological properties of the soil that has a harmful effect on humans and other organisms or that destroys the natural quality of the soil is called soil pollution.
- Various types of fertilizers, D.D.T. etc. disinfectants, weedicides like 2, 4-D and 2,4,5-T etc., combine with the soil to cause soil pollution, which leads to a decline in the production potential of land.

### D. Nuclear Pollution:

- These pollutants originate from nuclear power generation centres and atomic tests, which pollute water, air and soil.
- These pollutants are harmful not only to the present generation but also to future generations.
- The following are the sources of radioactive pollution-
  1. Pollution caused by fuels used in nuclear reactors.
  2. Pollution arising from the use of nuclear weapons.
  3. Pollution arising from waste materials discharged from nuclear power stations.
  4. Pollution caused by rays used in the medical field.
  5. Pollution arising from the Sun's ultraviolet rays.
  6. Pollution arising from radioactive materials used in research.
- In the Second World War, atomic bombings on **Hiroshima** and **Nagasaki** on 6 August, 1945 and 9 August, 1945, respectively, caused the loss of millions of lives in addition to many diseases in their offsprings.
- On 28 March, 1979 in the US, there was also a severe mishap at the Three Mile Island Reactor.
- On 26 April, 1986, there was an accident in the reactor in Chernobyl, Ukraine, which was the most damaging and horrific mishap in the reactor.
- In March 2011, there was an accident in Japan's Fukushima Daiichi nuclear reactor.

### E. Noise Pollution:

- Undesirable noise or noise present in the atmosphere is called noise pollution.
- Many types of vehicles, such as motor-cars, buses, jet-aircraft, tractors, railway engines, generators, loud-speakers, televisions, radios, and sirens of factories and machines, cause noise pollution.
- The unit of loudness or noise is the **decibel (dB)**.
- A sound of 25–30 decibels is sufficient for normal deaf and hard of hearing people. The sound of 5dB is extremely low, 75dB is moderately high, 95dB is extremely loud and sound over 120dB is very annoying.

- Green plants that control noise pollution are called, '**Green Mufflers**'.

✎ **Note :** Sound up to 60dB is not harmful to a healthy human.

### E. Electronic Pollution:

- Scientists have named invisible electromagnetic waves emitted from television, computers and video game devices etc. as electronic pollution.
- Some special types of invisible rays emitting from electronic devices have adverse effects not only on the eyes but also on general health and brain fibres.
- The six major pollutants are carbon monoxide, lead, nitrogen oxides, ground-level ozone, particle pollution (often referred to as particulate matter), and sulfur oxides.

## C2 Zoology

- Zoology studies various animals and their activities.

### 8. Classification of Animal Kingdom

- The animal kingdom is mainly divided into two subgroups – **A. Unicellular Animal** and **B. Multicellular Animal**

#### A. Unicellular Animal:

- A unicellular animal is placed in a single Phylum Protozoan.

#### Phylum Protozoa:

- The body of organisms of the phylum Protozoa is made up of only one cell.
- The protozoa is both free-living or parasitic.
- One or more nuclei are found in the organisms of the Protozoa phylum.
- Protozoan movement is caused by Pseudopodia, Flagella or Cilia.
- All biological functions (digestion, respiration, excretion, reproduction etc.) take place inside the body. Respiratory and excretory action in protozoa occurs by diffusion from the cell surface.
- Infection of **Entamoeba Histolytica** causes a disease called amoebic dysentery or amoebiasis.
- Amoeba, Euglena, Paramecium etc. are organisms of the Protozoa phylum.

#### B. Multicellular Animals:

- Multicellular animals are divided into 9 phyla Porifera, Coelenterata, Platyhelminthes, Nematoda, Annelida, Mollusca, Arthropoda, Echinodermata and Chordata.

#### 1. Phylum Porifera:

- Animals of Phylum Porifera are aquatic, mostly found in marine.

- Organisms of phylum Porifera show the cellular level of body organisation.
- The organisms of phylum Porifera are multicellular, but they lack tissues.
- The main body cavity is called Spongocoel in which water enters through numerous microscopic holes (**Ostias**) and exits through a large exhalant opening or Osculum.
- Sycon (Scypha), Leucosolenia, Euplectella, Spangilla etc. are organisms of phylum Porifera.

## 2. Phylum Coelenterata:

- The organisms of the phylum Coelenterata are aquatic, mostly marine which are solitary or colonial.
- The animals of the phylum Coelenterata are dimorphic.
- The two primary cellular levels in the body are the outer epidermis and the inner gastrodermis. In the middle of these, there is a jelly-like layer called Mesoglea.
- The mouth is surrounded by thread-like sensory tentacles, which help in catching food etc.
- Hydra, Jellyfish, Obelia, Physalia, Coral, etc. are organisms of the phylum Coelenterata.

## 3. Phylum Platyhelminthes:

- Most of the members of the phylum Platyhelminthes are parasites of other animals (mainly vertebrates) and some members are pathogenic.
- Triploblastic body formation, but the body cavity is absent.
- The body of organisms of the Phylum Platyhelminthes is dorso-ventrally flattened.
- Digestive system (incomplete) and excretory system (Flame cells) and reproductive system are absent from phylum Coelenterata.
- Phylum Coelenterata lacks typical skeletal, vascular and respiratory systems.
- Liver Fluke, Schistosoma, Taenia etc. are organisms of phylum Platyhelminthes.
- **Flame cells** help in osmoregulation in Platyhelminthes.

(SSC CGL, 2023 Tier-1)

- **Platyhelminthes** group of Kingdom Animalia has unsegmented, bilaterally symmetrical, soft bodies, with a triploblastic construction (comprising three layers of cells) and a lacking coelom, skeleton and anus. (SSC CGL, 2023 Tier-1)

## 4. Phylum Nematoda:

- The body of organism of the phylum Nematoda is bilaterally symmetrical, elongate and usually tapered at both ends. Nematodes, also called roundworms, are among the most abundant animal on Earth.
- The alimentary tract is straight with a terminal mouth and anus.

- Pseudocoel cavity present in nematoda.
- Excretion in organisms of the phylum Nematoda is by protonephridia.
- Usually unisexual with sexual dimorphism.
- The organism 'Enterobius' (pinworm or threadworm) of this phylum is found mainly in the anus of young children. It causes children to choke, reduce hunger and also to vomit.
- Roundworms (Ascaris), Threadworm, Wuchereria etc. are organisms of the phylum Nematoda.

## 5. Phylum Annelida:

- Their body is long, slender, bilaterally symmetrical True coelom and distinctly segmented.
- Motion is mainly by setae made of chitin.
- A well-developed and complete digestive system is present in Annelida.
- Respiration is usually through the skin and in some by gills.
- Haemoglobin is dissolved in plasma.
- Annelids are monoecious and dioecious.
- Earthworms, Leeches, Nereis etc. are the organisms of the phylum Annelida.
- **Annelida** is a phylum of animals found in fresh water ponds, lakes and swamps and provides setae or parapodia for locomotion. (SSC CGL, 2023 Tier-1)

## 6. Phylum Mollusca:

- Most of the molluscan are **marine**, some inhabit freshwater and some terrestrially in damp soil.
- Respiration in the organism of the phylum Mollusca is through **gills (ctenidia)**.
- Shell is always present in the organisms of the phylum Mollusca.
- Digestion, circulation, excretion and nervous system develop.
- The radula is the main feeding organ and also very significant to the majority of the mollusks (especially gastropod) taxonomy.
- The blood is colourless or blue due to the presence of hemocyanin.
- Excretion is often by metanephridia. Examples - snail, conch, octopus etc. are organisms of phylum Mollusca.
- Pearl is formed between the mantle and shell after the deposition of fine silica, the color and lustre of pearl depend upon the light penetration.

## 7. Phylum Arthropoda:

- The body of the organisms of the Phylum Arthropoda is usually divided into three parts (head, thorax and abdomen).

- Each segment usually bears a pair of lateral jointed appendages adapted for food ingestion, locomotion, respiration, copulation etc.
- In these, the circulatory system is open.
- The body cavity of the organisms of the phylum Arthropoda is called **haemocoel**.
- The Malpighian Tubules (MTs) are the main excretory organs in most insects.
  - They play a key role producing primary urine and osmoregulation, selectively reabsorbing water, ions, and solutes.
  - Besides these functions conserved in most insects, MTs can serve some specialized tasks at different stages of some species' development.
- Respiration through gills (**aquatic forms**) or tracheae or book lungs (**terrestrial forms**).
- Green Gland- It is also known as the antennal gland or maxillary gland.
  - In some species, the organs are also called green gland or antennal gland because of their colour and location (e.g., *Astacus*).
  - In some freshwater crustacean species, the organs are situated near the maxillary segments and are called maxillary glands. It is a simple structure.
  - The green glands have a round bulbous end sac, a long coiled tube like labyrinth and a bulbous bladder opening outside by excretory pore.
- In the organisms of the phylum Arthropoda sexes mostly separate with sexual dimorphism.
- Insecta is a major class of the phylum Arthropoda.
- The insects ideally have three pairs of legs.
- A cockroach has 13 chambers in the heart.
- The bees, ants and termites found in this phylum are social insects.
- Cockroach, Lobster, Crab, Grasshopper, Musca, Mosquito, etc. are common organisms found in this phylum.
- Lignin is not the main component of the exoskeletons of arthropods. (SSC CGL, 2023 Tier-1)

## 8. Phylum Echinodermata:

- All animals in the Phylum Echinodermata are inhabitants of the sea.
- Water Vascular System is found in the organisms of the phylum Echinodermata.
- Organisms of the Phylum Echinodermata have tube feet for locomotion, feeding and respiration.
- Echinodermata has a relatively less developed nervous system and sensory organs.
- They have extensive power of regeneration.

- Starfish, Antedon, sea cucumber, brittle star, sea lilies, etc. are the organisms of Phylum Echinodermata.

✎ **Note :** The function of Aristotle's Lantern found in the alimentary system of sea urchins is to chew food.

## 9. Phylum Chordata:

- The organisms of the Phylum Chordata have a spinal cord or notochord.
- The dorsal tubular central nervous system is present in the midline of the body.
- Pharyngeal gill-slits are present in the embryonic stage of all chordates.
- The Phylum Chordata is divided into three sub-phyla -Urochordata, Cephalochordata and Vertebrata.

### Major Classes of Phylum Chordata:

#### A. Pisces:

- All animals in the Pisces are asymmetric.
- All the animals of the Pisces are aquatic.
- Respiration occurs through **Gills**.
- Their **heart is two-chambered** and contains only venous blood.
- In some fish, the skeleton is made of cartilage, such as Sharks, Scoliodon (Dog fish) and in some made of bones. Such as Rohu (*Labea rohita*), Sea horse (Hippocampus) etc.

### Important Information

|                                 |                                  |
|---------------------------------|----------------------------------|
| Largest living Bird             | Ostrich                          |
| Largest Ape                     | Gorilla                          |
| Largest Egg                     | Ostrich                          |
| Largest Terrestrial Mammal      | African Elephant                 |
| Largest and the Heaviest Mammal | Blue Whale                       |
| Smallest Mammal                 | Shrew                            |
| Smallest Bird                   | Humming Bird                     |
| Fastest Running Animal          | Cheetah                          |
| Marsupials                      | Kangaroo                         |
| Egg-laying Mammal               | Echidna and Duck billed Platypus |

#### B. Amphibia:

- Animals of this class are amphibians, i.e., adapted for both aquatic and terrestrial life.
- Amphibians are cold-blooded.
- Respiration in organisms of this class usually occurs through the skin, gills and lungs.
- Three-chambered heart is (two arteries and one ventricle) found in Amphibians.

- The tadpole is the larval stage of annular amphibians, such as frogs and toads. This early life stage more closely resembles a small fish than to an amphibian.
  - During tadpole stage, the body is characterized by two distinct traits: a roundish form - including the head- that is paired with a long, flexible tail.
- Frog, bufo, salamander, etc. are an examples of Amphibians.

### C. Reptilia:

- This class consists mainly of terrestrial animals.
- Reptilians are cold-blooded animals, i.e., hetro-thermic.
- The skeleton of reptiles is completely made up of bones.
- Respiratory activity in reptiles is done by the **lungs**.
- In these, the heart is usually three-chambered while the **crocodile is only the reptile that has a four-chambered heart**.
- The eggs of reptiles are covered with calcareous shells.
- For locomotion, some have legs while some animals (like snakes) are footless.
- The fangs of venomous snakes are modified as **maxillary teeth**.
- Snakes, Crocodiles, Lizards, Turtles etc. are examples of reptiles.

- 🔗 **Note** : 1. King Cobra (Nagraj) is the only snake to make a nest.
- 🔗 **Note** : 2. Sea snake (Hydrophis) is the most venomous snake in the world.
- 🔗 **Note** : 3. The Mesozoic Era is called the era of reptiles.

### D. Aves:

- The forelimbs of birds are transformed into feathers, which help them fly.
- The jaw is a set of bones that holds teeth. It consists of two main parts.
  - The upper part is the maxilla. It doesn't move.
  - The moveable lower part is called the mandible. You move it when you talk or chew.
  - The two halves of the mandible meet at your chin. The joint where the mandible meets your skull is the temporomandibular joint.
- Birds have a four-chambered heart with two arteries and two ventricles.
- Birds are homeothermic, i.e., warm-blooded animals.
- **Bird** is NOT an example of "viviparous" animals. (SSC MTS, 2022)
- Aves or birds breathe through the lungs.
- The bones of birds are hollow (Pneumatic bones), they do not contain bone marrow.

- The uropygial gland, or preen gland, is a bilobed holocrine gland located dorsally at the base of the trunk.
- The syrinx is the vocal organ of birds.
- Generally, the urinary bladder is absent in birds.
- In females, the left ovary often develops.
- Pigeon, Crow, Sparrow, Cuckoo, etc. are the creatures of the class Aves.

- 🔗 **Note** : 1. The cuckoo lays its eggs in other bird's nests.
- 🔗 **Note** : 2. Khanjan birds come from Siberia to India only for nutrition, not for reproduction.
- 🔗 **Note** : 3. Kiwis Ostrich, Penguin Emu are unable to fly.
- 🔗 **Note** : 4. Balanoglossus belongs to **Hemichordata** phylum of the animal kingdom. (SSC MTS, 2022)

### Mammalia:

- Mammalians are homeothermic i.e., warm-blooded animals.
- Sweat and oil glands are found on the skin of mammals.
- **The heart** of mammals has **four chambers** (two atria and two ventricle).
- Teeth appear twice in the life of most members of this class.
- The red blood cells in mammals are devoid of a nucleus (except the camel and the lama).
- Pinna is a characteristic feature of all mammals.
- There are **12 pairs of cranial** nerves in the class Mammalia.
- Mammalia is divided into the following three sub-classes–
  1. Proththeria- These are egg-laying. E.g. Echidna, Platypus.
  2. Metatheria- They give birth to a premature baby who lives in a sac called marsupial until they develop. E.g. Kangaroo Opossum etc.
  3. Eutheria - They give birth to fully grown babies. E.g. Humans, Elephants, Squirrels etc.
- **Rat** is an example of Phylum Mammalia of Animal Kingdom. (SSC MTS, 2022)
- **Kupffer cells** are found in the liver of mammls. (SSC CGL, 2023 Tier-1)

- 🔗 **Note** : **Flatworms** an endoparasited found in animals. (SSC CGL, 2023 Tier-1)

### Animal Tissue:

- Tissue is a group of cells that have similar structure and that function together as a unit.
  - A nonliving material, called the intercellular matrix, fills the spaces between the cells.
  - This may be abundant in some tissues and minimal in others.

- Histology is the microscopic study of tissues and organs through sectioning, staining, and examining those sections under a microscope.
  - Otolaryngology is a branch of medicine. It studies normal and pathological anatomy and physiology of the ear as well as its diseases, diagnosis, and treatment.
  - The term 'tissue' was introduced by Xavier Bichat in the year 1801.
- The tissues found in the body of animals can be divided into the following categories.
- (1) Epithelial Tissue
  - (2) Connective Tissue
  - (3) Muscular Tissue
  - (4) Nervous Tissue

### 1. Epithelial Tissue:

- **Ruysch** first used the term epithelium.
- Epithelial tissue is present on the outer, inner, or independent surfaces of animals.
- Epithelial tissue lacks blood cells.
- The epithelium mainly acts as a protective covering for the body and internal organs (**Lungs, Heart, Kidney etc.**).
- Epithelium Protects the cells of internal tissues from injury, harmful substances and bacteria.
- They help in the transportation of ion mucus or other fluids to many tubular organs (Respiratory, Genitals, Ureters etc.).
- The epithelium of skin or other sensory organs works to receive sensation.

### 2. Connective Tissue:

- Connective tissues are most widely distributed throughout the body.
- They make up about 30 percent of the body.
- Connective tissues are found in the inner and outer sides of each organ and between different organs.
- Connective tissues work to connect organs and their various tissues.
- Fluid connective tissue (**blood and lymph**) also helps in transport.
- Connective tissues also act to control body temperature and prevent diseases.
- There are three major categories of connective tissue-
  - (a) Connective Tissue proper
  - (b) Skeletal Tissue and
  - (c) Vascular Tissue.

### 3. Muscular Tissue:

- Muscular tissue is also called Contractile Tissue.
- Muscular tissue makes up about 40 to 50 per cent of the body.

- There are three types of muscular tissue - (a) **Striated Muscles**, (b) **Unstriated Muscles** and (c) **Cardiac Muscles**.

#### (a) Striated or Stripped Muscles:

- Stripped or striated muscles are often found in those parts of the animal's body, which function at their own will. Therefore, they are also called **Voluntary Muscles**.
- Most of the striated muscles are attached to bones at both ends, hence they are also called **Skeletal Muscles**.
- Movement of hand feet and body are responsible through these muscles.

#### (b) Unstriated or Unstripped Muscles:

- Unstripped muscular tissue is present on the walls of organs that move involuntarily; Such as alimentary canal, urinary bladder, gall bladder, uterus, blood vessels etc.
- Unstriated muscles are also known as Involuntary muscles.
- Unstriated muscles control spontaneous movements.

#### (c) Cardiac Muscles:

- In composition, these muscles are similar to the striated muscles but the work is similar to the unstriated muscles.
- Cardiac muscles are found only in the heart walls.
- If the nerves that go into the heart are cut and removed, the heart will still keep beating at its normal rate.
- The largest muscle of the human body is **gluteus maximus** (**hip muscle**) and the smallest muscle is **stapedius**.

### 4. Neural or Nervous Tissue:

- The nervous system of organisms is made up of these tissues.
- The function of nerve tissue is to move the nerve impulse from one part of the body to another.
- Specialized Cells for the transport of impulses are called nerve cells or Neurons.
- Neurons are the structural and functional units of nerve tissue.

## 9. Human Body

### A. Digestive System

- The entire process of digestion of food in the human body goes through the following five stages:
  1. Ingestion
  2. Digestion
  3. Absorption
  4. Assimilation
  5. Defecation
- 1. **Ingestion:** Consumption of food in the mouth is called Ingestion.
- 2. **Digestion:** The conversion of complex food into simple substances in the presence of water is called Digestion.



- **Digestive Organs:** The digestion of food takes place in the alimentary canal located in the abdominal cavity of our body. The food starts from the mouth cavity and passes out as waste material from the anus through the oesophagus, stomach, duodenum, small intestine and large intestine.
- The average length of the alimentary canal of man is 8–10 m, in which the longest is the small intestine (about 6 m).
- In humans, the small intestine is divided into Duodenum, Jejunum and Ileum respectively and the large intestine is divided into the cecum, colon and rectum respectively.
- About 4 inches from the cecum the **Vermiform Appendix** is attached to it, which is considered a vestigial organ because it is of no use.
- In addition, liver, pancreas and salivary glands also help in digestion.
- **Digestion:** Catalytic enzymes made from the protein in our alimentary canal digest food. For example, the enzyme present in saliva in the oral cavity, the enzyme present in gastric juice in the stomach. Enzymes of pancreatic juice in the duodenum, enzymes of intestinal juice in the small intestine perform chemical action on food. There is no digestion in the oesophagus and large intestine.
- **Magnesium Hydroxide** is used as an antacid to neutralize stomach acidity. (SSC MTS, 2022)

#### Human Dentition:

- There are 16 teeth in each of both jaws in a human being. In total, both jaws have 32 teeth.
- On each side of each jaw, there are two incisors, one canine, two premolars and three molar teeth.
- Following is the dental formula of an adult man.

$$I \frac{2}{2}, C \frac{1}{1}, PM \frac{2}{2}, M \frac{3}{3} = \frac{8}{8} \times 2 = \frac{16}{16} = 32$$

- Human teeth generate twice. First in infancy 20 teeth come out, which are called **milk teeth**. Whose dental formula is as follows –

$$I \frac{2}{2}, C \frac{1}{1}, PM \frac{0}{0}, M \frac{2}{2} = \frac{5}{5} \times 2 = \frac{10}{10} = 20$$

- The upper layer of teeth is mainly made of calcium phosphate and calcium carbonate. **Enamel** is the **hardest substance** in the **whole body**.

#### Tongue:

- The tongue is a muscular muscle on the surface of the oral cavity.
- There are small buds on the surface of the tongue, whose function is to gain knowledge of the taste of food. It is only through taste buds that we can understand the sour, sweet and pungent taste.
- The front part of the tongue is made to feel sweet, the back part is bitter and both the sides are made to feel sour.

- The tongue helps in chewing and swallowing food as well as controlling voices.

#### Salivary Glands:

- Three pairs of salivary glands are found around the jaws of humans.
- Saliva secretes from the salivary glands.
- Saliva contains about 99 per cent water and 1 per cent portion contains enzymes, proteins, salts etc.
- Saliva contains Ptylin (**Salivary amylase**) which break starch into sugar.
- Saliva assists in chewing and swallowing food that reaches the mouth cavity.
- Some enzymes present in saliva (such as lysozyme) destroy the bacteria coming in the mouth with food.

### Key Organs for Digestion

#### Digestion in Stomach:

- As soon as food reaches the stomach through the oesophagus, peristalsis starts from the stomach towards the pyloric part.
- Due to peristalsis, the gastric juice gets mixed with food to covert into a thin paste-like white pulp called **Chyme**.
- The gastric juice is secreted by the pyloric glands present in the stomach wall.
- The high acidity (pH 1.0 to 3.0) of gastric juice is due to the hydrochloric acid present in it.
- Hydrochloric acid makes the food medium acidic and eliminates the effects of saliva on food.
- Gastric juice contains enzymes called pepsin and renin.
- Pepsin breaks down proteins and converts them into simpler substances, peptones and protease.
- Renin helps in the digestion of milk proteins.

#### Digestion in Small Intestine:

- Digestion of chyme or liquid food flowing from the stomach is done in the small intestine.
- The small intestine is mainly formed of three parts, duodenum, jejunum and ileum, with lengths of 30 cm, 2.5 m and 3.5 m respectively.
- Pancreatic juice, secreted by the pancreas is mixed with food in duodenum. It contains following major enzymes -
  - A. Trypsin:** It breaks down proteins into proteases and peptones.
  - B. Amylase:** It works and breaks down chyme starch, glycogen, and other polysaccharides (other than cellulose) into disaccharide sugars called maltose.
  - C. Lipase:** It converts emulsified fats into glycerol and fatty acids.
- Intestinal juice contains enzymes such as maltase, sucrose, lactose, enterokinase, intestinal lipase, nucleases, to digest nutrients.

- Intestinal juice is alkaline and about 2 litres of intestinal juice is secreted daily in a healthy human body.
- Digestion of food is completed in the small intestine where it is absorbed.

### 3. Absorption:

- Absorption of digested food into blood is called Absorption. For this activity to happen, there is a unique structure called Villi on the inner surface of the small intestine wall.

### 4. Assimilation:

- The process of using absorbed food in the body is called assimilation.
- Assimilated substances are called metabolites.

### 5. Defecation:

- After absorption, the remaining part of the chyme in the large intestine takes the form of faeces or stool which passes out through the anus.

### Liver:

- It is the **largest gland** in human body.
- It converts an excess amount of glucose into glycogen and also converts glycogen into glucose when needed.
- The liver converts excess protein into carbohydrates.
- Fibrinogen protein is produced in the liver, which helps to form a blood clot with vitamin K.
- Heparin protein is also produced in the liver, which does not allow blood coagulation inside the body.
- The liver also destroys dead **RBCs**.
- The liver synthesizes bile.
- Bile is stored in the gall bladder.
- Bile juice emulsifies fat by reaching the duodenum through the bile duct, which makes digestion of fat easier.
- Bile destroys bacteria present in food.
- When the bile duct is obstructed, the liver cells stop absorbing the bilirubin from blood, causing it to spread throughout the body, known as jaundice.

### Pancreas:

- The pancreas is considered as the second largest gland in the human body.
- It has features of both Endocrine and Exocrine glands.
- The pancreas secretes alkaline pancreatic juice.
- The pancreas contains enzymes to digest all three main food carbohydrates, fats and proteins. Thus, the pancreatic juice is called a **complete digestive juice**.
- Steapsin, the enzyme which converts fats into fatty acids and glycerol, is secreted by **Pancreas**. (SSC MTS, 2022)

### Islets of Langerhans:

- The island of Langerhans is a part of the pancreas.
- Its  $\alpha$ -cell secretes glucagon,  $\beta$ -cell secretes insulin and  $\delta$ -delta cell secretes somatostatin hormone.

### Insulin :

- Insulin was discovered by **Banting and Best**.
- Insulin controls the action of glycogen formation by glucose.
- Insulin deficiency causes diabetes.
- Excess of insulin causes hypoglycemia.

✎ **Note :** Diabetes is caused due to excess amount of glucose in the blood.

- Glucagon reverts glycogen into glucose.
- Somatostatin is a polypeptide hormone that increases the period of assimilation of foods.

## B. Circulatory System

- The process of blood circulation was discovered by **William Harvey**.
- The following four major parts fall under the blood circulation system are- (1) **Heart** (2) **Arteries** (3) **Veins** and (4) **Blood**.

### Heart :

- Heart is surrounded by pericardium.
- The average weight of the heart in an adult human is about 300 gram.
- The heart is the central organ of the blood circulation system.
- The heart has four chambers. In the front portion, there is a **right auricle** and a **left auricle** while in the back, there is a **right ventricle** and a **left ventricle**.
- There is a bicuspid valve between the left atrium and the left ventricle. It is also called **Mitral Valve**.
- Tricuspid valve occurs between the right atrium and right ventricle.
- The heart beats about 72 to 75 times per minute.
- In the fetus, the heart beats about 150 times per minute.
- The heart pumps about 70 ml of blood per beat.
- A heartbeat wave is initiated by the **Sino-Atrial Node (S.A. Node)**.
- A pacemaker is a small battery-operated device that helps the heart beat in a regular rhythm.
  - Traditional pacemakers have three parts: a generator, wires (**leads**) and sensors (**electrodes**). Some newer pacemakers are wireless.
- Normal human blood pressure is 120/80 mm Hg, with systolic 120mm and diastolic 80 Hg.

| Medical Devices  | Uses                                                                           |
|------------------|--------------------------------------------------------------------------------|
| Stethoscope      | Used to measure the heart rate                                                 |
| Pacemaker        | when the heart rate is high or low, it is used to bring it to the normal state |
| Sphygmomanometer | Used to measure blood pressure.                                                |

|                                    |                                                                                             |
|------------------------------------|---------------------------------------------------------------------------------------------|
| Computed Tomography Scan (CT Scan) | It is used to detect any abnormality or deformity in the entire body.                       |
| Electrocardiogram (ECG)            | Used to detect cardiac abnormalities.                                                       |
| Electroencephalograph (EEG)        | find problems related to abnormalities of the brain                                         |
| Auto Analyzer                      | Used to check glucose, urea, cholesterol etc.                                               |
| MRI                                | MRI-Magnetic Resonance Imaging can detect abnormalities or deformities throughout the body. |

- The blood pressure measuring device is called a **Sphygmomanometer**.
- The CO<sub>2</sub> present in the blood increases the heart rate by lowering the pH in the blood.
- Excess acidity in the body increases heart beating rate, while excessive alkalinity makes beating rate reach abnormal levels.

#### Veins :

- A blood vessel carrying blood, from the body to the heart is called a Vein.
- The vein contains impure blood, i.e, blood containing carbon dioxide, but as an exception in the pulmonary vein, there is pure blood (**oxygen-rich blood**). The pulmonary vein carries blood from lungs to the left atrium which is purified.

#### Artery:

- The blood vessels that carry blood from the heart to the body are called arteries.
- The arteries contain pure blood, i.e, oxygenated blood, but as exception, the pulmonary artery supplies impure blood.
- The **pulmonary artery** carries blood from the right ventricle to the lungs.
- Pureblood (oxygen-rich blood) flows to the left part of the heart while impure blood (blood containing carbon dioxide) flows to the right.
- The vessels that carry blood to the heart muscle are called **Coronary Arteries**.
- A heart attack occurs when the coronary artery is obstructed due to some reason.
- The path of blood in the heart or circulation of blood has the following order -  
Left atrium → left ventricle → aorta → various body parts → inferior and superior venacava → right atrium → right ventricle → pulmonary artery lung → pulmonary vein → left atrium (pure blood with oxygen).

### C. Lymph Circulatory System

- It is the portion of lymph tissue that reaches into the lymph cells by secreting out of the extracellular fluid (**ECF**). It is light yellow or colourless substance.
- Plasma is the essential fluid in blood, tissue and lymph.
- **Lymph contains white blood cells only.**
- Granules found in the lymph are called lymphocytes.
- The lymph flow occurs in one direction only, from the organs to the heart.

#### Functions of Lymph:

- Lymphocytes are formed by lymph.
- Lymphocytes present in the lymph protect the body from diseases by subsuming harmful bacteria.
- Under the immunity system, Lymph destroys pathogenic substances, bacteria and viruses etc. Lymph helps heal the wound.
- The lymph nodes act as a filter for the human body by trapping dust particles, bacteria, cancer cells, etc.
- Lacteals or the lymph cells present in the small intestine wall absorb fat.
- The lymph nodes, spleen, thymus gland, tonsils and red bone marrow are the major lymphoid organs.

#### Blood:

- Blood is a fluid connective tissue.
- Blood is an alkaline solution which has a pH value of 7.4.
- Women possess about a litre less blood than men.
- Adult humans usually have 5 to 6 litres of blood in their bodies.
- Blood has two major constituents-(1) Plasma and (2) Blood Corpuscles.

1. **Plasma:** It is the inanimate fluid part of the blood and is about 55 percent of the blood.
  - Plasma contains **91% to 92%** of water and **8% to 9%** of solids. It mainly comprises of: Coagulants, mainly fibrinogen, aid in blood clotting.
  - Through it, various types of chemical substances (food items, proteins, minerals, hormones, gases, etc.) are transported.
  - **Serum:** When fibrinogen protein is separated from plasma, the remaining plasma is called Serum.
2. **Blood Corpuscles:** Blood corpuscles constitute about 45 percent of the blood. The following types of corpuscles are found in the blood.

#### A. RBCs Red Blood Corpuscles or Erythrocytes):

- Red blood cells are found only in the blood of vertebrates and make up about 40 percent of the blood.
- These contain 99 per cent of the total blood corpuscles.
- Heme pigment and globin protein are found in red blood cells.

- The colour of blood is red due to the presence of Haemoglobin pigment.
- The main function of haemoglobin is to transport oxygen.
- Deficiency of haemoglobin leads to **Anemia**.

### B. White blood cells (W.B.C. or Leucocytes):

- Their main function is to provide protection to the body.
- W.B.C are mainly of five types - (1) Eosinophils, (2) Basophils, (3) Neutrophils, (4) Monocytes and (5) Lymphocytes. There are also two types of lymphocytes- (A) 'B' lymphocytes and (B). 'T' lymphocytes.
- The presence of excessive amount of white blood cells in the blood is called Leukemia. it is also called Blood Cancer.
- The largest W.B.C in size is monocytes.
- The most protective W.B.C. is lymphocytes.

### C. Blood Platelets:

- The major contribution of platelets is in the formation of blood clots.
- Blood platelets are found only in mammalian types of blood.
- In a normal human body, the amount of blood is 7-8 per cent of its weight (5-6 litres on average).
- The blood covers about 1 / 13<sup>th</sup> of the body.
- The amount of haemoglobin is about 15 grams per 100 ml of blood.
- The amount of glucose is about 80–120 ml per decilitre blood.
- In the body, blood formation takes place in the red bone marrow.
- The accumulation of excess blood or the blood bank of the body is located in the **Spleen**.
- In the body, the lifespan of R.B.C. is about **120 days**.
- Spleen is called the **Graveyard of RBCs**.
- The ratio of R.B.Cs and W.B.Cs. is 600 : 1.

✎ **Note :** A hemocytometer determines the number of RBCs.

✎ **Note :** The blood platelets are also known as **thrombocytes**. (SSC MTS, 2022)

✎ **Note :** **Anticoagulants** are commonly known as blood thinners. (SSC MTS, 2022)

### Blood Group:

- The blood group was discovered by Karl Landsteiner.
- Variability in the blood is due to the presence of glycoproteins in red blood particles, called **Antigen**.
- Antigens are of two types (1) **Antigen - A** and (2) **Antigen - B**.
- **Antibody** - These special types of proteins are found in plasma in the absence of antigens, which are of two types - (1) **Antibody- a** (2) **Antibody - b**.
- There are four types of blood groups based on antigens and antibodies.

Blood group A - antigen-A and antibody-b

Blood group B - antigen-B and antibody-a

Blood group AB - antigens both A and B but no antibodies present.

Blood group O - antigen absent, but both antibody-a and b present.

### Blood Transfusion :

- Blood group has special importance in blood transfusion when received by somebody. Based on this, blood is offered according to the following chart.

| Recipient Blood Group |     |     |     |     |
|-----------------------|-----|-----|-----|-----|
| Blood Donor Group     | A   | B   | AB  | O   |
| A                     | Yes | No  | Yes | No  |
| B                     | No  | Yes | Yes | No  |
| AB                    | No  | No  | Yes | No  |
| O                     | Yes | Yes | Yes | Yes |

- Therefore, blood group AB is called the **universal recipient** and blood group O is called the **universal donor**.
- The Rh factor in the blood of the rhesus monkey was discovered by **Landsteiner** and **Wiener**.
- According to Karl Landsteiner, the following four categories of humans are based on different blood groups and antigens present in them.

| Serial No. | Blood group | Antigen | Antibody     |
|------------|-------------|---------|--------------|
| 1.         | A           | A       | Anti- B or b |
| 2.         | B           | B       | Anti- A or a |
| 3.         | AB          | A and B | None         |
| 4.         | O           | None    | Both a and b |

- According to Bernstein, ABO blood group is a genetic characteristic of human.

| Mother-Father Blood Group   | Blood Groups of Offspring |            |
|-----------------------------|---------------------------|------------|
|                             | Possible                  | Impossible |
| O × O                       | O                         | A,B,AB     |
| O × A<br>A × A              | O,A                       | B,AB       |
| B × B<br>O × B              | O,B                       | A,AB       |
| A × B                       | O,A,B,AB                  | -          |
| A × AB<br>A × AB            | A,B                       | O,AB       |
| B × AB<br>AB × AB<br>A × AB | A, B, AB                  | O          |

#### D. Excretory System

- **Excretion:** The removal of toxic wastes from the body of organisms is called excretion. In other words, excretion refers to the removal of nitrogenous excretory substances such as ammonia, urea, uric acid etc.
- Following are the primary excretory organs in humans- 1. Skin, 2. Lungs, 3. Liver, 4. Kidneys

##### Skin:

- Sweat glands of the skin excrete water, CO<sub>2</sub>, urea and salts in the form of sweat.
- The oily glands of the skin secrete sebum.

##### Lungs:

- The exhalation of carbon dioxide formed as a result of oxidation of carbohydrates in the cells of the body is performed mainly in the lungs during respiration process.
- The lungs also emit volatile components of certain foods such as garlic, onions and some spices.

##### Liver:

- Liver cells contribute significantly to the excretion by converting nitrogenous substances of excess amino acids and ammonia of blood etc. into urea.

##### Kidney:

- The kidney is a bean-shaped organ of dark red colour.
- In humans and other mammals, it is present in a pair.
- Its outer part is called **Cortex** and the inner part is called Medulla.
- Each kidney is made up of about 10,00,000 renal tubules called **Nephrons**.
- The renal tubule or nephron is the structural and functional unit of the kidney.
- Apart from urine formation, osmotic control (balance of water and minerals) is also an important function of the kidney.
- Urine is formed in the renal tubules in which the excretory substances remain dissolved.
- Each renal tubule is divided into four major parts -
  1. Bowman's Capsule
  2. Proximal Convoluted Tubule
  3. Henle's Loop
  4. Distal Convoluted Tubule
- The pit of the Bowman's Capsule contains a dense cluster of thin blood cells called the glomerulus.
- The glomerulus and the Bowman's capsule together are called **Malpighian Corpuscle**.
- The main function of each kidney is to filter out blood and remove unnecessary and waste materials from it.
- The blood supply to the kidney is very high (about 20-25% of the total blood) compared to other organs.

- About 125 millilitres per minute or 180 litres per day filtration of blood occurs in both kidneys and about 1.5 litres of urine is produced per day.
- Urine contains typically 95% water, 2% ions of unnecessary salts, 2.6% urea, 0.3% creatinine, uric acid, etc.
- The urine is light yellow due to the Urochrome pigment present in it.
- The pH value of the urine is 6.
- Often the stones formed in the kidney are made of **calcium oxalate**.
- Irregularity in the functioning of the kidney increases the amount of urea in blood. This is called **Uremia**.
- Dialysis is a treatment for people whose kidneys are failing.
  - When anyone has kidney failure, his kidneys don't filter blood the way they should.
  - As a result, wastes and toxins build up in your blood-stream.
  - Dialysis does the work of your kidneys, removing waste products and excess fluid from the blood.

#### Main Excretory Products of Animals

- **Amino Acids:** Excessive amino acids are excreted as soon as possible by some animals like a mussel, snail, some Echinodermata etc. This type of excretion is called **Aminotelic excretion** or **Aminotelism**.
- **Ammonia-NH<sub>3</sub>:** In most animals, ammonia produced as a result of the deamination process is highly toxic and soluble in water. Often aquatic animals, with large amounts of water, emit it quickly. Such emission is called **ammonotelism**. Such excretion occurs in Protozoa, Porifera, Cnidaria, Annelida, Numerous Mollusca, Arthropoda, Fishes, Turtles, Amphibian Tadpoles.
- **Urea:** Most terrestrial animals (adult amphibians and all mammals) and such aquatic animals which cannot afford to lose of much water, convert ammonia into urea and emit it. Such type of excretion is called **Uricotelic Excretion** or **Ureotelism**.
- **Uric Acid:** Terrestrial animals (birds, reptiles, insects, some snails, etc.) in dry environments that need to store water make uric acid from ammonia. It is not toxic. Hence, these can be retained in the body for a considerable period of time before being discharged from the body. This is called **uricotelic excretion** or **Uricotelism**.
- **Trimethylamine Oxide:** This substance is soluble in water, but not toxic. Many marine animals excrete it.
- **Guanine:** There is absolutely no need for water in its excretion. Spiders excrete their nitrogenous substances as guanine.

#### E. Nervous System

- In organisms body, there is a network of thin cells called **nerves**.



- The nervous system receives the information of atmospheric changes from the sensory organs and transmits them at a rapid rate in the form of electrical impulses and establishes functional coordination between different parts of the body.
  - **Schwann cells** also called neurilemma cells, are the main glial cells in the PNS and play an essential role in the survival and functions of neurons. (SSC CGL, 2023 Tier-1)
  - The human nervous system is mainly divided into three parts –
    - (I) Central Nervous System
    - (II) Peripheral Nervous System
    - (III) Autonomic Nervous System
  - (I) Central Nervous System:** The central nervous system controls the body responses of animals. The brain and spinal cord are covered by it.
  - (a) Brain:** The brain of man is safe in the cranial cavity of the skull.
    - The human brain weighs about 1.3–1.4 kg.
    - The brain has three major parts, viz., **forebrain, midbrain** and **hindbrain**.
    - The cerebrum, thalamus and hypothalamus are part of the forebrain.
    - Cerebellum, medulla oblongata and pons Varolii are parts of the hindbrain.
    - The cerebrum is the largest part of the brain.
    - **Cerebrum:** It is the centre of intelligence, will power, voluntary motions, knowledge, learning, memory, speech and thinking. It is an analysis and coordination centre of inspiration derived from the senses.
    - **Thalamus:** It gives the feeling of heat, pain, touch etc.
    - **Hypothalamus:** Its main function is to control the hormones secreted by endocrine glands. Thus, it contains the centres which control hunger, thirst, temperature, love, hatred etc. It also regulates feelings of anger, aggression, emotions, pain, happiness and pleasure. It controls the rhythm of sleep and daily activities.
    - The corpora quadrigemina and cerebral peduncle are part of the midbrain.
    - **Corpora Quadrigemina:** It is the controlling centre of vision and hearing.
    - **Cerebral Peduncle:** It is also called Crura Cerebri, which connects other parts of the brain to the spinal cord.
    - **Cerebellum :** This is located in the upper part of the hindbrain. It is the second-largest part of the hindbrain after cerebrum. Its function is to maintain the balance of the body and control the contraction of voluntary muscles. It coordinates all skilful actions.
    - **Medulla Oblongata:** This is the lower part of the hind brain, and is often called only the medulla.
  - The main functions of the medulla oblongata are to control heart beating rate and intensity, respiration rate, food ingestion, vomiting, coughing, sneezing, hiccups, taste, secretion of saliva, hearing balance and movement of the tongue.
  - **Spinal Cord:** Spinal cord is the posterior part of the medulla oblongata. Its main functions are as follows –
    - Spinal cord controls and coordinates reflex actions.
    - It carries stimuli to and from the brain.
    - Both the above functions of the spinal cord are essential for Homeostasis.
    - Reflex action was first discovered by **Marshall Hall**.
  - II. Peripheral Nervous System:** It consists of nerves emanating from the central nervous system.
    - There are two types of peripheral nerves-(1), Cranial nerves related to the brain and (2) Spinal nerves related to the spinal cord.
    - There are 12 pairs of cranial nerves and 31 pairs of spinal nerves in the human body.
  - III. Autonomic Nervous System:** The Autonomic Nervous System (ANS) is that part of the peripheral nervous system that regulates and controls the functions of visceral organs. Some of it is made up of cranial nerves and some of spinal nerves.
    - Autonomic Nervous System can be divided into two parts -
      - 1. **Sympathetic Nervous System**
      - 2. **Parasympathetic Nervous System**
- Functions of the Sympathetic Nervous System:**
1. It dilates the pupil.
  2. It reduces the secretion from salivary glands.
  3. It increases blood pressure by contracting blood vessels.
  4. It increases the rate of heart-beat.
  5. It stimulates the secretion of hormones from adrenal glands.
  6. It relaxes the muscles of the urinary bladder.
  7. It stimulates the secretion of sweat.
  8. It reduces the rate of peristalsis by relaxing the muscles of the alimentary canal.
  9. It increases the number of red blood cells in the blood.
  10. This prevents the external genitalia from being stimulated but encourages ejaculation.
- Functions of the Parasympathetic Nervous System:**
1. It contracts the pupil of the eye.
  2. It stimulates the secretion of salivary glands and lacrimal glands.
  3. It reduces blood pressure by dilating the blood vessels in the skin.
  4. It reduces the rate of heartbeat.
  5. It reduces the secretion of hormones of the adrenal glands.
  6. It contracts the muscles of the urinary bladder for urination.
  7. It stimulates the external genitals.

🔍 **Note :** The functions of the parasympathetic nervous system are generally reversed to those of the sympathetic nervous system.

- A unit of nerve tissue is called a neuron or nerve cell.
- Nerve cells are the longest cells of the body.
- Sensory or Afferent nerve cells transmit impulses from peripheral organs and transport them to the central nervous system.
- The motor or efferent nerve cells transmit impulses from the central nervous system to the peripheral organs.
- Synapses refer to the points of contact between neurons where information is passed from one neuron to the next. Synapses mostly form between axons and dendrites.
- **Epilepsy** is a disorder resulting in abnormal electrical discharges from the brain cells causing seizures. (SSC CGL 2021)

## F. Skeletal System

- Skeletal system gives shape to all vertebrates, including humans.
- The skeletal system of a human body consists of two parts - (I) the **Exoskeleton** and (1) the **Endoskeleton**.
- The exoskeleton consists of hair and nails.
- The endoskeleton includes the inner skeleton framework, i.e. the bones and cartilage.
- The endoskeleton of an adult human contains 206 bones.
- The endoskeleton of an infant contains 300 bones.
- Calcium phosphate is found in maximum quantity in human bones.
- The endoskeleton consists of two parts - (I) **Axial Skeleton** and (II) **Appendicular Skeleton**.
- **Axial Skeleton:** The skeleton forming the main axis of the body is called the axial skeleton. It includes the skull, thoracic and vertebral bones. There are 80 bones in adults and 87 in infants.

**(a) Skull:** Skull is the endoskeleton part of the human head. It consists of 29 bones in total. Out of this, 8 forms the shell (case) around the brain, i.e, cranium, cranial cavity. Fourteen bones from the remaining form the skeleton of the face. There are 6 bones in the middle ear and a bone called **Hyoid** is located at the root of the tongue between mandible and larynx.

**(b) Vertebral Column:** Vertebral column of an adult consists of 26 (33 in infants) vertebrae. All vertebral cartilages are connected by an intervertebral disc. Intervertebral discs help to make the vertebral column flexible.

🔍 **Note :** The smallest bone of the body is the stapes and the largest bone is the femur. The femur, also called thighbone, is the upper bone of the leg or hind leg.

- Arthroplasty is a surgical procedure to restore the function of a joint.
  - A joint can be restored by resurfacing the bones.
  - An artificial joint (called a prosthesis) may also be used.
- We can divide the entire vertebral column into the following parts:
  1. Cervical Vertebrae in neck - 7
  2. Thoracic Vertebrae in the thorax - 12
  3. Lumbar Vertebrae in Lumbar - 5
  4. Sacrum at base of Lumber - 1 (5 in infants)
  5. Coccyx in the Pelvis - 1 (4 in infants)
- The first vertebra of the neck is called **atlas**. It supports the weight of the skull.
- Sternum, ribs and vertebral column form the skeletons of our neck and thorax.
- The sternum is the chest bone. It is a long, narrow, flat bone and is located along the body's midline in the anterior thoracic region.
- There are 12 pairs of Ribs in our body. It forms the lateral part of our thoracic cage.

### Functions of the Vertebral Column:

- The vertebral column keeps the head close and protects the spinal cord.
- It provides support to the neck and thorax.
- It helps humans to stand and walk.
- It provides flexibility to the neck and thorax, making it easier to rotate.

**(II) Appendicular Skeleton:** It contains 126 bones of our upper and lower limbs, i.e, the arms and legs; and the girdles connecting them to the thorax. Their description is as follows.

### (a) Pectoral Girdle and Upper Extremity:

It consists of the following 64 bones –

|                 |   |    |
|-----------------|---|----|
| Pectoral Girdle | - | 4  |
| Upper arm       | - | 2  |
| Forearm         | - | 4  |
| Wrist           | - | 16 |
| Palms           | - | 10 |
| Finger          | - | 28 |

### (b) Pelvic Girdle and Lower Extremity:

It contains the following 62 bones -

|               |   |    |
|---------------|---|----|
| Pelvic Girdle | - | 2  |
| Thigh         | - | 2  |
| Patella       | - | 2  |
| Shank         | - | 4  |
| Ankle         | - | 14 |
| Sole          | - | 10 |
| Toe           | - | 28 |

- The forelimbs or hands are called the upper extremity and the hind limbs the lower extremity.

- Girdle of the upper extremity is called **Pectoral Girdle** and the girdle of the lower extremity is called **Pelvic Girdle**.
- The main bone of the forelimb 'humerus' is attached to the pectoral girdle and the femur of the hindlimb is connected to the Pelvic Girdle.

#### Functions of the Skeletal System:

- It provides a definite structure to the body.
- It provides the basis for muscles to join.
- It protects the soft organs present inside the body.
- It helps in respiration, nutrition and circulation.
- These red blood cells are formed in the bone marrow of skeletal bones.

🔗 **Note :** The ligaments connect the bones while the tendons connect the muscles to the bone.

- An undifferentiated layer, **Mesoglea** is present in between the ectoderm and the endoderm. (SSC CGL 2022 Tier-1)

#### G. Respiratory System

- Combustion of glucose with oxygen releases energy, water and carbon dioxide. The process of inhalation of oxygen and exhalation of carbon dioxide is called **respiration**.
- The respiratory system consists of all the organs through which air passes in and out are nose and nasal passages, pharynx, larynx or voice box, trachea, bronchi, bronchioles and lungs etc.
- Through lungs, gases are inhaled and exhaled. It is the most important part of the human respiratory system. Hence, it is called pulmonary respiration.

#### Nose and Nasal Passages:

- The external nasal opens into two separate (right and left) passages which have a long and erect nasal septum in the middle to separate them.
- The cavity inside the nose is layered in the mucous membrane, which causes the secretion of mucus. Due to mucus the nasal passage remains moist and sticky. Therefore, the outside air gets moist before reaching the lungs.
- The mucous membrane prevents dust particles, bacteria or other microbes from entering the body.
- **Pharynx:** The pharynx in the airway is located behind nasal passages.
- It is about 13 cm long and has a long, funnel-shaped cavity.
- **The Larynx or Sound Box:** The part of the respiratory tract that connects the pharynx to the trachea is called the **larynx or soundbox**.
- The main function of larynx is to produce sound.
- The larynx is a leafy structure made of flexible cartilage at the entrance, known as **Epiglottis**. While swallowing food, it closes the glottis like a lid, so that food cannot enter the respiratory tract.

- **Trachea:** It is attached to larynx. These are tubules 12 cm long and 2.5 cm wide joined with the larynx. It reaches the thoracic cavity and divides into two small branches (**the right and left**) called primary bronchi. The secondary bronchi enter the bronchi of the right lung into its three lobes, while the bronchi of the left lung divide into two secondary bronchi. The splitting of the last branch leads to bronchioles, which eventually form the Alveolar Ducts.

- **Lungs:** There are two lungs in the thoracic cavity, surrounded by a pleural membrane.
- The right lung of a man is somewhat larger and wider than the left lung but slightly smaller in length. A network of blood capillaries is spread across the lungs. There are about 150 million alveoli in each lung, in which gaseous exchange occurs between the air and the blood.

- The process of respiration can be divided into four categories - (1) **External respiration**, (2) **Transport of gases**, (3) **Internal respiration** and (4) **Cellular respiration**.

1. **External Respiration:** It consists of two processes, respiration and exchange of gases.

#### Breathing:

- Respiratory activity is the inhalation of air from the environment and then exhalation. It occurs at a fixed rate.
- Respiration is the filling of air into the lungs and expiration or exhalation is the removal of air from the lungs.
- During the lungs swell, causing the air pressure to decrease slightly from the pressure of the outside air and the air is drawn into them.
- During exhalation, the inflated lungs deflate back to normal, causing the air pressure to rise slightly above the external air pressure and some of the air exits out.

#### Exchange of Gases:

- Exchange of gases takes place inside the lungs. It involves the exchange of oxygen and carbon dioxide gases due to the difference in their pressure. The direction of diffusion of these two gases is opposite to each other.

#### 2. Transportation of Gases :

- The movement of gases (**oxygen and carbon dioxide**) from the lungs to the body cells and again from the cells back to the lungs is called transportation of gases.
- Oxygen is transported by a red pigment colour haemoglobin. Haemoglobin is found in red blood cells.
- It is an important function of blood to transport O<sub>2</sub> from the lungs to all the cells of the body and CO<sub>2</sub> from the cells to the lungs.
- Carbon dioxide transport blood in the following three ways -  
(A) **In the form of Dissolved in Plasma:** Carbon dioxide dissolves in plasma to form carbonic acid and at this state, about 7% CO<sub>2</sub> is transported in our body.

**(B) In the form of bicarbonates:** In the blood, about 70% of carbon dioxide ( $\text{CO}_2$ ) is transported as bicarbonates.

**(C) In the form of Carbamino Compounds:** About 23% of  $\text{CO}_2$  in the blood is transported as carbamino haemoglobin.

**3. Internal Respiration:** Internal respiration is the gaseous exchange that occurs between the blood and tissue material in the body.

**4. Cellular Respiration:** Like nutrients in the body, oxygen ( $\text{O}_2$ ) is also used in cells. Glucose is called cellular fuel. The process of oxidation of glucose with the help of oxygen in the cell is called **cellular respiration**.

- The types of cellular respiration are - (a) Anaerobic respiration and (b) Aerobic respiration

**(a) Anaerobic Respiration:**

- It occurs in the absence of oxygen.
- There is incomplete oxidation of foods and during the process **carbon dioxide** and **ethyl alcohol** are formed.
- Sometimes other different organic substances like - malic acid, oxalic acid, butyric acid, lactic acids are also formed.
- This process results in the formation of lesser energy.
- Anaerobic respiration occurs transiently in the tissues of higher plants, in sprouting seeds and fruits.
- This type of respiration often occurs regularly in many fungi and bacteria.
- Organisms that produce energy by aerobic respiration in normal conditions, but can survive by producing energy by respiration even in the absence of oxygen are called **facultative anaerobes**. Example- Lactic acid bacteria.
- Organisms that can survive only by anaerobic respiration in the absence of oxygen and die under the influence of oxygen are called **obligate anaerobes**.

**(b) Aerobic Respiration:**

- When respiration occurs in the presence of oxygen, it is called **aerobic respiration** and the organism that performs such action is called **aerobes**.
- In this activity, complete oxidation of food is carried out, which results in the formation of carbon dioxide ( $\text{CO}_2$ ) and water ( $\text{H}_2\text{O}$ ). A large amount of energy is also produced.
- The complex process in cellular respiration can be divided into three parts - (I) **Glycolysis** and (II) **Kreb's cycle** (III) **Oxidative phosphorylation by the electron transport mechanism**.

**(I) Glycolysis:**

- It is the first stage of aerobic respiration, which occurs in the cytoplasm.
- It was first studied by scientists named **Embden, Meyerhof and Parnas**. Due to which it is also called **EMP path**.
- It is also called sugar fermentation or anaerobic respiration.
- In glycolysis, energy is released in the absence of oxygen.

- In glycolysis, two molecules of pyruvic acid are formed from one molecule of glucose and some energy is released.
- Glycolysis results in a net gain of 2 ATP (Adenosine Triphosphate) molecules i.e,  $7300 \times 2 = 14600$  calories or 14.6 kcal energy.

**(II) Krebs Cycle:**

- It is a cyclic series of hydrogenation and carboxylation reactions.
- The Krebs Cycle was described by **Sir Hans Adolf Krebs** in the year 1937.
- The Krebs Cycle is also known as the **citric acid cycle** or **tricarboxylic acid cycle**.
- The enzymes of the reactions of this cycle are mainly dissolved in the matrix of mitochondria.

**(III) Electron Transport System:**

- Maximum ATP molecules are formed during the Krebs cycle.
- In this process, energy is generated from the oxidation of high-energy compounds such as NADH formed during the Krebs cycle and glycolysis. This action occurs on Cristae particles of the inner surface (membrane) of mitochondria.

✎ **Note :** Respiratory rate in a healthy adult human is approximately 12–15 times per minute.

- The duration of the heart cycle in a healthy human being is 0.8 seconds.

**Production of Energy:**

- In body cells, there is often a net gain of 38 ATP molecules from the biological oxidation of a glucose molecule.
- A '**glycerol-3 phosphate shuttle**' in the cell of the striated muscle, brain, etc., while a '**mallet-aspartate shuttle**' works in the cells of the liver, kidney, heart etc.
- Cells in which 'glycerol-3-phosphate' function has a net gain of 36ATP molecules instead of 38 ATP per glucose molecule.

✎ **Note :** One molecule of NADH produces 3 molecules of ATP and one molecule of  $\text{FADH}_2$  produces 2 molecules of ATP.

**H. Endocrine System**

- The gland consists of cells, tissues or organs whose cells synthesize and secrete a substance. These are three types in vertebrate animals –

**(I) Exocrine Glands:** These are duct glands.

- Secreted materials from it flow into the ducts and are released on the surface of the corresponding epithelial layer. Example- Milk gland, sweat gland, lacrimal gland, mucous gland, salivary gland etc.

**(II) Endocrine Glands:** These are ductless glands.

- Secreted substances or hormones from it released into the tissue material reach the blood cells and circulate throughout the body, such as pituitary gland, thyroid, parathyroid, adrenal, pineal and thymus gland.

**(III) Mixed Glands:** It includes both exocrine and endocrine types of tissue or cells—for example, pancreas.

**Major endocrine glands and hormones secreted from them:**  
**Pituitary Gland:**

- It is located in the sella turcica in the sphenoid bone of the cranium.
- It weighs between 0.5 and 1 gram.
- Many of its hormones control other endocrine glands. It is thus known as the **Master Gland**.

**Hormones secreted from the pituitary gland and their functions:**

**1. Somatotropin or Growth Hormone -STH or GH :**

- It controls the growth of the body, mainly bone growth.
- Growth Hormone Deficiency (GHD) causes dwarfism.
- In adult humans, its excess causes gigantism or acromegaly disorders.

**2. Thyroid-Stimulating Hormone – TSH:**

- It stimulates the thyroid gland to secrete hormones.

**3. Adrenocorticotrophic Hormone-ACTH:**

- It is secreted by corticotroph cells of the anterior pituitary.
- It controls the secretion of the adrenal cortex.

**4. Luteotropic Hormone - LTH :**

- It is secreted by lactotroph cells of the anterior pituitary.
- It stimulates milk secretion from the breasts for the infant.

**5. Follicle Stimulating Hormone - FSH:**

- It stimulates the growth of seminiferous tubules of testes and spermatogenesis in males.
- It stimulates the growth and development of the ovarian follicles and oogenesis in women and also stimulates the secretion of female sex hormones 'Estrogen'.

**6. Luteinizing Hormone-LH:**

- It induces the secretion of the male hormone testosterone in males.
- In women, LH and FSH are the stimulators of ovulation, maturation and secretion of female hormones.

**7. Vasopressin or Antidiuretic Hormone-ADH:**

- It helps in maintaining water balance in the body.
- Its main function is to increase the reabsorption of water from the distal convoluted tubules of nephrons and collecting ducts in the kidney.
- Oxytocin is a natural hormone that manages key aspects of the female and male reproductive systems, including labor and delivery and lactation, as well as aspects of human behavior.

- Human's hypothalamus makes oxytocin, but your posterior pituitary gland stores and releases it into your bloodstream.

**Thyroid Gland:**

- This gland is located just below the larynx (Adam's apple) on either side of the trachea in the neck of the human being.
- Its length in adult humans is about 5 cm and width is about 3 cm.
- It weighs about 25 grams.
- It leads to the secretion of tetraiodothyronine ( $T_4$ ) or thyroxine and triiodothyronine ( $T_3$ ) hormone.
- These increase the rate of energy production and the basal metabolic rate.

**Thyroxine Deficiency Disease:**

- Myxoedema:** This disease occurs in adults due to low secretion of thyroid. It dramatically reduces the metabolic rate, i.e., BMR. Hence, appearing the symptoms of premature ageing.
- Cretinism:** This disease is caused due to hyposecretion of thyroid in the embryonic stage or even in childhood. Thus, the mental and physical development of the child is retarded and he remains stunted.
- Common Goitre or Simple Goitre:** Thyroid gland enlargement is called goitre disease; a lack of iodine in food causes this disease.
- Hashimoto's Disease:** This disease occurs due to excessive hyposecretion or damage to the thyroid gland due to ageing, injury, infection, surgery etc.
  - This is called 'Suicide' of thyroid.

**Disease Due to Excess of Thyroxine :**

- Exophthalmic Goitre:** In this, the hyposecretion thyroid gland often enlarges. Protrusion of the eyeballs is due to the accumulation of mucus in eye orbits. The sight of such a person seems to be frightening and staring.
- Plummer's Disease:** In this disease, the goitre swells due to the formation of one or more nodules in the thyroid gland.
  - It is also called Toxic Multinodular Goitre. It increases heartbeat rate and respiratory rate.

**Parathyroid Gland:**

- It is located just behind the thyroid gland in the throat.
- It is a gland derived from the endoderm of the fetus.
- It secretes the **Parathormone Hormone** also known as Collip's Hormone.
- The **Parathormone** and **Calcitonin** secreted by this hormone help in maintaining the ideal amount of calcium ion in blood.

**Adrenal Gland:**

- This gland consists of two parts -
  1. The outer part, i.e., cortex
  2. The inner part, i.e., medulla



### Hormones secreted by the Cortex and Their Functions:

**I. Glucocorticoids:** They regulate carbohydrate, protein and fat metabolism. Cortisol is the most essential hormone among them.

- The cortisol hormone disrupts the body's immune system. Therefore, it is injected at the time of organ transplant.

**II. Mineralocorticoids:** Its main function is the reabsorption of salts by the renal tubules and controls the amounts of other salts in the body. Of these, aldosterone is the most important hormone.

**III. Sex Hormone:** These hormones control sex, hair patterns and sexual behaviour.

🔗 **Note :** Damage to the adrenal cortex leads to disturbances in metabolic function known as Addison's Disease.

- Due to this discovery, **Thomas Addison** is called the father of **endocrinology**.

#### Medulla:

- The medulla secretes hormones, epinephrine and norepinephrine, derived from the tyrosine amino acids.
- Vasodilation due to the effect of **Epinephrine** increases blood circulation in the brain, skeletal muscles, heart, lungs, liver etc. It reduces the blood pressure caused by **Norepinephrine**.
- Due to the effect of norepinephrine, vasoconstriction reduces blood circulation in the organs of the peripheral and abdominal organs such as skin, digestion, excretion, reproduction etc., which are more active during sleep, rest and when relaxed. It reduces the functioning of these organs and increases blood pressure.
- The adrenaline hormone secreted from the adrenal gland is also called **Fight and Flight Hormone**.
- These hormones are ready to react in the body in stress threatening conditions.
- Secretion of adrenaline or epinephrine causes an increase in heart rate and excitement in the body.

#### D. Gonads:

**1. Ovary:** It secretes the following hormones –

**(a) Estrogen:** It is called female growth hormone. It is helpful in the development of secondary sexual traits of the female.

**(b) Progesterone:** It induces the development of symptoms necessary for pregnancy.

**(c) Relaxin:** In pregnancy, these are secreted from corpus luteum and placenta. This hormone softens the pubic symphysis of the pelvic girdle, making the cervix wider and facilitating childbirth.

#### 2. Testes:

- Cells of Leydig secrete male hormones, Androgens from testes.

- People who have anthophobia have an extreme fear of flowers.

- “Anthos” is the Greek word for flowers, while phobia means fear. Someone with anthophobia may be afraid of any flower or a specific type.

- Any part of a flower or plant — from stem to leaf to petal — may cause fear.

- The primary androgen is testosterone. It is called the **Growth Hormone**.

- It promotes the development of male sexual characteristics and sexual behaviour.

## 10. Nutrients

Following types of nutrients are required for conducting and editing various types of biological functions in organisms - proteins, carbohydrates, mineral salts, fats, nucleic acids, water and vitamins.

### 1. Vitamins:

- **Funk** discovered vitamins.
- Vitamins are complex organic compounds.
- Vitamins control the actions of catalysts in metabolic reactions in the body.
- About 20 vitamins have been known so far. These are in two categories - (i) **Water-soluble** (Vitamin B,C) and (ii) **Fat-soluble** (Vitamin A,D,E,K).
- The chemical name for vitamin 'A' is **retinol**.
- Vitamin A as the “anti-infection” vitamin.
- People with vitamin 'K' deficiency cannot be easily operated, as there is a fear of excessive blood loss.
- Vitamin 'D' is considered as a **Hormone**.
- Vitamins and its sources and diseases caused by its deficiency.

| Vitamin                                                                | Disease due to Deficiency                                      | Sources                                                                  |
|------------------------------------------------------------------------|----------------------------------------------------------------|--------------------------------------------------------------------------|
| Vitamin A (Retinol)                                                    | Nightblindness, xerophthalmia, infection, inchanges            | Carrots, Green Vegetables, Milk, Butter, Egg, Liver etc.                 |
| Vitamin B <sub>1</sub> (Thiamine)                                      | Beri-Beri, growth retardation                                  | Cereals, Legumes, Soybeans, Milk etc.                                    |
| Vitamin B <sub>2</sub> (Riboflavin)                                    | Cheilosis                                                      | Paneer, Egg, Green Vegetables, Milk, Meat, Yeast etc.                    |
| Vitamin B <sub>3</sub> (Niacin)                                        | Pellagra                                                       | Yeast, Meat, Fish, Egg, Milk, Legumes etc                                |
| Vitamin B <sub>5</sub> (Pantothenic Acid)                              | Skin disease retarded growth, white hair                       | Egg, Milk, Meat, Groundnut etc                                           |
| Vitamin B <sub>6</sub> (Pyridoxine)<br>Vitamin B <sub>7</sub> (Biotin) | Anaemia, skin diseases, muscle cramps skin diseases, hair fall | Milk, Yeast, Cereals, Meat etc. Wheat, Egg, Vegetables/Meat, Fruits etc. |

|                                                |                                                           |                                                                |
|------------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------|
| Vitamin B <sub>9</sub><br>(Folic Acid)         | Anemia, retarded growth                                   | Vegetables, Pulses, Yeast, Meat, Egg etc.                      |
| Vitamin B <sub>12</sub><br>(Cynocobal-amin)    | Pernicious Anaemia, Nervous system disturbances           | Milk, Meat, Fish, Egg, Intestinal Bacteria etc.                |
| Vitamin C<br>(Ascorbic Acid)                   | Scurvy                                                    | Citrus Fruits, Tomatoes, Almond, Vegetables etc.               |
| Vitamin D<br>(Calciferol)                      | Rickets (in Children) Osteomalacia (in Adults)            | Butter, Cod Liver Oil, Egg, etc. and Sunlight.                 |
| Vitamin E<br>(Tocopherol)                      | Lack of reproductive capacity, weak genitalia and muscles | Oil, Cereals, Egg-yolk, Soybean etc.                           |
| Vitamin K<br>(Naphthoquinone or Phylloquinone) | Impaired Blood Clotting                                   | Green Leafy Vegetables, Egg, Soybean, Intestinal Bacteria etc. |

### Protein:

- Protein is a complex organic compound. It consists of 20 types of amino acids.
- Out of which 10 amino acids are called Non-Essential amino acids. They are made in our body and the remaining 10 amino acids are obtained by food substances, which are called Essential amino acids.

### Types of Protein:

**A. Simple Protein:** This type of protein is made up of only amino acids. Example- Globulins, Histones etc.

**B. Conjugated Proteins:** These types of proteins contain specific non-amino acid components in addition to amino acids. Example Glycoprotein, Chromoprotein etc.

**C. Derived Proteins:** These types of proteins are formed by the process of hydrolysis. Example Peptone, Protease Peptide.

- Soybean has the highest protein content.
- Soybean contains about 40% of protein.
- Groundnut contains protein, fat and sugar.
- The amount of protein in groundnut is about 2.5 times higher than that in eggs.
- Groundnut contains about 25.8 per cent of protein and about 49.1 per cent of fats.
- Hair is made up of a **Keratin** protein.
- Keratin is the major structural component of nails and hair in animals.
- **Tyrosine** is the amino acid present in protein-rich foods.
- Lack of tyrosine makes a person feel unhappy and tired.
- **Casein** protein is present in milk due to which the milk looks white.
- The light yellow colour of cow milk is due to the presence of Carotene mineral salts. Lactose, vitamins and other ingredients are found in milk.

- Another protein called **albumin** is also found in milk.
- The enzyme that digests milk protein is called **renin**.
- **Renin**, after converting the milk soluble protein casein into semi-solid and less soluble calcium paracaseinate converts milk into curd.
- Protein is a complex nitrogen-containing organic material.
- Protein consists of molecules of carbon, hydrogen, oxygen and nitrogen.
- Amino acids are monomers of protein.
- Amino acids are essential for the development of skin, muscles and bones.
- The appropriate daily intake of protein for a normal working woman is about 45-46 grams.
- Feeding mother requires 65 to 70 grams of protein per day.
- Fats have the highest amount of calories per unit of food.
- Metabolic oxidation of one gram of carbohydrates or protein yields about 4.0 kcal, while one gram of fat yields 9.3 kcal of energy.
- The sources of fat are both animals and vegetables.

### Functions of Proteins:

- Proteins are essential for physical development.
- Protein also provides energy to the body.
- Contractile proteins (actin and myosin) contract the muscles and give motion to the body and organs.
- Defensive proteins protect the body in the form of antibodies.
- Some proteins in the form of hormones regulate the actions of cells.

### 3. Carbohydrates:

- It is made up of a mixture of carbon, hydrogen and oxygen (1 : 2 : 1).
- Carbohydrates supply 50% to 75% of the human body's energy.

### Types of Carbohydrates:

**A. Mono Saccharides:** This is a simple form of carbohydrate. Ex. Glucose, Triose, Galactose etc.

**B. Disaccharides:** Two molecules of monosaccharides form Disaccharides. Ex. Sucrose, Maltose, Lactose etc.

**C Polysaccharide:** Polysaccharide consisting of several molecules of monosaccharides such as Starch, Chitin, Glycogen etc.

- Wheat, Rice, Maize, Millet, Potato, Sweet potato etc. are the primary sources of carbohydrates.

### Functions of Carbohydrates:

- They provide heat and energy to the body.
- It forms nucleic acids (RNA and DNA).

### 4. Minerals:

- Minerals control metabolic functions of the human body.

## Important Minerals and Its Functions

| Mineral    | Diseases due to deficiency               | Daily need (approx)                                                  | Functions                                                                              | Sources                                                                      |
|------------|------------------------------------------|----------------------------------------------------------------------|----------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Sodium     | Low blood pressure, muscle cramps        | 1.5 gram                                                             | Mechanisms of nerves and muscles, heart beat, etc.                                     | Simple Salt, Green Vegetables, Meat, Fish, Poultry and Milk                  |
| Magnesium  | Loss of Appetite, nausea, mental fatigue | 310-420 milligram                                                    | Bone and teeth formation and function of nervous system function                       | Green Vegetables, Milk, Cereals                                              |
| Iron       | Anaemia                                  | 8 milligram (men) 18 milligram (women) 27 milligram (pregnant women) | Formation of Red Blood Cells (RBC) (component of haemoglobin)                          | Green Leafy Vegetables, Bran Flour, Millet, Ragi, Raisins, Meat, Liver, etc. |
| Calcium    | Astigmatism, Tetany                      | 1.2 gram                                                             | Bone and tooth formation, help in blood clot and function of muscle and nervous system | Milk, Vegetable, Cereal, Whole Grains, Eggs, Fish, etc.                      |
| Iodine     | Goitre                                   | 150 microgram                                                        | Synthesizing thyroxine hormone secreted by thyroid gland                               | Seafood, Iodized Salt                                                        |
| Phosphorus | Weakening of bones                       | 700 milligram                                                        | Strengthening bones and teeth                                                          | Milk, Meat, Vegetables, Cereal, etc.                                         |
| Potassium  | Low blood pressure                       | 3.5-4.7 gram                                                         | Maintaining muscle contraction and transmission of nerve impulses, heart beat.         | Meat, Milk, Grains, Fruits, Vegetables.                                      |
| Zinc       | Loss of appetite, retarded growth        | 8-11 milligram                                                       | For functioning of Insulin                                                             | Meat, Fish, Other food items                                                 |
| Copper     | Anaemia, Weakness of Connective Tissues  | 900 microgram                                                        | Iron metabolism, development of connective tissues and blood vessels                   | Fish, meat, liver, green vegetables, dry fruits, etc.                        |

### 5. Fats:

- Fat is made up of a mixture of carbon, hydrogen and less amount of oxygen.
- It consists of glycerol and fatty acids.
- Fats are of two types - Saturated and Unsaturated.
- Unsaturated fats are obtained from vegetables and fish.
- Saturated fat is obtained from palm and coconut.
- An adult person obtains about 20 to 30% of energy from fat.
- Oxidation of 1 gram of fat provides 9.3 cal. of energy.

🔗 **Note :** Eating unsaturated fat is beneficial for patients suffering from Hypercholesterolemia, Hyperlipidemia and coronary artery disease.

### Functions of Fats:

- It accumulates under the skin in the body and prevents heat loss.
- Fats provide energy to the body.

- The fat protects various parts of the body from injury.
- Fat is helpful in body development.

### 6. Nucleic Acid:

- It is a nucleotide polymer of oxygen, hydrogen, nitrogen, carbon and phosphorus.
- It is found in small amounts in the DNA and RNA of our cells.

### Functions of Nucleic Acids:

- It produces chromatin threads.
- It produces a variety of enzymes.
- It synthesizes and controls proteins.
- It transmits genetic properties from generation to generation.

### 7. Water:

- It is consumed as a drink.
- Water accounts for 60–70% of weight of a human body.

### Functions of Water:

- Water regulates our body temperature.

- It helps in the excretion of body waste.

🦋 **Note :** Excess nitrate in drinking water causes Blue Baby disease.

### 13. Human Diseases and Their Treatment

- Interferon is used as a precautionary and preventive drug in viral infection.
- Flu or influenza is a worldwide disease.

| Diseases Caused by Bacteria |                             |                          |
|-----------------------------|-----------------------------|--------------------------|
| Disease                     | Carrier Bacteria            | Affected Limb            |
| Tetanus                     | Clostridium Tetani          | Nervous System           |
| Typhoid                     | Salmonella Typhi            | Intestine                |
| Cholera                     | Vibrio Cholerae             | Intestine                |
| Pneumonia                   | Streptococcus Pneumoniae    | Lungs                    |
| Tuberculosis                | Mycobacterium Tuberculosis  | Lungs                    |
| Plague                      | Yersinia Pestis             | Lungs, between both Legs |
| Gonorrhoea                  | Neisseria Gonorrhoeae       | Urinary Tract            |
| Diphtheria                  | Corynebacterium Diphtheriae | Trachea                  |
| Hooping cough (Pertussis)   | Bordetella Pertussis        | Respiratory System       |
| Leprosy                     | Mycobacterium Leprae        | Nervous System, Skin     |
| Syphilis                    | Treponema Pallidum          | Reproductive Organ       |

| Diseases Caused by Virus                          |                   |                                |
|---------------------------------------------------|-------------------|--------------------------------|
| Disease                                           | Carrier Virus     | Affected Limb                  |
| AIDS                                              | HIV               | Immune System                  |
| Polio                                             | Poliovirus        | Neck, Spine and Nervous System |
| Influenza                                         | Orthomyxo viruses | Respiratory Tract              |
| Smallpox                                          | Variola Virus     | Whole-body (skin)              |
| Chickenpox                                        | Varicella Virus   | Whole-body (skin)              |
| Measles                                           | Paramyxovirus     | Whole-body (skin)              |
| Rabies                                            | Rhabdo Virus      | Nervous System                 |
| Herpes                                            | Herpes Virus      | Skin                           |
| Hepatitis B                                       | hepatitis B Virus | Liver                          |
| <b>*AIDS: Acquired Immuno Deficiency Syndrome</b> |                   |                                |

- The cause of amoebiasis or **diarrhoea** is a protozoan called **Entamoeba Histolytica**.

- The cause of sleeping sickness is a protozoan parasite called **Trypanosoma** which is generated by the bite of Tse-Tse fly.
- Glaucoma or **trachoma** is the disease of eye.
- **Chemotherapy** is used to treat cancer.
- Oral Rehydration Therapy (ORT) is associated with diarrhoea therapy.
- SARS is an acronym for Severe Acute Respiratory Syndrome.

| Diseases Caused by Protozoa |                       |                 |
|-----------------------------|-----------------------|-----------------|
| Disease                     | Protozoa              | Affected Limb   |
| Malaria                     | Plasmodium            | RBC and Spleen  |
| Pyorrhoea                   | Entamoeba gingivalis  | Gum             |
| Sleeping sickness           | Trypanosoma Gambiense | Brain           |
| Amoebiasis (Dysentery)      | Entamoeba Histolytica | Intestine       |
| Kala-azar                   | Leishmania Donovan    | Bone Marrow     |
| Diarrhoea                   | Giardia Intestinalis  | Small Intestine |

- SARS is a viral disease that primarily affects the human respiratory system.
- Paracetamol is used to relieve body pain and reduce fever.
- Penicillin is the first antibiotic.
- Penicillin was discovered by **Alexander Fleming**.
- Typhoid disease mainly affects human intestines.
- **Sir Ronald Ross** discovered that malaria is caused by unicellular protozoan 'Plasmodium' and female anopheles mosquito functions as a carrier of Plasmodium.
- The term malaria was coined by **John Macculloch**.
- Laveran discovered the malaria parasite 'Plasmodium' in the blood of a person affected by malaria.
- Due to malaria, red blood cells (RBC) are destroyed and blood deficiency occurs.
- The female anopheles mosquito is the carrier of malaria.

| Diseases Caused by Fungus |                              |
|---------------------------|------------------------------|
| Disease                   | Fungus                       |
| Asthma                    | Aspergillus Fumigatus        |
| Athlete's foot            | Tinea Pedis and Trichophyton |
| Baldness                  | Tinea Capitis                |
| Ringworm                  | Trichophyton and Microsporum |

- The organ affected by malaria is **Spleen**.
- **Chloroquine, Camoquin**, etc. are used in the treatment of malaria.
- Dengue is a viral disease caused by **Aedes aegypti, Aedes albopictus** and **Culex fatigues** mosquitoes.

- Dengue causes severe pain in bones and joints, along with a high fever.
- Dengue is also known as **Breakbone fever**.
- The number of platelets in the blood of a patient suffering from dengue decreases.
- Plasmodium vivax is a digenetic animal.
- The life cycle of Plasmodium vivax is completed in two hosts - human and female anopheles.
- Plasmodium vivax causes **malaria**.
- It lives as an endoparasite in red blood cells and liver cells.
- The BMD test is used to identify **Osteoporosis Disease**. Osteoporosis is a bone disease in which bones become weak and brittle.
- Food poisoning is caused by the bacteria '**Salmonella Bacilli**'.
- In osteoporosis disease, the Bone Mineral Density decreases and the micro-structure of the bone is destroyed.
- Poisoning from the bacterium '**Clostridium Botulinum**' is called botulism.
- Itai-Itai disease is caused by **cadmium** poisoning.
- Phenylketonuria is a type of hereditary disease. The body of a person affected by phenylketonuria is not able to break down the amino acid 'Phenylalanine'.
- In phenylketonuria, phenylalanine accumulates in the blood.
- Due to this, the action of respiration is not performed properly.
- Potassium conducts the functions of the heartbeat and pulse system.
- The deficiency of potassium causes low blood pressure.
- The primary sources of potassium are milk, meat, fish, cereals, fruits, vegetables etc.
- The first hour during a heart attack is known as the **Golden Hour**.
- A drug called Beta-blockers is used to prevent heart attacks and high blood pressure.
- **Arsenic-74** is used in detecting tumours, Sodium-24 in detecting blood clots in the circulatory system, Cobalt-60 and Gold-198 in the treatment of cancer, Iodine-131 in the treatment of thyroid disorders and Carbon-14 is used to detect residues of organisms (Plants & animals).
- Radioactive phosphorus ( $P^{32}$ ) and cobalt 60 are used for the treatment of Leukemia.
- Leukaemia is a cancer of the body's blood-forming tissues.
- The presence of albumin in the urine and its effect is expected to cause kidney failure.

#### Other Diseases

##### Haemophilia:

- Haemophilia is a sex-linked genetic disease.
- Haemophilia is also known as **Bleeder's Disease**.
- In patients with haemophilia, blood does not clot on the injury for a long time.
- Haemophilia is also known as "**Royal Disease**" due to its origin from **Queen Victoria**.
- Haemophilia is a disease that is often apparent in men and women as its carrier.

##### Athlete's Foot:

- Infection of athlete's foot is caused by fungus Tinea pedis and Trichophyton.
- Athletes foot affects the soft part of the skin (especially the middle of the fingers).

##### Down Syndrome:

- Down syndrome is a genetic disorder.
- Down syndrome is also called Mongoloid Idiocy.
- Down syndrome is caused by the 21st pair of chromosomes in humans having three  $[2n + 1 (21) - 47]$  instead of two chromosomes.
- In Down syndrome, the human head is round, the neck is thick, the face is open and the eyes are oblique.

##### Hepatitis-B:

- Hepatitis-B disease factor is the Hepatitis-B virus, which is a **DNA virus**.
- Hepatitis-B causes inflammation and irritation in the liver.
- Hepatitis-B is an infectious disease.

#### Disease and Related Vaccines

| Disease                                            | Vaccines         |
|----------------------------------------------------|------------------|
| Diphtheria, Whooping Cough (Pertussis) and Tetanus | DPT              |
| Diphtheria and Tetanus                             | DT               |
| Dog Bite                                           | Rabies Vaccine   |
| TB                                                 | B.C.G. Vaccine   |
| Polio                                              | OPV              |
| Smallpox                                           | Smallpox Vaccine |

- In phenylketonuria, the human brain is damaged and a state of mental insensitivity occurs.
- Diphtheria, pertussis (whooping cough) and tetanus disease caused by Corynebacterium Diphtheriae, Bordetella Pertussis, and Clostridium Tetani, respectively.
- The B.C.G. vaccine is applied immediately after childbirth to prevent Tuberculosis.
- Mumps is a **viral disease**.
- In Mumps the parotid gland enlarges in a painful form.
- Children are affected by Blue Baby Syndrome (Methemoglobinemia) disease when the amount of nitrate in water is more than 10 ppm.
- In Blue Baby Syndrome, the colour of the lips and body of children turns blue.



### Tetanus:

- Tetanus disease is also known as 'Lock Jaw'.
- In tetanus, the body of the patient becomes crooked and swaggar.
- An infectious disease called tetanus is caused by bacteria called **Clostridium Tetanus**.

### Minamata:

- Minamata is a neurological disease.
- Minamata disease is caused by an excess of **mercury (Hg)** in the body.
- Minamata disease was first discovered in the city of Japan.

### Filariasis:

- Filaria is also called **Elephantiasis**.
- **Filaria** is caused by a roundworm (nematode) called **Wuchereria bancrofti**.
- **Female Culex** and **Anopheles** mosquitoes act to spread filariasis.

### HIV:

- AIDS is a **viral disease**.
- HIV virus is the cause of AIDS disease which affects white blood cells.
- In AIDS, the body's immunity is reduced.
- AIDS is transmitted through sex, through unsafe intercourse and from an infected mother to infants through breast-feeding.
- **ELISA** (Enzyme-Linked Immuno Sorbent Assay) test is used to identify AIDS.
- The Western blot test is also used for HIV infection.
- HIVP-24 antigen (P.C.R.): Test shows the intensity of HIV.
- **Gidobudine (Azidothymidine)**: It is a type of antiretroviral drug used in the treatment of HIV/AIDS.
- **CD-4 count**: This is used to test immunity.

### Japanese Encephalitis:

- Domestic pigs and wild sparrows are carriers of the virus of Japanese encephalitis.
- Infection of this virus is done by Culex mosquito in humans and animals.

### Jaundice:

- The liver is affected by jaundice.
- In jaundice, yellow coloured **bilirubins** spreads throughout the body by staying in the blood, causing the skin and eyes to turn yellow.

### Smallpox:

- Smallpox is caused by the **variola virus**.
- Smallpox is a highly contagious disease.
- Smallpox spreads through the patient's skin, sputum, air, cloth etc.
- Smallpox vaccine was invented by **Edward Jenner**.
- Edward Jenner is said to be the **father of Immunology**.

### Leprosy:

- Leprosy is a contagious disease.
- Bacteria named Mycobacterium leprae and Mycobacterium lepromatosis causes leprosy.

### Thalassemia:

- Thalassemia is a genetic disease.
- Patients of Thalassemia cannot synthesize haemoglobin in the body.

### Bird Flu :

- Bird Flu is the name of a disease known as **Avian Influenza**.
- Bird Flu is caused by the **virus H<sub>5</sub>N<sub>1</sub>**.
- Tamiflu is an effective medicine for bird flu.

### Other Important Facts

- Visceral leishmaniasis is a diseases that is transmitted by the bite of an infected female. (SSC CHSL 2023 Tier-1)
- Chikungunya is an infection caused by **Aedes** mosquito. (SSC CHSL 2022 Tier-1)
- The study of human beauty is called **Kalology**.
- Sex determination in humans depends on the **chromosome** of the male and not on the chromosome of females.
- If the normal body temperature falls below 95 ° F, such a condition is called Hypothermia.
- At the beginning of placenta formation, the HCG hormone is secreted in large quantity in urine. Pregnancy is checked by its presence in urine.
- Humans usually excrete about 1.45 litres of urine per day. In breathing, the normal in and out is the quantity of air inhaled and exhaled per breath is about 500 millilitres. This is called Tidal Air Volume.
- According to genetics, the marriage of Rh<sup>-</sup> man and Rh<sup>+</sup> woman is possible.
- The fetus developing in the uterus is nourished by the **placenta**.
- **Alzheimer** disease affects the human brain.
  - In Alzheimer, the memory capacity of humans is reduced.
- First of all, German Psychiatrist Dr. A. Alois Alzheimer recongnized this disease.
- Electroencephalogram is used to reveal brain diseases such as epilepsy, brain cancer, brain TB etc.
- EEG was discovered by a scientist '**Hansberger**'.
- Common Cold is a contagious disease.
- Common Cold is transmitted through a sneeze, air etc.
- **Rhinovirus** is responsible for the common cold.
- Astigmatism is a disease associated with the eyes.
- Visibility decreases in the person affected by Astigmatism disease.
- **Ginger** is a plant of the phylum '**Zingiberaceae**'. The ginger plant contains the sympodial rhizome, which is a modified stem. It grows horizontally inside the ground.

- The process of taking food by an animal is called Ingestion.
- Insectivorous plants eat insects because the soil in which they grow lacks nitrogen.
- Epiphytes are plants that depend on other plants for shelter.
- Grana and stroma are found in chlorophyll.
- Important factors in seed germination are mainly air, moisture and suitable temperature. There is no need for sunlight.
- Often, Azolla, blue-green algae and rhizobium are used as biofertilizers.
- Onion cultivation is carried out by transplanting the plant.
- The age of the tree is determined based on the number of annual rings present in it.
- The branch of agricultural science which deals with the food, shelter, health and reproduction of domestic animals is called **animal husbandry**.
- BMR refers to **Basal Metabolic Rate**.
- Itching disappears because it stimulates some nerves, which direct the brain to increase the production of histamine chemicals.
- The giant dinosaurs found on Earth in the Mesozoic era were reptiles.
- The excretion of uric acid by birds helps in water conservation in the body.
- The biological organization is the correct sequence – Cells > Tissues > Organ > Organ Systems > Organism Body.
- When an eye is donated, the part of the donor's eye used is '**cornea**'.
- Seal and Whale are aquatic mammals.
- The baby born after in vitro fertilization and then implantation in the uterus is called '**test-tube baby**'.
- Sulpha drugs are used in the treatment of bacterial diseases.
- The first sulfa drugs '**prontosil**' was discovered in 1932.
- **P-Amino Salicylic acid** drug is used in the treatment of both tuberculosis (TB) and leprosy.
- Most photosynthetic activities occur in the **blue** and **red** area of light
- Maximum damage to a tree is caused by the destruction of its bark.
- The plants grown in the desert are called **Xerophytes**.
- The plants grown in high humid areas or marshy areas are called **Hygrophytes**.
- Aquatic plants are called **Hydrophytes**.
- The plants grown in saline areas are called **Halophytes**.
- The correct sequence of the ecosystem food chain is **Plants > Vegetarian > Carnivores**
- **Quinine** is obtained from the bark of the Cinchona plant.
- The tapeworm performs anoxic respiration.
- Respiratory Coefficient (R.Q.) refers to the ratio of carbon dioxide produced and oxygen used  $\left( \frac{\text{CO}_2}{\text{O}_2} \right)$
- The manufacture of amino acids by methane, hydrogen, water and ammonia was proved by **Stanley Miller** through his experiment.
- Other chromosomes except sex chromosomes are known as **Autosomes**.
- Ranikhet disease is an infectious disease of chickens.
- It is a viral disease.
- Foot and Mouth Disease and cowpox are viral infectious diseases among cattle.
- Anthrax is a communicable disease found among cattle and caused by '**Bacillus anthracis**' bacteria.
- A protein 'Prion' is the cause of **Madcow Disease**.
- Commercial cork is derived from the plant Quercus Suber.
- Coconut fruit is a **drupe**.
- Due to transpiration, water comes out of the leaves as vapour.
- Plants get nitrogen in the form of **nitrate**.
- Lack of magnesium and iron in the soil is the cause of chlorosis (deficiency of green colour) in the plant.
- Transpiration is measured by the **Potometer**.
- The common name of Parthenium hysterophorus is **Carrot grass**. (SSC CHSL 2021)
- An organism **Ascaris** has a well-defined muscular pharynx. (SSC CGL, 2023 Tier-1)
- Jelly fish - Coelenterate
- Cray fish - Insect
- Whale fish - Mammal
- Devil fish - Mollusca (SSC CGL, 2023 Tier-1)
- **Hookworm** is the common term for Ancylostoma. (SSC CGL, 2023 Tier-1)
- Meandrina is the generic name of **Brain coral** coelenterata animal having soft tube-shaped bodies that live together in large groups.
- **Flatworms** an endoparasite found in animals. (SSC CGL, 2023 Tier-1)
- The **Notochord** is an embryonic midline structure common to all members of the phylum Chordata that serves as a source of midline signals to surrounding tissues and as a major skeletal element of the developing embryo. (Selection Post Phase XI)
- **Hornwort** is a flowerless, spore-producing plant that is usually a thin, horn-like, or needle-like capsule with spores that develop from a flat, green leaf. (Selection Post Phase XI)
- Biological stain **Safranin** is used in histology and cytology to colour all cell nuclei red. (SSC CHSL 2021)



# Environment and Ecology



## Topics of the Unit

● Environment : An Introduction ● Ecology and Ecosystem ● Biodiversity ● Miscellaneous

### 1. Environment : An Introduction

- The word Environment is derived from the French word 'Environ' which means to encircle or surround.
- Environment is defined as **'the sum total of biotic and abiotic components that surrounds and influences an organism'**. Everything that surrounds an organism is collectively known as its environment. (UPPCS, 2006)
- Silent spring is an environmental science book published in 1962. It was written by an American marine biologist ecologist **Rachel Carson**.
- Sustainable development is the concept of development that meets the need of the present without compromising the ability of future generations to meet their own needs.
- The Brundtland Report, published in 1987 by United Nations World Commission on Environment and Development, coined the term **"Sustainable Development"**. This word was coined by WCED report titled **"Our Common Future"**. (UPPCS, 2020)

| Events related to Environment Protection                 | Year/Place                                               |
|----------------------------------------------------------|----------------------------------------------------------|
| United Nations Conference on the Environment             | 5-6 June 1972, Stockholm, Sweden                         |
| United Nations Conference on Environment and Development | 3-14 June 1992, Rio de Janeiro, Brazil                   |
| Special session of the UN General Assembly               | 23-27 June, 1997 New York                                |
| World summit on Sustainable Development                  | 26 August - 4 September, 2002 Johannesburg, South Africa |
| Millennium Development Goals Summit                      | 20-22 September, 2010 New York                           |
| UN Conference on Sustainable Development                 | 20-22 June, 2012 Rio de Janeiro                          |
| United Nations Summit on Sustainable Development, 2015   | 25-27 September, 2015 New York                           |
| Stockholm + 50                                           | 2-3 June, 2022 Stockholm, Sweden                         |

- The discussion on **'Sustainable Development'** was started after submitting Our Common Future report on environment to the United Nations in 1987.

- The Environment (**Protection**) Act of India was enacted in 1986.
- Blue carbon is that type of Carbon which is captured by oceans and coastal ecosystems.
- **Sustainable Development's** literal meaning is Natural resources should be used by the present generation in such a way that if there is minimum degradation of natural resources.
- **An ecosystem** is a structural and functional components of the biosphere, made up of a community of living organism and their physical environment, which interact and exchange materials with each other.
- Components of ecosystem are - **Abiotic and Biotic**.
- **Abiotic components consists** - Energy, Rainfall, Temperature, Atmosphere, Substratum, Materials, latitude and Altitude.
- **Biotic components consists** - Primary producers, consumers.
- Ecotone is a zone of Junction between two or more diverse ecosystems. Example - Mangrove ecosystem represent and ecotone between marine and terrestrial ecosystem.
- In Nature, many species occupy the same habitat but they perform different functions. The functional characteristics of a species is referred to as **"Niche"**.
- The earth is perhaps the only planet in the solar system that supports life. The portion of the earth which sustains life is called **Biosphere**.
- **Organism** within an ecosystem are connected through feeding relationships or trophic levels, where one organism serves as food for another. This series of organism each other creates a **Food Chain**.
- A food web depicts all potential energy and nutrient transfer among organism in an ecosystem, while a food chain follows only a single pathway of food.
- **SDG - 6** will target the water availability for all and its permanent management upto **2030** in India.
- **NITI** Aayog is the Nodal Institution for implementation of Sustainable Development Goals in India.
- **Rachel Carson** Wrote the book **'Silent Spring'**, published in **1962** which set the tone for an environmental movement in the world.

- National Environment Engineering Research Institute (NEERI) was established in 1958 (Nagpur).  
(CAPF 2012, 2024)
- The title of the Rio-20 declaration was “**The future we want**”.  
(GPSC 2002, 2004, 2014)
- The first ‘Earth Summit’ was held at Rio-de-Janeiro (Brazil).
- The Headquarter of World Meteorological Organization is located at Geneva.
- The headquarter of United Nations Environment Programme (UNEP) was located at Nairobi.
- The National Green Tribunal, established in 2010, as per the National Green Tribunal Act is a specialised judicial body equipped with expertise solely for the purpose of adjudicating environmental cases in the country.
- In the year 1997, the World Environment Conference was organised in Kyoto.
- The Earth Summit + 5 was held in 1997.
- The Genetic Engineering Appraisal Committee is constituted under the Environment (Protection) Act, 1986.
- In the marine environment, Phytoplanktons are the main primary producers.
- The correct order in the food chain of the various components of a terrestrial grass ecosystem is **Grass Grasshopper Frog Snake**.
- The ecological pyramids are of three categories - pyramid of numbers, pyramid of biomass and pyramid of energy or productivity.
- The pyramid of energy in any ecosystem is Always upright.
- The Biomass Pyramid of **Pond/Marine/Aquatic is inverted**.
- The amount of energy decreases during the transfer from one trophic level to another in an ecosystem.
- Ponds and swamps are the example of “**Lentic Habitat**” in the freshwater community.
- **Nutrient cycling** is a concept that explains how nutrients move from the physical environment to the living organism, and subsequently recycled back.
- Ecological succession is the process by which the mix of species and habitat in an area changes over time.
- **Marine ecosystem** covers approximately **70%** of the earth's surface and contain approximately **97%** of the planet's water. Approximately **85 %** of the dissolved materials in seawater are sodium and chlorine.

## 2. Ecology and Ecosystem

- Ecology is the branch of biology that explains the relationship between organism and their environments.
- The term 'Ecology' was coined by the German zoologist, Ernst Haeckel in 1866 to describe the 'economics' of living forms.
- A.G. Tansley (1935) coined the term “**ecosystem**” to recognize the integration of the biotic community and its physical environment as a fundamental unit of ecology, within a hierarchy of physical systems that span the range from atom to universe.
- **Karl Mobius** called the idea of the ecosystem as Biocoenosis.
- **Forbes** called ecosystem as Microcosm.
- Ecological niche describes not only the physical space occupied by an organism but also its functional role in the community of organisms.
- The actual location or place where an organism lives is called Habitat.
- **Marine Ecosystem** covers the largest area of the earth's surface.
- Deforestation is the main causes of ecological imbalance in India.
- Solar energy is the primary source of energy in an Ecosystem.
- 10 percent law is related with transfer of energy in a food chain from one trophic level to other.
- **Ecotones** are areas of steep transition between ecological communities, ecosystems, and/or ecological regions along an environmental or other gradient.
- The ocean is our planet's life support and regulate the global climate system. It is the world's largest ecosystem, home to nearly a million known species and containing vast untapped potential for scientific discovery.
- Cropland includes areas used for the production of adapted crops for harvest.
- Coral reefs host far more number of animal phyla than those hosted by tropical rainforests.
- Bio-geo-chemical cycle is the movement of nutrient elements through various components of an ecosystem.
- The slogan of Chipko Movement is “**Ecology is permanent economy**”.
- Arne Naess coined the term ‘**deep ecology**’. Arne Naess is widely regarded as the foremost Norwegian philosopher and one of the most influential intellectuals of the twentieth century.
- Grinnell enunciated the concept of the ecological niche.
- The Ecological Footprint tracks the use of productive surface areas. Generally these areas are: grazing land, fishing grounds, cropland, built-up land, forest area, and carbon demand on land.
- **Under the Ecological Transition**, the relationships between humans and the physical environment is studied.
- Marine ecosystem is not a sub-category of terrestrial ecosystem.



- The flow of energy in the ecosystem is unidirectional (or **one-directional**). The energy enters the plants (from the sun) through photosynthesis during the making of food. This energy is then passed on from one organism to another in a food chain. The energy given out by the organisms as heat is lost to the environment. It does not return to be used by the plants again. This makes the flow of energy in the ecosystem '**unidirectional**'.
- The Pyramid of Biomass is a graphical representation that depicts the extent of biomass per unit area within different trophic levels in an **ecological system**.
- In grasslands and forests, there is a gradual decrease in biomass of organisms at successive levels from the producers to the top carnivores. Thus pyramids are upright.
- However, in a pond as the producers are small organisms, their biomass is very less and this value gradually shows an increase towards the apex of the pyramid, thus making the pyramid inverted in shape.
- **The Ten Percent Law** of transfer of energy from one trophic level to the next was introduced by **Raymond Lindeman in 1942**.
- According to this law, during the transfer of energy from organic food from one trophic level to the next, only about ten percent of the energy from organic matter is stored as flesh.
  - The remaining is lost during transfer, broken down in respiration or lost to incomplete digestion by higher trophic level. When organisms are consumed, 10% of the energy in the food is fixed into flesh and is available for next trophic level (**carnivores or omnivores**).
  - When a carnivore or an omnivore consume that animal, only about **10%** of energy is fixed in its flesh for the higher level. Thus, at every level of the food chain (**first, second, third and top level**), the consumer converts only 10% of the accumulated energy into his body weight.
- The concept of 'Ecological Transition' was first used by John W. Bennett. He proposed the concept in his book "**The Ecological Transition : Cultural Anthropology and Human Adaptation**". "Ecological transition" mean, the development of an anthropocentric orientation toward the natural world that emerged in the Western Renaissance but has since characterized every civilization and nation.
- The actual location or place where an organism lives is called Habitat. (**BPSC Pre, 2019**)
- A community of organism together with the environment in which they live is called Ecosystem. (**IAS Pre, 2015**)
- Correct order of biological organisation ranging from organism to Biosphere - Population - Community - Ecosystem - Landscape. (**UPPCS Pre, 2017**)
- Field, garden are artificial ecosystem. (**Jharkhand PCS, 2013**)
- The number of organism that can be supported by the environment in a given area is known as carrying capacity. (**Uttarakhand PCS, 2012**)
- The primary source of energy in Ecobody is solar energy. (**CGPSC, 2011, 2016; UPPCS Mains, 2015**)
- 10 Percent law is related to energy transfer from a lower trophic level to a higher trophic level.

### Exam Oriented Facts

- Eucalyptus is known as **Environmental evil**.
- It absorbs too much inland water and decreases water level at the place of its plantation.
- It is mostly found in Australia.
- **Lentic Ecosystem** refers to the static water habitats like ponds, lakes, swamps and marshes. **Lotic Ecosystem** refers to the moving water habitats like rivers.
- **Ecotone** is a region of transition between two biological communities.
- Term '**Ecosystem**' was coined by A.G. Tansley.
- Order of Ecosystem productivity in decreasing order- Mangrove, Grasslands, Lake, Ocean. An ecosystem with more diversity has more productivity.
- The entire sequence of communities that successively change in a particular area are called 'Sere'.
- **Pycnocline** - It shows density gradient in an aquatic system.
- **Halocline** - It shows a salt gradient in an aquatic system.
- **Thermocline** - Represents the change in temperature with a depth of an aquatic system.
- Arne Naess in 1973 used the term '**Deep ecology**' for the first time.
- **Ecological Niche** term was coined by **Joseph Grinnell** in 1917, who called it Micro-Habitats.
- The concept of 'Ecological Transition' was first used by John W. Bennett. He proposed the concept in his book "The Ecological Transition : Cultural Anthropology and Human Adaptation".
- **Indian Wild Life Protection Act** was passed in 1972.
- **Environment (Protection) Act** was passed in 1986.
- **Forest Conservation Act** was passed in 1980.
- Oceanic outflow is that process in which warm & nutrient less water at the surface is replaced by cold & nutrients rich water by air flow (wind).
- **Eco-sensitive zones** are mentioned under the Environment (Protection) Act, 1986. The vehicles used for commercial activities in eco-sensitive zones have been regulated but are not prohibited hence except agriculture, rest of the human activities are not prohibited but some of these are restricted and some of them have been regulated.



- The thin layer of gases surrounding the earth is called the atmosphere. The atmosphere is majorly consists of Nitrogen, Oxygen, Carbon dioxide etc. The air around us is a mixture of gases.
- Nitrogen is the most abundant gas available in the environment.
- We need oxygen to survive and therefore we depend on the plants and trees for our survival. The process by which plants make their food is called photosynthesis. In this process, they consume CO<sub>2</sub> present in the atmosphere and release oxygen in the atmosphere.
- Air is a mixture of gases. By volume, about 78% of this mixture is nitrogen and about 21% is oxygen. Carbon dioxide, argon, methane, ozone and water vapour are also present in very small quantities.

### 3. Biodiversity

- Biodiversity is all the different kinds of life we'll find in one area.
- It consist the variety of animals, plants, fungi, and even microorganisms like bacteria that make up our natural world.
- Bio-diversity is denoted with (a) **alfa**, (b) **beta** and (g) **gamma** indicating different categories. This classification was done by **Whittaker in 1960**.
- The term **Biological diversity** was coined by **Raymond F. Dasmann** in his book '**A Different kind of Country**' in 1968.
- The word biodiversity is a contraction of the phrase "**biological diversity**" and was first coined in 1985 by **Walter Rosen** of the National Research Council as a title word in a seminar, organized to discuss biological diversity.
- Each of these species and organisms work together in ecosystems, like an intricate web, to maintain balance and support life.
- Natural habitat destruction is the main reason for the decrease in biodiversity.
- Habitat loss is a consequence of human activities such as deforestation, resource extraction, agriculture, urbanization, alteration of the sea-floor due to trawling (fishing), or the release of pollutants.
- Government of India in collaboration with the Norwegian Government has established a centre for Biodiversity Policy and Law at Chennai.
- Biodiversity hotspots are regions that contain a high level of species diversity, many endemic species and a significant number of threatened or endangered species.
- Eastern Himalayas (**Part of Himalaya hotspots**), Western Ghats (Part of Western Ghats and Sri Lanka), Most North-eastern India and Andaman group of Islands (Part of Indo-Burma/Indo-Myanmar hotspots) and Nicobar group of Islands (**Part of Sundalands hotspots**) are 'Hotspot' of Biodiversity in India.
- Giant sequoia trees are the largest trees by volume in the world. Many giant sequoias are between 250 and 300 feet tall, the tallest being about **325 feet high**.
- The greatest diversity of animal and plant species occurs in Tropical moist forests.
- Tropical rain forests are found in South and Central America, central Africa and South-East Asia, and are characterised by a high monthly mean temperature (**above 18°C**) and high precipitation (**>100mm per month**).
- Shielded by the Nilgiri Plateau to the North and the Mannarkad Plains to the South, the Silent Valley was named a national park in 1984.
- The Cartagena Protocol is the Convention on Biological Diversity. It is an international agreement which aims to ensure the safe handling, transport and use of living modified organisms (**LMOs**) resulting from modern biotechnology that may have adverse effects on biological diversity, taking also into account risks to human health.
- It was adopted on 29 January 2000 and entered into force on 11 September 2003.
- **United Nations Organization** has declared decade 2011-2020 as United Nations Decade on Biodiversity.
- Less number of trophic levels is not responsible for the increase in the biodiversity of an ecosystem.
- The Himalayan Range is very rich in species diversity. It is a confluence of different biogeographically zones is the most appropriate reason for this phenomenon.
- The Biodiversity Act was passed by Lok Sabha on 2nd December, 2002 and by Rajya Sabha on **11 December, 2002**.
- National Biodiversity Authority of India was established in 2003, in Chennai.
  - NBA checks the biopiracy and protects indigenous and traditional genetic resources.
  - Application for Intellectual Property Rights related to genetic/biological resources cannot be made without the approval of the **NBA**.
- If rainforests and tropical forests are the lungs of the Earth then surely wetlands function as its kidneys.
- Vultures are exposed to the drug, when they consume carcasses of animals that were treated with diclofenac shortly before death.
  - Vultures die from kidney failure within days of exposure to diclofenac-contaminated tissues, with post-mortem findings of extensive visceral gout (**Oaks et al. 2004**).

- The marine animal called dugong which is vulnerable to extinction is a Mammal. It is given legal protection under Schedule I of the Wildlife (Protection) Act, 1972.
- The 10th Conference of the Parties to the United Nations Conference on 'Biological Diversity' was held at Nagoya, Japan.
- The 15th Conference of the Parties to the Convention on Biological Diversity (COP 15), chaired by China and hosted by Canada, took place in Montreal on 7-9 December 2022. It was preceded by the 5th session of the open-ended working group on the negotiation of the post-2020 global framework for biodiversity on 3-5 December 2022.
- Alpha diversity index shows the mean species diversity in a habitat at a local scale.
- $\beta$  diversity measures the increase in species diversity along transects and is particularly applicable to the study of environmental gradients.
- Gamma diversity describes the overall species diversity across communities within a larger geographic area.
- Salt-water crocodile is found in the Andaman and Nicobar Islands.
- In India, Slow Loris lives in the dense forests of the North East.
- **Ex-situ Conservation** - Conserving biodiversity outside the areas where they naturally occur is known as ex-situ conservation. Examples - Seed banks, Botanical gardens, Zoological parks etc.
- **In-situ Conservation** - Conserving the animals and plants in their natural habitats is known as in-situ conservation. Examples - National Parks, Sanctuaries, Biosphere reserves, Reserved forest, Protected forest and Nature Reserves.

#### Green House Effect :

- The green house gases called with this name because it produces a "greenhouse effect". Burning fossil fuels produces carbon dioxide, a greenhouse gas. The greenhouse effect makes the earth warmer, just as a greenhouse is warmer than its surroundings. Carbon dioxide is the main cause of human-induced climate change.
- The Paris Agreement is a legally binding international treaty on climate change. It was adopted by 196 Parties at the UN Climate Change Conference (COP21) in Paris, France, on 12 December 2015. It entered into force on 4 November 2016.
- The 26th United Nations Climate Change Conference (COP26) was held in Glasgow, U.K. in 2021.
- The Kyoto Protocol was adopted on 11 December 1997. Owing to a complex ratification process, it entered into force on 16 February 2005. Currently, there are 192 Parties to the Kyoto Protocol.

| Convention                     | Related Subject    |
|--------------------------------|--------------------|
| Cartagena Protocol             | Biosafety          |
| Stockholm Convention pollutant | Persistent organic |
| Montreal Protocol              | Ozone Layer        |
| Kyoto Protocol                 | Climate Change     |

- The concept of Greenhouse Gases was postulated by Joseph Fourier.
- The main component of greenhouse gases are Carbon dioxide, Methane, Nitrous oxide, Chlorofluorocarbons etc.
- Carbon-di-oxide has highest contribution in global warming.
- Net zero means cutting greenhouse gas emissions to as close to zero as possible, with any remaining emissions re-absorbed from the atmosphere, by oceans and forests for instance.
- India, at the 26th session of the United Nations Framework Convention on Climate Change (COP 26) in November, 2021, announced its target to achieve net zero by 2070.
- Presently, China is the largest contributor to carbon dioxide (CO<sub>2</sub>) emissions .
- Bhutan is known as 'carbon negative country' in the world.
- The United Nations Framework Convention on Climate Change (UNFCCC) ratified by 198 countries became effective on March 21, 1994.

#### Ozone Layer :

- 'Ozone layer' absorbing ultraviolet radiation, mostly exists in Stratosphere .
- The maximum concentration of ozone is found in Stratosphere.
- CFCs are responsible for Ozone Hole.
- Chlorofluorocarbons (CFCs) are nontoxic, nonflammable chemicals containing atoms of carbon, chlorine, and fluorine.
- Ozone protects the biosphere from Ultraviolet rays.
- Harmful ultraviolet radiation coming from the sun can cause Skin cancer.
- Significantly, the largest and deepest hole in the ozone is over Antarctica. It is due to excessive use of CFCs and an increase in greenhouse gases.

#### 4. Miscellaneous

- The United Nations Conference on Environment and Development (UNCED), also known as the 'Earth Summit' was held in Rio de Janeiro, Brazil from 3 - 14 June 1992.

- **The Global Environment Facility (GEF)** was established on the eve of the 1992 Rio Earth Summit to tackle our planet's most pressing environmental problems. Carlos Manuel Rodriguez is presently the Chief Executive Officer and Chairperson of the Global Environment Facility.
- In 2012, the United Nations Conference on Sustainable Development was held in Rio and is also commonly called Rio+20 or **Rio Earth Summit 2012**.
- **National Environmental Engineering Research Institute (NEERI)** is situated in Nagpur, Maharashtra. It was established as **Central Public Health Engineering Research Institute (CPHERI)** in 1958 to focus on water supply, sewage disposal and related diseases and to some extent on industrial pollution.
- NEERI is a pioneering laboratory in the field of environmental science and engineering and part of **Council of Scientific and Industrial Research (CSIR)**.
- WMO is an intergovernmental organization with a membership of 193 Member States and Territories WMO was originated from the International Meteorological Organization (IMO) which was founded in 1879 to facilitate the exchange of weather information across national borders. WMO became a specialized agency of the United Nations on 17 March, 1951.
- **Green Development** is a book written by **W.M. Adams**. \*The full name of this Book is '**Green Development: Environment and Sustainability in a Developing World**'. First edition of this book was published in the year 1990.
- India's first Antarctic Research Station is known as "Dakshin Gangotri".
- India constructed its first research base, Dakshin Gangotri, during the 1983-84 season.
- Agenda 21 is a comprehensive plan of action to be taken globally, nationally and locally by organizations of the United Nations System, Governments, and Major Groups in every area in which human impacts on the environment.
- Agenda 21, the Rio Declaration on Environment and Development, and the Statement of principles for the Sustainable Management of Forests were adopted by more than 178 Governments at the United Nations Conference on Environment and Development (**UNCED**) held in Rio de Janeiro, Brazil, 3 to **14 June 1992**.
- In 1992, countries joined an international treaty, the United Nations Framework Convention on Climate Change (**UNFCCC**) as a framework for international cooperation to combat climate change.

### Exam Oriented Facts

- The Maximum biodiversity is found in Tropical rain forest. [UPPCS (Pre.), 2012]
- Biodiversity increases towards the equator. [UKPSC (Pre.), 2012]
- India has four biodiversity hotspots namely Himalaya, Indo-Burma (Northeastern India and Andaman Islands), Sunda lands (Nicobar Islands) and Western Ghat. [RAS/RTS (Pre.), 2008]
- Destruction of natural habitats is the most important factor for the loss of biodiversity. [UPPCS (Pre.), 2023; Jharkhand PCS (Pre.) 2010]
- Endangered species are listed in Red Data Book. Significantly Red Data Book is published by IUCN. [UPPCS (Pre.), 2013; UKPSC (Pre.), 2017]
- The Ramsar Convention was associated with the conservation of wetlands. [UPPCS (Mains), 2008]
- World Wetlands Day is celebrated every year on 2 February, Notably this day marks the date of the adoption of the Convention on Wetlands on 2<sup>nd</sup> February, 1971 in the Iranian of Ramsar [UPPCS (Pre.), 2023; UP RO/ARO Re-exam (Pre.) 2016]
- The Biodiversity Act was passed in 2002. In February 2003, the President assented the Bill. [UP UDA/LDA (Mains), 2010; CGPSC (Pre.), 2018]
- The concept of Greenhouse Gases was postulated by Joseph Fourier. [UPPCS (Mains), 2011]
- The main component of Green House gases is carbon Dioxide which is responsible approximately 64% of Green House gas. [65<sup>th</sup> BPSC (Pre.) 2019; UPPCS (Mains), 2011]
- Climate change is caused by Green house gases, Depletion of the Ozone Layer, Pollution etc. [MPPCS (Pre.), 2014; UPPCS (Mains), 2017]
- Cartagena protocol is related to Biosafety Agreement. [Jharkhand PCS (Pre.), 2016]
- The total amount of the green house gases produced, directly or indirectly to support human activities, is referred to as carbon foot print. [RAS/RTS (Pre.) 2018]
- New Zealand, in 2005 introduced for the first, a carbon tax to address global warming. [IAS (Pre.) 2006]
- India's first National Action Plan on Climate Change was released in 2008. [UPPCS (Pre.) 2016; UPPCS (Pre.) 2018; UP RO/ARO (Mains), 2021]
- National Green Tribunals (NGT) headquarters is located at New Delhi. [MPPCS (Pre.), 2023]



# Science & Technology



## Topics of the Unit

- Science and Technology : An Introduction ● Biotechnology ● Nano Technology ● Indian Nuclear Research ● Indian Defence Technology ● Indian Space Program

1

## Science and Technology

### An Introduction

Science and Technology have always been an integral part of Indian culture. In ancient times it was termed as Natural Philosophy. After the attainment of Indian freedom, the Government of India has spared no effort to establish a modern S&T infrastructure in the country. It is notable that the Department of Science and Technology plays a pivotal role in promotion of Science and Technology in the country. Notably, Department of Science and Technology (DST) was established in 1975, which comes under the Ministry of Science and Technology.

### Policies related to S&T :

Four "Science, Technology and Innovation Policies" (STIP) have been implemented in the country since independence. Recently, the **Draft** of the 5th National Science, Technology and Innovation Policy has been finalized and the draft has been released by the **Department of Science and Technology (DST)** on its website. Significantly DST comes under the Ministry of Science & Technology.

#### (i) Science, Technology and Innovation Policy 1958 :

- India's first 'Science, Technology and Innovation Policy' was directed by Jawahar Lal Nehru while Scientist Homi Jahangir Bhabha was one of the prominent Scientist in 1958.
- This Policy Resolution (1958) laid the foundation stone of science and scientific ecosystem in India.

#### (ii) Technology Policy Statement, 1983 :

- The Technology Policy of Government of India was announced by the Prime Minister Indira Gandhi at the session of the 70th Indian Science Congress held in Tirupati (**Andhra Pradesh**) in January, 1983.
- The Policy included emphasis on achieving technological capability and technological self-reliance.

#### (iii) Science and Technology Policy, 2003 :

- Science and Technology Policy, 2003 was announced at the 90th Indian National Science congress held at Bengaluru (**Karnataka**) in January 2003.
- The main policy objectives are to advance scientific temper and fully integrate science and technology into all spheres of national activity on a sustainable basis.

#### (iv) Science Technology and Innovation Policy, 2013:

The then Prime Minister Dr. Manmohan Singh presented the Science, Technology and Innovation Policy, 2013 at the inaugural session of the Centenary Session (100<sup>th</sup>) of the Indian Science Congress in Kolkata in January, 2013.

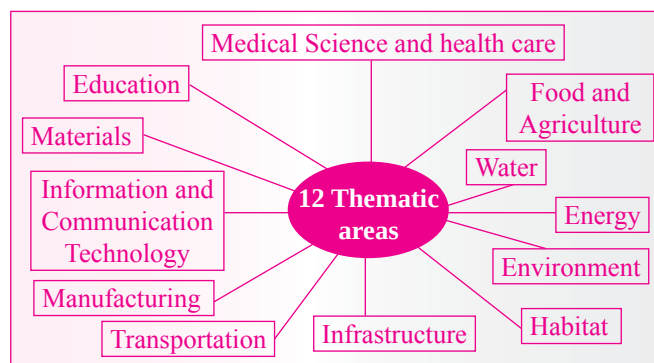
- The objective of the policy is to benefit of science, technology and innovation for National Growth and sustainable and more inclusive growth.
- Other objectives to encourage scientific thinking in all sections of the society i.e. development of scientific temper.

#### (v) National Science, Technology and Innovation Policy, 2020

- The 5<sup>th</sup> Science, Technology and Innovation Policy aims to foster, develop and nurture a robust system of evidence and stakeholder-driven STI planning, information, evaluation and policy research in India.
- India has declared the year **2010-2020** as the **Decode of Innovation**.

#### Technology Vision, 2035 :

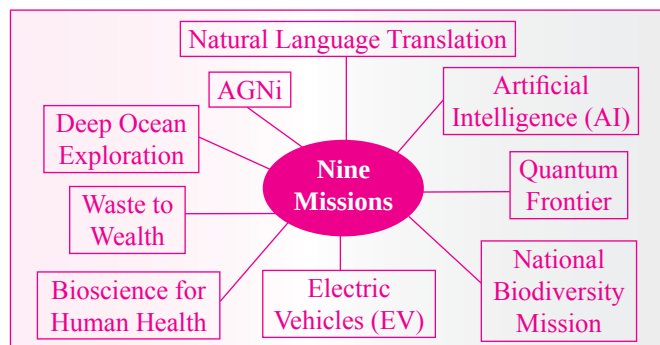
- In January 2016, the Prime Minister unveiled the Technology Vision Document, 2035' while inaugurating the 103<sup>rd</sup> Indian Science congress (Mysore, Karnataka).
- This vision was dedicated to former President Late Dr. A.P.J. Abdul Kalam.
- The Technology Vision, 2035, document is being referred to as the Technology Information forecasting and Assessment council (TIFAC).
- The following 12 thematic areas have been identified under the technology Vision, 2035 document on which technologies are to be focused –





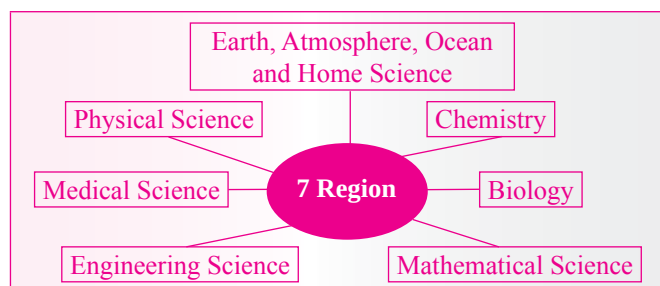
### Nine Missions of Science and Technology :

- To ensure India's sustainable development, the Prime Minister's Science Technology and Innovation Advisory Council (**PM-STIAC**) has set up 9 National missions.
- Each mission will be lead by lead ministry and involve international and national institutional partners, young scientists and industries.



**Leaky Pipeline** - The "leaky pipeline" metaphor describes the way in which women become underrepresented minorities in the STEM fields. Significantly, in mathematics the disequilibrium starts before undergraduation with fewer females choosing to major in these fields.

**Shanti Swarup Bhatnagar Award** : This award is given to Indian Scientists **under the age of 45** for outstanding research in seven areas; who have in the opinion of CSIR, made a uniquely significant and outstanding contribution to the fundamental and applied advancement of knowledge.



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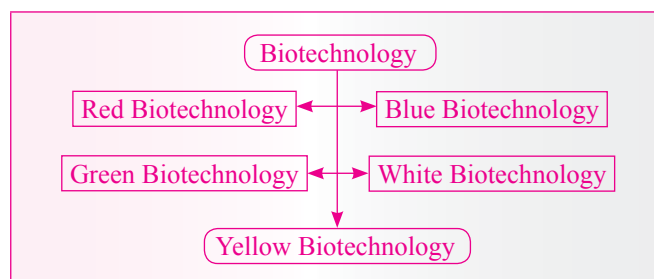
## Biotechnology

- Biotechnology is the system of manufacturing products by using biological processes, such as microorganism, plants and animals in technology to improve the quality of human life.
- Under this the following are produced -
  - (i) Manufacturing of antibodies, vitamins, vaccines, plastics etc.
  - (ii) Disposal of toxic wastes using bacteria.
  - (iii) Pollution control and production of new fuels.
  - (iv) Germplasm development.
  - (v) Embryo transfer technique

- (vi) Enzyme and protein technology
  - (vii) Fermentation
  - (viii) Bio-transformation
  - (ix) Stabilization of cell and cell products etc.
- The following techniques for manufacturing targeted products in Biotechnology -
    - (i) Gene engineering or DNA Recombinant Technique.
    - (ii) Hybridization Technique.
    - (iii) Cell and tissue Culture.
    - (iv) Protoplasm Fragmentation etc.
  - Biotechnology is of two types on the basis of transfer can be divided into.



- Gene biotechnology : Involve gene transfer
- Non-gen Biotechnology : Involves cell, tissue or entire organs.
- Apart from this, the Science of Biotechnology is divided into the following sub-disciplines -



- (i) **Red Biotechnology** : It deals with medical procedures using stem cells to obtain living organisms for the production of new drugs or to regenerate damaged human tissues or possibly to redevelop entire organs.

### Examples :

- (a) Designing organism to produce antibiotics.
  - (b) Engineering variety of genetic curves through genetic manipulation.
  - (c) Manufacturing variety of test instruments.
- (ii) **White Biotechnology** : White Biotechnology uses enzymes and microorganism to produce value -added chemicals from renewable sources.

**Note** : White Biotechnology also called '**Grey Biotechnology**'. Example - Pharmaceutical industry, food industry, mining industry, fuel industry, production of industries related to environment protection etc.

- (iii) **Green Biotechnology** : This technology is used in agriculture sector for research and development of insect resistant crops.



(iv) **Blue Biotechnology** : This technology is used in marine environment, so that new techniques can be researched and developed to control the spread of waterborne harmful organisms.

(v) **Yellow Biotechnology** : This is new branch of Biotechnology. Insect are used as a resource, so that humans can get benefited.

**Example** : Lac insect, honey obtained from bee, silk obtained from silkworm.

- Indian Scientist **M.S. Swaminathan** (1960s) developed new techniques to increase food production in India and started the **Green Revolution**.
- For this contribution, he is called the father of '**Economic Ecology**'.

#### **What is Bt. Brinjal :**

Bt Brinjal is a transgenic brinjal created by inserting a gene Cry1AC from the soil bacterium *Bacillus thuringiensis* into Brinjal.

#### **What is Golden Rice :**

Golden Rice is a new type of rice that contains beta carotene (provitamin A a plant pigment that the body converts into vitamin A as it needs).

- **Human Genome Project (HGP)** : In the year 1998, the 'US Department of Energy' and the 'National Institute of health' jointly started work on the human Genome Project (HGP). It was formally started in 1990 and it was completed in the year 2003.
- It was an international science-driven research program towards the determination of the DNA sequencing of the complete human genome.
- This was the first attempt to determine the blueprint of Human **DNA** genome sequence.
- India was not involved in this project, but with the help of this project, India started human Genome Project.
- Government of India started Genome India Project. This is a national project funded by Department of Biotechnology.
- Significantly, the Indian population of 1.3 billion consists of 74600 population groups, and several thousands of them are endogamous.
- Specific aim of this project -
  - To create a exhaustive catalog of genetic variations
  - To create a reference haplotype structure of Indians.
  - Design genome wide arrays for research and diagnostics at an affordable cost.
- **Black/Dark Biotechnology** : Application of biotechnology related to Bioterrorism is called dark biotechnology.
- **In Vitro Fertilization (IVF)** : In vitro fertilization or IVF

is an artificial process through which artificial pregnancy is created in women.

- This method is popularly known as '**Test Tube Baby Programme**'.
- In 1978 a child named **Louise Brown** was born by using this technique for first time in **England**.
- **Robert Edward**, who developed the test tube baby technique, was awarded the **Nobel Prize** in **Medicine** in the **year 2010**.
- **Surrogacy** : Surrogacy is such a process, through which a childless couple can get child.
- When a women carries a child of a couple who are unable to conceive or carry a child due to physical or medical reasons, it is termed a '**Surrogacy**'.
- Surrogacy is also called '**Renting a Womb**' in other words, because there is an agreement between the women and the couple, under which the women bears the child in her womb and after the birth of the child, she hands it over to the couple.
- This women is called '**Surrogate mother**'.
- **Three Parent Baby Technology/Mitochondrial Replacement Therapy** - 'Three parent baby' means a baby whom most of its DNA comes from its mother and father and some from a female Donor.
- Three Parent Baby Technology can be considered as an advanced form of IVF technology.
- Under this, egg of the mother and the egg of another female mother (donor) are mixed with the sperm of the father.
- **Britain** is the first country in the world to give legal recognition to three parent baby technology.
- **Bioinformatics** : Bioinformatics is the branch of biology, which deals with the acquisition, storage, analysis, distribution, interpretation etc. of biological information.
- In this technique of biology, information technology and mathematics are used.
- In this process the desired result can be easily obtained by analyzing the data with the help of computer and suitable bioinformatic software.
- Brain mapping is also called '**brain fingerprinting**'.
- Brain mapping test was invented by American neurologist **Dr. Lawrence A. Farwell** did in **1955**.
- **Terminator Gene** : Plants inhibit the development of their embryo due to effect of terminator gene.
- Under this, such gene can be inserted in any plant, due to which a good crop can be obtained from the plant, but its seeds can not produce new plants.
- Genetic Use Restriction Technologies (**GURTs**) may be defined as a set of 'technological means that rely on

genetic transformation of plants to introduce a genetic switch mechanism which prevents unauthorized use of either particular plant germplasm, or trait(s) associated with that germplasm.

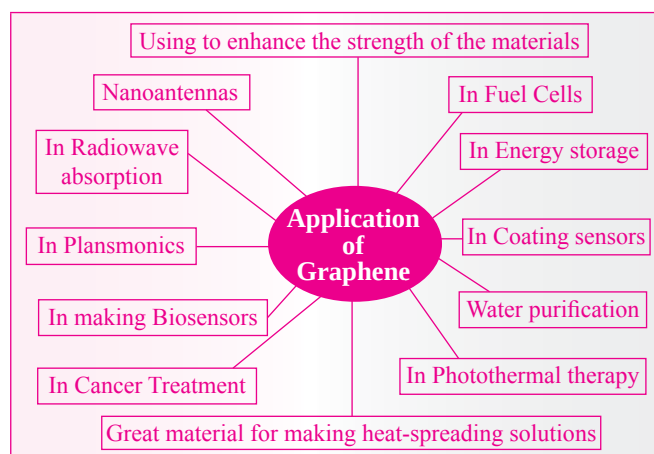
- Since seed produced from plants with such genes will not be able to produce new plants, farmers have to buy seeds from seed companies every time.

### 3

## Nano Technology

- Nano Technology refers to the branch of science and engineering devoted to designing, producing and using structures, devices and systems by manipulating atoms and molecules at nanoscale, i.e. having one or more dimensions of the order of 100 nanometres or less.
- Generally, under this, an overall study of the techniques and related principles used at the microscopic level of 1-100 nanometres.
- 1 nanometre is 1 billionth part of 1 metre (i.e.  $10^{-9}$  metre).
- In simple word, the management and manufacturing of substance and devices at the nano level through technical skills comes under nanotechnology.
- The first hypothesis regarding nanotechnology was made in 1959 by a Physicist Richard P. Feynman.
- **Richard P. Feynman** is called **father of** nanotechnology.
- Father of nanotechnology in India is, **Professor C.N.R. Rao**.
- 'Nano' is a **greek** word, which means '**Dwarf**'.
- **Norio Taniguchi** (1974 AD) used the term nanotechnology for the first time.
- Nanotechnology is used in the fields of energy, cosmetics, water purification and treatment, medicine, space, defence, agriculture, communication and electronics.
- **Fullerene or Carbon - 60 :**
- Fullerene is a molecule of carbon with zero dimensionality, which is found in spherical, ellipsoid, tube etc.
- Fullerene is used in batteries, paper batteries, automobiles, aircraft and Pacemaker etc.
- **Graphene :** Graphene is two-dimensional conductor of carbon atoms. It is the isotopes of basic elements such as graphite, carbon nanotubes (CNTs), charcoal and fullerene.
- Graphene is mainly extracted from graphite, but while graphite a three-dimensional (3D) crystallized material, graphene has a two-dimensional (2D) orientation.
- It is the thinnest and strongest element in the substance known for as.
- **Geim** and **Novoselov** was awarded the **Nobel Prize** in physics (2010), for discovery of graphene.

### Application of Graphene :



### Green Nanotechnology :

- Green nanotechnology has been described as an evolution of clean technology.
- Overall, there are two main goals of green nanotechnology-
  - (i) Production of nanomaterial and products without harming the environment or human health.
  - (ii) Production of nanoproducts that provide solution for environmental problems.

### 4

## Indian Nuclear Research

- The Atomic Energy Commission was established by the Government of India in 1948.
- Dr. **Homi J. Bhabha** was the first chairman of the commission.
- The Department of Atomic Energy was established in August, 1954 for carrying out of nuclear power programs.
- The Prime Minister is the ex-officio chairperson of the commission.

### Main Centres of Nuclear Research and Development :

#### A. Atomic Research Centre (BARC) :

- Bhabha Atomic Research Centre is located in **Trombay (Mumbai)**.
- Dr. Bhabha founded the Atomic Energy Foundation centre, in 1954 and after his death in 1966, the centre is now known as BHABHA Atomic Research Centre.
- The BARC promotes R&D in nuclear field which also helps the related industry and mining sectors.
- A CIRUS thermal reactor has been set up at BARC in collaboration with Canada.
- The experimental reactors are also called '**Zero Power Reactors**'.
- It is because their specific purpose is nuclear research rather than producing energy.
- In addition to producing radioisotopes in research reactors, work on nuclear technologies is also done.

### B. Indira Gandhi Centre for Atomic Research (IGCAR)

- This centre was established in 1971 at **Kalpakkam** in Tamilnadu.
- In 1985, it was renamed as Indira Gandhi Centre for Atomic Research (IGCAR).
- The main task of IGCAR is research and development in the field of fast Breeder Reactor.
- The Fast Breeder Reactor was being installed at this centre using mixed MOX ( $\text{PuO}_2 + \text{UO}_2$ ) fuel of Plutonium and Uranium.

### Fast Breeder Reactor (FBR) has the following characteristics:

- (i) The chain reaction is continuous in FBR by fast-moving neutrons.
- (ii) It has a much larger number of fragmented neutrons than in a heated reactor.
- (iii) It has a minimum level of emission of radioactivity.
- (iv) It uses sodium as a coolant.

### C. Kalpakkam Mini-Reactor:

- It is also called **KAMINI** using the acronym.
- While Uranium or Plutonium is used as a fuel in other experimental reactors, KAMINI uses Uranium-233 as fuel.
- KAMINI Thorium is the first reactor in the world to use Uranium-233 fuel cycle.
- This reactor is also used to trace criminals in addition to research.

### D. Variable Energy Cyclotron Centre (VECC):

- The headquarter of VECC is located in **Kolkata**.
- This centre promotes research for the production of atomic chemistry and nuclear physics radioisotopes.
- Currently, this centre has 3 cyclotrons. K130 Cyclotron which has been in operation since 1977; the K500 superconducting cyclotron through which the internal beam was accelerated in 2009, but it detected primary harmonic magnetic field error. It is now being fixed to make the beam available for use and also the 30 MeVH Medical Cyclotron is under installation.

### E. Raja Ramanna Centre for Advanced Technology (RRCAT)

- This centre was established in 1984 in **Indore**.
- The development of technology in the field of laser and particle accelerators is undertaken at this centre.

### Other Key Units of the Department of Atomic Energy

| Institute Name                                           | Place     |
|----------------------------------------------------------|-----------|
| Atomic Minerals Directorate for Exploration and Research | Hyderabad |
| Guru Jal Board                                           | Mumbai    |
| Nuclear Fuel Complex                                     | Hyderabad |

|                                            |          |
|--------------------------------------------|----------|
| Uranium Corporation of India Limited       | Jaduguda |
| Indian Rare Earth Limited                  | Mumbai   |
| Nuclear Power Corporation of India Limited | Mumbai   |

✎ **Note :** Apsara-U, Apsara, Cirus, Dhruva, Kamini, Purnima-I, Purnima-II, Purnima-III, Zerlina, are the names of BARC nuclear reactors. Out of these, Apsara, Cirus, Purnima-I, II, III and Zerlina are not Operational.

### Atomic Power Stations of India:

- Nuclear Power Corporation of India Limited (NPCIL) was established in 1987. The Bharatiya Nabhikiya Vidyut Nigam Limited (BHAVANI) was established in 2003.
- Its (NPCIL) function is to manage nuclear power generation.
- Tarapur Atomic Power Station has been established with the help of America.
- Tarapur is the **first** nuclear power plant in India.
- Enriched Uranium is used here as fuel that is imported from America.
- **Rawatbhata Nuclear Power Plant** is located in Rawatbhata (Rajasthan).
- It was established in collaboration with **Canada**. At present, it is the **largest 'Nuclear Park' in India**.

### Nuclear Power Plants in India

| Atomic Power Plants            | Place                              |
|--------------------------------|------------------------------------|
| Tarapur Atomic Power Plant     | Maharashtra                        |
| Rajasthan Atomic Power Plant   | Rawatbhata (Rajasthan)             |
| Madras Atomic Power Plant      | Kalpakkam (Tamilnadu)              |
| Narora Atomic Power Plant      | Bulandshahar (Uttar Pradesh)       |
| Kakrapar Atomic Power Plant    | Surat (Gujarat)                    |
| Kaiga Atomic Power Plant       | Uttar Kannada district (Karnataka) |
| Kudankulam Nuclear Power Plant | Tirunelveli (Tamilnadu)            |

### Neutron Bomb :

- The explosive power of this bomb is comparatively less.
- Its radiation capacity is high.

### Nuclear Test :

- India conducted its first nuclear test on **18<sup>th</sup> May, 1974** at Pokhran (Jaisalmer, Rajasthan).
- The bomb had a capacity of 12 kg TNT.
- This test was named **Smiling Buddha**.
- A second nuclear test was conducted in Pokhran on 11 and 13 May 1998 which was named **Shakti-98**.
- Three scientists share the credit for the success of the **Shakti-98 project**. They are as follows-

1. R.Chidambaram, 2. Dr. A.P.J. Abdul Kalam and 3. Anil Kakodkar.

- India's test was done in the category sub-kiloton (i.e. less than 1 kiloton) category.
- The biggest advantage of the sub-kiloton explosion is that India can continue trials in the laboratory even if India has signed the Comprehensive Nuclear Test Ban Treaty (CTBT).

🔍 **Note :** A nuclear weapon or nuclear bomb is an explosive device whose base of destructive power is a nuclear reaction.

🔍 **Note :** The inventor of the atom bomb is **Otto Hahn**.

🔍 **Note :** Otto Hahn is considered the father of nuclear chemistry and harbinger of the atomic age.

#### **Nuclear Reactor :**

- A Nuclear Reactor is a device in which nuclear reactions are generated, and the Chain reaction is controlled to release large amount of steady heat, thereby producing a good quantity of energy.

#### **Parts of Nuclear Reactor :**

- **Fuel** - Uranium is basic fuel.
- **Moderator** - Materials in the core which slows down the neutrons released from fission so that they cause more fission. it is usually water, but may be heavy water.
- **Coolant** - A fluid circulating through the core so as to transfer the heat from it. Significantly, in light water reactors the water moderator functions also as primary coolant.
- **Shield** - A nuclear shield is fitted around the reactor to absorb any radiation from leaking into its immediate environment. Usually made of lead or special types of plastics.

#### **Nuclear Fission :**

- Under the process of nuclear fission, an atomic nucleus is split by bombardment of neutrons, as a result energy is generated -

Example :



- The atomic bomb is based on process of nuclear fission.

#### **Nuclear Fusion :**

- Under the process of nuclear fusion, two lighter atomic nuclei combine together to form a larger atomic nucleus.
- Example :** Helium atoms are formed by the fusion of Hydrogen atoms and a large amount of energy is generated.



#### **International Thermonuclear Experimental Reactor (ITER)**

- ITER is being operated by many countries of the world including China, European Union State, Japan, India, South Korea, Russia at Cadarache in France.
- The primary objective of **ITER** is the investigation and demonstration of burning plasma. Expect this **ITER** will also test the availability and integration of technologies essential for a fusion reactor.
- In this project a machine is being used namely Tokamak. Tokamak is an experimental machine designed to harness the energy of fusion.
- In this project Europe is responsible for the largest portion of construction cost (**45.6 percent**), the remain is shared equally by China, India, Japan, Korea, Russia and US (**9.1 percent each**).
- **Nisargruna Biogas Technology :**
- Nisargruna biogas plants have been developed from biodegradable waste like cow dung, grass, paper, kitchen waste, dry leaves.
- The '**Slurry**' obtained from this biogas plants can be used as fertilizer
- Methane ( $\text{CH}_4$ ) released from them can be used as an energy product.
- This technology is developed by BARC.

#### **Some major radioactive drugs**

| Medicine       | Use                                                     |
|----------------|---------------------------------------------------------|
| Cobalt-60      | It emits gamma rays. It Destroys cancer cells.          |
| Phosphorus-32  | Treatment of polycythemia vera (a type of blood cancer) |
| Iodine-131     | Diagnosis of disease related to the thyroid gland       |
| Samarium-153   | for the diagnosis of Arthritis                          |
| Holmium-166    | for the diagnosis of arthritis                          |
| Technetium-99m | for Radiotherapy                                        |

## **5**

### **Indian Defence Technology**

- Defence Research and Development Organisation (DRDO) was established in **1958**.
- The Chief and Director General of DRDO acts as the scientific advisor to the Defence Minister.

#### **Indian Missile Program:**

- In July 1983, the **Integrated Guided Missile Development Program-IGMDP** was launched.
- The foundation stone of this program was laid down by the former Prime Minister of India, Smt. Indira Gandhi.
- This program is running under the aegis of DRDO.



### 1. Prithvi

- It is a **surface-to-surface** ballistic missile. **Prithvi-I** and **Prithvi-II** have a firing range of 150 kms and 250 kms respectively.
- In February 1988, the first test of the Prithvi missile was conducted at **Chandipur** Integrated Test Range.
- The first test of the Prithvi missile was carried out in February, 1988.
- Prithvi-I missile has been delivered to the Indian Army. Prithvi-II is its air force version, with a range of 250-350 km. Prithvi-III (Dhanush) is a naval version.
- Prithvi missiles are based on fluid propellants.

### 2. Dhanush :

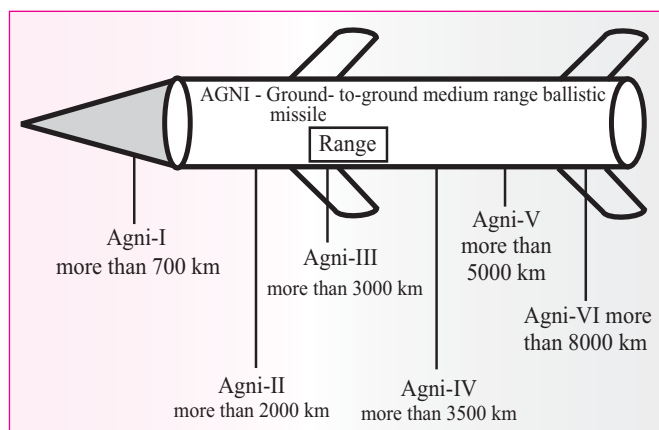
- It is Prithvi-II missile's naval orientation.
- Its firing range is 350 kms.
- It is a **surface-to-surface** missile.

### 3. Akash:

- It is a medium-range **surface-to-air missile**.
- Its firing range is about **30 kms**.
- This can also be fired from the mobile launcher.
- "Akash" is comparable to the American Patriot missile.

### 4. Agni :

- It is a **surface-to-surface** medium-range ballistic missile.
- There are five categories of Agni missile - Agni-I, Agni-II, Agni-III, Agni-IV and Agni-V.



- **Agni-I** has a range of more than **700 km**.
- **Agni-II** has a range of more than **2000 km**.
- **Agni-III** has a range of more than **3500 km**.
- **Agni-IV** has a range of more than 3500 km, while **Agni V** has a range of more than 5000 km.
- **Agni-VI** has a range of more than 8000 km.
- **Agni-IV** is a two-stage **solid propellant** missile.
- **Agni-V** and **Agni-VI** is equipped with electronic devices that jam the enemy's radars so that it will remain untraceable to the enemy.
- India has also joined the Intercontinental Ballistic Missile (ICBM) club with the Agni-V and Agni-VI test.

- The club includes the United States, Russia, China, France and the United Kingdom.

### 5. Trishul

- It is a **surface-to-air missile**.
- Its firing range is **9 kms**.
- In 2008, the Trishul Missile development program was launched.

### 6. Nag:

- It is an **anti-tank** guided missile.
- The firepower of this missile is 4 km.
- It works on the **Fire and Forget Principle**, once fired, it does not need to be redirected.

### 7. BrahMos:

- It has been developed under a joint project between India and Russia.
- Brahmos produces supersonic cruise missiles that can be launched from submarines, ships, aircraft or land platform.
- The word "**BrahMos**" comes from the word **Brah**, derived from the river Brahmaputra of India and the word **Mos** from the river Moskva of Russia.
- Its firing range is 290 km which has been increased to 450-500 km in its later version.
- It moves at almost thrice the speed of sound.

### Other Defence Armaments & Equipment:

#### Battle Tank Arjun :

- This battle tank has been developed by D.R.D.O.
- It can also work in the dark.
- Its maximum speed is 70 kms per hour.

#### T-90 Bhisma Tank :

- It is a missile launcher with a firing range of 4 kms.
- It can also protect itself from landmines laid.

#### Tejas:

- Tejas is the first indigenously built light combat aircraft of 4<sup>th</sup> generation.
- It has been developed by Hindustan Aeronautics Limited (HAL).
- In January, 2011 the then Defence Minister dedicated it to the Indian Air Force and in July, 2016 its first squadron was inducted into the Indian Air Force.

#### Drones :

- These are unmanned Aerial Vehicles (UAVs) which are **self-propelled** and based on pre-planned missions.
- The drone is controlled from the ground. They are much cheaper than military aircrafts and they can be flown and controlled remotely.
- These are of two types - one for surveillance and the other equipped with missile bombs.

#### Lakshya :

- It is a **pilot-less aircraft**.
- It is used as a target for the trial of **surface to air** and **air to air** missiles and tanks.



- It is a jet engine driven aerial vehicle (UAV) and can be used 10 times in its life.
- It can be remotely controlled within the range of 100 kms.
- It is used for training of all three branches of the Armed Forces.

#### **Dhruv :**

- It is an advanced light helicopter with twin engines.
- It has been developed by Hindustan Aeronautics Limited.

#### **Pinaka :**

- It is a **multi-barrel rocket launcher**.
- It is named after Lord Shankara's bow 'Pinaka'.
- It has 12 rockets in its tubes which can be fired within a gap of 44 seconds with a payload of 100 kg.
- Its MK-I variant has a range of 38 kms and 60 km range of the MK-II version. In December, 2019 its firing range 75-90 km was also successfully tested.

#### **Kali 5000 :**

- Kali (Kilo Ampere Linear) 5000 is a powerful **beam weapon**.
- It emits microwave waves of several GW power which have the effect of dismantling electronic systems and computer chips of aircraft and missiles and eventually destroying them.
- The Kali 5000 is developed by BARC and DRDO.

#### **K-15 :**

- K-15 or '**Sagarika**' is a submarine-launched ballistic missile (SLBM), which can also carry nuclear warheads.
- It was successfully tested in **February 2008**.
- This missile is developed by **DRDO**.
- It used two stage solid propellants.

#### **Sarath :**

- It is a one of a missile platform developed for deployment of Akash, Trishul and Nag missile.
- By this, any missile will be loaded and taken to war zones and will be dropped at appropriate places.

#### **Airborne Early Warning & Control System (AEW&C) :**

- Airborne Early Warning & Control System (**AEW&C**), is a force multiplier system of systems for detecting & tracking of enemy/hostile aircrafts/ UAVs etc.
- It also enables operators onboard and on ground to identify, assess the threat and take actions to guide our interceptors to those for neutralizing those threats.
- The system is fully net centric, with complete command and control functions not only providing the available information to ground through its multiple data links but also can receive information from ground, integrate and fuse them onboard to provide the operators onboard a composite picture of environment.
- As a command centre, it enables onboard operators to select, command and guide specific interceptor aircrafts towards enemy threat efficiently and neutralize them.

#### **Project - 75 :**

- Project 75 is an ambitious project of India. Significantly, this project involves the acquisition of six ships of the **Kalvari-class diesel-electric attack submarines**.
- The P75 Kalvari-class **diesel-electric / air-independent propulsion (AIP)** submarines are based on the **Scorpene-class submarines**, which were designed by French naval shipbuilding firm Naval Group (formerly known as DCNS) in partnership with Spanish shipbuilding firm Navantia.
- The new submarines are being built by Mazagon Dock Shipbuilders (formerly known as Mazagon Dock) in Mumbai, India, using the technology and training provided by the Naval Group.
- The six scorpene class submarines under P75 are:
  1. **INS Kalvari** (commissioned in 2017)
  2. **INS Khanderi** (commissioned in 2019)
  3. **INS Karanj** (commissioned in 2021)
  4. **INS Vela** (commissioned in 2021)
  5. **INS Vagir** (launched in 2020)
  6. **INS Vagsheer** (Launched on 20 April, 2022)

#### **Project 75I (India) :**

- The Project 75 (India)-class submarines, or P-75I, for short, are a planned class of diesel-electric submarines, which are to be built for the Indian Navy. **The P-75I class is a follow-on of the P-75 class submarines** of the Indian Navy.
- This project envisages the indigenous construction of submarines equipped with a state-of-the-art **air-independent propulsion system**.

#### **Ballistic Missiles :**

- Ballistic missiles are applied with the necessary force during launching but are dropped by gravity to hit the target.

#### **Cruise Missile:**

- Cruise class missile is able to find its target and hit it.

#### **Stealth Technology:**

- Aeroplanes, ships, submarines, missiles and satellites are made invisible from the access of sonar, radar and infrared etc. by the use of stealth technology.

#### **Other Important Points**

- Dr. A.P.J. Abdul Kalam is said to be the father of Indian Missile Technology.
- The outer atmospheric layer consists of electrically charged ions, hence it is also called ion system.
- **Juno** of US Space Agency (NASA), is a space research vehicle, launched to study Jupiter, the fifth planet in the solar system.
- **Dr. A.P.J. Abdul Kalam** is the first President of India who flew for 30 minutes in Sukhoi fighter aircraft of the Indian Air Force.

|                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ● <b>Nuclear fuel</b> is used in modern submarines.                                                                                                                      |
| ● The first nuclear explosion was conducted by the <b>United States</b> in July 1945 which name was 'Trinity'.                                                           |
| ● <b>Aryabhata</b> was the first satellite launched by India.                                                                                                            |
| ● Vikram Sarabhai Space Centre (Thumba village) was established in Thiruvananthapuram because it is located on the geomagnetic equator.                                  |
| ● The Earth rotates from west to east. In order to take advantage of rotation in this direction, artificial satellites are launched from the west direction to the east. |
| ● <b>Chronograph</b> is a device that provides prior information about cyclones.                                                                                         |
| ● These storms rise in the sun.                                                                                                                                          |
| ● <b>Polygraph</b> machine is used as a lie detector machine.                                                                                                            |
| ● Polygraph machine is based on the principle that activities which occur in the mind of a human being are reflected in the physical activities of man.                  |
| ● Holography is a technique of marking and repeating a stereoscopic (3D) pattern of an object.                                                                           |
| ● The full name of FAX is Far Away Xerox.                                                                                                                                |
| ● The Council of Scientific and Industrial Research (CSIR) was established in 1942. Its headquarter is located at New Delhi.                                             |
| ● The Prime Minister of India is the ex-officio President of the CSIR.                                                                                                   |

## 6 Indian Space Program

- In 1945, the science writer, Arthur C. Clarke in his paper, published in the 'Wireless World Magazine', proposed the principle of radio communication through geostationary satellite.
- In his honour, the geostationary class is also called '**Clarke Orbit**'.
- After continuous research in this direction, some satellites were launched into space.
- The world entered into the space age with the successful launch of the **Sputnik-1** satellite (USSR) in 1957.
- The Indian National Committee for Space Research (INCOSPAR) was formed in India in 1962.
- The first **chairman** of this committee was a famous space scientist **Dr. Vikram Sarabhai**. (MPPCS Pre, 2019)
- He is called the **Father of Indian Space Programme**.
- India's spaceward odyssey began on November 21, 1963, with the launch of the US Nike Apache sounding rocket from Thumba, near Thiruvananthapuram.

- The rocket was taken to the launch site on a bullock cart; later rockets would take bicycles.
- The Indian National Space Research Committee worked under the Department of Atomic Energy.
- Later, the Indian Space Research Committee was reorganized.
- **The Indian Space Research Organization (ISRO)** was established on 15<sup>th</sup> August, 1969, after restructuring.
- Number of centres and units were set up for the successful space program. These centres are as follows:

### **Vikram Sarabhai Space Centre, Thiruvananthapuram (VSSC):**

- The centre is responsible for the rocket research and launch vehicle development projects.
- It plays an important role in developing Rockets and Launch Vehicles.
- VSSC has developed India's Launch Vehicles SLV-3, ASLV, PSLV and GSLV.

### **UR Rao Satellite Centre, Bengaluru (URSC) :**

- URSC carries out the design and development of satellite projects at this centre.
- The URSC Centre has also undertaken the testing and management of satellites.

### **SHAR Centre, Sriharikota:**

- It is also known as **Satish Dhawan Space Centre**.
- The SHAR centre is located on the eastern coast of Andhra Pradesh and is a major launching centre of ISRO.
- Various performance stages of solid fuel rockets of launch vehicles are tested on the Earth from this centre.

### **Master Control Facility, Hassan (MCF):**

- This centre is located at Hassan district of Karnataka.
- The work of placing the INSAT satellite in orbit, maintaining regular operation and contact of the satellite with the centre is done at this centre.
- The centre also monitors and controls all the activities of the satellite in the orbit.

### **National Remote Sensing Centre, Hyderabad (NRSC):**

- Its main campus is located in **Balanagar, Hyderabad** (Telangana).
- Its other campuses are located at Shadnagar – Rangareddi district in Telangana, Jeedimetla in Hyderabad and Begumpet in Hyderabad.
- This agency works under the Department of Space.
- The NRSC identifies, classifies and monitors the mineral resources on the Earth based on the information received from the satellites.

### **ISRO Telemetry, Tracking and Command Network (ISTRAC):**

- The main function of this network is to provide surveillance, telemetry and control facilities to ISRO's launch vehicles, satellite missions and other space agencies.

- Its headquarter is located in **Bengaluru**.
- ISTRAC's strict international standards are based on distance follow-up control ground centres at Bengaluru, Lucknow, Shar (Harikota), Thiruvananthapuram, Port Blair, Brunei, Biak (Indonesia) and Mauritius etc.

#### **Antrix Corporation Limited :**

- Antrix Corporation Limited (ACL), Bengaluru is a wholly owned Government of India Company under the administrative control of the Department of Space.
- Antrix Corporation Limited was incorporated as a private limited company owned by Government of India in September 1992.
- It is a Marketing arm of ISRO for promotion and commercial exploitation of space products, technical consultancy services and transfer of technologies developed by ISRO.
- Another major objective is to facilitate development of space related industrial capabilities in India.
- As the commercial and marketing arm of ISRO, Antrix is engaged in providing Space products and services to international customers worldwide.
- With fully equipped state-of-the-art facilities, Antrix provides end-to-end solution for many of the space products, ranging from supply of hardware and software including simple subsystems to a complex spacecraft, for varied applications covering communications, earth observation and scientific missions; space related services including remote sensing data service, Transponder lease service; Launch services through the operational launch vehicles (PSLV and GSLV); Mission support services; and a host of consultancy and training services.

#### **Major Indian Satellites:**

- **Aryabhata** is the first Indian satellite built with indigenous technology.
- It was launched from the 'KOSMOS-3M' launch vehicle on 19<sup>th</sup> April, 1975 from the Kapustin Yar Space Centre of the former SOVIET Union.
- Aryabhata satellite of 360 kg was placed in Low Earth Orbit (LEO :  $563 \times 619$  km).
- After this, Bhaskar I, the first indigenously built experimental remote sensing satellite and weighing 442 kg, was launched from the former Soviet Union on 7<sup>th</sup> June, 1979.
- **Rohini Range:** Four satellites were launched by the Indian Satellite Launch Vehicle [SLV-3 Rocket] from the Indian Launch Centre (Sriharikota) under this series.
- The first experimental test launched by Indian Launch Vehicle SLV-3E1 in August, 1979 from Indian soil, failed.

- On 18<sup>th</sup> July, 1980, the second experimental test Rohini RS-1 was successfully launched by PSLV-3E2 rocket from Sriharikota and thus India became 6<sup>th</sup> member of (ISC)
- The fourth experimental test Rohini RS-D2 was launched successfully by PSLV-3 rocket from Sriharikota on 17<sup>th</sup> April, 1983.
- **APPLE :** It was India's first communication satellite placed on the geostationary orbit.
- It was launched by the Ariane-1 (V-3) launch vehicle on 19<sup>th</sup> June, 1981, from the Kourou Space Launch Centre in French Guiana.

#### **Satellites :**

- The celestial bodies orbiting a planet under the influence of gravitational force are called **satellites**. They are both **natural** and **artificial**.
- The Moon is the natural satellite of the Earth. Many man-made satellites revolve around the planets.
- **Low Earth-Orbit Satellite:** This category of satellites orbit their planet in an elliptical circuit in the range of about 160 to 2000 km from the Earth's surface.

#### **Geo-Synchronous Satellite:**

- It is also called **stationary**.
- These satellites revolve in a circular orbit.
- At an altitude of 36000 km, they revolve around the Earth once in 24 hours.
- The Earth revolves on its axis in 24 hours, so geostationary satellites appear to be stationary relative to the Earth.
- INSAT and GSAT series satellites are placed in the Geo-Synchronous **Satellite** category.

#### **Indian National Satellite (INSAT) System:**

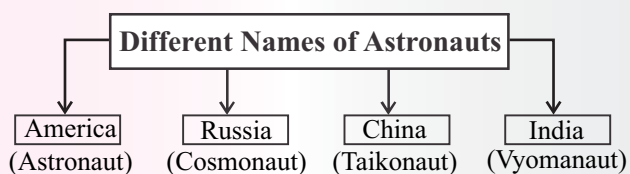
- The Indian National Satellite System is known as a multipurpose working satellite system.
- It is used in broadcasting programs on AIR and Doordarshan.
- INSAT system is also useful in collecting scientific data like meteorological information and geo-survey data.
- The first generation of the INSAT system had four satellites INSAT-1A, 1B, 1C and 1D. Its second, third and fourth generation satellites are ready for launch.
- Now, ISRO governs the launching of communication satellites of GSAT series.

#### **Indian Remote Sensing Satellite System :**

- Indian Remote Sensing Satellite-IRS has been developed for survey and continuous monitoring of natural resources on the Earth.
- Cartosat satellites have been launched under this programme.
- **Cartosat-1** is India's first remote sensing satellite, capable of providing orbital stereoscopic images.

## Important Facts

- **Sputnik-I** was the first satellite launched in the space by the former Soviet Union.
- **Sputnik-II** was the first satellite to take **living dog 'Laika'** into space.
- **Yuri Gagarin** of the former Soviet Union was the first man to enter space.
- Yuri Gagarin orbit the Earth on 12<sup>th</sup> April, 1961, in a vehicle called **Vostok**.
- **Valentina Tereshkova** of the former Soviet Union became the first female cosmonaut.
- Luna 9 was the first spacecraft to land on the lunar surface.
- The first experimental spacecraft was **Soyuz 4**.
- **Neil Armstrong** was the first human to step on the moon.
- On 20<sup>th</sup> July, 1969, Neil Armstrong got this achievement when he reached to moon by Apollo II Spacecraft.
- Neil Armstrong was followed by his co-astronaut Buzz Aldrin who also stepped on the moon.
- On 3<sup>rd</sup> April, 1984, the first Indian to go into space, was Squadron Leader **Rakesh Sharma**. He along with two Soviet cosmonauts went on a space trip in a Soyuz T-11 spacecraft.
- Smt. Indira Gandhi asked Squadron Leader Rakesh Sharma at Soviet Space Centre, "How does India look from space?" Then Rakesh Sharma replied that "**Saare Jahaan Se Achcha**" or "Better than the Whole World".
- **Kalpana Chawla**, a woman astronaut of Indian origin, was the first woman to enter space. She died in an accident on February 1, 2003, when her spacecraft 'Columbia' (Mission STS107) was destroyed shortly after the entry into atmosphere on return.



- **METSAT** : It was launched from the Satish Dhawan Space Centre in Sriharikota (Andhra Pradesh) on 12<sup>th</sup> September, 2002.
- The Polar Satellite Launch Vehicle-PSLV-C4 was used for this purpose.
- METSAT is the first meteorological space satellite launched by the country.
- Earlier, INSAT series of satellites were used to obtain meteorological information.

- The METSAT was renamed as 'Kalpana-1' in memory of Kalpana Chawla, the first female astronaut of Indian origin.

## EDUSAT :

- This satellite was launched from the Satish Dhawan Space Centre, Sriharikota on 20<sup>th</sup> September, 2004.
- It was the first satellite in the world dedicated to educational work.

## Chandrayaan-I :

- Chandrayaan-I is India's first mission to the moon.
- On 22<sup>nd</sup> October, 2008, the Moon mission was launched by the Polar Satellite Launch Vehicle (PSLV-C11).
- The launch was done from the Satish Dhawan Space Centre in Sriharikota. Chandrayaan-I also carried the national flag.
- The flag was installed by the Moon Impactor Probe on the surface of the moon.
- After America, Russia, China, the European Union and Japan, India is the sixth country that has been successful in sending a vehicle to the moon.

## Mangalyaan:

- Mangalyaan was fully indigenous project prepared by Indian Scientists.
- The Polar Satellite Launch Vehicle PSLV-25 has successfully launched the vehicle from the Satish Dhawan Space Centre in Sriharikota, Andhra Pradesh on 5<sup>th</sup> November, 2013.
- On 24<sup>th</sup> September, 2014, at 8 am, it entered into the orbit of Mars.
- With this achievement, India became the first country to reach Mars in its first attempt.
- The equipments Mangalyaan is carrying will be used in future for weather, farming, land and communication satellites.

## Chandrayaan-II :

- India's Chandrayaan-II mission was successfully launched by GSLV Mark III M1 rocket from the second launch pad of Satish Dhawan Space Centre at Sriharikota, SHAR on **22<sup>nd</sup> July, 2019**.
- This was the **first operational flight** of GSLV Mark-III rocket.
- Chandrayaan-II mission consists of an Orbiter, Lander and a Rover.
- Separating from the orbiter to land in the south pole region of the Moon on 7<sup>th</sup> September, 2019, the lander lost contact with ISRO's control centre in the process.

## Chandrayaan-III :

- On 5<sup>th</sup> of August 2023, Chandrayan-3 mission entered lunar orbit and India became the first country to touch down near the lunar south pole.
- Notably, Chandrayan-3 was launched on July 14, 2023.
- The primary objective of this mission was to demonstrate soft landing near to lunar south pole region.



- A 6-wheeled Pragyan Rover (weighing 27 kg) was to be landed on the lunar surface through a Vikram lander weighing 1471 kg.
- It was planned that the lander will have a soft landing on the moon, but due to lost contact with ISRO, it landed on the lunar surface by a hard landing.

#### Satellite Launch Vehicle, SLV-3 :

- On 18<sup>th</sup> July, 1980, the SLV-3 was successfully tested.
- With this achievement, India became the sixth member country of the Space Club after Russia, America, France, Japan and China.
- It was a four-stage simple-calibre launch vehicle.
- Solid fuel (propellant) is used in it.

#### Augmented Satellite Launch Vehicle-ASLV :

- It is an augmented form of SLV-3.
- It is constructed for carrying satellites up to the weight of 150 kg and placing them in the Earth's lower orbit.

#### Polar Satellite Launch Vehicle - PSLV :

- It is a four-stage polar launch vehicle.
  - In PSLV, solid propellants are used in the first and third stages and liquid propellants are used in the second and fourth stages.
  - In solid propellant, Ammonia Perchlorate is used as an oxidizer and Hydroxyl Terminated Poly Butadiene (HTPB) as fuel.
  - Nitrogen Tetra Oxide ( $N_2O_4$ ) is used as an oxidizer in the second phase as liquid propellant and Unsymmetrical Di Methyl Hydrazine (UDMH) as fuel. Whereas the fourth stage uses a mixture of Oxides of Nitrogen (MON-3) as an oxidizer and Mono Methyl Hydrazine (MMH) as fuel.
  - At present, PSLV has the following versions -
- Core-Alone (CA) Version**-It is without booster motors (Light Policy for India).
  - Standard Version** - It has 6 strap-on booster motors with 9 tonnes propellants.
  - Extra Large (XL) Version** - It has 6 strap-on booster motors with 12.2 tonnes propellants (used for the first time to launch Chandrayaan-I, to launch satellites in geostationary orbit.)
  - QL Versions** - It has four strap-on boosters with a 12.2-tonnes propellants.
  - DL Version**- It has two strap-on boosters with a 12.2-tonnes propellants.

#### GeoStationary or GeoSynchronous Satellite Launch Vehicle-GSLV :

- It is a Geosynchronous or Geostationary Satellite Launch Vehicle.
- It is a three-stage satellite launch vehicle using solid propellants in the first stage, the liquid propellant in the second phase and cryogenic engine in the third phase.

- Cryogenic technology uses liquid Hydrogen ( $-253^\circ\text{C}$ ) and liquid Oxygen ( $-183^\circ\text{C}$ ) as propellants at extremely low temperature.
- GSLV-MKII and GSLV-MK III are the latest versions of this launch vehicle.
- **GSLV** carries satellites up to 1.8 tonnes in weight.
- **GSLV-MK II** carries satellites up to 2.5 tonnes in weight.
- **GSLV-MK III** is used for satellites up to 4 tonnes, in weight.

#### Cryogenic Technology:

- The word **cryogenic** is derived from the Greek language meaning production of materials at minimum temperature.
- Temperature below 0 to  $-150^\circ\text{C}$  are called cryogenic temperature.
- Hydrogen (at  $-253^\circ\text{C}$ ) and Oxygen (at  $-183^\circ\text{C}$ ) is used as fuel in cryogenic engines. Since fuel is used in an optimum state, it is called a **cryogenic engine**.
- Cryogenic engines generate a large amount of energy.
- In a cryogenic engine, the fuel ignition rate can be controlled.
- In this engine, much force is produced per unit load of the propellant due to which the vehicle gets more thrust.
- After America, Japan, France, China and Russia, India is the sixth country that has successfully tested cryogenic technology.

#### Important for Exam Point of View

- **GPS-Aided Geo Augmented Navigation-GAGAN:** ISRO and Airports Authority of India (AAI) have launched GPS for Indian Airspace. The supporting land promotion guidelines have implemented the **GAGAN** project as a satellite-based augmentation mechanism.
- This augmentation system will be operated by a group of seven spacecrafts.
- It will be useful to get information related to security, telecom, sea navigation, besides assistance in aviation.
- **'Bhuvan'** is a software developed by the Indian Space Research Organization (ISRO).
- It will allow the terrain of India to be seen on Internet in the form of three-dimensional (3D) images.
- Like Google Earth and Wikimapia, heights of different terrain can be viewed through varied heights.
- Sriharikota Island separates Pulicat Lake from the Bay of Bengal.
- The new name of METSAT is **Kalpana-I**.
- The air in the exosphere is extremely sparse and gradually merges into outer space above.
- Communication satellites are located in outer space.



|                                                                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ● The US Space Agency NASA has sent Rover named <b>Sojourner, Spirit, Opportunity, Curiosity</b> and <b>PERSEVERANCE</b> on Mars for exploration.                                                                   |
| ● <b>Cassini</b> is a robotic spacecraft launched by NASA to study Saturn and its satellites.                                                                                                                       |
| ● Evidence of the presence of Sulfate on Mars has been obtained as a result of NASA's <b>Spirit</b> and <b>Opportunity</b> missions.                                                                                |
| ● The presence of sulfate clearly indicates that water is present on this planet.                                                                                                                                   |
| ● The presence of gypsum on Mars has also been established.                                                                                                                                                         |
| ● The presence of methane in the atmosphere of Mars indicates traces of life on it.                                                                                                                                 |
| ● Space shuttles are vehicles that are launched like rockets.                                                                                                                                                       |
| ● They revolve around the Earth like satellites and land again like aeroplanes.                                                                                                                                     |
| ● <b>Challenger, Columbia, Discovery, Atlantis</b> and <b>Endeavor</b> , etc. are NASA's retired space shuttles.                                                                                                    |
| ● The <b>Galileo</b> Project is a multi-satellite operation project of the European Space Agency (ESA) and the European Union (EU), like the Global Positioning System, GPS of the US and <b>GLONASS</b> of Russia. |
| ● India's NAVIC (IRNSS : Indian Regional Navigation Satellite System) is a regional satellite-based navigation system based on 7 satellite in the IRNSS series.                                                     |
| ● Abdul Kalam Island, formerly known as <b>Wheeler Island</b> is located in Odisha.                                                                                                                                 |
| ● Missiles are tested here.                                                                                                                                                                                         |
| ● The island is located near Gahirmatha Marine Sanctuary.                                                                                                                                                           |
| ● The threatened Olive Ridley (tortoise) species inhabit this sanctuary.                                                                                                                                            |

### Exam Oriented Facts

|                                                                                                            |
|------------------------------------------------------------------------------------------------------------|
| ● Dr. vikram Ambalal Sarabhi was considered as the father of the Indian space programme. (MPPCS Pre, 2019) |
| ● Aryabhata was the first satellite launched by India on april 19, 1975.                                   |
| ● Laika was a soviet space dog who became the first animal to orbit the earth in space. (UPPCS GIC 2010)   |
| ● Yuri Gagarin was the first astronaut in space. (MPPCS Pre, 2010)                                         |
| ● Valentina Tereshkova is world's first woman cosmonaut. (UP Lower Sub (SPI) Pre 2004; UPPCS Pre, 2001)    |
| ● Neil Armstrong was the first man who placed his foot on the Moon. (66 <sup>th</sup> BPSC Pre, 2020)      |

|                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ● NASA's Cassini space craft is related to planet Saturn. (UK PSC Pre, 2016; IAS Pre 2008)                                                                         |
| ● The concept of expanding universe is based on Doppler Effect.                                                                                                    |
| ● Black-hole is a collapsed star. (UIPPCS Pre, 2019)                                                                                                               |
| ● The tail of a comet always points way from the sun. (UPPCS Mains, 2011)                                                                                          |
| ● Highly dense stars are called Neutron stars. (UK Lower Sub Pre, 2010)                                                                                            |
| ● A geostationary satellite has a period of 24 hours. (UPPCS Mains, 2010)                                                                                          |
| ● The communication satellites are located in Exosphere. (UPPCS Mains, 2004)                                                                                       |
| ● The 'NISAR' satellite is jointly developed by ISRO and NASA (UPPCS Pre, 2013)                                                                                    |
| ● The world's highest ground-based telescopic observatory is located at the atacama desert of northern chile. (IAS Pre, 2002)                                      |
| ● GPS stands for Global Positioning System. (UPPCS Mains, 2015)                                                                                                    |
| ● ISRO's master control facility is located at Karnataka. (UPPCS GIC, 2010)                                                                                        |
| ● Vikram Sarabhai space centre is located in Thiruvananthapuram, Korala. (UP UDA/LDA Pre, 2010)                                                                    |
| ● Chandrayan-3 rover 'Pragyan' has two payloads : Alpha Particle X-ray spectrometer (APXS) and laser included Breakdown spectroscopy (LIBS). (UP RO/ARO Pre, 2023) |
| ● Moon express is world's first private flight plan to go on the moon. (Jharkhand PCS Pre, 2016)                                                                   |
| ● The motto of Defence Research and Development Organization is - Balasya Mulam Vigrayanam. (RAS/RTS Pre, 2021)                                                    |
| ● The Indian Army has established a quantum laboratory at military college of Telecommunication Engineering, Mhow Madhya Pradesh. (MPPCS Pre, 2022)                |
| ● India's first indigenous anti-radiation missile is Rudram. (66 <sup>th</sup> BPSC Pre, 2020)                                                                     |
| ● Missile Brahmos was developed jointly by India and Russia. (UPPCS Mains, 2004; UPPCS Pre, 2003; UP UDA/LDA Pre, 2013)                                            |
| ● The Australia group was established in 1985 (IAS Pre, 2011)                                                                                                      |
| ● North Atlantic Treaty Organisation (NATO) was signed on 14 <sup>th</sup> April, 1949.                                                                            |



# Computer



## Topics of the Unit

- Computer : An Introduction ● Main Functions of Computer ● Development of Computer in India ● National Super Computing Mission ● Types of Computer ● Main Parts of Computer : ● Computer Programming Language ● Computer Network ● Important Internet Glossaries ● The Words Related to Computer

### Computer : An Introduction

- An electronic machine that calculates a large scale of data is called **Computer**.
- The word 'Computer' is derived from the word '**compute**', which means calculation.
- Computer is generally called a Data Processing Machine.
- A computer is a device that receives data as input and transforms it following a special set of instructions, to produce the desired output.

**Programme** – The instructions on which the computer works are called **Programme**.



### Main Functions of Computer :

- Compilation of Data
- Data Collection
- Processing of Data
- Release information received through data
- **Data** : Data is a set of raw facts, figures and statistics from which meaningful information is obtained after processing.
- **Processing** : The collection, manipulation and processing of collected data for the required use is known as **data processing**. It is a technique normally performed by a computer. The processing includes retrieving, transforming or classification of information.
- **Bit** : Bit is the **smallest unit** of computer memory.
- In the bit memory, the data is stored in the binary form, 0 or 1.
- Bit is the short form of the Binary digit.
- **Nibble** : A group of four bits is called a Nibble. It is equal to half a byte.
- **Byte** : A **byte** is a **standard unit** of computer memory.
- A byte consists of 8 bits to store any letter in the memory.
- **Character** : In addition to number signs that are used to convey language and meaning are called **Character**, i.e. a, b, c, d, 0, 1, 2, 3, Q, #, \$ 1 < > etc.

### Development of Computer in India :

#### HEC - 2M

- (Hollerith Electronic Digital Computer - 2M), it was produced by British Tabulating Machine Works, Letchworth.
- Computer Technology had emerged in the word late 1940s but India bought its first computer in the year 1956.
- The official name of this computer was **HEC-2M** and was established in Kolkata based **Indian Statistical Institute**.

#### TIFRAC

- It was India's first indigenous computer, which was developed in the year of 1962.
- The full name of this computer is - TATA Institute of Fundamental Research Automatic Calculator.

#### PARAM

- India's Supercomputer Program was launched in 1980s when US refused to give India '**Cray**' computer.
- C-DAC (Centre for Development of Advanced Computing) was established in year 1988, with the objective of achieving self-reliance in the field of supercomputing.
- PARAM Supercomputers series is designed and built by C-DAC, Pune.
- PARAM 8000, India's 1st Giga-scale supercomputer in 1990.
- **PARAM 10000**, 100 Giga-flop supercomputer in 1998.
- PARAM Padma, 1 Tera-flop supercomputer in 2002.
- This was India's first supercomputer to enter the Top 500 list of supercomputers of the world (**ranked 171 in June 2003**).

✎ **Note** : Notably, Supercomputers have very high storage capacity and can store thousands of times more data than an average personal Computer. Except this, a supercomputer can process billions of instructions in a second. Modern supercomputers have thousands of processors and are used for complex computations.

- Thereafter other supercomputers of the PARAM series were PARAM 10,000, PARAM Padma, PARAM Yuva, PARAM Yuva-II, PARAM Biochrome, PARAM Bio Blaze, PARAM Ishan, PARAM Shavak etc. were developed.
- Some remarkable supercomputers of the PARAM series are PARAM Shivay (IIT-BHU), PARAM Shakti (IIT-Kharagpur), PARAM Brahma (IISER-Pune).

### Exam Oriented Facts

- The first computer was made by Charles Babbage.  
(UPPCS Pre, 2007)
- Charles Babbage is known as 'Father of Computer'.  
[UP Lower (Mains), 2013; UK UDA/LDA Pre, 2017; UK PSC (Mains), 2002, 2006]
- Dr. Alan M Turing invented electronic computer.  
(MPPCS, Pre 2006, 2000)
- The first digital computer built with IC chips is known as IBM System/360.  
(UK PSC Pre 2006)
- The main board of computer is known as Motherboard.  
[UK PSC (Mains) 2002]
- A pen drive is a removable secondary storage unit.  
(UK PSC Pre, 2006)
- In the USB port anyone plug in the cable of keyboard.  
(UP Lower Sub Mains, 2015)
- A network of networks is simply called Internet.  
(UK PSC Pre, 2010)
- DSL (Digital Subscriber Line) is a fixed connection most popular in Areas without access to cable or fiber internet.  
(MPPCS Pre, 2023)
- The first page displayed by used browse after opening a website is called Home page. (MPPCS Pre, 2015, 2018)
- The internet works on packet switching only.  
[UP Lower Sub (Mains), 2015]
- A database that contains the names and adress of various hosts on internet is called Domain Name system.  
(MPPCS Pre, 2021)
- IPV6 protocol defines an IOP adress of 128 bit.  
(MPCS Pre, 2022)
- Bluetooth technology allows wireless communication between equipments.  
(UPPCS Mains, 2011)
- India manufactured super computer 'PARAM' in Pune.  
(RAS/RTS Pre, 1999)

- The Father of Indian Super Computer is Vijay Bhatkar.  
(MPPCS Pre, 2015)
- Laser printer is usually used for desktop printing.  
(UK PCS Mains, 2002)
- WWW on the Internet stands for world wide web.  
(UK PSC Pre, 2005; UPPCS Pre, 2015; UPPCS Mains, 2010)

### National Super Computing Mission

- National Supercomputing Mission (NSM) has set up to provide the country with supercomputing infrastructure to meet the increasing computational demands of academia, researchers, MSMEs, and startups.
- It is a first of its kind attempt to boost the country's computing power. National Super Computing Mission is steered jointly by the Department of Science and Technology (DST) and Ministry of Electronics and IT (MeitY) and implemented by the Centre for Development of Advanced Computing (C-DAC), Pune and the Indian Institute of Science (IISc), Bengaluru.

### I - NSM Systems

| Sr. No. | Institute Name     | HPC System Name | Computing Power  |
|---------|--------------------|-----------------|------------------|
| 1.      | IIT(BHU), Varanasi | PARAM Shivay    | 838TF            |
| 2.      | IISER, Pune        | PARAM Brahma    | 1.70PF           |
| 3.      | IIT, Kharagpur     | PARAM Shakti    | 1.66PF           |
| 4.      | JNCASR, Bangalore  | PARAM Yukti     | 1.8PF            |
| 5.      | IIT, Kanpur        | PARAM Sanganak  | 1.66PF           |
| 6.      | C-DAC, Pune        | PARAM Siddhi-AI | 5.2PF/210PF (AI) |
| 7.      | IIT, Hyderabad     | PARAM Seva      | 838TF            |
| 8.      | NABI, Mohali       | PARAM Smriti    | 838TF            |
| 9.      | IISC, Bangalore    | PARAM Pravega   | 3.3PF            |
| 10.     | C-DAC, Bangalore   | PARAM Utkarsh   | 838TF            |
| 11.     | IIT, Roorkee       | PARAM Ganga     | 1.66PF           |
| 12.     | IIT, Gandhinagar   | PARAM Ananta    | 838TF            |
| 13.     | NIT, Trichy        | PARAM Porul     | 838TF            |
| 14.     | IIT, Guwahati      | PARAM Kamrupa   | 838TF            |
| 15.     | IIT, Mandi         | PARAM Himalaya  | 838TF            |

### II - R&D and Application development systems

| Sr. No. | Institute Name | HPC System Name | Computing Power | Year of Commissioning |
|---------|----------------|-----------------|-----------------|-----------------------|
| 16.     | C-DAC, Pune    | SANGAM Testbed  | 150 TF          | 2017                  |
| 17.     | C-DAC, Pune    | PARAM Shrestha  | 100 TF          | 2018                  |

|     |                  |                             |        |      |
|-----|------------------|-----------------------------|--------|------|
| 18. | C-DAC, Pune      | PARAM Embryo                | 100 TF | 2020 |
| 19. | C-DAC, Pune      | PARAM Neel                  | 100 TF | 2020 |
| 20. | SETS, Chennai    | PARAM Spoorthi              | 100 TF | 2020 |
| 21. | C-DAC, Pune      | Bioinformatics R&D Facility | 230 TF | 2021 |
| 22. | C-DAC, Bangalore | System Software lab         | 82TF   | 2020 |
| 23. | C-DAC, Pune      | PARAM Sampooran             | 27 TF  | 2020 |

### III - PARAM Vidya under NSM HRD (For education and training)

| Sr. No. | Institute Name | HPC System Name | Computing Power | Year of Commissioning |
|---------|----------------|-----------------|-----------------|-----------------------|
| 24.     | C-DAC, Pune    | PARAM Vidya1    | 52.3 TF         | 2022                  |
| 25.     | IIT, Kharagpur | PARAM Vidya2    | 52.3 TF         | 2022                  |
| 26.     | IIT, Palakkad  | PARAM Vidya3    | 52.3 TF         | 2022                  |
| 27.     | IIT, Chennai   | PARAM Vidya4    | 52.3 TF         | 2022                  |
| 28.     | IIT, Goa       | PARAM Vidya5    | 52.3 TF         | 2022                  |

### Types of Computer

#### Micro Computer :

- Microprocessors are used in microcomputer.
- Microcomputers are used in homes and small businesses.
- Microcomputer is also called P.C. (Personal Computer)
- PC is divided into following categories.
  - (i) Desktop Computer
  - (ii) Laptop Computer
  - (iii) Palmtop Computer
  - (iv) Note Book Computer
  - (v) Tablet Computer

#### Mini-Computer :

- Mini-computers are large in size.
- Word length of mini-computer is 32 bit or more.
- Mini-computers are used for payroll, accounting and scientific experiments etc.

#### Mainframe Computer :

- Mainframe computers are used for server computers in large companies and offices.

- On the mainframe computer, multiple users can log in simultaneously.

- Mainframe computers have a large memory.

#### Supercomputer :

- The term 'Supercomputer' was first used in the US in 1920s, when today's computers with binary digit technology were not evolved.
- Supercomputer is a well-connected group of high-quality computers mounted on high steel shelves in which several microprocessors work together.
- Supercomputers can solve any problem of the computer immediately.
- Units such as **gigaflops**, **teraflops** and **petaflops** are used to describe the performance of the supercomputer.
- In a Supercomputer, billions and trillions of calculations are processed within seconds.
- Supercomputers are used in meteorological research, nuclear weapons, quantum physics and study of chemicals etc.
- The updated **Top-500** list of the world's fastest supercomputers was released in June, 2023. In this list US's supercomputer '**Frontier**' got top position as the world's fastest supercomputer.
- The supercomputer of Japan 'Fugaku' ranks second.
- Three supercomputers of India, '**Param Siddhi AI** (131<sup>st</sup>)', '**Pratyush**' (169<sup>th</sup>) and '**Mihir**' (316<sup>th</sup>) have also been ranked in the list.
- With high computing capacity (RMAX) 4.62 petaflops, "**Param Siddhi AI**" is the fastest supercomputer of India at present. It is established at the Centre for Development of Advanced Computing (C-DAC), Pune, India.

#### Digital Computer :

- The Digital Computer counts digits.
- In a digital computer, all data are stored as binary digit.
- A digital computer converts data and program into binary form 0 and 1 and converts them into **electronic form**.

#### Analog Computer :

- In the Analog Computer, the sides of physical quantities are presented constantly as analogies.
- Analog computers continue to receive information in the form of signal that is converted and displayed as data.
- A simple clock, speed meter of vehicle are examples of Analog Computer.

#### Quantum Computer :

- A computer that is based on quantum mechanics is called **Quantum Computer**.
- Quantum bits or Q bits can encode more information than traditional bits.



## Generations of Computer :

- Generations of Computer are based on the electronic apparatuses of the computers.
- Computers are classified into following five major categories -

| Generation           | Hardware                                                                               | Software                                                                                                      | Characteristics                                                                             | Example                                                                                                   |
|----------------------|----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| I<br>1940-1956       | Use of vacuum tube and magnetic Drum Memory                                            | Use of Machine language                                                                                       | Big size, expensive, limited application                                                    | (i) ENIAC (Electronic Numerical Integrator and Calculator).<br>(ii) UNIVAC (Universal Automatic Computer) |
| II<br>1956-1963      | Use of transistor, magnetic core for memory, use of magnetic tape and disk             | Programming language. FORTRAN, COBOL                                                                          | Small in size, high storage capacity and fast speed.                                        | IBM 1620, IBM 7094, UNIVAC 1108                                                                           |
| III<br>1964-1975     | Use of integrated circuit                                                              | Use of O.S. (Operating system), use of high level language BASIC                                              | Very small size, application in documentation and processing                                | Minicomputer                                                                                              |
| IV 1975 - Present    | Use of integrated circuit, microprocessors memory of semiconductor at very large scale | Spread sheet software, Data base software, Graphical user interface.                                          | Fast speed and Cheap                                                                        | Micro computer                                                                                            |
| V Present and onward | Multimedia, Internet, optical disk, parallel processing hardware                       | Internet and Multimedia, Artificial intelligence software use of all high level language as C, C++, Java etc. | Very small, fast speed, easy in application, multifaceted application (Sound, visuals text) | Notebook, Palm top                                                                                        |

## Main Parts of Computer :

Computer has 4 main units.

- Central Processing Unit (CPU)
  - Memory unit
  - Input device
  - Output device
- C.P.U. :** The term Central Processing Unit has its acronym as C.P.U. This is the main hardware of the computer.
    - C.P.U. is also called the **brain of the computer**.
    - C.P.U. has two parts.
      - Control Unit :** Its main function is to control and operate the functions of the hardware of the computer.
    - The Control unit directs the exchange of data between ALU and Memory.
      - ALU :** The full form of ALU is **Arithmetic Logic Unit**. ALU performs all logical and arithmetical tasks in a computer.
    - **Memory Unit :** A memory or memory unit is that part of a computer through which the storage and instructions and retrieval of data are carried out.
    - There are two types of Computer memory -
      - (i) Internal memory
      - (ii) External memory
  - Memory Capacity** is measured in byte, megabyte, kilobyte, gigabyte or terabyte.
    - Primary or Internal memory is of two types. (A) RAM (B) ROM
  - (A) RAM (Random Access Memory)**
    - It is the main memory of the computer.
    - No sequence is followed by RAM in accessing information.
    - RAM is a volatile memory.
    - The capacity or size of RAM is 256 MB, 512 MB, 1 GB, 2 GB etc.
  - (B) ROM- (Read Only Memory)**
    - ROM memory can only be read.
    - ROM is a permanent memory. (Non-volatile)
    - **Motherboard** - The motherboard is the main Printed Circuit Board (PCB) where each plug of computer is plugged.
    - CPU, RAM etc. are organised inside the Motherboard.
  - External Memory or Secondary memory :**
    - Main examples of secondary memory are Hard disk, Floppy disk, CD.ROM, DVD, Pen Drive, Blu-ray Disk etc.



**Hard Disk :** A hard disk has more than one disk. Each disk is divided into the track and each track is divided into the sector.

**DVD (Digital Versatile Disc or Digital Video Disk)**

This is an optical storage device, which is similar to CD, but its storage capacity is more than 15 times to that of CD. DVD is of two types -

- (i) DVD-R (Recordable)
- (ii) DVD-RW (Rewritable)

- **Pen Drive** - Pen Drive is also known as USB flash drive. It is most popular among current data storage devices.
- **Blu-ray Disk** - Blu-ray Disk is an optical disk which is the advance version of DVD. In Blu-ray Disk, blu represents the colour of laser and ray represents optical ray.

**Input Devices :**

- All devices which are used to enter data and instructions into the computer are called **Input Devices**.

**A. Keyboard :** A keyboard is the main and the most important input device.

- A keyboard is a device that has keys similar to a typewriter.
- Text, number symbol etc. are used as input into a computer through the keyboard.

**B. Mouse :** A computer mouse is used to select text, icons, files and folders in the graphical interface by controlling the cursor.

**C. Scanner :** Through this, the shape or written information on a page can be scanned and processed as input directly into the computer.

- A hard copy can be converted to soft copy through a scanner.

**D. OMR (Optical Mark Reader)** - OMR scanner checks the presence of pencil and pen marks on the OMR sheet.

**E. Barcode Reader :** A barcode reader is used to read a barcode printed on top of the product.

- The barcode reader uses a laser beam to read the code.

**F. Trackball and Joystick :** Trackball and Joystick are used to play games on the computer.

**G. MICR - (Magnetic Ink Character Recognition) :**

- It is used to read the letters written in a special way with special ink (Iron Oxide) through computer.
- It is used by bank in **Cheques/drafts**.

**Note** - MICR code consists of numbers from 0 to 9 and four symbols (total 14 characters) are used.

**Output Devices:**

- These hardware devices are used to display, project or physically produce computer information.

**A. Monitor** - The monitor is also called as **Visual Display Unit**.

- The image displayed on the monitor is made up of thousands of small coloured dots (.) which are called **Pixels**.

- There are three types of monitors-
  - (1) CRT (Cathode Ray Tube)
  - (2) LCD (Liquid Crystal Display)
  - (3) LED (Light Emitting Diode)

**B. Printer :** The result obtained from computer is printed on paper and given to the user permanently.

- There are many types of printers such as impact printer, DOT matrix printer, inkjet printer and laser printer.

**C. Plotter :**

- It is used to obtain high quality drawing and graphs on large paper.
- It is mainly used in engineering, architect, building construction, city planning, map etc.

➤ **Computer Hardware :** Hardware is that part of computer that we can touch or see.  
Example - System unit, monitor etc.

➤ **Computer Software :** Software is an information, command or method on which a computer's hardware functions.

➤ **Program :** A computer program is a collection of instructions that can be executed by a computer to perform a specific task.

- A set of programs is called software.

➤ There are two types of software.

- (1) System Software
- (2) Application Software

➤ **System Software :**

- (1) System software is the main program of the computer.
- (2) System software controls the internal functioning of the computer.

➤ Operating system acts as a bridge between hardware and software.

➤ Programs in the computer run with the help of the operating system such as Linux, Windows 7, Windows 8, Windows 10.

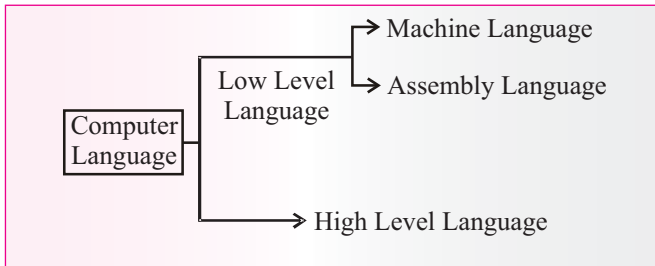
➤ **Utility Software :** The system software which helps in the maintenance of the computer is called utility software. For example, anti-virus software.

➤ **Application Software :** It is a group of programs that is designed by computer programmers to perform a particular task. For example, word processing software, database software, graphic software.

➤ **Specialist Software :** It is used for a specific task, e.g. camera application installed in a smartphone and is designed for the special purpose of photography.

**Computer Programming Language**

- The computer understands only one language which is called Machine Language. It comprises 0 and 1 digit, hence, called **Binary Language**.



**Language Translator** - A translator is programming language processors that converts a computer program from one language to another type of language translator -

(i) **Assembler** : It converts assembly language or low level language into machine language.



(ii) **Compiler** :

➤ It converts high level Programming language into low level programming language. It translates the entire program in one way and reports all the error in the program at once in their line order.

(iii) **Interpreter** :

- It converts high level language into machine language (low level) like compiler.
- It translate one line of the source program into machine language and processes the previous line before translating the next line.
- BASIC , C, C++, JAVA etc. all are high-level languages.
- **Fortran** is also a high-level language. It is an acronym of Formula Translation.
- Fortran is a very easy language for scientific and engineering computing.

**Computer Network** :

- Computer network is a group of interconnected, independent computers, capable of communicating with each other.
- **Local Area Network (LAN)** : In a computer network, Local Area Network is limited to the geographical periphery. For example, a computer network at home.
- **Wide Area Network (WAN)** : The geographical periphery of WAN is large. For example, a network of networks spread across a city or a country. In this network, computers, are connected by leased lines or switched circuits.
- **Metropolitan Area Network (MAN)** : It has more than two LAN connections. Routers, switches and hubs combine to form a Metropolitan Area Network.
- Metropolitan Area Network is a network located within the boundaries of a city.
- **Optical Fibre** : Optical Fibre is a very thin fibre made of glass, plastic or silica.

- Optical fibre works on the principle of complete internal reflection of light.
- Optical fibre is suitable for long distance communication.
- Through wireless communication media, data and information reach from one device to another in the form of waves such as Bluetooth, Infrared, Microwave etc.
- **Wi-Fi, Wireless Fidelity** : Wi-Fi is a wireless technology of Local Area Network.
- **WiMAX (Worldwide Interoperability for Microwave Access)** : It is a wireless technology for long-range and high speed.
- The maximum range of Wimax is 50 km.

**Modem** :

- A Modem is an abbreviation of Modulator and Demodulator.
- The computer generates a digital signal while only an analog signal can be sent over telephone.
- A Modem is a device that transmits digital signal from a computer to analog signal and transmits them from telephone or cable lines and converts the analog signal received from telephone or cable lines into a digital signal to make it usable by the computer.

**Internet and e-mail** :

- Internet is a worldwide computer network through which information can be exchanged very easily.
- It is a large network of many small computer networks spread across the globe.
- There are many types of computers. Hypertext was developed to remove mutual inconsistencies and establish links amongst them.
- To connect a computer to the internet, we have to take the service of ISP (Internet Service Provider).
- Broadband allows the internet to run at a high speed. It requires a different type of Modem.
- Every network has rules to control the process of sending and receiving data. These rules are called **Protocols**.
- Various Types of Protocols :
  - (1) TCP (Transmission Control Protocol)
  - (2) IP (Internet Protocol)
  - (3) HTTP (Hypertext Transfer Protocol)
- **Chatting** : Online chat may refer to any kind of communication on the Internet that offers a real-time transmission of text messages from sender to receiver.
- Online Chatting is of two types :
  - (a) Text Chat
  - (b) Voice Chat
- **Text Chat** : It involves the exchange of information in the form of texts or words.
- **Voice Chat** : In a voice chat, messages are heard and the message is broadcast through voice.

- **Video Streaming :** By video streaming, video and audio can be seen and listened to instantly on internet.
- Through the downloading process, various softwares and games can be downloaded via internet.
- In online shopping, we can purchase or sell items through internet while sitting at home.

📌 **Note :** Internet service was started in India on August 15, 1995.  
First company to provide Internet - Videsh Sanchar Nigam Limited (VSNL).  
The first private sector company to start internet service - **Satyam Infoway - 1998.**

#### Important Internet Glossaries :

- **Website :** It is a group of related web pages.
- To view a website, an internet address is required which is called URL (Uniform Resource Locator).
- **URL (Uniform Resource Locator) :** A unique address expressing the name of the server on the internet is called a unique address URL.
- URL means searching the whereabouts of a service, organization or server on the internet like [http:// www.bing.com/in](http://www.bing.com/in) is a URL.
- **Web Page :** A Web Page contains a repository of information in the form of text, picture, video, audio and animation.
- **Web Browser :** It is a client program in which all types of websites and web pages are available and can be opened at [www](http://www).
- The web browser is used to access all the features and sources available on the internet through the **World Wide Web**.
- **Home Page :** The first page of any website is called **Home Page**.
- **World Wide Web :** The World Wide Web is a web of information sources. It is also known as **www** or **web**. This application was invented by **Tim Berners Lee**.
- **E-mail :** Currently, E-mail is the fastest medium of exchanging information.
- With the help of email, we can send a message to our friends, classmates sitting in any corner of the world or businessmen for business purpose which is received instantly.
- The messages of the email remain secure in the server of the recipient computer network.
- When a designated person logs in to his computer at his convenience, he receives this information.

#### Abacus :

- it is an ancient calculating device, which was invented in ancient Babylon to calculate numbers.

- It is called the world's first calculator.
- The world's first complete electronic computer is **ENIAC** (Electronic Numerical Integrator and Computer) whose inventor J.P. Eckert and John Mauchly.
- Bluetooth is an industry standard with the help of which computers are connected to personal networks by wireless technology over the short distance by radio waves.
- 256 values can be represented in one byte.
- **Unix** is the first operating system written in 'C' language. This made it easier to use it on a new.
- **Maya II** is a DNA computer, in which DNA thread is used instead of silicon chip.

#### Important Facts Related to Computer :

- Charles Babbage made the first computer in 1837.
- Charles Babbage is called the **Father of Computer**.
- The inventor of the electronic computer is **Dr. Alan M. Turing**.
- Computer literacy means being able to use a computer.
- The electronic path that sends signals from one part of the computer to another is called **Bus**.
- Computer literacy day is observed on **2<sup>nd</sup> December** every year.
- The first computer, called TIFRAC, was manufactured in India.
- **Bengaluru** is called the **Silicon Valley** of India.
- Bhartiya Janata Party is the first political party in India to have its own website on the internet.
- **JS Kilby** developed the integrated circuit chip. This chip consists of layers of silicon.
- The credit for the invention of the internet goes to **Wilton Curf**.
- The feature of Deep Blue Computer, which can work as much as 32 computers, i.e., it can think 200 million moves of chess in a second.
- Chess world champion Garry Kasparov was defeated by Deep Blue supercomputer.
- The **world's first electronic digital computer** is named **ENIAC**.
- **"The Hindu"** is the first Indian newspaper to be available on the internet.
- A byte is made up of eight bits.
- 1024 bytes equals to 1 kilobyte (**1KB**)
- 1024 KB equals to 1 Megabyte (**1MB**)
- 1024 MB equals to 1 Gigabyte (**1 GB**)
- 1024 GB equals to 1 Terabyte (**1 TB**)
- Sanskrit is the easiest language for computerization.
- **COBOL** is a high-level language (**HLL**).
- In a compiler program the computer translates the high-level language into low-level language.

- A fault/error in a computer is called **bug**.
- In 1998, the scientists at C-DAC Pune, built the computer 'Param-10,000' with the ability to perform one trillion calculations per second. The latest computer of the Param series is **Param Anant**.
- Nuclear tests on computers are known as **Subcritical Tests**.
- When a running program on a computer suddenly goes wrong or ends, it is called **Crash**.
- PROLOG is a computer language of the fifth generation.
- In the 2G, 3G and 4G spectrum, the word 'G' is used for word **Generation**.
- The range of a word length for a personal computer is 32 bits or 4 byte.
- The range of a word length for a supercomputer is 64 bits or 8 byte.
- **Spam** is a type of unsolicited mail that is sent to a large number of users. It is commonly used for email advertisement, malware etc.
- **Virus** : It is a malicious program, which enters the memory of different computers by joining with any useful program or through the internet.
- It does the work of spoiling, erasing or changing the data.
- It can enter the hard disk's boot sector to reduce or slow down the disk's capacity or prevent programs from running.
- Some computer virus examples are - Nimda, Sasser, Scammer, Sarcam, Melissa, Conflicker, Sobig etc.
- Software designed to find and destroy potential viruses, this program is called Anti Virus Program.
- Norton, McAfee, Kaspersky etc. are example of antivirus program.
- Unknown/known person entering the computer system through the network without his consent interfering with confidential data or information is called **hacking**.
- The repeated harassment of an individual, group or organization by the internet or any other electronic method is called **cyber Stocking**.

### The Words Related to Computer

- ALU - Arithmetic Logic Unit
- ALGOL - Algorithmic Language
- ASCII - American Standard Code for Information Interchange
- BASIC - Beginner's All-Purpose Symbolic Instruction Code
- CPU - Central Processing Unit
- CAD - Computer-Aided Design
- C-DOT - Centre for Development of Telematics

- DTS - Desk Top System
- DTP - Desk Top Publishing
- FAX - Far Away Xerox
- Flops - Floating Operations Per Second
- HLL - High-Level Language
- HTML - Hypertext Markup Language
- LAN - Local Area Network
- MODEM - Modulator Demodulator
- RAM - Random Access Memory
- ROM - Read-Only Memory
- VDU - Visual Display Unit
- WAN - Wide Area Network
- WWW - World Wide Web

### Exam Oriented Facts

- Artificial Intelligence is about making a machine Intelligence.
- John Mearthy is known as the father of AI.
- Blind Search can be used in small search space significantly, Blind.
- Search is also known as uniformed search, and it does not contain any domain information.
- Utility based agent deals with the happy and unhappy state.
- Recognition patterns is the kind of learning algorithm for "facial identities for facial expressions".
- Data mining is the application of machine learning methods to a large database.
- Anomaly detection technique helps in detecting the outliers in Data.
- The must significant phase in genetic algorithm is cross over.
- Open data is a data that can be freely used, reused and redistributed by anyone subject only, at most, to the requirement to attribute and sharelike.
- Big Data brings together data from many disparate sources and application.
- Deepfake AI is a type of artificial intelligence used to create convincing images, audio and video hoaxes.
- Artificial neural Network (ANN) is a computer program that mines the way human brains process information.



# Sports-Players



## Topics of the Unit

● Olympic Games ● Commonwealth Games ● Asian Games ● Cricket ● Hockey ● Football ● Badminton ● Tennis ● Chess ● Athletics ● Table Tennis ● Basketball ● Polo ● Golf ● Baseball ● Billiards ● Snooker ● Wrestling ● Water Polo ● Swimming ● Boxing ● Shooting ● Volleyball ● Kabaddi ● Kho Kho ● Handball ● Sports Awards

1

## Olympic Games

### Ancient Olympic Games :

- According to the Greek Calendar '**Olympiad**', the first Olympic Games were held in **776 B.C** in **Olympia**, Greece.
- These games are named **Olympics** due to being held in the city '**Olympia**'. (SSC GD, 2019)
- Ancient Olympic Games were held in honour of the Greek God '**Zeus**'.
- These Games were organized as '**Religious and Athlete Festival**'.
- In Ancient Olympics, winners were awarded Crowns made of '**Wild Olives**'.
- Olive Branches are considered a symbol of peace in Greece.
- Theodosius, the Emperor of Rome banned these Games in 394.
- In **December, 2022** P.T. Usha elected the first woman President of the Indian Olympic Association.
- The olympics include the Summer Games and the Winter Games.
- The Olympic Charter indicates that in order to be accepted, a sport must be widely practiced by men in at least 75 countries and on four continents and by women in no Fewer than 40 countries and on three continents.

### Modern Olympic Games :

- French linguist and sociologist, **Baron Pierre de Coubertin** is credited with to start the Modern Olympic Games.
- The Modern Olympic Games began in **Athens, Greece** in 1896. (SSC GD, 2019)
- It is held every 4 years. (SSC CGL, 2023)

### International Olympic Committee (IOC) :

- The efforts of **Coubertin** led to the establishment of the International Olympic Committee (IOC) at the Conference of 12 Countries in Paris on 23<sup>rd</sup> June, 1894.
- The IOC is responsible for the development and administration of the Olympic Games.

- It is headquartered in **Lausanne, Switzerland**.
- This Committee conducts the Olympic Games and determines the host city and rules for the Games.
- Initially, the Committee had a total of 11 members, but currently, it comprises of 41 honorary members 1, honour member (USA) and 107 active members.
- The Greek merchant, **Demetrios Vikelas**, was the first President of the Committee.
- On 10<sup>th</sup> September 2013, **Thomas Bach** of Germany became the 9<sup>th</sup> President of the IOC.
- Thomas Bach was re-elected for a second four year term on **10<sup>th</sup> March, 2021**.
- **Neeta Ambani** is the first Indian woman member of the International Olympic Committee.
- She was elected as a member on **4<sup>th</sup> August, 2016** (129<sup>th</sup> Session).
- **Sir Dorabji Tata** was the first Indian to be appointed as a member of the IOC.
- He was elected as a member of the IOC in 1920.

### Indian Olympic Committee :

- Temporarily, the All India Olympic Committee was formed in 1923-24 and the All India Olympic Games (later, Indian National Games) were organized in February, 1924.
- In these games, 8 athletes were selected to participate in the 1924 Paris Olympics.
- The **Indian Olympic Association (IOA)** was formed in 1927 on the initiative of Harry Crowe Buck (Manager of this team) and Dr.A.G Noehren.
- Sir, Dorabji Tata and Dr. A.G. Noehren were elected as the founding President and Secretary General respectively.
- Sir Dorabji tata had provided financial support to the Indian Olympic Moment

### Olympic Flag and Sign :

- The Olympic flag was designed at the suggestion of Baron de Coubertin.
- In 1914, the Olympic flag was displayed and accepted for the first time at the IOC's 20<sup>th</sup> Annual Assembly in Paris.
- It was first hoisted at the Antwerp Olympics (**1920**). (**7<sup>th</sup> Olympics**).



- The Olympic flag, made of white cloth, depicts five coloured interlocking rings as one of the emblems of the Olympic symbol.
- These five rings symbolize fair and free competition within five continents.

**Blue** - Europe                      **Yellow** - Asia  
**Black** - Africa                      **Green** - Australia and Oceania  
**Red** - North and South America

#### **Olympic's Motto :**

- The Olympic's motto was of three words **Citius, Altius, Fortius**, in Latin it means- **"faster, higher, stronger."**
- This motto was adopted in 1894, at the time when IOC constituted and presented the motto very first in Paris Olympic 1924.
- This motto was composed by **Father Henri Didon**.
- On **20<sup>th</sup> of July, 2021**, International Olympic Committee approved the change in motto - The motto was updated to Citius, Altius, Fortius - community (**Faster, Higher, Stronger - Together**).

#### **Olympic Torch :**

- The Olympic Torch is an integral part of the Olympic Games.
- The tradition of lighting the torch in the Modern Olympic Games started in 1936 from the Berlin Olympics.
- A few days before the starting of the Games, the torch is relayed and brought to the sacred '**Hera Temple**' in Athens and lit by the Sun rays.
- Then, it is brought to the venue through a relay race.
- This torch lits the stadium torch (**Cauldron**).

#### **Olympic Medal :**

- Three types of medals are awarded to the winners of the Olympic Games.
- **Gold Medal:** It is 60 mm in the circle and 3 mm thick. It is made of 0.925 grade silver on which a layer of 6 grams of gold is coated.
- **Silver Medal:** It is made of 0.925 grade silver which is 60 mm in circle and 3 mm thick.
- **Bronze Medal :** The bronze medal is made entirely of bronze (**97% Copper, 0.5% Tin and 2.5% Zinc**).

#### **Official Olympic Anthem :**

- An eminent Greek poet **Costis Palamas** wrote lyrics of the Olympic Hymn in 1893.
- The Hymn was composed in 1896 by the Greek composer **Spyros Samaras**.
- The composition was accepted as the official Olympic Anthem at the 55<sup>th</sup> IOC Session Committee in 1958 and was sung for the first time at the 1960 Winter Olympics (**squaw valley**).
- The Anthem is sung at the opening and closing ceremonies of each Olympic Games.
- The Anthem is composed and written in Greek and translated into English.

- Tokyo (Japan) hosted first Olympic in Asia in 1964.

#### **Other Important Points :**

- The Olympic Charter was compiled in 1908. Although, some of the rules of the Olympic charter was written by Pierre de Coubertin in 1898.
- In the Antwerp Olympics(1920), the tradition of swearing-in at the Olympic Games began.
- One of the most prestigious players of the host country takes an oath on behalf of all the competing players.
- Olympic mascots have been a key part of the Games since 1968.
- TV broadcast of the Olympic Games started from the 1960 Rome Olympic Games.
- In the Opening Ceremony's march past of the Olympics, the **Greece** team leads the march while the **host** team is at the **last**.
- The order of the other teams is fixed according to the English alphabetical order.
- 11 Israeli athletes were killed in the Palestine terrorist attack at the **Munich Olympics (1972)**.
- Women also started participating in Olympic Games from the **Paris Olympics (1990)**.
- At the **London Olympics, 2012** Saudi Arabia, Qatar and Brunei sent women athletes for the first time.
- Thomas Hicks was the first American male athlete to win the Marathon Gold Medal in the Olympic Games.

(SSC CHSL, 2023)

#### **Most in the Olympic Games :**

- USA's swimmer **Michael Phelps** holds the record of winning the most gold medals in a single Olympics.
- Phelps, popularly known as **Golden Shark**, won a total of 8 golds in various swimming events at the Beijing Olympics (2008).
- Previously, this record was in the name of another US male swimmer, Mark Spitz.
- At the Munich Olympics (1972), Mark Spitz won 7 gold medals in various swimming events. (SSC MTS 2019)
- Michael Phelps also holds the record for winning the most Olympic medals overall.
- Phelps won a total of 28 medals, including 23 gold, 3 silver and 2 bronze in the Olympics concluded between 2004-2016. (SSC MTS, 2019)
- Michael Phelps also holds the record for winning the most Olympic gold (23), the most Olympic gold medals in individual events (13) and the most Olympic medals in individual events (16).
- Previously, the record was in the name of **United Soviet Union's** female gymnast **Larissa Latynina**, who had won 14 individual and 4 team Olympic medals between 1956-1964.
- Latynina won the most gold medals at the then Olympic Games (Women).

- She won a total of 9 gold medals in gymnastics.
- **America** holds the record for the most Olympic gold medals won by a country in an Olympics.
- The United States won 83 gold medals at the Los Angeles Olympics (1984).
- Most times (4) the Olympic Games had been organized by **America** (1904, 1932, 1984 and 1996).
- The city that hosts the Olympic Games most is **London**.
- The Olympics Games of 1908, 1948 and 2012 were held in London.

### **Olympics and India :**

- Indian Olympic Association was established in 1927.  
(SSC CGL Pre, 2023)
- Officially, India started participating in Olympics at the 1928 Amsterdam Olympics under the Indian Olympic Association (IOA).
- Although, Norman Pritchard of British origin first participated at the Olympics (Paris, 1900) on behalf of India.
- But the citizenship of Pritchard was controversial who won 2 silver medals in athletics event at the Paris Olympics.
- In the 1920 **Antwerp Olympics**, for the first time, India sent a team of 6 players.
- There were two wrestlers, four athletes and two managers in this team.
- Among these players, **Phadappa Dareppa Chaugule** had secured 19<sup>th</sup> position in the marathon.
- Chaugule was the first Indian Olympic Marathon runner to participate in the Blister Marathon.
- Apart from Chaugule, another Indian marathon runner Sadashiv could not complete the Datar Marathon race.
- A team of players sent under the Temporary Indian Olympic Committee to the 1924 Paris Olympics including 7 athletes and 7 tennis players (including two women - **Nora M. Poli and Meher Tata**).
- Officially, Indian women first participated in the Helsinki Olympics (1952). These 4 women were - **Mary D'Souza** (Athletics), **Neelima Ghosh** (Athletics), **Dolly Nazir** (Swimming) and **Aarti Saha** (Swimming).
- Excluding Norman Pritchard, the first Indian who won a medal in the individual event of the Olympics is K.D. Jadhav (Wrestling Bronze-1952 Helsinki).
- The first Indian woman who won an Olympic Medal was Karnam Malleswari (Weightlifting Bronze- 2000, Sydney).
- The first Indian female boxer Olympic medalist is M.C. Mary Kom (**Bronze - 2012, London**).
- The first Indian female badminton player who won an Olympic Medal is Saina Nehwal (**Bronze-2012, London**).
- The first Indian woman wrestler who won the Olympic medal is Sakshi Malik (**Bronze - 2016, Rio-de-Janerio**).

- In the 2008 Beijing Olympics , the gold medal was won by Abhinav Bindra in Air Rifle 10 m is India's first gold medal in an individual event.
- **Sushil Kumar** is the first player from India who had won medals in two consecutive Olympics (**2008 Beijing, Bronze and 2012 London, Silver**).
- From 1928 to 1956, India had won the gold medals 6 times in a row in hockey.
- India has won a total of 8 gold medals in hockey so far. India won its last gold medal in hockey in the 1980 Moscow Olympics.

### **Paris Olympics- 2024**

- The 2024 Summer Olympics, known as the Games of the XXXIII Olympiad and marketed as Paris 2024, was a global multi-sport event held in France from July 26 to August 11, 2024, with the opening ceremony taking place on July 26.
- Following 16 days of remarkable sporting accomplishments, the USA finished first in the medal standings with 40 gold, 44 silver, and 42 bronze medals. China secured second place with 40 gold, 27 silver, and 24 bronze medals.
- Four National Olympic Committees (NOC) won their first-ever gold medals at Paris 2024: **Botswana, Dominica, Guatemala** and **Saint Lucia**.
- The official Paris Olympic and Paralympic Games slogan was "Ouvrons Grand les Jeux."
  - The slogan highlights how the Games will be open to the powerful emotions and passions of sport, with some competitions staged outside the traditional stadium setting.
  - The slogan for the Games, which translates as "Games Wide Open," reflects how the walls between the city and the stadium will vanish, and the spectators will feel connected with the athletes when the Games arrive in the French capital in two years' time.

### **Paris 2024 Olympic Games key figures**

- The XXXIII Olympiad
- 26 July to 11 August 2024
- 19 days of competition (handball, football and rugby take place from 24 July)
- 329 events
- Athletes from the territories of 206 National Olympic Committees and the IOC Refugee Olympic Team represented
- 32 sports (including the 4 additional sports)
- 4 additional sports proposed by the Paris 2024 Organising Committee: skateboarding, sport climbing, surfing and breaking
- 15 new events

- 754 sessions (competitions and ceremonies)
- 10,500 athletes
- 5,084 medals have been produced, using 18 grammes of iron from the Eiffel Tower
- First medal for the Refugee Olympic Team: Cindy Ngamba (bronze) – boxing – women's 75kg

- These Olympic Games were the first to be planned and delivered in line with the reforms of Olympic Agenda 2020. They were younger, more inclusive, more urban and more sustainable.
- They were the very first Olympic Games with full gender parity, because the International Olympic Committee (IOC) allocated 50 per cent of the quota places to female athletes and 50 per cent to male athletes.
- Paris Olympics 2024 medal table

#### Paris Olympics, 2024 : Medal Table

| Rank | Country       | G  | S  | B  | T   |
|------|---------------|----|----|----|-----|
| 1    | United States | 40 | 44 | 42 | 126 |
| 2    | China         | 40 | 27 | 24 | 91  |
| 3    | Japan         | 20 | 12 | 13 | 45  |
| 4    | Australia     | 18 | 19 | 16 | 53  |
| 5    | France        | 16 | 26 | 22 | 64  |
| 6    | Netherlands   | 15 | 7  | 12 | 34  |
| 7    | Great Britain | 14 | 22 | 29 | 65  |
| 8    | South Korea   | 13 | 9  | 10 | 32  |
| 9    | Italy         | 12 | 13 | 15 | 40  |
| 10   | Germany       | 12 | 13 | 8  | 33  |
| 71   | India         | 0  | 0  | 5  | 5   |

#### Paris Olympics, 2024 and India :

- The Paris Olympics 2024 have ended with India ranking 71st in the medal standings, a drop from their 48th position in Tokyo 2020. Although the country secured six medals – one silver and five bronze – there were numerous close calls and disappointing results, leading to widespread debate about the future of sports in India.
- Neeraj Chopra earned a silver medal in javelin with a throw of 89.45 meters, marking his second Olympic medal and making him India's fifth athlete to achieve two Olympic medals.
- Manu Bhaker became the first Indian woman to win an Olympic shooting medal and the first athlete from independent India to win two medals in a single Games, securing medals in both individual and mixed team events.

- India secured three medals in shooting, including its first-ever Olympic medal in the 50m rifle 3 positions, achieved by Swapnil Kusale.
- This represented India's highest medal count in shooting at the Olympics. Indian athletes participated in 69 events across 16 sports, including archery, athletics, badminton, boxing, equestrian, golf, hockey, judo, rowing, sailing, shooting, swimming, table tennis, and tennis.
- Lakshya Sen became the first Indian to reach the semi-finals in men's badminton at the Olympics, finishing in fourth place. Wrestler Vinesh Phogat was disqualified in the final of the women's 50 kg category for being 100 grams overweight.
- India has won a total of 41 Olympic medals to date. Notable achievements include Norman Pritchard's silver medals (1900 Paris), KD Jadhav's bronze (1952 Helsinki), Karnam Malleswari's bronze (2000 Sydney), Abhinav Bindra's gold (2008 Beijing), and Neeraj Chopra's gold (2020 Tokyo).
- Men's hockey has claimed 13 medals, including eight golds, while wrestling has won eight medals. India's best-ever Olympic performance was at Tokyo 2020, with seven medals, including one gold. The second-best performance was at the 2012 London Olympics, where India won six medals (two silver and four bronze).

#### Indian Medal Winners at Paris Olympics 2024

| Indian athletes                | Medal  | Event                                |
|--------------------------------|--------|--------------------------------------|
| Manu Bhaker                    | Bronze | Women's 10m air pistol event         |
| Manu Bhaker and Sarabjot Singh | Bronze | 10m air pistol mixed team event      |
| Swapnil Kusale                 | Bronze | Men's 50m rifle 3 positions          |
| Indian hockey team             | Bronze | Men's hockey                         |
| Neeraj Chopra                  | Silver | Men's Javelin Throw                  |
| Aman Sehrawat                  | Bronze | Wrestling Men's 57kg freestyle event |

#### Paralympic Games

- The Paralympic Games is a major international multi-sport event.
- In this game, Disabled athletes participate.
- The International Paralympic Committee organise this event.
- The first Paralympic Games took place in Rome, Italy in 1960.
- In this games 400 athletes from 23 countries were participated.

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- Since then they have taken place every four years.
- Since the summer games of Seoul, Korea in 1988 and the winter games in Albertville, France in 1992 the Games have also taken part in the same cities and venues as the Olympics due to an agreement between the IPC and IOC.

### Summer Paralympic-2020, Tokyo

- The 16<sup>th</sup> Summer Paralympic Games were held in Tokyo, Japan between 24 August and 5 September 2021.
- In this Paralympic, 162 countries participated, **[SSC CGL (Pre.) 2023]**
- Tokyo is the first city in the world to host the Paralympic Games for the second time.
- Earlier in the year 1964, the Paralympic Games were held here.
- In Tokyo Paralympics, 2020, 4403 athletes participated.
- Host nation **NPC Japan** have the biggest delegation at the Games with 254 athletes.
- Two new sports, badminton and taekwondo were introduced in place of sailing and 7A-side football in the Paralympic games.
- The Tokyo 2020 Paralympics mascot, was Someity.
- The motto of the game was **"United by Emotion"**.
- A total of 86 countries won medals in Paralympics 2020.
- Australian cyclist Paige Greco became the first **Tokyo 2020 Paralympic** gold medallist.
- Ukraine's Maksym Krypak became the most awarded athlete at the Games.

#### Top 5 countries in Paralympic 2020 and India

| Rank | Country                    | Gold | Silver | Bronze | Total |
|------|----------------------------|------|--------|--------|-------|
| 1    | People's Republic of China | 96   | 60     | 51     | 207   |
| 2    | Great Britain              | 41   | 38     | 45     | 124   |
| 3    | United States of America   | 37   | 36     | 31     | 104   |

|    |             |    |    |    |     |
|----|-------------|----|----|----|-----|
| 4  | RPC*        | 36 | 33 | 49 | 118 |
| 5  | Netherlands | 25 | 17 | 17 | 59  |
| 24 | India       | 5  | 8  | 6  | 19  |

\* Russian athletes participated in the Paralympics-2020 under the banner of RPC.

### Tokyo Paralympics-2020 and India

- India's biggest-ever 54 para-athletes participated in Tokyo Paralympics.
- In this event India secured 24<sup>th</sup> Rank. **[SSC CGL Pre. 2023]**
- India's Para-Badminton player Palak Kohli made history by becoming the youngest para-badminton player (19 years old) in the world to participate (SL3-SU5 Women's Doubles) in Tokyo 2020. Paralympics.
- Javelin thrower **Tek Chand** led India's charge during the opening ceremony. Tek Chand was India's flag-bearer at the Tokyo Paralympics opening ceremony.
- Trailblazing shooter **Avani Lekhara** was India's flag-bearer at Tokyo 2020 Paralympic Games closing ceremony.
- Harvinder Singh (Punjab) and Vivek Chikara (U.P) became the first male archers from the country to qualify for the games.
- Prachi Yadav, a canoeist from Gwalior qualified in kayaking and canoeing for Tokyo Paralympics 2020, was the only entry from India in this category at the mega event.
- IAS officer Suhas Lalinakere Yathiraj is the first administrative officer, who represented India in Paralympics.
- Sakina Khatun became India's first female powerlifter (50kg) to qualify for the Tokyo Paralympics.
- Someity is the official mascot of the Tokyo Paralympics 2020. **[SSC CGL (Pre.) 2023]**
- India won 19 medals in Paralympic 2020. **[SSC CGL (Pre.) 2023]**

### India's Tokyo Paralympics Medals

| Name                  | Sport     | Event                                   | Medal  | Name              |
|-----------------------|-----------|-----------------------------------------|--------|-------------------|
| Sumit Antil           | Athletics | Men's Javelin Throw - F64               | GOLD   | Sport Class: F64  |
| Pramod Bhagat         | Badminton | Men's Singles SL3                       | GOLD   | Sport Class: SL3  |
| Krishna Nagar         | Badminton | Men's Singles SH6                       | GOLD   | Sports Class: SH6 |
| Manish Narwal         | Shooting  | P4 - Mixed 50m Pistol SH1               | GOLD   | Sport Class: SH1  |
| Avani Lekhara         | Shooting  | R2 - Women's 10m Air Rifle Standing SH1 | GOLD   | Sport Class: SH1  |
| Yogesh Kathuniya      | Athletics | Men's Discus Throw - F56                | SILVER | Sport Class: F56  |
| Nishad Kumar          | Athletics | Men's High Jump - T47                   | SILVER | Sport Class: T47  |
| Mariyappan Thangavelu | Athletics | Men's High Jump - T63                   | SILVER | Sport Class: T42  |
| Praveen Kumar         | Athletics | Men's High Jump - T64                   | SILVER | Sport Class: T44  |



|                     |              |                                        |        |                  |
|---------------------|--------------|----------------------------------------|--------|------------------|
| Devendra Jhajharia  | Athletics    | Men's Javelin Throw - F46              | SILVER | Sport Class: F46 |
| Suhas Yathiraj      | Badminton    | Men's Singles SL4                      | SILVER | Sport Class: SL4 |
| Singhraj Adhana     | Shooting     | P4 - Mixed 50m Pistol SH1              | SILVER | Sport Class: SH1 |
| Bhavina Patel       | Table Tennis | Women's Singles - Class 4              | SILVER | Sport Class: 4   |
| Harvinder Singh     | Archery      | Men's Individual Recurve - Open        | BRONZE | Sport Class: ST  |
| Sharad Kumar        | Athletics    | Men's High Jump - T63                  | BRONZE | Sport Class: T42 |
| Sundar Singh Gurjar | Athletics    | Men's Javelin Throw - F46              | BRONZE | Sport Class: F46 |
| Manoj Sarkar        | Badminton    | Men's Singles SL3                      | BRONZE | Sport Class: SL3 |
| Singhraj Adhana     | Shooting     | P1 - Men's 10m Air Pistol SH1          | BRONZE | Sport Class: SH1 |
| Avani Lekhara       | Shooting     | R8 - Women's 50m Rifle 3 Positions SH1 | BRONZE | Sport Class: SH1 |

### Winter Olympics – 2022:

- 24<sup>th</sup> Winter Olympic Games were held between 4<sup>th</sup> - 20<sup>th</sup> February, 2022 in Beijing, China.
- The first torchbearer was Ioannis, Antoniou, Olympic participant in alpine skiing (2018, 2022).
- **"Together for a shared future"** was the official motto of the olympic.
- The official **Mascot** of the Winter Olympic Games, 2022 was the **'Bing Dwen Dwen'**.
- In Mandarin **'Chinese'**, **"Bing"** has several meanings, though the most common is ice. The word also symbolises purity and strength. While "Dwen Dwen" means robust and lively, and also represents Children.
- In this games Norway won 37 medals including 16 Gold, 8 Silver and 13 Bronze, and topped in the medal list.
- The host country People's Republic of China got 3<sup>rd</sup> Rank with 15 medals (9 Gold, 4 Silver, 2 Bronze),
- Top 5 Countries in the medal table are as follows :

| SI Fundamental Quantities and Their Units |                            |      |        |        |       |
|-------------------------------------------|----------------------------|------|--------|--------|-------|
| Rank                                      | Country                    | Gold | Silver | Bronze | Total |
| 1.                                        | Norway                     | 16   | 8      | 13     | 37    |
| 2.                                        | Germany                    | 12   | 10     | 5      | 27    |
| 3.                                        | People's Republic of China | 9    | 4      | 2      | 15    |
| 4.                                        | United States of America   | 8    | 10     | 7      | 25    |
| 5.                                        | Sweden                     | 8    | 5      | 5      | 18    |

- Significantly India completed at the winter olympics 2022 at Beijing, China.
- On behalf of India **Arif Khan** was the country's flag-bearer during the opening ceremony.
- The 2026 winter Olympics will be held **in Italy**.

## 2

## Commonwealth Games

### Introduction :

- Commonwealth Games are the second-largest grand sporting event in the world after the Olympic Games.
- Its background lies in British Empire.
- Ashley Cooper, the resident of Yorkshire (England), gave the idea to organize this event in a magazine "Greater Britain" in 1891.
- With the efforts of MM Bobby Robinson, a Canadian athlete, the 'First British Empire Games' were held in **Hamilton, Canada** in the mid-1930s amongst the British Empire Countries.
- 11 countries have participated in 6 sporting events.
- In 1970 and 1974, these Games were known as the 'British Commonwealth Games'.
- Finally, from the year 1978, its name was shortened to **"Commonwealth Games"**.
- Its international regulatory body was renamed as **'The Commonwealth Games Federation'**. Its headquarterd in **London**.
- Commonwealth Games are held amongst the member countries of the Commonwealth, in which only the residents of these countries can participate.
- Currently, the Commonwealth has **56 member** countries.
- In Commonwealth Games 1994, held in Victoria (Canada) only individual events were included.
- In 1998, four-team events were also included in the Commonwealth Games which were held in Kuala Lumpur (Malaysia).
- These games were - **Cricket (ODI), Hockey (Women & Men), Football (Men's), Rugby Sevens (Men's)**.
- Cricket was dropped from the Commonwealth Games held at Manchester (England) in 2002.



- Basketball was included in the Melbourne (Australia) Commonwealth Games in the year 2006, but dropped at the Delhi Commonwealth Games (2010).

### Commonwealth Games – 2022

- The 22<sup>nd</sup> Commonwealth Games were held between 28 July - 8 August 2022 at Birmingham (U.K.).

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- This was the third occasion when England hosted this games. Earlier in London (1934) and Manchester (2002).
- This was the 7<sup>th</sup> occasion when UK (United Kingdom of Great Britain and Northern Ireland) hosted Commonwealth Games.
- In 22<sup>nd</sup> Commonwealth Games 2022, 72 Countries/Region along with more than 4500 athletes participated in 19 Games and 8 Para Games.
- 4 Newly Games were included in this tournament - Women T-20 Cricket, 3 × 3 Basket Ball, 3 × 3 Wheelchair Basketball and Mixed synchronised diving.
- Shooting was removed from this tournament.
- The Opening and closing ceremony of the 2022 commonwealth Games were held at Alexander Stadium.
- Significantly, Alex Yee of England won the first gold of the tournament in men's triathlon.
- **Perry** was the official mascot of the 2022 Common Wealth Games in Birmingham, England. This is a Multi-coloured bull.
- It is important to mention here that 23<sup>rd</sup> Common wealth Games (2026) will be held in victoria (Australia).
- Australia's Emma mckee was the most successful player of this game. She won 6 Gold, 1 Silver and 1 Bronze.

### Commonwealth Games Held So Far

| Year | Organizing Countries | Number of Participating Countries | Number of Events | First Position |
|------|----------------------|-----------------------------------|------------------|----------------|
| 1930 | Canada               | 11                                | 6                | England        |
| 1934 | England              | 16                                | 6                | England        |
| 1938 | Australia            | 15                                | 7                | Australia      |
| 1950 | New Zealand          | 12                                | 9                | Australia      |
| 1954 | Canada               | 24                                | 9                | England        |
| 1958 | Britain              | 35                                | 9                | England        |
| 1962 | Australia            | 35                                | 9                | Australia      |
| 1966 | Jamaica              | 34                                | 9                | England        |
| 1970 | Scotland             | 42                                | 9                | Australia      |
| 1974 | New Zealand          | 38                                | 9                | Australia      |
| 1978 | Canada               | 46                                | 10               | Canada         |
| 1982 | Australia            | 46                                | 10               | Australia      |
| 1986 | Scotland             | 26                                | 10               | England        |
| 1990 | New Zealand          | 55                                | 10               | Australia      |

|                                |           |    |    |           |
|--------------------------------|-----------|----|----|-----------|
| 1994                           | Canada    | 63 | 10 | Australia |
| 1998                           | Malaysia  | 70 | 15 | Australia |
| 2002                           | Britain   | 72 | 17 | Australia |
| 2006                           | Australia | 71 | 16 | Australia |
| 2010                           | India     | 71 | 17 | Australia |
| 2014                           | Scotland  | 71 | 17 | England   |
| 2018                           | Australia | 71 | 18 | Australia |
| 2022                           | U.K.      | 72 | 19 | Australia |
| *(19 sports and 4 Para sports) |           |    |    |           |

### Top Ten Countries in the 21<sup>st</sup> Commonwealth Games

| Sl. No. | Country      | Gold | Silver | Bronze | Total |
|---------|--------------|------|--------|--------|-------|
| 1       | Australia    | 67   | 57     | 54     | 178   |
| 2       | England      | 57   | 66     | 53     | 176   |
| 3       | Canada       | 26   | 32     | 34     | 92    |
| 4       | India        | 22   | 16     | 23     | 61    |
| 5       | New Zealand  | 20   | 12     | 17     | 49    |
| 6       | Scotland     | 13   | 11     | 27     | 51    |
| 7       | Nigeria      | 12   | 9      | 14     | 35    |
| 8       | Wales        | 8    | 6      | 14     | 28    |
| 9       | South Africa | 7    | 9      | 11     | 27    |
| 10      | Malaysia     | 7    | 8      | 8      | 23    |

### Commonwealth Games and India :

- India had participated for the first time in the Second Commonwealth Games held in London in 1934.
- India did not participate in the Commonwealth Games at **Auckland (1950), Perth (1962) and Edinburgh (1986)**.
- So far Australia, Canada, England, New Zealand, Scotland and Wales had participated in all Commonwealth Games.
- India won 1 Bronze medal in the Second Commonwealth Games in London, 1934.

### India's Achievements in Commonwealth Games

| Held at                                | Gold | Silver | Bronze | Total |
|----------------------------------------|------|--------|--------|-------|
| 1934-London(5 <sup>th</sup> )          | —    | 1      | —      | 1     |
| 1958 – Cardiff (6 <sup>th</sup> )      | 2    | 1      | 1      | 4     |
| 1966 – Kingston(8 <sup>th</sup> )      | 3    | 4      | 3      | 10    |
| 1970 – Edinburgh(9 <sup>th</sup> )     | 5    | 4      | 3      | 12    |
| 1974 – Christchurch(10 <sup>th</sup> ) | 4    | 8      | 3      | 15    |
| 1978 – Edmonton(11 <sup>th</sup> )     | 5    | 4      | 6      | 15    |
| 1982- Brisbane(12 <sup>th</sup> )      | 5    | 8      | 3      | 16    |
| 1990-Auckland(14 <sup>th</sup> )       | 13   | 8      | 11     | 32    |
| 1994- Victoria(15 <sup>th</sup> )      | 6    | 11     | 7      | 24    |
| 1998-Kuala Lumpur(16 <sup>th</sup> )   | 7    | 10     | 8      | 25    |
| 2002-Manchester(17 <sup>th</sup> )     | 30   | 22     | 17     | 69    |

|                                     |    |    |    |     |
|-------------------------------------|----|----|----|-----|
| 2006-Melbourne(18 <sup>th</sup> )   | 22 | 17 | 11 | 50  |
| 2010-New Delhi(19 <sup>th</sup> )   | 38 | 27 | 36 | 101 |
| 2014-Glasgow(20 <sup>th</sup> )     | 15 | 30 | 19 | 64  |
| 2018-Gold Coast(21 <sup>st</sup> )  | 26 | 20 | 20 | 66  |
| 2022-Birmingham (22 <sup>nd</sup> ) | 22 | 16 | 23 | 61  |

#### Commonwealth Games 2022 and India:

- In 2022 games 322 members represented including 215 athletes and 107 officers.
- India was the Champion in wrestling by winning 12 medals (6 Gold).
- Sanket Sargar was the first Indian to win a medal in Birmingham. He bagged a Silver in the men's 55kg weightlifting event.
- Mirabai Chanu was the first Indian to win a gold at CWG 2022.
- Sudhir won the first medal for India, a gold in para sports at the CWG 2022.

| Commonwealth Games 2022 : India medal winners by sport |           |           |           |           |
|--------------------------------------------------------|-----------|-----------|-----------|-----------|
| Sport                                                  | Gold      | Silver    | Bronze    | Total     |
| Wrestling                                              | 6         | 1         | 5         | 12        |
| Weightlifting                                          | 3         | 3         | 4         | 10        |
| Boxing                                                 | 3         | 1         | 3         | 7         |
| Badminton                                              | 3         | 1         | 2         | 6         |
| Table Tennis                                           | 3         | 1         | 1         | 5         |
| Athletics                                              | 1         | 4         | 3         | 8         |
| Lawn bowls                                             | 1         | 1         | 0         | 2         |
| Para Table Tennis                                      | 1         | 0         | 1         | 2         |
| Para Powerlifting                                      | 1         | 0         | 0         | 1         |
| Judo                                                   | 0         | 2         | 1         | 3         |
| Hockey                                                 | 0         | 1         | 1         | 2         |
| Cricket                                                | 0         | 1         | 0         | 1         |
| Squash                                                 | 0         | 0         | 2         | 2         |
| <b>TOTAL</b>                                           | <b>22</b> | <b>16</b> | <b>23</b> | <b>61</b> |

### 3 Asian Games

- The first Asian Games were held in **New Delhi** in 1951 with the efforts of Pt. Jawaharlal Nehru and Antony De Mello.
- In these Games, 11 countries (India, Nepal, Sri Lanka, Japan, Philippines, Iran, Thailand, Malaysia, Indonesia, Myanmar and Afghanistan) had participated.
- '**Shining Sun**' was declared the symbol of the Asian Games by the Asian Games Association.
- Asian Games are also known as '**Asiad**'.

- The rules of these games are supervised by the Olympic Council of Asia(OCA) under the International Olympic Council (IOC).
- The headquarter of OCA is located in **Kuwait City, Kuwait**.

#### Asian Games, 2022 :

- Over 12,000 athletes from all 45 members of the Olympic Council of Asia participated in the **19th Asian Games**, held in **Hangzhou, China**, from September 23 to October 8, 2023.
- A total of **481 events** took place, with competitions in nine sports – archery, artistic swimming, boxing, breaking, hockey, modern pentathlon, sailing, tennis, and water polo – serving as qualifiers for the Paris **2024 Olympics**.
- The three mascots for the Games are a group of robots, representing Memories of Jiangnan, which is a geographic area roughly China's eastern regions south of the Yangtze River.
- The robots are Chenchen, Congcong, and Lianlian.
- The motto of the Asian Games 2023 was "**Heart to Heart, at Future**". It was announced in 2019. The design of the Asian Games 2023 medal was named "Shan Sui" (Lake and Mountain). It was inspired by **Jade Kang** of **Liangzhu culture**.

| Asian Games : Venue , Country and Games |      |                   |                         |              |
|-----------------------------------------|------|-------------------|-------------------------|--------------|
| Sl. No.                                 | Year | Venue             | Participating Countries | No. of Games |
| 1.                                      | 1951 | New Delhi         | 11                      | 6            |
| 2.                                      | 1954 | Manila            | 19                      | 8            |
| 3.                                      | 1958 | Tokyo             | 20                      | 13           |
| 4.                                      | 1962 | Jakarta           | 16                      | 13           |
| 5.                                      | 1966 | Bangkok           | 18                      | 14           |
| 6.                                      | 1970 | Bangkok           | 18                      | 13           |
| 7.                                      | 1974 | Tehran            | 25                      | 16           |
| 8.                                      | 1978 | Bangkok           | 25                      | 19           |
| 9.                                      | 1982 | New Delhi         | 33                      | 21           |
| 10.                                     | 1986 | Seoul             | 27                      | 25           |
| 11.                                     | 1990 | Beijing           | 36                      | 29           |
| 12.                                     | 1994 | Hiroshima         | 42                      | 34           |
| 13.                                     | 1998 | Bangkok           | 41                      | 36           |
| 14.                                     | 2002 | Busan             | 44                      | 38           |
| 15.                                     | 2006 | Doha              | 45                      | 39           |
| 16.                                     | 2010 | Guangjhu          | 45                      | 42           |
| 17.                                     | 2014 | Inchiyon          | 45                      | 36           |
| 18.                                     | 2018 | Jakarta/Palembang | 45                      | 40           |
| 19.                                     | 2023 | Hangzhou          | 45                      | 40           |

| Asian Games 2022 Medal Standings |      |        |        |       |
|----------------------------------|------|--------|--------|-------|
| Team/NOC                         | Gold | Silver | Bronze | Total |
| People's Republic of China (CHN) | 201  | 111    | 71     | 383   |
| Japan (JPN)                      | 52   | 67     | 69     | 188   |
| Republic of Korea (KOR)          | 42   | 59     | 89     | 190   |
| India (IND)                      | 28   | 38     | 41     | 107   |
| Uzbekistan (UZB)                 | 22   | 18     | 31     | 71    |
| Chinese Taipei (TPE)             | 19   | 20     | 28     | 67    |
| Islamic Republic of Iran (IRI)   | 13   | 21     | 20     | 54    |
| Thailand (THA)                   | 12   | 14     | 32     | 58    |
| Bahrain (BRN)                    | 12   | 3      | 5      | 20    |
| D.P.R. Korea (PRK)               | 11   | 18     | 10     | 39    |

### India in 19<sup>th</sup> Asian Games, 2022 :

- A 655-member Indian contingent participated at the Asian Games 2023.
- The 19th edition of the continental quadrennial multisport meet was originally scheduled for 2022 but was postponed by a year due to **COVID-19**.
- India finished their Asian Games 2023 campaign with a record haul of 107 medals - 28 gold, 38 silver and 41 bronze.
- This surpassed India's previous record tally achieved at the last edition at Jakarta 2018, where a 570-strong Indian squad racked up 70 medals - 16 gold, 23 silver and 31 bronze.
- Shooting led the way for India at the Asian Games 2023 with an unprecedented haul of 22 medals, which included seven gold.
- Athletics, headlined by **Neeraj Chopra's** successful title defence in the javelin throw, came a close second with six gold along with 14 silver and nine bronze.
- The cricket and kabaddi teams also bagged two gold medals each while the men's hockey team's gold secured a spot at the **Paris 2024 Olympics**.
- India also earned their first Asian Games badminton gold medal courtesy of the men's doubles pair of Chirag Shetty and Satwiksairaj Rankireddy.

| India's Asian Games 2022 medals tally: By sport |      |        |        |       |
|-------------------------------------------------|------|--------|--------|-------|
| Sport                                           | Gold | Silver | Bronze | Total |
| Shooting                                        | 7    | 9      | 6      | 22    |
| Athletics                                       | 6    | 14     | 9      | 29    |
| Archery                                         | 5    | 2      | 2      | 9     |

|                |           |           |           |            |
|----------------|-----------|-----------|-----------|------------|
| Squash         | 2         | 1         | 2         | 5          |
| Cricket        | 2         | 0         | 0         | 2          |
| Kabaddi        | 2         | 0         | 0         | 2          |
| Badminton      | 1         | 1         | 1         | 3          |
| Tennis         | 1         | 1         | 0         | 2          |
| Equestrian     | 1         | 0         | 1         | 2          |
| Hockey         | 1         | 0         | 1         | 2          |
| Rowing         | 0         | 2         | 3         | 5          |
| Chess          | 0         | 2         | 0         | 2          |
| Wrestling      | 0         | 1         | 5         | 6          |
| Boxing         | 0         | 1         | 4         | 5          |
| Sailing        | 0         | 1         | 2         | 3          |
| Bridge         | 0         | 1         | 0         | 1          |
| Golf           | 0         | 1         | 0         | 1          |
| Wushu          | 0         | 1         | 0         | 1          |
| Roller skating | 0         | 0         | 2         | 2          |
| Canoe          | 0         | 0         | 1         | 1          |
| Sepaktakraw    | 0         | 0         | 1         | 1          |
| Table tennis   | 0         | 0         | 1         | 1          |
| <b>TOTAL</b>   | <b>28</b> | <b>38</b> | <b>41</b> | <b>107</b> |

### Number of Medals India won at the Asian Games

| Year | Gold | Silver | Bronze | Total | Rank |
|------|------|--------|--------|-------|------|
| 1951 | 15   | 16     | 20     | 51    | 2    |
| 1954 | 4    | 4      | 5      | 13    | 5    |
| 1958 | 5    | 4      | 4      | 13    | 7    |
| 1962 | 10   | 13     | 10     | 33    | 3    |
| 1966 | 7    | 4      | 11     | 22    | 5    |
| 1970 | 6    | 9      | 10     | 25    | 5    |
| 1974 | 4    | 12     | 12     | 28    | 7    |
| 1978 | 11   | 11     | 6      | 28    | 6    |
| 1982 | 13   | 19     | 25     | 57    | 5    |
| 1986 | 5    | 9      | 23     | 37    | 5    |
| 1990 | 1    | 8      | 14     | 23    | 11   |
| 1994 | 4    | 3      | 16     | 23    | 8    |
| 1998 | 7    | 11     | 17     | 35    | 9    |
| 2002 | 11   | 12     | 13     | 36    | 7    |
| 2006 | 10   | 17     | 26     | 53    | 8    |
| 2010 | 14   | 17     | 34     | 65    | 6    |
| 2014 | 11   | 10     | 36     | 57    | 8    |
| 2018 | 15   | 24     | 30     | 69    | 8    |
| 2022 | 28   | 38     | 41     | 107   | 4    |

➤ Data, based on, website of Indian Olympic Association.

- Cricket is known as the “**Game of Gentlemen**” and is played across five continents.
  - England is considered the father of Cricket.
  - In 1767, **Hambledon Club** became the first cricket club in the world in **Hampshire (England)**.
  - **Marylebone Cricket Club (MCC)** was established in 1787.
  - The first Cricket Test Match was played between Australia and England in Melbourne, Australia, from 15<sup>th</sup>-19<sup>th</sup> March 1877.
  - On **5<sup>th</sup> January 1971**, the first One Day Cricket Match was played between Australia and England in Melbourne, Australia.
  - This match was of 40–40 overs.
  - First women world cup was held in England in 1973.
- SSC GCL (Pre.) 2023**
- England’s **W.G. Grace** is considered the **Father of Modern Cricket**.
  - **Kerry Packer** of Australia is considered the **Father of ODI Cricket**.
  - The International Cricket Council (ICC) is the supreme governing body of Test Matches, ODIs and T-20 Cricket.
  - In 1909 “**Imperial Cricket Conference**” was established by Australia, England and South Africa.
  - In 1965, it was changed into ‘International Cricket Conference’. In 1989, it renamed again as “**International Cricket Council**” (ICC).
  - Initially, its headquarter was located in Lords, England.
  - On 1<sup>st</sup> August 2005, the **headquarter** was shifted to **Dubai (UAE)**.
  - Presently, in ICC, there are a total of 12 full-time members and 94 associate members.
  - On **27<sup>th</sup> November 2015**, the first day-night Test Match was played between Australia and New Zealand with Pink Ball in Adelaide (**Australia**).

### History of Indian Cricket:

- Cricket was introduced in India by officers and employees of the East India Company.
- **Calcutta Cricket Club** was established in 1792.
- On **25<sup>th</sup> June 1932**, India played its first Test Match at **Lord’s**.
- England defeated India by 158 runs in this test match.
- C.K. Naidu was the captain of the Indian Cricket Team in this match.
- After independence, India played the first Test series against Australia in the year 1948.
- This was the first foreign tour of India after Independence.
- In this series, **Lala Amarnath** was the captain of the

Indian Cricket Team and Don Bradman was the captain of the Australian Cricket Team.

- India had won their first Test Match defeating England in Madras in 1952.
- In the same year, India won the first Test Series defeating Pakistan.
- For the first time, outside the Indian sub-continent, India had won the Test Series against New Zealand in 1967–68 under the captaincy of **Nawab Pataudi (Junior)**.
- On **13<sup>th</sup> July, 1974**, India played their first one-day match against England.
- **Ajit Wadekar** got the honour of captaining the Indian team in its first One Day match.
- On **11<sup>th</sup> June, 1975**, India won their first ODI in the First World Cup.
- Indian Premier league was started in 2008.

**(SSC CGL (Pre.) 2023)**

- India beat East Africa by 10 wickets in this match.
  - Virender Sehwag was the first captain of the Indian cricket team in Twenty-20 format match.
  - The maximum limited of overs per bowler has been set at 4 overs.
- [SSC CGL (Pre.) 2023]**
- On **1<sup>st</sup> December, 2006**, India won the match played against South Africa.
  - The Syed Mushtaq Ali Trophy is a domestic Twenty 20 Cricket Championship in India.
- (SSC CHSL, 2023)**

### Major Trophies of Domestic Cricket in India :

#### A. Ranji Trophy

- It is the oldest domestic cricket competition in India.
- Ranji Trophy started in 1934-35.
- This trophy was named after India’s first international cricketer **Ranjit Singh Ji**.
- He played for England and Sussex, popularly known as Ranji.
- The trophy was donated by Maharaja Bhupinder Singh of Patiala.
- The first Ranji Trophy winning team is Mumbai.
- The Most Ranji Trophy runs were scored by **Wasim Jaffer** (12,038 runs) and the most Ranji wickets were taken by **Rajinder Goyal** (639 wickets).
- **Mumbai** won the Ranji Trophy most of the (41) times.
- The 2022-23 Ranji Trophy was the 88<sup>th</sup> Season of this Trophy. In the final match Saurashtra defeated Bengal by 9 wickets to win their second title.

#### B. Vijay Hazare Trophy:

- The competition is named after Vijay Hazare, the former captain of the Indian cricket team. It is also known as Ranji ODI Trophy.
- It started in 2002-03.

- The first Vijay Hazare Trophy-winning team is **Tamil Nadu**.
- The Vijay Hazare Trophy is administrated by BCCI.
- Saurashtra cricket team is the current champion, defeating Maharashtra in the 2022-23 version of this trophy.

### C. Duleep Trophy :

- This is a four day National First Class Domestic Cricket Competition.
- It started in 1961-62.
- It is named after the Prince of Nawanagar, **Mr. Duleep Singh**.
- The first Duleep Trophy-winning team is the **West Zone**.
- Its runner-up is awarded '**Devicha Trophy**'.
- In Duleep Trophy, the Pink Ball was used for the first time in 2016.
- The 59<sup>th</sup> season of Duleep Trophy was won by west zone by defeating South Zone.

### D. Deodhar Trophy :

- This is a Limited Over Domestic **List A** category cricket competition.
- It started in 1973-74.
- The trophy is named after **DB Deodhar**, popularly known as **Grand Old Man of Indian Cricket**.
- The first Deodhar Trophy-winning team is **South Zone**.
- In 2019-20, the trophy was won by 'India B' defeating 'India C'.
- The tournament was played amongst five zones (East, West, North, South and Central Zone) till 2014-15 session.
- From 2015-16, BCCI changed its format; now it is played amongst Teams of 'India A', 'India B' and 'India C' 'selected by BCCI.

### E. Irani Cup :

- It is a first-class five-day domestic cricket competition played between the present Ranji Trophy winner and the Rest of India.
- It started from 1959 to 1960.
- It is named after the late **Z.R. Irani**.
- He was associated with the Board of Control for Cricket in India from the establishment of BCCI (1928) till his death in 1970.
- The first Irani Cup winning team is Bombay.
- Vidarbha won the trophy of 2018-19 defeating the Rest of India.
- "**Rest of India**" has won the Irani Cup the most 28 times.

### Other Domestic Cricket Tournaments:

- **Rohinton Baria Trophy** - It is an Inter-University Competition.
- **Cooch Behar Trophy** - It is an Inter-State Competition for Boys Under-19.
- **C.K. Naidu Trophy** - It is a limited-overs domestic competition.

- **Vijay Merchant Trophy**.
- **Rani Jhansi Trophy** - It is a Women's domestic cricket competition.
- **Indira Priyadarshini Trophy** - It is a Women's ODI (one day) cricket competition.

### Board of Control for Cricket in India (BCCI):

- The Board of Control for Cricket in India (BCCI) was established in Mumbai in the year 1928 under the Chairmanship of **R.E. Grant Govan**.
- Since then, the BCCI has been affiliated with the International Cricket Council (ICC).

### Components of Cricket :

- Length of the pitch - 22 yards (20.12 m).  
**SSC CGL (Pre.) 2023**
- Weight of the ball – not less than 5.5 ounces / 155.9 grams and not to exceed 5.75 ounces / 163 grams. **(SSC CGL, 2022)**
- The circumference of the ball is not less than - 8.81 inches or 22.4 cm and should not exceed 9 inches or 22.9 cm.
- The length of the bat (maximum) is 38 inches (96.52 cm), width (maximum): 4.25 inches (10.8 cm).
- The length of the stump is 28 inches (71.12 cm).

| T-20 Cricket World Cup |                     |             |              |
|------------------------|---------------------|-------------|--------------|
| Year                   | Organizing Country  | Winner      | Runner-up    |
| 2007                   | South Africa        | India       | Pakistan     |
| 2009                   | England             | Pakistan    | Sri Lanka    |
| 2010                   | West Indies         | England     | Australia    |
| 2012                   | Sri Lanka           | West Indies | Sri Lanka    |
| 2014                   | Bangladesh          | Sri Lanka   | India        |
| 2016                   | India               | West Indies | England      |
| 2021                   | UAE, Oman           | Australia   | New Zealand  |
| 2022                   | Australia           | England     | Pakistan     |
| 2024                   | West Indies and USA | India       | South Africa |
| 2026                   | India and Srilanka  | —           | —            |

### General Terms of Cricket:

- Pitch, popping crease, return crease, wicket, throw, maiden, wide, four, six, batsman, bowler, chinaman, wicketkeeper, slip, gully, cover, point, fielder, mid-on, mid-wicket, mid-off, long-off, long-on, third man, bouncer, short-pitch, run out, LBW (Leg Before Wicket), over the wicket, round the wicket, stroke, swing, off-Spinner, leg-spinner, follow-on, etc.
- In cricket, the batsman gets out in the following 10 ways. 1. Clean Bowled, 2. Catch Out, 3. Run Out, 4. LBW (Leg Before Wicket), 5. Hit Wicket, 6. Handling the Ball, 7. Hit the Ball Twice, 8. Obstruction of the field, 9. Stump-Out, 10. Time-Out.



| Men's One Day International Cricket World Cup |                                                 |             |             |
|-----------------------------------------------|-------------------------------------------------|-------------|-------------|
| Year                                          | Organizing Country                              | Winner      | Runner-up   |
| 1975                                          | England                                         | West Indies | Australia   |
| 1979                                          | England                                         | West Indies | England     |
| 1983                                          | England                                         | India       | West Indies |
| 1987                                          | India & Pakistan                                | Australia   | England     |
| 1992                                          | Australia & New Zealand                         | Pakistan    | England     |
| 1996                                          | India, Sri Lanka & Pakistan                     | Sri Lanka   | Australia   |
| 1999                                          | England, Scotland, Wales, Ireland & Netherlands | Australia   | Pakistan    |
| 2003                                          | South Africa, Zimbabwe & Kenya                  | Australia   | India       |
| 2007                                          | West Indies                                     | Australia   | Sri Lanka   |
| 2011                                          | India, Sri Lanka & Bangladesh                   | India       | Sri Lanka   |
| 2015                                          | Australia & New Zealand                         | Australia   | New Zealand |
| 2019                                          | England & Wales                                 | England     | New Zealand |
| 2023                                          | India                                           | Australia   | India       |
| 2027                                          | South Africa & Zimbabwe and Namibia             | —           | —           |
| 2031                                          | India and Bangladesh                            | —           | —           |

5

## Hockey

- The modern form of Hockey was developed mainly in schools of **England** in mid-18<sup>th</sup> century.
- Firstly, in 1861, 'Blackheath Rugby and Hockey Club' was established in England as an organized club.
- On 16<sup>th</sup> April 1875, the English Hockey Association was established at the Cannon Street Hotel in London (England).
- It is considered to be the beginning of professional hockey games.
- In 1883, the rules regarding this game were established by the '**Wimbledon Hockey Club**'.
- The Hockey Association in 1886 recognized these rules.
- The First Hockey Association was established in the U.K (United Kingdom) in 1876.
- This institution continued to exist for the next 6 years.
- In 1886, it was revived by 9 founding club members.

### International Hockey Federation (FIH):

- On 7<sup>th</sup> January, 1924, the International Hockey Federation (Federation Internationale de Hockey: FIH) was established by the efforts of Paul Léauté in Paris (France).
- It is the international administrative body related to the game of Hockey (**HQ-Lausanne, Switzerland**).
- The International Women's Hockey Association was established in 1927.
- Both the associations were merged in 1982.

- The first president of FIH was Paul Léauté.
- The founding members of FIH were Austria, Belgium, Czechoslovakia, France, Hungary, Spain and Switzerland.

### Major Events in International Hockey :

- On **26<sup>th</sup> January, 1895**, the first international hockey match was played between Wales and Ireland at Rhyl.
- For the first time, hockey was included in the 1908 (London) Olympic Games.
- This event is being held continuously since the Olympics of 1928 (Amsterdam) after being excluded from some Olympic Games.
- **Women's Hockey** was first included in 1980 Moscow Olympics.
- The first Hockey World Cup was held in Barcelona, Spain, in 1971.
- Indian Men's Hockey Team won Bronze medal in Paris Olympics 2024.

| Men's Hockey World Cup |                           |           |           |                  |
|------------------------|---------------------------|-----------|-----------|------------------|
| Year                   | Place                     | Winner    | Runner-Up | India's Position |
| 1971                   | Barcelona (Spain)         | Pakistan  | Spain     | Third            |
| 1973                   | Amstelveen (Netherlands)  | Holland   | India     | Second           |
| 1975                   | Kuala Lumpur (Malaysia)   | India     | Pakistan  | First            |
| 1978                   | Buenos Aires (Argentina)  | Pakistan  | Holland   | Sixth            |
| 1982                   | Mumbai (India)            | Pakistan  | Germany   | Fifth            |
| 1986                   | London (England)          | Australia | England   | Twelfth          |
| 1990                   | Lahore (Pakistan)         | Holland   | Pakistan  | Tenth            |
| 1994                   | Sydney (Australia)        | Pakistan  | Holland   | Fifth            |
| 1998                   | Utrecht (Netherlands)     | Holland   | Spain     | Ninth            |
| 2002                   | Kuala Lumpur (Malaysia)   | Germany   | Australia | Tenth            |
| 2006                   | Monchengladbach (Germany) | Germany   | Australia | Eleventh         |
| 2010                   | New Delhi (India)         | Australia | Germany   | Eighth           |
| 2014                   | The Hague (Netherlands)   | Australia | Holland   | Ninth            |
| 2018                   | Bhubaneswar (India)       | Belgium   | Holland   | Sixth            |
| 2023                   | India                     | Germany   | Belgium   | Ninth            |

### Hockey in India:

- Hockey is considered the **National Sport** of India.
- The credit for popularizing hockey in India goes to Britishers.
- The first Hockey Club in India was established in Calcutta in 1885–86. **[SSC CGL (Pre.) 2023]**
- The first Hockey Association in India was the **Bengal Hockey Association**.

- Bengal Hockey Association was established in 1908.
- The Sindh Hockey Association was established in Karachi in 1920.
- **The Indian Hockey Federation** was established in 1927 under the leadership of **Colonel Bruce Turnbull**.
- Currently, its headquarter is located in **New Delhi** (earlier it was located in Gwalior).
- It is the first Non-European Hockey Federation to be part of FIH.
- On 28<sup>th</sup> April 2008, the Indian Hockey Federation was disbanded by the Indian Olympic Association.
- On 20<sup>th</sup> May 2009, **Hockey India** a new organization was established.
- Presently, “**Hockey India**” is the supreme body to conduct all the activities of Men and Women hockey in India.
- It was recognized as **National Sports Federation** by the Ministry of Youth Affairs and Sports (Government of India) on 28<sup>th</sup> February, 2014.
- India’s participation in the Olympics had begun in the 1928 Amsterdam Olympics.
- In its first Olympics India had won the gold medal defeating Austria, Belgium, Denmark, Switzerland and Holland. India beat Holland 3–0 to win its first ever olympic gold medal.
- India set a record of winning 6 consecutive gold medals in the Olympics held from 1928 to 1956.
- India’s highest (altitude of 8000 feet) Hockey Astro Turf ground has been built at **Shilaroo** (Himachal Pradesh) in 2010.
- The ground prepared by artificial grass made of plastic on the iron wire using state-of-the-art technology is called ‘**Astro Turf**’.

#### Other Key Facts:

- The shape of the Hockey field is rectangular.
- Each team consists of 11–11 players. **(SSC MTS, 2022)**
- Each team can replace 3 players during the game.
- Once replaced, the player cannot participate in that game again.
- As per the new rules (effective from 1<sup>st</sup> January, 2019), the duration of the game will be 60 minutes [15-2-15 minutes (5 minutes timeout) -15-2-15 minutes]. **(SSC MTS, 2022)**
- That is, there will be four sessions of 15 minutes and a break of 2 minutes between every two sessions and a 5 minute time interval after the first two sessions.
- In Ice Hockey there can only be maximum of 6 players on Ice for each team at time, 1 Goalie and 5 Skaters.
- A long corner is awarded if a defender accidentally puts the ball over the back line. **SSC CGL (Pre.) 2023**
- The “**Penalty Stroke**” is given for breaking the rules in a men’s match.

- The “**Penalty Bully**” is given for breaking the rules in women’s matches.
- The length of the hockey field can be 91.40 meters and width up to 55 meters.
- The weight of the ball can be between 156-163 grams.
- The circumference of the ball may be 2.81 inches to 2.94 inches.
- The total weight of the hockey stick does not exceed 737 grams (about 26 ounces).
- The length of the hockey stick does not exceed 105 cm.
- **The length of the goal post is 4 yards (3.66 m).**
- The arc of 'D' is 16 yards (15 m).
- The distance of the Penalty stroke is 7 yards (6.4 m).

#### Some Terminologies used in Hockey:

Passback, Goal, Bully, Offside, Free-hit, Corner hit, Penalty Stroke, Penalty Corner, Penalty Bully, Dribbling, Jab and Lounge, D, Astroturf, Right back, Left-back Scoop, Sideline, Tie Breaker, Rolling, Push in, Half volley, Full back, Undercutting, Sudden Death, Infringement, Flick, Reverse Flick, Shooting Circle, etc.

## 6

## Football

- Football is the most popular sport in the world.
- **England** owes the credit for developing the modern form of football.
- In 1857, the first football club in the world was “**Sheffield Football Club**” that was established in England.
- Federation Internationale de Football Association (FIFA) was formed in Paris on **21<sup>st</sup> May, 1904**.
- Its 8 founding countries were France, Belgium, Denmark, Germany, Netherlands, Spain, Sweden and Switzerland.
- FIFA organizes international football matches and also works for its development.
- The credit for establishment of FIFA goes to the French citizen ‘Jules Rimet’.
- Its headquarter is located in **Zurich (Switzerland)**.
- The first President of FIFA was **Mr. Robert Guerin (France)**.
- Currently, the President of FIFA is **Gianni Infantino**.
- England had joined FIFA membership in the year 1906.
- On the issue of professional and non-professional players, England was excluded from FIFA.
- England rejoined FIFA in the year 1946.
- Football was included as an event in all the Olympics except the 1896 (Athens) and 1932 (Los Angeles) Olympics.
- Women’s football was officially included in 1996.

#### Other Important Facts:

- International football grounds for adults can be 100 to 110 meters in length and 64 to 75 meters in width.

- The circumference of the football may be 27-28 inches.
- Its weight may be 410 to 458 grams (14-16 ounce).
- Football cannot be changed during games without the permission of the referee.
- In the game of Football the distance between the goalpost is 7.32 meters (24 feet).
- The football matches are played in two-time formats of 45–45 minutes duration.
- Two teams can change their ends after the intermission.
- From 1864, hand touching or handling in football was banned.
- In 1870, the requirement of 11 players was accepted.
- A maximum of two players can be substituted after the game starts.
- The player who is off-field can substitute the player who is in-field, cannot be sent again.
- If a player is eliminated by the referee, no other player can substitute him.
- The distance between the goal line and the penalty spot in football is 12 yards.

#### Football in India:

- Football is the second most popular sports in India after cricket.
- Football games got its popularity in India from the time of the British Empire.
- **Dalhousie Club** was the first football club in India.
- **All India Football Federation (AIFF)** has the administrative responsibility of football in India.
- **'Santosh Trophy'** is the symbol of the National Football Championship. (SSC CHSL, 2017)
- Santosh Trophy was started in the year **1941**.
- **'Begum Hazrat Mahal Trophy'** is a symbol of National Women's Football Championship.
- Rovers Cup is related to football.
- It was a football tournament started by British Football lovers in 1891 in Bombay.
- **'Durand Cup'** is the oldest football championship in India. (SSC GD, 2019)
- It started in 1888.
- Kolkata is called the **'Home of Indian Football'**.
- The national team of India qualified for World Cup football in 1950.
- Bengaluru Football Club won Durand Cup 2022. (SSC CGL (Pre.) 2023)
- India was the host country of AFC women Asia Cup Football 2022. (SSC CGL (Pre.) 2023)
- At the time, India could not participate in the next round due to being barefoot (without shoes).
- In the 1956 Melbourne Olympics, the Indian team was at the fourth position in football.

- The Indian team won the gold medal in Asian Games of 1951 and 1962 in football.

| Men's Football World Cup |              |                |                        |
|--------------------------|--------------|----------------|------------------------|
| Year                     | Winner       | Runner-Up      | Venue                  |
| 1930                     | Uruguay      | Argentina      | Uruguay                |
| 1934                     | Italy        | Czechoslovakia | Italy                  |
| 1938                     | Italy        | Hungary        | France                 |
| 1950                     | Uruguay      | Brazil         | Brazil                 |
| 1954                     | West Germany | Hungary        | Switzerland            |
| 1958                     | Brazil       | Sweden         | Sweden                 |
| 1962                     | Brazil       | Czechoslovakia | Chile                  |
| 1966                     | England      | West Germany   | England                |
| 1970                     | Brazil       | Italy          | Mexico                 |
| 1974                     | West Germany | Holland        | West Germany           |
| 1978                     | Argentina    | Holland        | Argentina              |
| 1982                     | Italy        | West Germany   | Spain                  |
| 1986                     | Argentina    | West Germany   | Mexico                 |
| 1990                     | West Germany | Argentina      | Italy                  |
| 1994                     | Brazil       | Italy          | United States          |
| 1998                     | France       | Brazil         | France                 |
| 2002                     | Brazil       | Germany        | Japan & South Korea    |
| 2006                     | Italy        | France         | Germany                |
| 2010                     | Spain        | Holland        | South Africa           |
| 2014                     | Germany      | Argentina      | Brazil                 |
| 2018                     | France       | Croatia        | Russia                 |
| 2022                     | Argentina    | France         | Qatar                  |
| 2026                     | –            | –              | Canada, Mexico and USA |

#### Football World Cup-2022 : Awards :

- **Golden Ball** - Lionel Messi (Argentina)
- **Golden Boot** - Kylian Mbappe (France)
- **Golden Glove** - Emiliano Martinez (Argentina)
- **FIFA Young Player** - Enzo Fernandez (Argentina)
- **FIFA Fair Play Trophy** - England
- Brazil has participated in all (22) Football World Cups held so far.
- Brazil holds the record for winning the World Cup the most 5 times.
- Italy and Germany have won this title 4-4 times each.

#### Football Glossaries/Vocabularies :

- Pass, Back Pass, Corner, Dribble, Linesman, Caesars Kick, Banana Kick, Winger, Sweeper, Back, Volley, Send Off, Bars, Tiebreaker, Sudden Death, Fist, Net, Lob, Through Ball , Total , Center, Penalty , Handball foul, Hattrick, Center, Penalty, Strike, etc. (SSC CGL (Pre.) 2023)

- Badminton is the second most popular sport in the world after football.
- The 'Net' was introduced to the game in 1860.
- It was played at "Poona" among British military officers in India.
- According to some sports historians, its rules were formulated by the British in Poona (India) in 1873, while some believe that in 1879, **Cornel Shelby** formulated the rules of the game.
- In 1893, the **Badminton Association of England (BAE)** was formed.
- In 1898, the first badminton tournament was held at **Guildford**.
- The first **All England Championship** was organized in 1899.
- **International Badminton Federation (IBF)** is the Supreme institution of sports of badminton.
- It was established in the year **1934**.
- The founding members of IBF are- England, Ireland, Scotland, Wales, Denmark, Holland, Canada, New Zealand and France.
- India and America were associated with IBF in the year 1936 and 1938 respectively.
- **Sir George Allen Thomas** of England was its first President.
- In September 2006, a meeting was held in Madrid accepted its new name **Badminton World Federation (BWF)**.
- In December 2004, it decided to shift its headquarter from Cheltenham (England) to **Kuala Lumpur (Malaysia)**.
- Badminton was included in the Olympic Games in 1992 (Barcelona).

#### World Badminton Championship :

- This championship was started in **Malmo (Sweden)** in 1977.
- It is organized every two years.
- **Winners of First World Championship:**
  - **Men's Singles** - Flemming Delfs (Denmark)
  - **Women's Singles** - Lene Koppen (Denmark)
- **Winners of World Championship, 2022**
  - **Men's Singles** - Viktor Axelsen (Denmark)
  - **Women's Singles** - Akane Yamaguchi (Japan)

#### Other Badminton Competitions

##### A. Thomas Cup:

- This is the **Men's International Team Event**.
- It was named after Sir George Allen Thomas, the first President of the IBF in 1939 after donating the cup as a donation.
- It is organized every two years.

- The first Thomas Cup was organized in Priston in 1948-49.
- Significantly, in May 2022 India have defeated the 14 time champions **Indonesia** to win the Thomas Cup for the **first time**.

##### B. Uber Cup :

- It is a **Women's International Team Event**.
- It was named after England's Badminton Player Betty Uber who presented the cup as a donation.
- It is organized every two years.
- The first Uber Cup was held in 1956-57.

##### C. Sudirman Cup:

- It is the **World's Mixed Team Championship**.
- It is named after Indonesian Badminton Player Dick Sudirman.
- It is organized every two years.
- The first Sudirman Cup was held in Jakarta (Indonesia) in 1989.

##### D. Bimantara Cup :

- **World Junior Championship**.
- Some other major competitions - World Grand Prix, European Cup, Yonex Cup, China Cup.

#### Badminton in India :

- Badminton got its popularity in India by British Military Officials.
- **Badminton Association of India** is the regulatory body of badminton in India.
- It was established in **1934**.
- Its headquarter is located in **New Delhi**.

#### National Badminton Trophy:

- Ibrahim Rahmatullah Cup
- Gulab Rai Chadda Cup
- Dr. Devraj Narang Cup
- Mohammad Shafi Qureshi Cup
- Vikas Topiwala Challenge Cup (Men's Singles Championship)
- Calcutta Badminton Cup (Men's Doubles Championship & Junior Singles Championship)
- Olympic Badminton Challenge Cup (Women's Singles Championship)
- All India Badminton Association Cup (Women's Doubles Championship)
- Chiranjit Lal Madan Cup
- Burdwan Challenge Cup (Mixed Doubles Championship)
- Fazal Ahmed Trophy, RR Nair Trophy, etc.

#### Badminton Court Dimensions

- The length of the Badminton court is 44 feet and the width is 20 feet. [SSC CGL (Pre.) 2023]
- The height of the net is 5 feet.
- The weight of the shuttle is 4.74 to 5.51 grams.
- The weight of the racket is 85-140 grams.



### ➤ **Key Glossaries/Vocabularies :**

Court, Long Service, Fault, Service, Rally, Backhand Smash, Love, Deuce, Lob, Let, Love all, Drop, Lift, Pen hand Push, Linesman, etc. are the terms related to Badminton.

8

## Tennis

- Tennis is considered to be the most prestigious sport among individual games.
- In the modern context, the game was developed in England.
- Modern Tennis is known as '**Lawn Tennis**'.
- Lawn Tennis is played on different types of courts.
- Some tennis matches were also played on 'Hard Court'.
- **International Tennis Federation:** (ITF) is the apex body of Tennis.
- It was founded in **Paris** in 1913.

### **Tennis in India :**

- The All India Lawn Tennis Association (AILTA) was formed in Lahore (now in Pakistan) in March, 1920.
- The first president of AILTA was **Samuel Parry O'Donnell**.
- In 1980, its name was changed to **All India Tennis Association (AITA)**.
- It is headquartered in **R.K. Khanna Tennis Complex**, is located in **New Delhi**.

### **Tennis Grand Slam :**

- Four major Lawn Tennis Competitions **Australian Open, French Open, Wimbledon** and **American Open** are jointly called **Grand Slam** (Grand Slam Tournament) of Tennis.
- The term Grand Slam for Tennis was used firstly in 1933 by an American journalist **John Kieran**.
- The player who wins all the four above-mentioned tennis competitions in a calendar year is called '**Grand Slam Winner**'.
- **Fred Perry (Britain)** was the first player to complete a "Career Grand Slam" by winning all four contests (1934, 1935, 1934, 1933) for the first time.
- The first male player who had won all four (Australia, French, Wimbledon and US Open) contests in 'the same calendar year' was **Donald Buzz**, while the first female player was **Maureen Connolly** (US, 1953).

### **Golden Slam :**

- Along with winning all four contests in the same calendar year, if a player also wins the tennis gold medal in Olympics, it is called **Golden Slam**. **Steffi Graf** is the only German player in the history of tennis who had achieved this distinction in 1988.
- The term **Grand Slam** was used in golf since 1930.

### **Other Tennis Tournaments :**

- Davis Cup is the Men's Tennis team competition. **[SSC CGL (Pre.) 2016]**
- The Fed Cup is the Women's team competition.
- Hopman Cup is an international mixed team competition.
- Pan-Pacific Trophy, Witman Cup, Masters Grand Prix, Aviation Cup, Volvo Tennis Cup, Evert Cup, Champions Cup, Citizen Cup, Family Circle Cup, Edgbaston Cup, Heineken Trophy, Hamlet Cup, ATP World Tour and WTA Tour Competitions, etc.

### **Dimensions of a Tennis Court:**

- The length of the tennis courts is 78 feet (both Singles and Doubles).
- The width of the tennis court is 27 feet (Singles) and 36 feet (Doubles).
- The height of the net is 3 feet.
- The weight of the tennis ball is 56.0 grams - 59.4 grams.
- The colour of the ball is white or yellow.
- The maximum height of the racket is 29 inches.

### **Glossaries/Vocabularies :**

- Service, Game, Love, Deuce, Fault, Return, Back Hand Drive, Serve, Seeding, Volley, Half Volley, Late, Tiebreaker, Change, In, Out, etc. **[SSC (GD) 2019]**

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## Chess

- **India** is considered the **Father of Chess**. **(SSC CHSL, 2017)**
- In ancient times the game was known as '**Chatur-Anga**' (**Chaturanga**).
- Four competitors could participate in the game.
- In the sixth century, the word 'Chaturanga' reached Persia from India where it was named Chess.

### **Game Format**

- The game of chess is played on a chess-board of which 32 houses are black and 32 houses are white.
- This board consists of 64 squares with 8 vertical and 8 horizontal rows.

### **Chess Pieces :**

- It has 1 King and 1 Queen each for both the competitors.
- 2 Bishops (camel), Rooks (elephant), Knights (horse) for both the competitors.
- 8-8 Pawns for both the competitors.

### **Glossaries/Vocabularies :**

- Stalemate, Gambit, Check, Checkmate, Bishop, Grand-master, Fide, Knight, Acquit, Adjournment, Back-Rank, Blocked, Doubled Pounce, Hanging, Hole, Norms, Swedel, Tabia, X-ray attack, Castle, Elo rating, Knight, Piece, etc.

### **Federation International Des Echecs:**

- On 20<sup>th</sup> July 1924, the **World Chess Federation (FIDE)** was established in **Paris (France)**.



- FIDE is the supreme regulatory body for the game of chess.
- Its headquarter is located in **Lausanne, Switzerland**.
- It is also responsible for organizing world level and continental level competitions.
- The first president of FIDE was **Alexander Rueb** of the Netherlands.
- FIDE organizes Chess Olympiad, Chess World Cup, Chess World Championships and other competitions.
- The FTY crypto cup is related to Chess.

[SSC CGL(Pre.) 2023]

#### Chess in India :

- The **All India Chess Federation (AICF)** was established in 1951.
- Its headquarter is located in **Chennai**.

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## Athletics

- The English word Athletics means “Track and Field Sports”.
- Athletics is also known as the ‘**Queen of Sports**’.
- It is the only event in the first Olympics held in 800 BC.
- The emergence of the Modern Olympics “Athletics” led to a group of diverse sports competitions.
- Generally, the events involved in athletics can be divided into the following three categories.  
(1) Track Games (2) Field Games and (3) Joint Events
- Currently, the track and field events at the international level include the following.

#### A. Track Events :

- 100, 200, 400, 800, 1500, 5000, 10000 m race. Marathon, 110 m. Hurdle, 400 m. Hurdle, 3000 m. Steeple chase, 20 km. and 50 km. Walking, 4x100 and 4x400 m. Relay.
- In women’s track events, 100 m hurdle race instead of 110 m hurdle race is organized.

#### B. Field Events:

- High jump, Pole Vault, Long Jump, Triple Jump, Shot Put, Flywheel Throw (discus throw), Javelin Throw, Wire Shot Throw (Hammer Throw).

#### C. Combined Events:

##### Decathlon:

- It is a Men’s and women's event.
- It is a two-day competition in which (for men) on the **first day** - 100 m. race, Long Jump, Shot Put, High Jump, 400 m race and on the **second day** - 110 m Hurdles, Flywheel Throw, Pole Vault, Javelin throw and a 1500 m. race is held.
- In this, individual scores are determined for each event and the athlete with the highest combined score is the winner.

- If an athlete is unable to participate in any one of the events, it is believed that he/she has opted out of the competition.

##### Heptathlon:

- It is a men and women’s event.
- It is also a two-day competition where the first **day** (for women) event 100 m Hurdle, High Jump, Shot Put, 200 m race and **second day** - Long Jump, Javelin Throw and 800 m race is held.
- The declaration of the winner's name is based on the highest combined score.

##### Modern Pentathlon:

- It has 5 events in a one-day tournament.
- This includes Fencing, Swimming, Shooting, Cross Country running and Horse Riding.

##### Triathlon:

- It includes Swimming, Cycling and Running events.

##### Steeplechase:

- The steeple chase was a Men’s Event in the modern Olympic Games until 2008.
- Women’s Steeplechase Event was inducted from the 2008 Beijing (China) Olympics.
- Its stipulated distance is 3000 meters.
- An athlete has to cross 28 hurdles.
- It consists of seven streams of water.

##### Gymnastics :

- Gymnastics is a sport where people perform exercise that requires strength, flexibility, balance and coordination. Example - Flips, Jumps etc.
- Dipa Karmakar is related to Gymnastics. (EPFO SSA, 2023)

##### Athletics Glossaries/Vocabularies :

- Heets, Start, On Your Marks, Set, False Start, Foot Fault, Take Off-Line, Runway, Stop Board, etc.
- In the year 1912, the **International Amateur Athletics Federation (IAAF)** was established by 17 National Athletics Federations at its first Congress (Sweden).
- Its headquarter is located in **Monaco**.
- In 2001, the organization was renamed ‘**International Association of Athletics Federations**’ (IAAF).
- Currently, it has 214 member associations.
- This association organizes world championships (athletics) every two years as well as other competitions related to athletics.

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## Table Tennis

- Table Tennis was invented in England in the early days of the 20<sup>th</sup> century and was originally called Ping-Pang.
- In 1921, the Table Tennis Association was formed in England.

- **International Table Tennis Federation (ITTF)** was formed in Berlin in the year 1926.
- Its headquarter is located at **Lausanne, Switzerland**.
- Its founding member countries are England, Sweden, Hungary, India, Denmark, Germany, Czechoslovakia, Austria and Wales.
- In 1926-27, the first World Championship of Table Tennis Competition was held at London (England).
- This championship is held at an interval of two years.
- From 1953, Asian players started participating in this championship.
- In 1988, Women's and Men's Singles and Doubles Events of Table Tennis were included in the Olympics.

#### Major International Table Tennis Competitions:

- Corbillon Cup (World-Women's Team), Swaythling Cup (World Men's Team), U Thant Cup, St. Bridewas Cup, Iran Cup (Men's Doubles), W. J. Pope Trophy (Women's Doubles), Heydusek Cup (World Mixed Doubles), Stiga Cup, etc.

#### Table Tennis in India:

- Table Tennis was started in India from Kolkata.
- The Bengal Table Tennis Association was established in Kolkata in 1934 as the first organization.
- In 1938, '**Table Tennis Federation of India**' (TTFI) was formed in Kolkata itself.
- In 1946, the Women's Singles Competition was started.
- The Junior Team championship for boys was started in 1954.
- The Sub-Junior National Championship was also started in 1994.
- Kolkata has the distinction of organizing 33<sup>rd</sup> World Table Tennis Championship in India in 1975.

#### Competitions held in India:

- Barna Bellock Cup (Men's Team), Peethapuram Cup (Men's), Jai Laxmi Cup (Women's Team), Travancore Cup (Women's), Gulf Cup (Team Competition), Indira Cup (Junior Men's), Kamala Ramanujan Cup (Sub-Junior), etc.

#### Perimeter

- The length of the table is 2.74 m (9 ft).
- The width of the table is 1.52 m. (5 ft).
- The height of the table is 76 cm (2.5 ft).
- The weight and the colour of the ball is 2.7 g (white or yellow).
- The height of the net is 15.25 cm.

#### Key Glossaries/Vocabularies:

- Rally, Service, Receiver, Stroke, Late, Point, Strike, Obstructs, Side Spin, Top Spin, Under Spin, Penholder, End Line, Foil, Half Volley, Back Spin, Chinese Grip, Center Line, Half Court, Reverse Sandwich, Free Hands, etc.

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## Basketball

- In 1891 the game was introduced in America by James Smith.
- A group of 5-5 players from each team participated in this game. (SSC CHSL, 2023)
- A Basket ball match is played in two halves of 20 minutes each.
- The **Federation International De Basketball Association (FIBA)** was established in 1932.
- The first World Championship of Basketball was held in 1950.
- The first basketball game in India was played in 1930.
- **Indian Basketball Association (BFI)** was established in 1950 (Mumbai).
- Its headquarter is located in **New Delhi**.
- Manika Batra is the first Indian paddler who win a medal at the ITTF-ATTU Asia cup 2022. (SSC CHSL, 2023)
- A ball screen technique is used in Basketball. (SSC CGL, 2023)

#### Dimension :

- The length of the court - 28m.
- The breadth of the court -15 m.
- The height of the basket (From the ground) - 3.05 m.
- The weight of the basket - 567-624 grams.
- The size of the basket - 29.5 inches (men) and 28.5 inches (female).

#### Basketball Glossaries/Vocabularies:

- End Line, Center Line, Dribble, Double Foul, Personal Contract, Multiple Throws, Intermission, Continuity Pass, Hook pass, Over-time, Outlet pass, Pick, Pivot, Tip-off, Ring guard, Backboard, Frontcourt, Point, Dead Ball, Basket Hanging, Lead Pass, Keyhole, etc.

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## Polo

- The modern polo game is believed to have originated from **Manipur, India**.
- Polo was played as "**Sagol Kangjei**" in 3100 BC.
- Over a period of time, Muslim rulers played Chaugan (polo) and Afghanistan-resident used to play '**Buzkashi**' on a horse, but the game of Buzkashi was very cruel because it was played with a goat, not a ball.
- Although, in 525 BC in Persia, it was played under the name '**Pulu**'.
- Kolkata Polo Club was established in 1862 .
- The first polo club was established at Silchar, Assam in 1833.
- In 1869, the game was taken to England by the 10<sup>th</sup> Hussars Regiment.

- The Hurlingham Polo Association first formulated the English rules of polo in 1875.
- A group of 4-4 players from each team participate in this game.

#### Dimension:

- The length of the field - 300 yards.
- The width of the field - 160 yards.
- The distance between goals - 250 yards.
- The breadth of the post - 8 yards.

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## Golf

- Golf is originated from the east coast of Scotland during the 15<sup>th</sup> century.
- The 'Leith' golfers established the first club in 1744.
- '**Duncan Forbes**' formulated the club rules.
- '**Stroke play**' was introduced in golf in 1759.
- In 1867, the first Women's golf (St. Andrews) club was established.
- In 1990, Olympics (Paris), Golf was included in the Olympic Games.
- The Professional Golf Association (PGA) was formed in the USA in 1916.
- The World Amateur Golf Council was established in 1958.
- In 2003, its name was changed to '**International Golf Federation**' (IGF).
- Its headquarter is located in **Lausanne, Switzerland**.

#### Game Format:

- In this game, the players participate as an individual or as a team.
- Players play in groups of two, three or four.
- There are two types of games in Golf.
- **Match Play** - The team with the most holes, though it wins.
- **Stroke Play** - In this, the player is the winner, who finishes the 'Course' in the lowest strokes.

#### Golf Dimensions:

- The area of the golf course is 125 to 175 acres.
- **The weight and circumference of the ball** is 45.93 gm and 4.27 cm.
- **The diameter of the hole** is 4.25 inches.
- **Tee** - It is the flat land from where the first shot is hit.
- **Fairway** - It is an area where the grass is closely cut and the player hits the ball.
- **Rough area** - It is an area of grassland along with the side of the fairway.
- **Hazards** - It includes areas, of water and trench.
- **Punting Grass** - In this area the 'Hole' is located.
- **The Club** - The Golfer puts the ball into the hole hitting the stroke by the club.

- A golfer can use a maximum of 14 clubs.
- Each golfer is allowed to have a caddie carrying clubs with him.
- **Wood**: It is used for long-range shots. It is usually made of wood, plastic or light metal.
- **Iron**: It is generally made of steel and it is used for small shots.
- **Putter**: It is made of light metal and is used to hit the ball a short distance towards or into the hole.
- **Key Glossaries/Vocabularies** : Hole, Halved, Par, Parry, Handicap, Bunker, Flagstick, Bogie, Foursome, Stimpie Tea, Putt Hall, Nibalik, Caddie, Lims, Iron, Course, Lai, Post, etc.

#### Major Competitions:

##### Men's Golf World Cup:

- It was started in 1953.
- It is the Men's annual international event.
- Initially, it was known as 'Canada Cup' which was named World Cup in 1967.

##### Women's Golf World Cup:

- It was started in 2000.
- It is a Women's professional event.
- It has not been organized since 2008.

#### Grand Slam:

- The term '**Grand Slam**' in golf was first used to refer to Bobby Jones, who had won four major golf events (American and British Open also American and British Amateur) in 1930.
- The modern standard for Grand Slams is - The Masters (April), The US Open (June), The Open Championship also known as The British Open (July), the PGA Championship (August) to win in a calendar year.
- Other golf competitions are Urban Golf, Raider Cup, Solheim Cup, Presidents Cup, Walker Cup, Curtis Cup, UBS Cup, The Seve Trophy, Tommy Bahamas Challenge, Palmer Cup, PGA Door, PGA European Tour, etc.

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## Baseball

- This game was developed in the US in the mid-19<sup>th</sup> century.
- In 1845, **Alexander Cartwright** formulated the rules of the game.
- He is considered as the **Father of Modern Baseball**.
- The player who throws the ball to '**batter**' is called '**pitcher**'.

#### Baseball Dimension:

- The bat of the baseball is spherical.
- The length of the bat is 42 inches and the maximum diameter 2.75 inches.

- The circumference of the ball is 9.00 - 9.25 inches.
- The diameter of the ball is 2.86 - 2.94 inches.
- The weight of the ball is 141.75 – 148.83 grams.
- The distance of each base is 90 feet.
- The distance between the first base and the third base is 127 feet.
- **Key Glossaries/Vocabularies** : Home, Diamond, Pitcher, Batter, Home Run, Baseman, Aight, Strike Ant-Rubber, etc.

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## Billiards

- Billiards is originated in the 15<sup>th</sup> century.
- **Snooker** is originated from **Billiards**.
- Billiards is derived from the French word **Billart** meaning a wooden stick or 'billy' and a ball.
- Snooker is especially popular in English speaking countries such as England, Ireland, Canada and South Africa.
- **'World Professional Billiards and Snooker Association' (WPBSA)** was established in 1968.
- Its headquarter is located in **Bristol, UK**.
- The 'World Ladies Billiards and Snooker Association' (WLBSA) was established in 1981.
- The World Billiards and Snooker Council (WBSC) was established in the year 1971.
- The council changed its name to **'International Billiards and Snooker Federation (IBSF)** in 1973.
- Its headquarter is located in **Dubai, United Arab Emirates**.
- **The 'World Confederation of Billiards Sports' (WCBS)** was established in 1992.
- Its headquarter is located in **Lausanne, Switzerland**.
- IBSF hosts non-professional Snooker and English Billiards competitions in the world.
- This body organizes Q Sports (Billiards-type games) which include Carrom, Billiards, Pool games of various categories and Snooker, etc.
- There are two types of Billiards games.

### A. English Billiards :

- It is played by two players or by two pairs of players on a table.
- The length of the table is 3.66 m.
- The breadth of the table is 1.83 m. (12x6 ft).

### Major Components of the Table:

- Cushion, Top Pocket, Center Pocket, Bottom Pocket, Spot, Center Spot, Pyramid Spot, Block Line, D, Long Butt Cue, Half Butt Cue, Rest and Half Butt Rest.

- In this game, 3 types of balls (white, spotted white or yellow and red) are used.
- Players use **'Cue'** to push their ball.

### Components of the Game:

- **To Win Hazard** : 2 points are scored when the cue ball is pocketed by the second white ball and 3 points are scored when the red ball is pocketed.
- **To Loss Hazard** : When the cue ball hits the pocket with the other white ball, 2 points are lost and when the red ball hits the pocket, 3 points are lost.
- **Key Glossaries/Vocabularies** : In Off, Pot, Steering, Mark, Scooby, Spot, Stroke, Short Genie, Cushion, Scratch, Break Pot, Long Genie ,Bolting, In Off Strigging, Bolding, Jigger, Visits, etc.

### B. Carom Billiards:

- It is played on a non-pocketed table.
- The length of the table is 3.05 m.
- The breadth of the table is 1.52 m.

### Major Components of the Table:

- Foot Cushion, Foot String, Foot Spot, Center String, Center Spot, Hand String, Hand Spot, Hand Cushion, Side rails, Diamond, etc.
- In this game, three coloured balls - red (target ball) - white and white spotted or yellow ball are used.
- **Key Glossaries/Vocabularies** : Lagging, Leg, Break Shot, Jumper Ball, Frozen Ball, Carrom. Safety Shot, Double Stroke, Cue, Jigger, Brake Pot, Inluck, In-off, Cansa, Bolting, Hazard, etc.
- **Major Trophies of Billiards**: Golf Flak Trophy, Arthur Walker Trophy.

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## Snooker

- It is played on the Billiards table with a pocket.
- 22 balls are used in this game.
- Of these 22 balls, **15 are red balls** and 6 balls are- yellow, green, brown, blue, pink, and black, while the 'cue ball' is white.
- The **World Professional Billiards and Snooker Association (WPBSA)** is the regulatory body of this game.
- It was established in **1968**.
- Its headquarter is located in **Bristol, U.K.**

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## Wrestling

- The credit for bringing Wrestling into the mainstream of the sport goes to the ancient Greek Olympic Games.
- In 708 BC, the first Wrestling competition was held in the ancient Olympics Games.

- **Professional Wrestling began in France in 1830.**
- Only 'Greco Roman' and 'Freestyle' Wrestling competitions were held at the Olympics.
- Wrestling was included at the 1896 Olympics (Athens) as a "showpiece" competition.
- Wrestling returned as 'free-style' at the 1904 Olympics (St. Louis).
- Greco-Roman wrestlers participated in the 1908 Olympics (London).
- The world regulatory body for Wrestling "**Federation Internationale des Luttes Associees**" - **FILA** was established in 1912.
- In 2014, its name was changed to '**United World Wrestling**' (UWW).
- Its headquarter is located in **Lausanne, Switzerland.**

#### **Dimensions :**

- In the international competition, a circular contest area of 9 m diameter and a central circle of 1m diameter.
- A 1 : 1 metre diameter mace in a match held on a mattress, called Matt.

#### **Wrestling Glossary:**

- Bridge, Flat, Sudden Death, Heave, Half Nelson, Cradle, Double, Nelson, Timekeeper, Tie, Foul, Obstacle in Bout, Caution, Warning, Dog fall, Fallback, Flying Marsh, Rebut, Bridge, Cross Pace, etc.

#### **Wrestling in India:**

- Some of the leading Wrestling players of India are - Karim Baksh, Khashaba Dadasaheb Jadhav, Gama Mahan, Dara Singh, Gobardhan and Ghulam, etc.
- **Khashaba Dadasaheb Jadhav** won a Bronze medal in Wrestling at the 1952 Helsinki Olympics.
- He was the first person in India's Olympics history to win a medal in the individual event.
- In the fourth Asian Games (Jakarta-1962), all the wrestlers of India got a place in the medal table. India received a total of 12 medals in both Wrestling styles.
- After this, Sushil Kumar won a Bronze medal in Wrestling in the 2008 Beijing Olympics and a Silver medal in the 2012 London Olympics.
- **Yogeshwar Dutt** won a Bronze medal in Wrestling in the 2012 London Olympics.
- Women Wrestler **Sakshi Malik** won a Bronze medal in Wrestling in the 2016 Rio Olympics.
- Ravi Kumar Dahiya won the 57kg men's freestyle wrestling silver medal at the Tokyo Olympics.
- Ravi's medal, in the men's 57kg freestyle was only India's second silver in wrestling at the olympics after sushil Kumar's triumph at London 2012.
- Except Ravi, Bajrang Punia made a remarkable Olympic debut winning the bronze medal in 65 kg freestyle event.

- Significantly, Aman Sehrawat won Bronze medal in Paris Olympics 2024 in Wrestling Men's 57 kg. freestyle event.

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## **Water Polo**

- It is an aquatic version of '**Rugby**'.
- The Indian word "Pulu" is anglicized as "Polo" which means 'a ball'.
- This game was started in England in 1859.
- The first authorized 'Water Polo' was played in 1873 at the Plunge of the Crystal Palace in London.
- The Modern Water Polo was started in 1880.
- The first international Water Polo match was played between England and Scotland in 1890.
- On 28<sup>th</sup> January, 1890 the first American Championship was organized.
- Water Polo as a demonstration sport, was included in the Olympics (Paris) in 1990.

#### **Game Rules :**

- 'Water Polo' is a two-team game.
- Each team consists of 13 players, 7 of which (6 players and 1 Goalkeeper) are in the pool and 6 are off the pool as substitutes.
- The game is played in four time periods of 6 to 9 minutes depending on the level of the game.
- In a tie, there are two extra half-games of 3-3 minutes are permitted.
- In the case of no result, this process continues until the result is declared.

#### **Dimension:**

- Water polo played in a rectangular pool.
- The pool is 20-30 meters in length and 10-20 meters in width.
- The goal post is 3 meters wide and 0.9 meters above the water surface.
- The weight of the ball is 400-450 grams .

#### **Water Polo Key Glossaries:**

- Punch, Dribble, Ball, Free throw, Corner Throw, Goal Throw, Penalty Throw, Donyi Polo, Goal Line, Personal, Fault, Ball Under, Is railing, Campus.
- World Regulatory Body of Water Sports, the "**International Swimming Association**"(FINA) was established in 1908 in London, UK.
- Its headquarter is located in **Lausanne, Switzerland.**
- The 1930 FINA Congress, Berlin, unanimously approved the establishment of an '**International Water Polo Board**' (IWPB).
- In 1968, the FINA Congress changed its name to **FINA Technical Water Polo Committee.**



- Swimming as a sport has a history of thousands of years.
- **Digby**, who writes on swimming, claims that 'Man is a better swimmer than a fish'.
- The first national swimming championship was organized in 1846 AD, in Sydney (Australia).
- In 1892, the first Women's Swimming championship was organized in Scotland.
- Swimming is the second biggest sport of Olympics (first-Athletics).
- Singles and team events are organized under Swimming.

#### Events in Swimming :

##### A. Back Stroke:

- In this event, the swimmer swims with the help of his back.

##### B. Freestyle:

- The swimmer can adopt any method of swimming as per their choice and convenience.
- It requires that the swimmer has to touch the pool with his hand or any limb while returning and at the end of the race.

##### C. Front Crawl:

- In this event, the swimmer alternately brings the hands up and down in each stroke.
- Also, water has to be pushed backward by the feet.

##### D. Butterfly

- Butterfly event was introduced in 1950.
- In this event, the swimmer has to keep his shoulders always parallel to the surface of the water.
- By bringing both hands together from above, one has to bring the shoulders from the front to the back.
- Both hands must move together.
- Feet are allowed to run simultaneously.

##### E. Breast Stroke:

- In this event, the body of the swimmer is parallel to the surface of the water.
- It is necessary that both hands are pushed forward from the chest together and brought back.
- The legs are folded and pushed backwards.

##### F. Medley Events:

- Individual and Relay events were organized under this event.
- In the individual event, a swimmer covers an equal distance for four strokes.
- Their order is as follows - Butterfly, Backstroke, Breaststroke and Freestyle.
- In a relay race, a swimmer has to get out of the 'pool' after using a single event in swimming for a certain distance.

#### Olympic Swimming Events (Male / Female):

- Freestyle - 50, 100, 200, 400, 800 and 1500 meters
- Backstroke - 100 and 200 meters
- Breaststroke - 100 and 200 meters
- Butterfly - 100 and 200 meters
- Individual Medley - 200 and 400 meters
- Freestyle Relay - 4x100 and 4x200 meters
- Medley Relay - 4x100 meters
- Mixed Medley Relay - 4x100 meters
- Marathon - 10 km

#### Dimensions -

- Large pool having 50 m long-distance swimming with 6,8 or 10 lanes and for short distances 25 m long pool having 4,5 or 8 lanes.
- The depth of the pool is 3 m (9 ft 10 in).
- The temperature of the water should be around-26° C.

#### Swimming Glossaries:

- Springboard, Twist, Zen, Stroke, etc.

#### National Sports of Countries

| Countries  | Sports                                    |
|------------|-------------------------------------------|
| India      | Hockey (popularly)                        |
| Spain      | Bullfighting                              |
| Canada     | Hockey (Winter), Lacrosse (Summer Season) |
| Australia  | Cricket                                   |
| Brazil     | Football                                  |
| Nepal      | Volleyball (pre-May 2017 Dandy Beo)       |
| Indonesia  | Badminton                                 |
| USA        | Baseball                                  |
| China      | Table Tennis                              |
| France     | Football                                  |
| England    | Cricket                                   |
| Japan      | Sumo                                      |
| Pakistan   | Hockey                                    |
| Malaysia   | Badminton                                 |
| Russia     | Football and Chess                        |
| Scotland   | Rugby Football                            |
| Bangladesh | Kabaddi                                   |
| Sri Lanka  | Volleyball                                |
| Bhutan     | Archery                                   |

#### Number of Players in a Team in Major Games

| Sports                   | Number of Players (in one team) |
|--------------------------|---------------------------------|
| Rugby Football           | 15                              |
| Hockey /Football/Cricket | 11                              |

|                              |        |
|------------------------------|--------|
| Baseball                     | 9      |
| Kho-kho                      | 9      |
| Water Polo                   | 7      |
| Netball                      | 7      |
| Kabaddi                      | 7      |
| Volleyball                   | 6      |
| Basketball                   | 5      |
| Polo                         | 4      |
| Lawn Tennis and Table Tennis | 1 or 2 |
| Badminton                    | 1 or 2 |
| Bridge                       | 2      |

### Famous Playgrounds and Related Sports

| Sports Field                      | Sports         | Venue           |
|-----------------------------------|----------------|-----------------|
| JL Nehru Stadium                  | Athletics      | Delhi           |
| Shivaji Stadium                   | Hockey         | Delhi           |
| Barabati Stadium                  | Cricket        | Cuttack, Odisha |
| Wankhede Stadium                  | Cricket        | Mumbai          |
| Eden Gardens                      | Cricket        | Kolkata         |
| Keenan Stadium                    | Cricket        | Jamshedpur      |
| Epsom Downs Racecourse            | Derby Race     | Britain         |
| Lords, Oval, Leeds                | Cricket        | Britain         |
| Brookland                         | Football       | England         |
| Indira Gandhi Stadium             | Indoor Games   | Delhi           |
| Harlington                        | Polo           | England         |
| Brooklyn                          | Baseball       | New York        |
| Sandy Lodge                       | Golf           | Scotland        |
| Vivekanand Yuba Bharati Krirangan | Football       | Kolkata         |
| Perth, Brisbane, Melbourne        | Cricket        | Australia       |
| Ambedkar Stadium                  | Football       | Delhi           |
| National Stadium                  | Hockey         | Delhi           |
| National Stadium                  | Hockey         | Mumbai          |
| Brabourne Stadium                 | Cricket        | Mumbai          |
| Green Park Stadium                | Cricket        | Kanpur          |
| Patney Mart Lake                  | Boat Race      | England         |
| Headingley Manchester             | Cricket        | Britain         |
| Black Health                      | Rugby Football | London          |
| Wembley Stadium                   | Football       | London          |

|                                        |                |          |
|----------------------------------------|----------------|----------|
| Twickenham                             | Rugby Football | England  |
| Trent Bridge                           | Cricket        | England  |
| White City                             | Dog Race       | England  |
| Yankee Stadium                         | Boxing         | New York |
| Forest Hill                            | Tennis         | New York |
| Arun Jaitley Stadium (Ferozshah Kotla) | Cricket        | Delhi    |
| MA Chidambaram (Chepauk Stadium)       | Cricket        | Chennai  |

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## Boxing

- Boxing was included as a demonstrative sport in 1904 in St. Louis Olympics.
- It received its official entry for the first time at the 1908 London Olympics.
- It was not included in the 1912 Stockholm Olympics, as Boxing was supposed to be illegal in Sweden.
- Boxing joined the Olympics as a permanent sporting event from the London Olympics, 1920.
- Officially, the emergence of Women's Boxing for the first time was in 1993.
- Women's Boxing was included officially in 2012 London Olympics.
- There are two categories in International Boxing events- A. Amateur B. Professional.

### A. International Amateur Boxing Association:

- It is an Institution controlling Amateur Boxing.
- It was founded in 1946 in London.
- The institution is currently located in **Lausanne, Switzerland**.

### B. Major Institutions associated with Professional Boxing:

- World Boxing Council, 1963.
- World Boxing Association, 1921 (as NBA) (WBA, 1962)
- International Boxing Federation, 1983
- World Boxing Organization, 1988
- International Women Boxing Organization, 1989
- **Ring Size:** The length and the width of the ring is to be between the maximum 4.9 m × 4.9m and a maximum 6.10 m × 6.10 m.

### Major Boxing Glossaries:

- Uppercut, Hook, Belt, Block, Blow, Punch, Jab, Knock-down, Knock out, Bell, Bounce, etc.
- The **Vel Barker Cup** is awarded for outstanding performance and technique at the Olympic Sports Boxing Event.

- There are three main shooting events - A. Rifle Shooting, B. Rapid Fire Pistol Shooting, C. Free Pistol Shooting.

#### A. Rifle Shooting:

- It has three basic categories - 1. Smallbore 2. Bigbore, 3. Air Rifle.
- These are determined by the types of rifles are used.
- There are three recognized shooting positions for rifle shooting - 1. Prone, 2. Standing, 3. Kneeling

#### B. Rapid Fire Pistol Shooting:

- It is sometimes also called **Silhouette Shooting**.
- In this, a contest from a distance of 25m takes on 5 targets with a total of 60 shots.

#### C. Free Pistol Shooting:

- The Contestant shoots from a distance of 50m.
- Competitors are allowed to take 60 shots.

#### Major Shooting Glossaries:

- Bull's eye, Bag, Marks-Manship, Shooting, Trench, Bird, Skeet Shooting, Target, Muzzle flash, etc.
- **Current Shooting Olympics Events** - Air Pistol, Air Rifle, Rapid Fire Pistol, Rifle Three Position, Skeet and Trap.

#### Indian Olympic Medalists in Shooting:

- **Rajyavardhan Singh Rathore** (Silver Medal), Men's Double Trap (2004, Athens Olympics).
- **Abhinav Bindra** (Gold Medal), Men's 10m Air Rifle (2008, Beijing Olympics).
- **Vijay Kumar** (Silver Medal), Men's 25m Rapid Fire Pistol (2012, London Olympics).
- **Gagan Narang** (Bronze Medal), Men's 10m Air Rifle (2012, London Olympics).
- Manu Bhaker (2 Bronze Medal), Women's 10m air pistol event.
- Manu Bhaker and Sarabjot Singh, 10m air Pistol mixed team event.
- Swapnil Kusale (Bronze) - Men's 50m rifle 3 Position.
- Singhraj Adhana is related to shooting. (SSC CGL Pre 2023)

- The number of players in the team is 6.
- The number of substitute players is 6.
- The line dividing the volleyball court is called **Centerline**.
- According to the rules of FIVB, the ceiling of the indoor sports complex is 12.50 meters for any international sports competition in volleyball.
- The weight of the ball is 260 to 280 grams. The Volleyball is multicoloured.

- The circumference of the volleyball is 65 to 67 cm.
- The height of the net is 2.43 m above the court for men.
- The height of the net is 2.24 m above the court for women.
- Beach Volleyball is a form of volleyball. There are two players to play in beach volleyball.
- The Net Antenna of Volleyball should have red and white stripes.
- If both the teams win two sets, the fifth final set should be played up to 15 points with a minimum lead of two points.
- The length and the width of the net in the volleyball game is 9.50 m × 1m.

- There are **7** players in Water Polo and Kabaddi.
- The '**Out**' Kabaddi players sit in Seating Blocks.
- **Bonus Line** is in the game of Kabaddi. The bonus line does not apply when the number of players is less than 6.
- '**Lona**' is related to Kabaddi Games. Two points are given for 'Lona'. The opposition team must have at least 6 players to score bonus points. (SSC CHSL, 2022)

#### Key Glossaries of Kabaddi:

- In Kabaddi game, the terms, Seating Block, End Line, Bonus Line, Baulk Line, Center Line, Sideline, Lobby etc. are used.

- Kho-kho sports requires precision and accuracy with excellent timing and speed when dives.
- A kho-kho team consists of 12 players with 9 players in the field and 3 additional (Substitute) players.

#### Dimensions of Kho-Kho:

- The playing arena is rectangular in shape.
- The total area including lobbies is 33m × 21 m.
- The length and breadth of the sports arena are 29m × 16 m.
- Sports arena for women and juniors is 27m × 16 m.
- The Free Zone is 2.75 m × 16 m.
- Finally, both the rectangles measure 16m × 2.75 m each.
- The number of squares in each cross lane is 8.
- The square size is 30 cm × 30 cm.

#### Key Glossaries of Kho-Kho :

- The players sitting in the square are called the **Chaser**.
- The chaser's opponent is called the **Runner**.
- There are a total of 4 innings (two innings for each team) in the Kho-Kho match.
- The interval time is of 5 minutes.

- The term 'Penalty Throw' is related to Handball and Water Polo.
- The total number of players in each team in Handball is 14, with 6 players in court, one goalkeeper and 7 substitutes.

### Major Dhyan Chand Khel Ratna Award :

- Formerly known as the Rajiv Gandhi Khel Ratna, it is India's **highest sporting honour**.
- It was established in 1991-1992.
- The award is given by the **Union Ministry of Youth and Sports**.
- Under this, a cash prize of **Rs. 25 lakh** is awarded.
- It is significant that major Dhyan Chand Khel Ratna Award 2023, was given to Chirag Chandrashekhar Shetty and Rankireddy Satwik Sai Raj. Both are related to Badminton.

### Arjuna Award :

- The award is given to outstanding international performers in last three years.
- Under this, a prize money of **Rs 15 lakh** and a bronze statue of Arjuna is given.
- Since 2001, this award is given only for those events which are under the following competitions - Olympic Games, Asian Games, Commonwealth Games, World Cups, World Championships, Domestic Games and Sports for the Physically Challenged.

### Arjuna Awards for outstanding performance in Sports and Games 2023

| S. No. | Name of the sportsperson  | Discipline          |
|--------|---------------------------|---------------------|
| 1.     | Shri Ojas Pravin Deotale  | Archery             |
| 2.     | Ms Aditi Gopichand Swami  | Archery             |
| 3.     | Shri Sreeshankar M        | Athletics           |
| 4.     | Ms Parul Chaudhary        | Athletics           |
| 5.     | Shri Mohameed Hussamuddin | Boxing              |
| 6.     | Ms R Vaishali             | Chess               |
| 7.     | Shri Mohammed Shami       | Cricket             |
| 8.     | Shri Anush Agarwalla      | Equestrian          |
| 9.     | Ms Divyakriti Singh       | Equestrian Dressage |
| 10.    | Ms Diksha Dagar           | Golf                |

|     |                                  |               |
|-----|----------------------------------|---------------|
| 11. | Shri Krishan Bahadur Pathak      | Hockey        |
| 12. | Ms Pukhrambam Sushila Chanu      | Hockey        |
| 13. | Shri Pawan Kumar                 | Kabaddi       |
| 14. | Ms Ritu Negi                     | Kabaddi       |
| 15. | Ms Nasreen                       | Kho-Kho       |
| 16. | Ms Pinki                         | Lawn Bowls    |
| 17. | Shri Aishwary Pratap Singh Tomar | Shooting      |
| 18. | Ms Esha Singh                    | Shooting      |
| 19. | Shri Harinder Pal Singh Sandhu   | Squash        |
| 20. | Ms Ayhika Mukherjee              | Table Tennis  |
| 21. | Shri Sunil Kumar                 | Wrestling     |
| 22. | Ms Antim                         | Wrestling     |
| 23. | Ms Naorem Roshibina Devi         | Wushu         |
| 24. | Ms Sheetal Devi                  | Para Archery  |
| 25. | Shri Illuri Ajay Kumar Reddy     | Blind Cricket |
| 26. | Ms Prachi Yadav                  | Para Canoeing |

### Dronacharya Award :

- It was started in **1985**.
- The award is given to coaches for their excellent training.
- Under this award, a cash prize of Rs 15 lakh to lifetime and a cash prize of 10 lakh to regular bronze statue of Dronacharya is given.

### Dronacharya Award for outstanding coaches in Sports and Games 2023

#### A. Regular Category:

| S. No. | Name of the Coach                | Discipline     |
|--------|----------------------------------|----------------|
| 1.     | Shri Lalit Kumar                 | Wrestling      |
| 2.     | Shri R. B. Ramesh                | Chess          |
| 3.     | Shri Mahaveer Prasad Saini       | Para Athletics |
| 4.     | Shri Shivendra Singh             | Hockey         |
| 5.     | Shri Ganesh Prabhakar Devrukhkar | Mallakhamb     |

#### B. Lifetime Category:

|    |                             |              |
|----|-----------------------------|--------------|
| 1. | Shri Jaskirat Singh Grewal  | Golf         |
| 2. | Shri Bhaskaran E            | Kabaddi      |
| 3. | Shri Jayanta Kumar Pushilal | Table Tennis |

### Dhyanchand Award :

- The award was started in 2002.
- This award is given to the players who have contributed to the progress of the game despite performing well and retiring from active sports life.
- Under this, **10 lakh** rupees is provided as prize money.

- Not more than three Awards will be given in a particular year subject to deserving sportspersons being available.

### Dhyan Chand Award for Lifetime achievement in Sports and Games 2023

| S. No. | Name of the sportsperson | Discipline |
|--------|--------------------------|------------|
| 1.     | Ms Manjusha Kanwar       | Badminton  |
| 2.     | Shri Vineet Kumar Sharma | Hockey     |
| 3.     | Ms Kavitha Selvaraj      | Kabaddi    |

### Maulana Abul Kalam Azad Trophy :

- It is a **Rolling Trophy**.
- This trophy is awarded to the best performing university in the inter-university competition.
- It also awards a replica of the trophy to the winning university.
- **Rs. 10 lakhs** is given to the university that secures first place, **Rs. 5 lakhs** to second place and **Rs. 3 lakhs** prize money to the third place.
- It was founded in 1956-57.

### Maulana Abul Kalam Azad (MAKA) Trophy 2023

| S. No. | Name of the sportsperson               | Discipline                           |
|--------|----------------------------------------|--------------------------------------|
| 1.     | Guru Nanak Dev University, Amritsar    | Overall winner university            |
| 2.     | Lovely Professional University, Punjab | 1 <sup>st</sup> runner up University |
| 3.     | Kurukshetra University, Kurukshetra    | 2 <sup>nd</sup> runner up University |

### Sports Fund Program:

- Sports Fund Program was launched for the pension of players in 1994.
- This pension is given to the players who have retired from active sports life after the age of 30 years.
- The pension that is given every month to the winners of various competitions is as follows:

|                                     |          |
|-------------------------------------|----------|
| (1) Olympic Games medalists         | Rs 10000 |
| (2) World Cup / World Championships |          |
| (a) Gold medalists                  | Rs 8000  |
| (b) Silver and Bronze Medal Winners | Rs 7000  |
| (3) Asian/Commonwealth Games        |          |
| (a) Gold medalist                   | Rs 7000  |
| (b) Silver and Bronze Medalists     | Rs 6000  |
| (4) Para-Olympic Games              |          |
| (a) Gold Medalists                  | Rs 5000  |
| (b) Silver and Bronze Medalists     | Rs 4000  |
| (c) Bronze Medalists                | Rs 3000  |

### The Prize Money for the Winners in Major International Competitions

| Sl. No. | Competition                            | Winning Amount (in Rs.) |              |              |
|---------|----------------------------------------|-------------------------|--------------|--------------|
|         |                                        | Gold Medal              | Silver Medal | Bronze Medal |
| 1.      | Olympic Games (Summer and Winter)      | 75 Lakh                 | 50 Lakh      | 30 Lakh      |
| 2.      | Asian Games                            | 30 Lakh                 | 20 Lakh      | 10 Lakh      |
| 3.      | Commonwealth Games                     | 30 Lakh                 | 20 Lakh      | 10 Lakh      |
| 4.      | Para-Olympic Games (Summer and Winter) | 75 Lakh                 | 50 Lakh      | 10 Lakh      |
| 5.      | Para-Asian Games                       | 30 Lakh                 | 20 Lakh      | 10 Lakh      |
| 6.      | Commonwealth Games (Para-Athletics)    | 30 Lakh                 | 20 Lakh      | 10 Lakh      |
| 7.      | Special Olympics (Summer and Winter)   | 5 Lakh                  | 3 Lakh       | 1 Lakh       |

### Upcoming Sports Events

| Competition                                   | Venue                                      |
|-----------------------------------------------|--------------------------------------------|
| <b>Cricket</b>                                |                                            |
| 9th ICC Men's Twenty-20 World Cup (2026)      | India and Sri Lanka                        |
| 12th Women's ICC T20 Cricket World Cup (2026) | England                                    |
| <b>Football</b>                               |                                            |
| 23rd FIFA Football World Cup (2026)           | Canada-Mexico America                      |
| <b>Competition</b>                            |                                            |
| <b>Venue</b>                                  |                                            |
| <b>Miscellaneous</b>                          |                                            |
| 33rd Summer Olympic Games (2024)              | Paris, France                              |
| 34th Summer Olympic Games (2028)              | Los Angeles, USA                           |
| 25th Winter Olympics                          | Italy                                      |
| 20th Asian Games (2026)                       | Nagoya, Japan                              |
| 20th Asian Games (2026)                       | Aichi-Nagoya, Japan                        |
| BWF World Badminton championship 2025         | Paris (France)                             |
| Men's FIH Hockey world Cup (2026)             | Waver, Belgium and Amstelveen, Netherlands |





# Miscellaneous



## Topics of the Unit

● National and International Days ● Major Lakes in India ● Tourist Places In India ● UNESCO World Heritage Sites : Indian Cultural and Natural Sites ● Renowned Personalities and Their Nicknames ● Major Research Institutes of India ● Major Instruments of India and Their Players ● Major Classical Dances and Dance Artists ● Indian Security System ● Indian Internal Security System ● International Awards and Honours ● Two Times Nobel Prize Winners ● National Awards and Honours ● Important Awards: Field and Prize Money ● Persons Honoured with Bharat Ratna ● Jnanpith Award Honoured Litterateur ● Major Mobile Apps and Portals ● Major Indian Writers and Their Books ● Latest Famous Books and Its Authors ● Major Foreign Authors and Their Books ● International Organizations ● International Organizations, Headquarters and Years of Establishment ● World's Major Organizations ● List of First Women in /of India ● Renowned Persons in India ● States Governors, Chief Ministers and Capitals

### 1 National and International Days

#### January

- 4 January World Braille Day
- 9 January Pravasi Bharatiya Divas
- 10 January World Hindi Day
- 12 January National Youth Day (Swami Vivekanand Birthday)
- 15 January Army Day
- 24 January National Girl Child Day
- 24 January International Day of Education
- 25 January National Voters Day
- 26 January Republic Day
- 26 January International Customs Day
- 30 January Martyrs' Day

#### February

- 2 February World Wetlands Day
- 4 February World Cancer Day
- 13 February World Radio Day
- 21 February International Mother Language Day
- 28 February National Science Day

#### March

- 3 March World Wildlife Day
- 7 March Janaushadhi Diwas
- 8 March International Women's Day
- 15 March World Consumer Rights Day
- 20 March International Day of Happiness
- 20 March World Sparrow Day
- 20 March, 2023 World Oral Health Day
- 21 March International Day of Forests
- 21 March World Poetry Day
- 22 March World Water Day
- 23 March (Bhagat Singh, Sukhdev, Rajguru) Martyrs' Day

➤ 23 March

➤ 24 March

➤ 27 March

#### April

- 2 April World Autism Awareness Day
- 7 April World Health Day
- 14 April Ambedkar Jayanti
- 17 April World Haemophilia Day
- 18 April World Heritage Day
- 21 April National Civil Services Day
- 22 April Earth Day
- 23 April World Book and Copyright Day
- 24 April National Panchayati Raj Day
- 25 April World Malaria Day
- 26 April World Intellectual Property Day

#### May

- 1 May International Workers Day or MayDay
- 3 May World Press Freedom Day
- 7 May World Athletics Day
- 8 May World Red Cross and Red Crescent Day
- 8 May International Thalassaemia Day
- 11 May National Technology Day
- 15 May International Family Day
- 17 May World Telecommunication Day
- 18 May International Museum Day
- 21 May National Anti -Terrorism Day
- 22 May International Day for Biological Diversity
- 23 May World Turtle Day
- 31 May World No Tobacco Day

#### June

- 3 June World Bicycle Day
- 5 June World Environment Day
- 7 June World Food Safety Day

|                       |                                                                  |                   |                                                                                    |
|-----------------------|------------------------------------------------------------------|-------------------|------------------------------------------------------------------------------------|
| ➤ 8 June              | World Oceans Day                                                 | ➤ 2 October       | World Habitat Day (First Monday of October)                                        |
| ➤ 12 June             | World Day Against Child Labour                                   | ➤ 5 October       | International Teachers' Day                                                        |
| ➤ 14 June             | World Blood Donor Day                                            | ➤ 8 October       | Indian Air Force Day                                                               |
| ➤ 20 June             | World Refugee Day                                                | ➤ 9 October       | World Post Day                                                                     |
| ➤ 21 June             | International Yoga Day                                           | ➤ 10 October      | World Mental Health Day                                                            |
| ➤ 23 June             | United Nation Public Service Day                                 | ➤ 11 October      | International Day of the Girl Child                                                |
| ➤ 25 June             | International Day of the Seafarer                                | ➤ 13 October      | International Day for Disaster Risk Reduction                                      |
| ➤ 26 June             | International Day Against Drug Abuse and Illicit Trafficking     | ➤ 14 October      | World Standards Day                                                                |
| ➤ 29 June             | National Statistics Day                                          | ➤ 16 October      | World Food Day                                                                     |
| ☐ <b>July</b>         |                                                                  | ➤ 24 October      | United Nations Day                                                                 |
| ➤ 1 July              | National Doctors' Day (Dr. Bidhan Chandra Rai Birthday)          | ➤ 31 October      | World Cities Day                                                                   |
| ➤ 1 July              | State Bank of India's Foundation Day                             | ➤ 31 October      | National Unity Day (Birthday of Vallabhbhai Patel)                                 |
| ➤ 6 July, 2024        | International Day of Cooperatives (First Saturday of July month) | ➤ 31 October      | Kisan Adhikar Diwas                                                                |
| ➤ 11 July             | World Population Day                                             | ➤ 31 October      | Indira Gandhi's Death Anniversary                                                  |
| ➤ 17 July             | World Day For International Justice                              | ☐ <b>November</b> |                                                                                    |
| ➤ 26 July             | Kargil Vijay Diwas                                               | ➤ 5 November      | World Tsunami Awareness Day                                                        |
| ➤ 28 July             | World Hepatitis Day                                              | ➤ 7 November      | National Cancer Awareness Day                                                      |
| ➤ 28 July             | World Nature Conservation Day                                    | ➤ 9 November      | Legal Services Day                                                                 |
| ➤ 29 July             | International Tiger Day                                          | ➤ 14 November     | Children's Day                                                                     |
| ☐ <b>August</b>       |                                                                  | ➤ 14 November     | World Diabetes Day                                                                 |
| ➤ 1 August – 7 August | World Breastfeeding Week                                         | ➤ 17 November     | National Epilepsy Day                                                              |
| ➤ 7 August            | National Handloom Day                                            | ➤ 19 November     | World Toilet Day                                                                   |
| ➤ 10 August           | World Lion Day                                                   | ➤ 21 November     | World Television Day                                                               |
| ➤ 12 August           | International Youth Day                                          | ➤ 26 November     | National Law Day The Constituent Assembly adopted the constitution on this day)    |
| ➤ 15 August           | National Independence Day                                        | ☐ <b>December</b> |                                                                                    |
| ➤ 19 August           | World Humanitarian Day                                           | ➤ 1 December      | World AIDS Day                                                                     |
| ➤ 20 August           | Indian Renewable Energy Day                                      | ➤ 2 December      | World Computer Literacy Day                                                        |
| ➤ 29 August           | National Sports Day (On Birthday of Dhyanchand)                  | ➤ 2 December      | International Day for Abolition of Slavery                                         |
| ☐ <b>September</b>    |                                                                  | ➤ 3 December      | International Day of Persons with Disabilities                                     |
| ➤ 5 September         | Teachers' Day (Birthday of S. Radhakrishnan)                     | ➤ 4 December      | Indian Navy Day                                                                    |
| ➤ 7 September         | International Day of Clean Air for Blue Skies                    | ➤ 5 December      | World Soil Day                                                                     |
| ➤ 8 September         | International Literacy Day                                       | ➤ 7 December      | Armed Forces Flag Day                                                              |
| ➤ 14 September        | Hindi Diwas                                                      | ➤ 9 December      | International Anti-Corruption Day                                                  |
| ➤ 15 September        | International Day of Democracy                                   | ➤ 10 December     | International Human Rights Day                                                     |
| ➤ 15 September        | National Engineer's Day                                          | ➤ 11 December     | International Mountain Day                                                         |
| ➤ 16 September        | World Ozone Day                                                  | ➤ 14 December     | National Energy Conservation Day                                                   |
| ➤ 21 September        | International Day of Peace                                       | ➤ 18 December     | International Migrants Day                                                         |
| ➤ 27 September        | World Tourism Day                                                | ➤ 19 December     | Goa's Liberation Day                                                               |
| ☐ <b>October</b>      |                                                                  | ➤ 22 December     | National Mathematics Day                                                           |
| ➤ 1 October           | International Day of Older Persons                               | ➤ 23 December     | National Farmers Days or Kisan Diwas (Birth Anniversary of Choudhary Charan Singh) |
| ➤ 2 October           | Lal Bahadur Shastri Jayanti                                      |                   | National Consumer Day                                                              |
| ➤ 2 October           | Mahatma Gandhi Jayanti                                           |                   | National Good Governance Day                                                       |
| ➤ 2 October           | International Day of Non-Violence                                | ➤ 24 December     |                                                                                    |
| ➤ 4 October           | World Animal Welfare Day                                         | ➤ 25 December     |                                                                                    |

| Major Lakes in India |                             |
|----------------------|-----------------------------|
| Lakes                | States/Union Territories    |
| Dal Lake             | Jammu & Kashmir             |
| Wular Lake           | Jammu & Kashmir             |
| Tarsar Lake          | Jammu & Kashmir             |
| Verinag Lake         | Jammu & Kashmir             |
| Manasbal Lake        | Jammu & Kashmir             |
| Sheshnag             | Jammu & Kashmir             |
| Anantnag             | Jammu & Kashmir             |
| Anchar Lake          | Jammu & Kashmir             |
| Nigeen Lake          | Jammu & Kashmir             |
| Surajtal Lake        | Himachal Pradesh            |
| Sattal Lake          | Uttarakhand                 |
| Nainital Lake        | Uttarakhand                 |
| Bhimtal Lake         | Uttarakhand                 |
| Deotal Lake          | Uttarakhand                 |
| Khurpatal Lake       | Uttarakhand                 |
| Damdama Lake         | Haryana                     |
| Pichola Lake         | Rajasthan                   |
| Sambhar Salt Lake    | Rajasthan                   |
| Rajsamand Lake       | Rajasthan                   |
| Jaisamand Lake       | Rajasthan                   |
| Lunkar-Nasar Lake    | Rajasthan                   |
| Fatehsagar Lake      | Rajasthan                   |
| Didwana Lake         | Rajasthan                   |
| Nakki Lake           | Rajasthan                   |
| Vembanad Lake        | Kerala                      |
| Ashtamudi Lake       | Kerala                      |
| Periyar Lake         | Kerala                      |
| Hussain Sagar Lake   | Telangana                   |
| Kolleru lake         | Andhra Pradesh              |
| Pulicat Lake         | Tamil Nadu & Andhra Pradesh |
| Berijam Lake         | Tamil Nadu                  |
| Loktak Lake          | Manipur                     |
| Chilika Lake         | Odisha                      |
| Lonar Lake           | Maharashtra                 |
| Tsogmo Lake          | Sikkim                      |
| Tamdil Lake          | Mizoram                     |

2

## Tourist Places In India

| Madhya Pradesh                       |                       |                                                                                                                     |
|--------------------------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------|
| Tourist Places                       | Location              | Built by                                                                                                            |
| Kandariya Mahadev Temple             | Khajuraho             | Raja Vidyadhara (Chandel Dynasty)                                                                                   |
| Madan Mahal Fort                     | Jabalpur              | Raja Madan Singh                                                                                                    |
| Mrignayani (Gujri Mahal) Mahal       | Gwalior               | Raja Man Singh Tomar                                                                                                |
| Lakshmana Temple                     | Chattarpur, Khajuraho | Yashovarma (Chandel Ruler)                                                                                          |
| Dhar Fort                            | Dhar                  | Raja Bhoj First                                                                                                     |
| Bhojshala Temple (of Mata Saraswati) | Dhar                  | Bhoj Parmara                                                                                                        |
| ManMandir Palace                     | Gwalior               | Raja Man Singh Tomar                                                                                                |
| Jai Vilas Palace                     | Gwalior               | Jayaji Rao Scindia (Maharaja of Gwalior)                                                                            |
| Kaliadeh Palace                      | Ujjain                | Nasir Shah                                                                                                          |
| Jahaz Mahal                          | Mandu                 | Ghiyas-ud-din Khalji                                                                                                |
| Ashrafi Mahal                        | Mandu                 |                                                                                                                     |
| Narsingh Dev Palace                  | Datia                 | Bir Singh Deo (Bundela Chief)                                                                                       |
| Chausath Yogini Temple               | Khajuraho             | Chandela Ruler                                                                                                      |
| Jahangir Mahal                       | Orchha                | Vir Singh Deo                                                                                                       |
| Maharashtra                          |                       |                                                                                                                     |
| Tourist Places                       | Location              | Built by                                                                                                            |
| Ellora Caves                         | Aurangabad            | Rashtrakuta by Ruler                                                                                                |
| Ajanta Caves                         | Aurangabad            | 2 <sup>nd</sup> century BCE till 6 <sup>th</sup> century, by Buddhist, Satavahana, Vakataka, Rashtrakuta dynasties. |
| Bibi ka Maqbara                      | Aurangabad            | Aurangzeb's son Azam Shah                                                                                           |
| Elephanta Caves                      | Mumbai                | By the rulers of Kalachuri and Rashtrakutas.                                                                        |
| Kanheri Caves                        | Mumbai                | —                                                                                                                   |
| Chatrapati Shivaji                   | Mumbai                | Frederick William                                                                                                   |
| Terminus (Victoria Terminus)         | Mumbai                | F.W. Stevens (Architect)                                                                                            |
| Gateway of India                     | Mumbai                | George Wittet (Architect)                                                                                           |
| Tamil Nadu                           |                       |                                                                                                                     |
| Tourist Places                       | Location              | Built by                                                                                                            |
| St. George Fort                      | Chennai               | Francis Day and Andrew Cogan (British East India's, representative)                                                 |
| Kailashnathar/ Kailashnatha Temple   | Kancheepuram          | Rajasimha (Pallava King)                                                                                            |
| Vivekanand Rock Memorial             | Kanyakumari           | —                                                                                                                   |

| <b>❑ Kerala</b>                   |                    |                                               |
|-----------------------------------|--------------------|-----------------------------------------------|
| <b>Tourist Places</b>             | <b>Location</b>    | <b>Built by</b>                               |
| Fort Kochi                        | Ernakulam          | By the Portuguese                             |
| Bekal Fort                        | Kasargod           | Shivappa of Ikkeri Dynasty                    |
| Mattancherry Mahal (Dutch Castle) | Kochi              | By the Portuguese                             |
| <b>❑ Telangana</b>                |                    |                                               |
| <b>Tourist Places</b>             | <b>Location</b>    | <b>Built by</b>                               |
| Golconda Fort                     | Hyderabad          | Mud fort made by the King of Warangal in 1143 |
| Mecca Masjid                      | Hyderabad          | Muhammad Quli Qutb Shah                       |
| <b>❑ Karnataka</b>                |                    |                                               |
| <b>Tourist Places</b>             | <b>Location</b>    | <b>Built by</b>                               |
| Tipu Sultan's Palace              | Bangalore          | Haider Ali and Tipu                           |
| Lal Bagh                          | Bangalore          | Haider Ali and Tipu                           |
| Chenna Keshava Temple             | Belur              | Vishnuvardhan                                 |
| <b>❑ Rajasthan</b>                |                    |                                               |
| <b>Tourist Places</b>             | <b>Location</b>    | <b>Built by</b>                               |
| Dhai Din Ka Jhopada               | Ajmer              | Qutb-ud-din Aybak                             |
| Anasagar Lake                     | Ajmer              | Arnoraja Chauhan                              |
| Ajmer Sharif (Dargah)             | Ajmer              | –                                             |
| Taragarh Fort                     | Bundi              | Raja Rao Bair Singh                           |
| Raniji ki Baori (Queens Stepwell) | Bundi              | Rani Nathavati                                |
| Anirudh Mahal                     | Bundi Fort         | Raja Anirudh Singh                            |
| Sukh Mahal                        | Bundi              | Raja Vishnu Singh                             |
| Junagadh Fort                     | Bikaner            | Raja Rai Singh                                |
| Vijaya Stambha                    | Chittorgarh        | Maharana Kumbha                               |
| Deeg Palace                       | Deeg               | Raja Badan Singh & Surajmal Singh             |
| Khanpur Palace                    | Dholpur            | Shahjahan                                     |
| Jantar Mantar                     | Jaipur             | Sawai Jai Singh II                            |
| Nahargarh Fort Jaipur             | Sawai Jai Singh II |                                               |
| Hawa Mahal                        | Jaipur Maharaja    | Sawai Pratap Singh                            |
| Umaid Bhawan                      | Jodhpur            | Maharaja Umaid ingh                           |
| Mehrangarh Fort                   | Jodhpur            | Rao Jodha                                     |
| Gagaron Fort                      | Jhalawar           | –                                             |
| Sunset Point                      | Mount Abu          | –                                             |
| Jain Temples of Dilwara           | Mount Abu          | Vastupal & Tejpal Vimal Shah                  |
| Lake Pichola                      | Udaipur            | –                                             |
| Jai Samand                        | Udaipur            | Maharana Jai Singh                            |

| Fatah Sagar Lake                    | Udaipur               | Maharaja Jai Singh and Maharana Fatah Singh |
|-------------------------------------|-----------------------|---------------------------------------------|
| Saheliyon-ki -Bari                  | Udaipur               | Maharaja Sangram Singh II                   |
| Lakshmi Niwas Palace                | Bikaner               | Maharaja Ganga Singh                        |
| <b>❑ Uttar Pradesh</b>              |                       |                                             |
| <b>Tourist Places</b>               | <b>Location</b>       | <b>Built by</b>                             |
| Aram Bagh                           | Agra                  | Babur                                       |
| Fatehpur Sikri                      | Agra                  | Akbar                                       |
| Agra Fort Agra                      | Akbar                 |                                             |
| Jahangir Mahal                      | Agra                  | Akbar                                       |
| Musamman Burj                       | Agra                  | Shahjahan                                   |
| Taj mahal Agra                      | Shahjahan             |                                             |
| Itmad-ud-Daulah Tomb                | Agra                  | Nurjahan                                    |
| Shish Mahal                         | Agra                  | Shahjahan                                   |
| Chini Ka Rauza                      | Agra                  | Allama Afzal Khan Mullah                    |
| Khas Mahal                          | Agra                  | Shahjahan                                   |
| Jama Mosque (Masjid)                | Agra                  | Shahjahan's daugh-ter Jehanara Begum        |
| Moti Masjid                         | Agra                  | Shahjahan                                   |
| Nagina Masjid                       | Agra                  | Shahjahan                                   |
| Mina Masjid                         | Agra                  | Shahjahan                                   |
| Anand Bhawan                        | Prayagraj (Allahabad) | Motilal Nehru                               |
| Akbar Fort                          | Prayagraj             | Akbar                                       |
| Chota Imambara                      | Lucknow               | Muhammad Ali Shah                           |
| Bada Imambara                       | Lucknow               | Asaf-ud-Daula                               |
| Dwarkadheesh Temple                 | Mathura               | Seth Gokul Das Parikh                       |
| Sati Burj                           | Mathura               | Raja Bhagwan Das                            |
| Akbar's Tomb                        | Sikandra              | Akbar and Jahangir                          |
| Govind Dev Temple                   | Vrindavan             | Amber's Raja Man Singh                      |
| Radha Vallabh Temple                | Vrindavan             | Sundar Das                                  |
| Shri Rangji Temple                  | Vrindavan             | –                                           |
| Shahji Temple                       | Vrindavan             | Shah Kundan Lal                             |
| <b>❑ Gujarat</b>                    |                       |                                             |
| <b>Tourist Places</b>               | <b>Location</b>       | <b>Built by</b>                             |
| Jhulta Minar (The Shaking Minarets) | Ahmedabad             | Sidi Bashir                                 |
| Sabarmati Ashram                    | Ahmedabad             | Mahatma Gandhi                              |
| Kankaria Lake                       | Ahmedabad             | Sultan Qutbuddin Ahmed Shah II              |

| ❑ Delhi (Union Territory)           |                        |                                                                               |
|-------------------------------------|------------------------|-------------------------------------------------------------------------------|
| Tourist Places                      | Location               | Built by                                                                      |
| Qutb Minar                          | Delhi                  | Qutbuddin Aybak & Iltutmish (Restoration and Expansion by Firuz Shah Tughlaq) |
| Tughlakabad                         | Delhi                  | Ghiyasuddin Tughluq                                                           |
| Hauz Khas                           | Delhi                  | Alauddin Khalji                                                               |
| Red Fort                            | Delhi                  | Shahjahan                                                                     |
| Humayun's Tomb                      | Delhi                  | Biga Begum (Hajji Begum)                                                      |
| Old Fort                            | Delhi                  |                                                                               |
| Safdarjung Tomb                     | Delhi                  | Shuja-ud-daula                                                                |
| Laxmi Narayan Temple                | Delhi                  | J.K. Birla                                                                    |
| Khirki Masjid                       | Delhi                  | Khan-i Jahan Junan Shah                                                       |
| Jama Masjid                         | Delhi                  | Shahjahan                                                                     |
| Moti Masjid                         | Delhi                  | Aurangzeb                                                                     |
| India Gate                          | New Delhi              | Edwin Lutyen (Architect)                                                      |
| Rashtrapati Bhavan                  | New Delhi              | Edwin Lutyen & Herbert Baker (Architect)                                      |
| ❑ Jammu & Kashmir (Union Territory) |                        |                                                                               |
| Tourist Places                      | Location               | Built by                                                                      |
| Chashme Shahi                       | Srinagar               | Shahjahan                                                                     |
| Nishat Bagh                         | Srinagar               | Asif Khan                                                                     |
| Pathar Mosque                       | Srinagar               | Noor Jahan                                                                    |
| Shalimar Bagh                       | Srinagar               | Jahangir                                                                      |
| Hazratbal Shrine                    | Srinagar               | Sadiq Khan                                                                    |
| Charar-i-Sharief                    | Srinagar               | Zain-ul-Abedin                                                                |
| ❑ Bihar                             |                        |                                                                               |
| Tourist Places                      | Location               | Built by                                                                      |
| Vishnupad Temple                    | Gaya                   | Rani Ahilyabai                                                                |
| Golghar                             | Patna                  | Captain John Garstin                                                          |
| Padri ki Haveli                     | Patna                  | Father Joseph                                                                 |
| Takht Sri Harimandir Singh          | Patna                  | Maharaja Ranjit Ji Patna Sahib                                                |
| Sher E Shahi (Jama Masjid)          | Patna                  | Sher Shah                                                                     |
| Pathar ki Masjid                    | Patna                  | Parvez Shah                                                                   |
| Sher Shah Tomb                      | Sasaram Sher Shah Suri |                                                                               |
| ❑ West Bengal                       |                        |                                                                               |
| Tourist Places                      | Location               | Built by                                                                      |
| Fort William                        | Kolkata                | –                                                                             |
| Belur Math                          | Kolkata                | Swami Vivekanand                                                              |
| Dakshineswar Kali Temple            | Kolkata                | Rani Rashmoni                                                                 |
| Nakhoda Masjid                      | Kolkata                | Abdur Rahim Osman                                                             |

| Victoria Memorial                                        | Kolkata (Architect) | W. Emerson                   |
|----------------------------------------------------------|---------------------|------------------------------|
| Acharya Jagadish Chandra Bose (Kolkata) Botanical Garden | Howrah              | Colonel Robert Kyd           |
| Shantiniketan                                            | West Bengal         | Devendra Nath Tagore         |
| ❑ Uttarakhand                                            |                     |                              |
| Tourist Places                                           | Location            | Built by                     |
| Jim Corbett Park                                         | Nainital            | –                            |
| Lakshman Jhula                                           | Rishikesh           | –                            |
| ❑ Punjab                                                 |                     |                              |
| Tourist Places                                           | Location            | Built by                     |
| Darbar Sahib (Golden Temple)                             | Amritsar            | Maharaja Ranjit Singh        |
| ❑ Odisha                                                 |                     |                              |
| Tourist Places                                           | Location            | Built by                     |
| Konark Temple                                            | Puri                | Narasimhadeva I              |
| Jagannath Temple                                         | Puri                | King Anantavarman Chodaganga |

### UNESCO World Heritage Sites : Indian Cultural and Natural Sites

| Place                                                     | State                  | Year |
|-----------------------------------------------------------|------------------------|------|
| Tajmahal                                                  | Uttar Pradesh          | 1983 |
| Agra Fort                                                 | Uttar Pradesh          | 1983 |
| Ellora Caves                                              | Maharashtra            | 1983 |
| Ajanta Caves                                              | Maharashtra            | 1983 |
| Konark Sun Temple                                         | Odisha                 | 1984 |
| Group of Monuments at Mahabalipuram                       | Tamil Nadu             | 1984 |
| Keoladeo National Park                                    | Rajasthan              | 1985 |
| Manas Wildlife Sanctuary                                  | Assam                  | 1985 |
| Kaziranga National Park                                   | Assam                  | 1985 |
| Khajuraho Group of Monuments                              | Madhya Pradesh         | 1986 |
| Churches and Convents of Old Goa                          | Goa                    | 1986 |
| Group of Monuments at Hampi                               | Karnataka              | 1986 |
| Fatehpur Sikri                                            | Uttar Pradesh          | 1986 |
| Sunderbans National Park                                  | West Bengal            | 1987 |
| Elephanta Caves                                           | Maharashtra            | 1987 |
| Group of Monuments at Pattadakal                          | Karnataka              | 1987 |
| Great Chola Temple                                        | Tamil Nadu 1987, 2004  |      |
| Nanda Devi & Valley of Flowers National Park Sanchi Stupa | Uttarakhand 1988, 2005 |      |
| Sanchi Buddhist Monument                                  | Madhya Pradesh         | 1989 |
| Qutb Minar and Its Monuments                              | Delhi                  | 1993 |
| Humayun's Tomb                                            | Delhi                  | 1993 |



|                                                                                         |                                                           |           |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------|-----------|
| Mountain Railways of India                                                              | West Bengal/Tamil Nadu                                    | 1999-2005 |
| Darjeeling Railway /Nilgiri/ Kalka-Shimla Railway                                       | Himachal Pradesh                                          | 2008      |
| Red Fort                                                                                | Delhi                                                     | 2007      |
| Mahabodhi Temple (Bodh Gaya)                                                            | Bihar                                                     | 2002      |
| Bhimbetka Rock Shelters                                                                 | Madhya Pradesh                                            | 2003      |
| Chatrapati Shivaji Terminus (Victoria Terminus)                                         | Maharashtra                                               | 2004      |
| Champaner-Pavagadh Archaeological Park                                                  | Gujarat                                                   | 2004      |
| Jantar Mantar (Jaipur)                                                                  | Rajasthan                                                 | 2010      |
| Western Ghats                                                                           | Karnataka, Kerala, Maharashtra, Tamil Nadu, Goa & Gujarat | 2012      |
| Hill Forts of Rajasthan                                                                 | Rajasthan                                                 | 2013      |
| A. Gagron Fort                                                                          | Jhalawar (Rajasthan)                                      | 2013      |
| B. Chittorgarh Fort                                                                     | Rajasthan                                                 | 2013      |
| C. Amber Fort                                                                           | Jaipur (Rajasthan)                                        | 2013      |
| D. Kumbhalgarh Fort                                                                     | Rajsamand                                                 | 2013      |
| E. Jaisalmer Fort                                                                       | Jaisalmer                                                 | 2013      |
| F. Ranthambhore Fort                                                                    | Sawai Madhopur (Rajasthan)                                | 2013      |
| Great Himalayan National Park                                                           | Himachal Pradesh                                          | 2014      |
| Rani ki Vav                                                                             | Patan (Gujarat)                                           | 2014      |
| The Architectural Work of Le Corbusier, An Out Standing Contribution to Modern Movement | Chandigarh                                                | 2016      |
| Archaeological Site of Nalanda Mahavihara                                               | Bihar                                                     | 2016      |
| Khangchendzonga National Park                                                           | Sikkim                                                    | 2016      |
| Historical City of Ahmedabad                                                            | Gujarat                                                   | 2017      |
| Victorian Gothic and Art Deco Ensembles of Mumbai                                       | Maharashtra                                               | 2018      |
| Jaipur City                                                                             | Rajasthan                                                 | 2019      |
| Kakatiya Rudreshwara (Ramappa) Temple                                                   | Telangana                                                 | 2021      |
| Dholavira: A Harappan city                                                              | Gujarat                                                   | 2021      |
| Charaideo's Maidams                                                                     | Assam                                                     | 2024      |

📌 **Note :** In November, 2021 UNESCO has included Srinagar in the prestigious list of Creative Cities Network in the category of 'Folk Art and Culture and Craft'.

### Major Cultural Institutions of India and Their Year of Establishment

| Establishment Year | Institutions                                         |
|--------------------|------------------------------------------------------|
| 1985               | East Zonal Cultural Centre (Kolkata)                 |
| 1986               | North Central Zone Cultural Centre (NCZCC Prayagraj) |

|                            |                                                                                                          |
|----------------------------|----------------------------------------------------------------------------------------------------------|
| 1945                       | Anthropological Survey of India (Kolkata)                                                                |
| 1948                       | National Library (Kolkata)                                                                               |
| 1952                       | Sangeet Natak Akademi (Inaugurated in 1953)                                                              |
| 1954                       | Lalit Kala Academy                                                                                       |
| 1959                       | National School of Drama (NSD)                                                                           |
| 1861                       | Archaeological Survey of India (ASI)                                                                     |
| 1784                       | Asiatic Society                                                                                          |
| 1985                       | Indira Gandhi National Centre for the Arts                                                               |
| 1891                       | National Archives of India                                                                               |
| 1891                       | Central Secretariat Library                                                                              |
| <b>State's Folk Dances</b> |                                                                                                          |
| <b>State</b>               | <b>Folk Dance</b>                                                                                        |
| Andhra Pradesh             | Chaddi, Siddhi Madhuri, Kuchipudi (Classical), Ghantamardala, Kummi, etc.                                |
| Assam                      | Bagurumba, Bihu, Nettle, Khel Gopal, Natpuja, Maharas, Kaligopal, Jhumura Hobjanai, etc.                 |
| Arunachal Pradesh          | Buiya, Chalo, Wancho, Ponung, Popir, Mask Dance, etc.                                                    |
| Uttar Pradesh              | Nautanki, Raslila, Jhula, Jadda, Kajree, Jaita, Chachri, Jangar, Jhora, Dhola, Dadra and Charakula, etc. |
| Uttarakhand                | Garhwali, Kumayuni, Jhora, Kajree, Chappeli, Raslila, etc.                                               |
| Gujarat                    | Dandiya Raas, Garba, Bhavai, Tippani, Padhar, Panihari, Nritya, etc                                      |
| Odisha                     | Odishi (Classical), Paika, Chhau, Chaitighoda, Ghoomara, etc.                                            |
| Bihar                      | Jhijhiya, Jat-Jatin, Kajari, Sohar-Khilouna,                                                             |
| Nagaland                   | Rangma, Bamboo Dance, Noorlim, Chong, Khaiva, Kuminaga, etc.                                             |
| Goa                        | Dekhni, Dhalo, Mando, Fugdi, Jagar, Koli, Tarangmail, Dhangar Dance, etc.                                |
| Karnataka                  | Karga, Yakshgana, Kunitha, Veeragase, Lambi, etc.                                                        |
| Kerala                     | Mohiniattam (Classical), Kathakali (Classical), Kaikotti kali, Thulal, Padayani, Kondattam etc..         |
| Chhattisgarh               | Jhoomar, Karma, Gendi Pandavani, Navarani, Diwari, Tapali, Panthi, Gaur Maria, Raut Nacha, etc.          |
| Jammu & Kashmir            | Damali, Hekat, Kud Dandinach, Mendajas, Rauf, etc.                                                       |
| Jharkhand                  | Alkap, Karya Munda, Paika, Jat-Jatin, Danga, Karama, Sirhul, Chhau, Domkach, Fagua, etc.                 |
| Tamil Nadu                 | Karagam Kavadi, Kummi, Kolattam, Bharatanatyam (Classical), etc.                                         |

|                  |                                                                                                                     |
|------------------|---------------------------------------------------------------------------------------------------------------------|
| West Bengal      | Jatra, Dhali, Bowl, Kirtan, Marasia, Gambhira, Mahal, Chhau, Kathi, etc.                                            |
| Punjab           | Bhand, Naqual, Dhaman, Bhangra, Daff, Giddha, etc.                                                                  |
| Madhya Pradesh   | Swang, Matki, Gangaaur, Badhai, Baredi, Naurata, Ahirai, Bhagoria, Pandavani, Teratali etc.                         |
| Mizoram          | Chailam, Jagtalam, Cheraw, Khullam, Thanglam, etc.                                                                  |
| Meghalaya        | Ka Shad Suk Mynsiem, Nongkrem, Laho, etc.                                                                           |
| Manipur          | Thangata, Khamba, Thoibi, Maharas, Rankhat, Manipuri (Classical), Rakhal, Nataras, Pung Chulom, Nupa, etc.          |
| Maharashtra      | Dahikala Dashavatar, Powada, Mauji, Lejim, Koli, Nakata, Lavani, Tamasha, Kavita, Bohada, Gafa, Gauricha, etc.      |
| Rajasthan        | Chakri, Kalbeliya, Panihari, Gangaaur, Neja, Fundi, Jhuma, Ghapal, etc.                                             |
| Himachal Pradesh | Jhamkada, Losar Shona Chuksam, Dandanach, Chapeli, Dhaman, Jhanta, Mahathu, Jhali, Nati, Dangi, Cham, Lahauli, etc. |

### Graveyards of Great Men

| Persons                | Places                     | Life Span |
|------------------------|----------------------------|-----------|
| Mahatma Gandhi         | Rajghat (New Delhi)        | 1869-1948 |
| Dr. Rajendra Prasad    | Mahaprayan Ghat (Patna)    | 1884-1963 |
| Jawaharlal Nehru       | Shanti Van (New delhi)     | 1889-1964 |
| Dr. B. R. Ambedkar     | Chaitya Bhumi (Mumbai)     | 1891-1956 |
| Morarji Desai          | Abhay Ghat (Ahemdabad)     | 1896-1995 |
| Guljari Lal Nanda      | Narayan Ghat (Ahemdabad)   | 1898-1998 |
| Chaudhari Charan Singh | Kisan Ghat (New Delhi)     | 1902-1987 |
| Lal Bahadur Sashtri    | Vijay Ghat (New Delhi)     | 1904-1966 |
| Jagjivan Ram           | Samta Sthal (New Delhi)    | 1908-1986 |
| Giani Zail Singh       | Ekta Sthal (New Delhi)     | 1916-1994 |
| Indira Gandhi          | Shakti Sthal (New Delhi)   | 1917-1984 |
| Shankar Dayal Sharma   | Karma Bhumi (New Delhi)    | 1918-1999 |
| Indra Kumar Gujral     | Smriti Sthal (New Delhi)   | 1919-2012 |
| K.R. Narayanan         | Uday Bhumi (New Delhi)     | 1920-2005 |
| Chandrashekar          | Jannayak Sthal (New Delhi) | 1927-2007 |
| Rajiv Gandhi           | Vir Bhumi (New Delhi)      | 1944-1991 |
| Atal Bihari Vajpayee   | Sadaiv Atal (New Delhi)    | 1924-2018 |

### Sites Related To Great Men

| Persons       | Sites                                              |
|---------------|----------------------------------------------------|
| Mahavir Swami | Pavapuri, Kundgram                                 |
| Gautam Buddha | Lumbini, Kapilvastu, Kushinagar, Bodhgaya, Sarnath |
| Jesus Christ  | Jerusalem, Nazareth                                |

|                         |                                          |
|-------------------------|------------------------------------------|
| Mohammad Sahib          | Mecca, Medina                            |
| Napoleon                | Corsica, Waterloo                        |
| Alexander The Great     | Macedonia                                |
| Emperor Akbar           | Fatehpur Sikri                           |
| Tipu Sultan             | Srirangapatnam, Mysuru                   |
| Maharana Pratap         | Chittor, Haldi Ghati                     |
| Guru Nanak              | Talwandi (Nankana Sahib), Kartarpur      |
| Sardar Patel            | Bardoli, Nadiad                          |
| Mahatma Gandhi          | Sabarmati, Sevagram, Porbandar           |
| Jawaharlal Nehru        | Anand Bhavan, Teen Murti Bhavan          |
| Vinoba Bhave            | Pavanar                                  |
| Arvind Ghosh            | Puducherry, Kolkata                      |
| Ramakrishna Paramahansa | Belur                                    |
| Subhas Chandra Bose     | Cuttack                                  |
| Dr. Rajendra Prasad     | Ziradei                                  |
| Rabindranath Thakur     | Shanti Niketan                           |
| Nelson Mandela          | Trafalgar                                |
| Abraham Lincoln         | Kentucky                                 |
| Bhagat Singh            | Lahore, Banga                            |
| Chandrashekar Azad      | Alfred Park, (Chandrashekhhar Azad Park) |

### India's Major Folk Arts

| States         | Folk Arts               |
|----------------|-------------------------|
| Uttar Pradesh  | Chowk Purna             |
| Gujarat        | Sathiya                 |
| Bihar          | Godna, Madhubani        |
| Rajasthan      | Henna, Rangoli, Mandana |
| West Bengal    | Alpana                  |
| Odisha         | Pattachitra             |
| Maharashtra    | Warli Painting          |
| Andhra Pradesh | Kalamkari, Nirmal       |
| Madhya Pradesh | Gond                    |

### Great deeds and Great Personalities related to them

| Persons             | Works                                                       |
|---------------------|-------------------------------------------------------------|
| Panini              | founder of Sanskrit grammar                                 |
| Maharishi Gautam    | founder of Nyaya Darshan                                    |
| Guru Arjun Dev      | construction of Golden Temple                               |
| Guru Govind Singh   | Founder of Khalsa Panth                                     |
| Vinoba Bhave        | Founder of Boodan Movement, establishment of Pawanar Ashram |
| Rabindranath Thakur | Establishment of Vishwa Bharati                             |

|                     |                                                |
|---------------------|------------------------------------------------|
| Baba Amte           | Establishment of Anandwan                      |
| Arvind Ghosh        | Establishment of Auroville Ashram (Puducherry) |
| Karl Marx           | Founder Scientific Socialism                   |
| Mother Teresa       | Founder of Nirmal Hriday                       |
| Henry Dunant        | Establishing of Red Cross                      |
| Robert Baden-Powell | Establishing of Scouting                       |
| Newton              | Principle of Universal Gravity                 |
| Aryabhatta          | Discovers Zero                                 |
| Maharshi Kapil      | originator of Sankhya philosophy.              |

### Dates of Establishment of Major States

| State Foundation Day                                                                  | Date        |
|---------------------------------------------------------------------------------------|-------------|
| Nagaland Day                                                                          | 1 December  |
| Manipur, Meghalaya & Tripura Day                                                      | 21 January  |
| Mizoram & Arunachal Pradesh Day                                                       | 20 February |
| Bihar Day                                                                             | 22 March    |
| Rajasthan Day                                                                         | 30 March    |
| Utkal (Odisha) Day                                                                    | 1 April     |
| Uttar Pradesh Day                                                                     | 24 January  |
| Himachal Pradesh Day                                                                  | 25 January  |
| Gujarat and Maharashtra Day                                                           | 1 May       |
| Sikkim Day                                                                            | 16 May      |
| Telangana Day                                                                         | 2 June      |
| Punjab, Haryana, Chhattisgarh, Madhya Pradesh, Karnataka, Kerala & Andhra Pradesh Day | 1 November  |
| Goa Day                                                                               | 30 May      |

### Renowned Personalities and Their Nicknames

| Persons                   | Nicknames                               |
|---------------------------|-----------------------------------------|
| Bhagat Singh              | Shaheed - E - Azam                      |
| Subhash Chandra Bose      | Netaji                                  |
| Mahatma Gandhi            | Rashttrapita, Bapu                      |
| Rajendra Prasad           | Deshratna, Ajatshatru                   |
| Rabindranath Thakur       | World Poet, Kaviguru, Gurudev, Frontier |
| Khan Abdul Gaffar Khan    | Frontier Gandhi                         |
| Muhammad Ali Jinnah       | Quaid-e-Azam                            |
| Dadabhai Naoroji          | Grand old man of India                  |
| Raja Rammohan Rai         | The father of Indian Renaissance        |
| Sardar Vallabh Bhai Patel | Iron Man                                |
| William Evert Gladstone   | Old Man of British Politics             |
| Lal Bahadur Shastri       | Man of Peace                            |
| Queen Elizabeth           | Madame Queen                            |

|                                                             |                                         |
|-------------------------------------------------------------|-----------------------------------------|
| Lala Lajpat Rai                                             | Punjab Kesari                           |
| Napoleon Bonaparte                                          | The Man of Destiny, The Little Corporal |
| Ashutosh Mukherjee                                          | Bengal Kesari                           |
| Kazi Nazrul Islam                                           | Rebel Poet                              |
| Dr. Srikrishna Singh                                        | Bihar Kesari                            |
| Mohammed-bin-Tughluq                                        | A Mixture of Contrasts                  |
| T. Prakasam                                                 | Andhra Kesari                           |
| Dhundiraj Govind Phalke                                     | Grandfather of Indian Films             |
| Sheikh Abdullah                                             | Sher-e-Kashmir                          |
| Yatindra Mohan Sengupta                                     | Deshpriya                               |
| Jayprakash Narayan                                          | Loknayak                                |
| Vallabhbhai Patel                                           | Sardar                                  |
| Sheikh Mujiburrahman                                        | Bangabandhu                             |
| Anugraha Narayan Singh                                      | Bihar Vibhuti                           |
| Chittaranjan Das                                            | Deshbandhu                              |
| Clive Lloyd                                                 | Super Cat                               |
| Bal Gangadhar Tilak                                         | Lokmanya                                |
| Pt. Madan Mohan Malaviya                                    | Mahamana                                |
| Major General Rajinder Singh                                | Sparrow                                 |
| Karpoori Thakur                                             | Jananayak                               |
| Chakravarti Rajagopalachari                                 | Rajaji                                  |
| C.F. Andruj                                                 | Deenbandhu                              |
| Ho Chi Minh                                                 | Uncle Ho                                |
| Jain - Ul - Abidin                                          | Akbar of Kashmir                        |
| Purushottam Das Tandon                                      | Rajarshi                                |
| Chandrashekhar                                              | Yuva Turk                               |
| Chaudhary Devi Lal                                          | Tau                                     |
| P.T Usha                                                    | Udanpari                                |
| Amir Khusro                                                 | Tota-e-Hind                             |
| Annie Besant                                                | Ma                                      |
| Lata Mangeshkar                                             | Swar Kokila                             |
| Sarojini Naidu                                              | Bharat Kokila                           |
| M.S. Golwalkar                                              | Guruji                                  |
| Lala Lajpat Rai, Bal Gangadhar Tilak, and Vipin Chandra Pal | Lal, Bal, Pal                           |
| Samudragupta                                                | Indian Napoleon                         |
| Jagjivan Ram                                                | Babuji                                  |
| Chanakya                                                    | Indian Machiavelli                      |
| Sunil Gavaskar                                              | Little Master                           |
| Martin Luther King                                          | Black Gandhi                            |
| John of Arc                                                 | Made of Orleans                         |
| Kapil Dev                                                   | Haryana Hurricane                       |

|                                                      |                              |
|------------------------------------------------------|------------------------------|
| Geoffrey Chaucer                                     | Father of English Poetry     |
| Major Dhyanchand                                     | Hockey Wizard                |
| Adolf Hitler                                         | Fuehrer                      |
| Syed Bandhu (Abdullah Khan and Syed Husain Ali Khan) | King Maker of Indian History |
| Mahakavi Kalidas                                     | Indian Shakespeare           |
| Jamnalal Bajaj                                       | Fifth son of Mahatma Gandhi  |
| William Shakespeare                                  | Bard of Avon                 |
| Ravi Shankar Maharaj                                 | Father of Gujarat            |
| Valmiki                                              | Adikavi                      |
| Florence Nightingale                                 | Lady with the Lamp           |
| Milkha Singh                                         | Flying Sikh                  |
| Sathyabhama Das Biju                                 | The Frogman of India         |
| A.R. Rahman                                          | The Mozart of Madras         |
| Rahul Dravid                                         | The Wall                     |

### Major Research Institutes of India

| Name of the Institutes                                        | Location            |
|---------------------------------------------------------------|---------------------|
| National Sugar Institute of India                             | Kanpur (U.P.)       |
| Indian Institute of Pulses Research                           | Kanpur (U.P.)       |
| Indian National Science Academy                               | New Delhi           |
| Indian Council of Agricultural Research                       | New Delhi           |
| Indian Meteorological Department                              | New Delhi           |
| Central Road Research Institute                               | New Delhi           |
| Indian Institute of Soil Sciences                             | Bhopal (M.P.)       |
| Central Institute of Medicinal Research                       | Lucknow (U.P.)      |
| National Institute of Immunology                              | New Delhi           |
| All India Institute of Medical Sciences (AIIMS)               | New Delhi           |
| National Botanical Research Institute                         | Lucknow (U.P.)      |
| Indian Institute of Toxicology Research                       | Lucknow (U.P.)      |
| Central Research Institute for Jute and Allied Fibres         | Barrackpore (W. B.) |
| Archaeological Survey of India                                | New Delhi           |
| Indian Institute of Petroleum                                 | Dehradun (U.K)      |
| National Vision Disability Empowerment                        | Dehradun (U.K)      |
| Indian Institute of Survey,                                   | Dehradun (U.K)      |
| Indian Institute of Chemical & Bio-sciences                   | Kolkata (W. Bengal) |
| Central Glass & Ceramic Institute                             | Kolkata (W.Bengal)  |
| National Geophysical Research Institute                       | Hyderabad           |
| National Brain Research Institute                             | Gurugram            |
| National Environmental Engineering Research Institute (NEERI) | Nagpur (M.H.)       |
| National Rice Research Institute                              | Cuttack (Odisha)    |

|                                                     |                         |
|-----------------------------------------------------|-------------------------|
| Centre for DNA and Finger Printing Diagnostics      | Hyderabad               |
| Bharat Electronics Limited                          | Bengaluru (H.Q.)        |
| Cellular and Molecular Biology, Science Center      | Hyderabad               |
| Central Water and Power Research Station            | Pune (M.H.)             |
| High Latitude Research Laboratory                   | Gulmarg (J.K.)          |
| Banaras Locomotive Works                            | Varanasi (UP)           |
| Plasma Research Institute                           | Gandhinagar (Gujarat)   |
| ICAR-Indian Grassland and Fodder Research Institute | Jhansi (Uttar Pradesh)  |
| Central Mining & Fuel Research Institute            | Dhanbad (J.H.)          |
| Central Institute of Horticulture                   | Lucknow (U.P.)          |
| Institute of Microbial Technology                   | Chandigarh              |
| Institute of Ecology                                | Bangaluru (K.A.)        |
| National Institute of Oceanography                  | Panaji (Goa)            |
| Indian Geomagnetic Institute                        | Mumbai (M.H.)           |
| Central Potato Research Institute                   | Shimla (H.P.)           |
| Central Planting Crop Research Institute            | Kasargod (Kerala)       |
| Central Salt & Marine Chemical Research Institute   | Bhavnagar (Gujarat)     |
| Central Mechanical Engineering Research Institute   | Durgapur (W. Bengal)    |
| Central Electrical Chemistry Research Institute     | Koraikudi (T.N.)        |
| Central Building Research Institute                 | Roorkee (U.K.)          |
| Central Food Technology Research Institute          | Mysore (Karnataka)      |
| India Security Press                                | Nashik (M.H.)           |
| Tata Institute of Fundamental Research              | Mumbai (M.H.)           |
| Bhabha Atomic Research Center Trombay               | Mumbai (Maharashtra)    |
| National Metallurgical Laboratory                   | Jamshedpur (Jharkhand)  |
| Central Agmark Laboratory                           | Nagpur (Maharashtra)    |
| Indian Sugarcane Research Institute                 | Lucknow (U.P.)          |
| Raman Research Institute                            | Bangaluru (Karnataka)   |
| Central Leather Research Institute                  | Chennai (Tamil Nadu)    |
| National Dairy Research Institute                   | Karnal (Haryana)        |
| National Occupational Health Institute              | Ahmedabad (Gujarat)     |
| CPR Environmental Education Centre                  | Chennai (Tamil Nadu)    |
| Central Tobacco Research Institute Rajahmundry      | (Andhra Pradesh)        |
| Sugarcane Breeding Institute                        | Coimbatore (Tamil Nadu) |
| Forest Research Institute                           | Dehradun (Uttarakhand)  |
| Ramakrishna Mission Culture Institute               | Kolkata (West Bengal)   |
| Centre for Nano and Self Matter Sciences            | Bengaluru (Karnataka)   |



| Major Instruments of India and Their Players |                                                                                                                                                                                                  |
|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Musical Instrument                           | Player                                                                                                                                                                                           |
| 1. Flute                                     | Hariprasad Chaurasia, Ronu Majumdar, Pannalal Ghosh, Santosh Sant, V. Kunjmani, Rajendra Prasanna, S. Neela, Rajendra Kulkarni, etc.                                                             |
| 2. Sitar                                     | Vilayat Khan, Pandit Ravi Shankar, Nikhil Ranjan Banerjee, Shahid Parvez, Bande Hasan, Budhaditya Mukherjee, Pt. Umashankar Mishra, Manju Mehta, Niladri Kumar, etc.                             |
| 3. Sarod                                     | Ayan Ali Khan, Rajeev Taranath, Vikas Maharaj, Alauddin Khan, Hafiz Khan, Ali Akbar Khan, Amjad Ali Khan, Zarine Daruwala, Vishwajeet Rai Chaudhary, Mukesh Sharma, P. Buddhadev Das Gupta, etc. |
| 4. Tabla                                     | Lachhu Maharaj, Shankar Ghosh, Swapan Chaudhary, Alla Rakha Khan, Latif Khan, Zakir Hussain, Kishan Maharaj, Gudai Maharaj, Sukhwinder Singh Pinky, Fayyad Khan, etc.                            |
| 5. Veena                                     | Badruddin Dagar, Sundaram, Balachandran, V. Doraiswami Iyengar, Kalyanakrishna Bhagavatar, etc.                                                                                                  |
| 6. Shehnai                                   | Ali Ahmed Hussain Khan, Bismillah Khan, Dayashankar Jagannath, Anant Lal, Madhukar T. Dhumal, etc.                                                                                               |
| 7. Violin                                    | Sangeeta Shankar, Dr. N. Rajam, Ambi Subrahmanyam, Vishnu Govind Jog, T.N. Krishnan, Kunnakudi Vaidyanathan, Sandeep Thakur, Jyotsna Srikanth, etc.                                              |
| 8. Pakhavaj                                  | Pt. Madan Mohan, Pt. Bholanath Pathak, Gopaldas, Chhatrapati Singh, Ustad Rahman Khan, etc.                                                                                                      |
| 9. Santoor                                   | Shivkumar Sharma, Tarun Bhattacharya, Bhajan Sopori Abhay Rustom Sopori, etc.                                                                                                                    |
| 10. Mridang                                  | Thanjavur Ramamurthy, Thakur Bhikham Singh, T.V. Gopala-Krishnan, Dr. Jagdish Singh, A.S. Rajagopal, etc.                                                                                        |
| 11. Rudravina                                | Pt. Vishwa Mohan Bhatt, Asad Ali Khan, Ustad Sadiq Ali Khan, Jyoti G. Hegde, etc.                                                                                                                |
| 12. Nadaswaram                               | Rajaratnam Pillai, Neeru Swami Pillai, Sheikh Chinna Maulana, T.K. Venupila, Haripad Murukadas, etc.                                                                                             |
| 13. Sarangi                                  | Ustad Bundu Khan, Ram Narayan, Sabri Khan, etc.                                                                                                                                                  |

| Major Classical Dances and Dance Artists |                                                                                                                                                                                                                                                                                         |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dance                                    | Artist                                                                                                                                                                                                                                                                                  |
| 1. Kathak                                | Sukhdev Maharaj, Lachhu Maharaj, Birju Maharaj, Gopi Krishna, Shovana Narayan, Sitara Devi, Chandralekha, Malavika Sarkar, Manjari Chaturvedi, Gauri Jog, Achchan Maharaj, Bindadin Maharaj, Narayan Prasad, Saswati Sen, etc.                                                          |
| 2. Odissi                                | Kelucharan Mohapatra, Mohan Goswami, Pankaj Charandas, Harekrishna Behera, Mayadhar Rawat, Sonal Mansingh, Kiran Sehgal, Samyukta Panigrahi, Rani Karna, Madhavi Mudgal, Indrani Rahman, Kalicharan Patnaik, Kumkum Mohanty, Sujata Mahapatra, Sharon Lowen (US), etc.                  |
| 3. Kuchipudi                             | Shobha Naidu, Raja Reddy, Radha Reddy, Yamini Krishnamurthy, Lakshmi Narayan Shastri, Swapna Sundari, Vedantam Satyanarayana Sharma, Vempati Chinna Satyam, Payal Ramchandani, Arunima kumar, Pratiksa Kashi, Uma Rama Rao, etc.                                                        |
| 4. Kathakali                             | Krishnan Nair, Uday Shankar, Ballal Tol Narayan Menon, Mrinalini Sarabhai, Shanta Rao, Krishnan Kutty, Anand Sivaraman, Gopi, Kanak Rale, Keshavan Namboodiri, Ruby Mishra, etc.                                                                                                        |
| 5. Bharatanatyam                         | Rukmani Devi Arundel, Yamini Krishnamurthy, Sonal Mansingh, Padma Subrahmanyam, T. Bala Saraswati, Ramgopal, S.K. Saroj, Mrinalini Sarabhai, Leela Samson, Malavika Sarkar, Vyjayanthi Mala Bali, Priyadarshini Govind, Nalini Prakas, Priya Murle, Kumari Kavita Ramu etc.             |
| 6. Mohiniattam                           | Ragini Devi, Bharti Shivaji, Kalyani Kutti Amma, Sridevi, Shanta Rao, Hema Malini, Tara Nidigadi, Geeta Singer, Sunandya Nair, Gopika Verma, Vijayalakshmi, Radha Dutta, Pallavi Krishnan, etc.                                                                                         |
| 7. Manipuri                              | Nal Kumar Singh, Atamb Singh, Guru Amli Singh, Jhaveri Sisters (Darshana, Nayana, Suvarna and Ranjana Jhaveri), Kalavati Devi, Savita Mehta, Charu Mathur, Rema Srikanth, Bimbavati, Gopal Singh, Guru Vipin Singh, Rajkumar Singhjeet Singh, Guru Nileswar Mukherjee, Sohini Ray, etc. |



### 3

## Indian Security System

- The Government of India ensures the security of the country.
- The highest command of the armed forces lies with the President. The actual responsibility of national security rests with the Cabinet.
- Indian Army, Navy and Air Force have their headquarters in New Delhi.
- Indian Army, Navy and Air force are divided into 7, 3 and 7 commands respectively.
- Chief Commanding Officer is the Chief of each Army Command.

### Commands and Headquarters of Indian Army, Navy and Air Force

| Army Commands              | Headquarters           |
|----------------------------|------------------------|
| Northern Command           | Udhampur               |
| Southern Command           | Pune                   |
| Western Command            | Chandimandir (Haryana) |
| Eastern Command            | Kolkata                |
| Southern - Western Command | Jaipur                 |
| Central Command            | Lucknow                |
| Training Command           | Shimla                 |

- The Chief of Naval Staff is an officer of Admiral rank.
- Each Command of Navy is headed by a Vice Admiral.

| Naval Command    | Headquarters  |
|------------------|---------------|
| Western Command  | Mumbai        |
| Eastern Command  | Visakhapatnam |
| Southern Command | Kochi         |

- The Chief of the Air Force is the Chief of the Air Staff, who is of the rank of 'Air Chief Marshal'.

| Airforce Commands     | Headquarters       |
|-----------------------|--------------------|
| Western Command       | New Delhi          |
| Eastern Command       | Shillong           |
| Southern Command      | Thiruvananthapuram |
| Central Command       | Prayagraj          |
| South-Western Command | Gandhinagar        |
| Training Command      | Bengaluru          |
| Maintenance Command   | Nagpur             |

### Posts of Commissioned Officers in Indian Forces

| Army               | Airforce          | Naval        |
|--------------------|-------------------|--------------|
| General            | Air Chief Marshal | Admiral      |
| Lieutenant General | Air Marshal       | Vice-Admiral |
| Major General      | Air Vice-Marshal  | Rear-Admiral |

|                    |                   |                      |
|--------------------|-------------------|----------------------|
| Brigadier          | Air Commodore     | Commodore            |
| Colonel            | Group Captain     | Captain              |
| Lieutenant Colonel | Wing Commander    | Commander            |
| Major              | Squadron Leader   | Lieutenant Commander |
| Captain            | Flight Lieutenant | Lieutenant           |
| Lieutenant         | Flying Officer    | Sub - Lieutenant     |

### Indian Naval Training Institutes

| Indian Naval         | Training Institutes |
|----------------------|---------------------|
| INS Shivaji          | Lonavala            |
| INS Chilka           | Khordha             |
| Indian Naval Academy | Kannur              |

### Indian Air Force Training Institute

|                                  |            |
|----------------------------------|------------|
| Air Force Academy                | Hyderabad  |
| Air Force Technical College      | Bengaluru  |
| Air Force Administrative College | Coimbatore |
| Paratroopers Training School     | Agra       |
| Elementary Flying School         | Bidar      |

### Indian Army Training Institute

|                               |             |
|-------------------------------|-------------|
| Indian Military Academy       | Dehradun    |
| National Defence College      | New Delhi   |
| National Defence Academy      | Khadakwasla |
| Defence Service Staff College | Wellington  |
| Artillery School              | Deolali     |
| Infantry School               | Mhow*       |
| Armored Corps Center          | Ahmednagar  |

\* Madhya Pradesh Government in 2003 has renamed the city as Dr. Ambedkar Nagar.

### 4

## Indian Internal Security System

### National Cadet Corps (NCC):

- National Cadet Corps was established in 1948.
- Its headquarter is located in New Delhi.
- The motto of the National Cadet Corps is 'Unity and Discipline'.
- NCC flag was introduced in 1954. It had three colours, red is for the Army, Deep Blue' for the Navy and Light Blue for the 'Air Force'. In the middle are the letters NCC and the golden NCC crest covered by a wreath of lotus.

### Border Security Force (BSF):

- Border Security Force was established in 1965.
- Its headquarter is located in Delhi. Its task is to defend the country's borders.

### Assam Rifles:

- Assam Rifles is the oldest paramilitary force in India. It was established in 1835 in the name in 'Cachar Levy'.

- Its headquarter is located in Shillong.
- Assam Rifles are called '**Sentinels of the Northeast**' and 'Friends of the Hill People'.

### **Central Reserve Police Force - (CRPF):**

- On **July 27, 1939**, the Crown Representative Police was established.
- It was renamed CRPF on 28 December 1949.
- Its headquarter is located in Delhi.
- Rapid Action Force (RAF) is a part of the Central Reserve Police Force.
- Rapid Action Force was set up on 11 December, 1991 to deal with riot-like situations. This organization came into full existence in October 1992.
- CRPF is the only force in the paramilitary forces consisting of 6 women battalions.
- 88 (Female) Battalion was established in 1986 as the first female battalion.

### **Sashastra Seema Bal:**

- Special Service Bureau was formed in 1963.
- It was renamed as 'Sashastra Seema Bal' (SSB) on 15 December, 2003.

### **Indo - Tibetan Boarder Police (ITBP):**

- Indo-Tibetan Border Police (ITBP) was formed in October, 1962.
- Its headquarter is located in New Delhi.
- The motto of ITBP is - Shaurya - Dridhata - Karma Nishtha.

### **Central Industrial Security Force (CISF):**

- Central Industrial Security Force 'was formed in 1969 to protect the industrial complexes of the Central Government.
- Its headquarter is located in New Delhi.

### **National Security Guards (NSG):**

- National Security Guards (NSG) was formed in 1986 to face the challenges of terrorism in India.
- Its headquarter is located in New Delhi.
- Its motto is 'Sarvatra Sarvottam Suraksha'.

## **5 International Awards and Honours**

### **Noble Prize**

- The Nobel Prize is set up by Alfred Bernard Nobel, a world-renowned Swedish scientist and inventor of dynamite, with interest from Permanent Fund of 10 Lakh Pound - 5 different fields - (1) **Literature**, (2) **Medical Science**, (3) **Physics**, (4) **Chemistry** and (5) **Peace**, is given in this field with special and notable contributions.
- The field of Economic Science was conferred with the Nobel Prize Award of Sweden in 1968, on the occasion of Sveriges Riksbank, **30th anniversary**.
- The first prize in economics was conferred in **1969**.
- Between 1901 and 2023, the Nobel Prize and the Sveriges Riksbank Prize in Economic Sciences in Memory of

Alfred Nobel were awarded 621 times to 1000 people and **Organisation**.

- Significantly in 1968, Sveriges Riksbank established the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel.
- The first Nobel Prize in Peace, Literature, Medicine, Chemistry and Physics was awarded in 1901.
- The Nobel Prize is announced each year in **October**.
- Nobel Prize is distributed on December 10, Alfred Nobel's death anniversary.
- Each Nobel Prize can award up to three people in a year.
- The Nobel Prize has so far been awarded only twice to dead persons - **Eric Axel Karlfeldt (in 1931)** and **Dag Hammarskjold (in 1961)**.
- In 1974, it was made a rule that Nobel Prize would not be awarded posthumously.
- The Red Cross has been awarded the Nobel Peace Prize three times (**1917, 1944 and 1963**).
- In 1915, Sir William Henry Bragg was succeeded by his son William L. Bragg, along with the Nobel Prize in Physics.
- Lawrence Bragg (**25 years old male**) and Malala Yusufzai (**17 years old female**) are the youngest Nobel Prize recipients.
- John Goodenough (**97 years**) is the oldest person to receive the **Nobel Prize**.

### **Two Times Nobel Prize Winners**

|                     |                                                       |
|---------------------|-------------------------------------------------------|
| 1. Marie Curie      | Nobel Prize in Physics in 1903 and in Chemistry 1911. |
| 2. Linus Pauling    | Chemistry in 1954 and Peace Prize in 1962.            |
| 3. John Bardeen     | Nobel Prize in Physics in 1956 and 1972.              |
| 4. Frederick Sanger | Nobel Prize for Chemistry in 1958 and 1980            |

### **Nobel Laureates (Scholars of India and Indian Origin) in 1980**

- **Abhijeet Banerjee** (born 1961) Indian-American Abhijeet Banerjee received the 2019 Nobel Prize in Economic Science. The award was given jointly with his wife Esther Dufflow and Harvard University professor Michael Kramer. He was awarded for his "**experimental approach to global poverty alleviation**". The famous books written by Abhijeet Banerjee and Esther Dufflow are "**Poor Economics**" and "**Good Economics for Hard Times**".
- **Kailash Satyarthi** (born 1954): In 2014, Kailash Satyarthi was awarded a Nobel Prize for his struggle against the oppression of children and youth and the right to education of all children. He was born in Vidisha, Madhya Pradesh. He has a degree in Electrical Engineering and a Master's Degree in High Voltage Engineering. He started the **Bachpan Bachao Andolan** in 1980, giving his career as an Electrical Engineer. He also led the global movement

against child labour. All this is a campaign of solidarity at the global level for the Protection and Promotion of Children's Rights.

- **Amartya Sen** (born 1933): Prof. Amartya Sen was awarded Nobel Prize for Economic Science in 1998. He is the first Asian to receive this honour. Shantiniketan born this scholarly economist has presented the concept of public welfare economics.
- **Subrahmanyam Chandrasekhar** (1910-1995): Dr. Subrahmanyam Chandrasekhar, an astrophysicist, was awarded Nobel Prize for Physics in 1983. He was educated at Presidency College, Chennai. He is the nephew of Nobel Laureate Sir C.V. Raman. Later, he moved to America. He propounded the theory in the constellations named 'White Dwarf'. The limit he has set for the mass of these constellations is called the Chandrasekhar Limit. His theory revealed many mysteries in the origin of the universe.
- **Mother Teresa** (1910–1997): Mother Teresa received the Nobel Peace Prize in 1979. She was born in Albania at Skopje which is now in Yugoslavia. Her childhood name was Agnes Gonxha Bojaxhiu. She joined the Sisters of Loreto in Ireland in 1928 and came to Kolkata in 1929 as a missionary. To serve the poor and the sick, he formed an organization called **Missionaries of Charity** and Nirmal Hridaya for the leprosy patients, drug addicts and the afflicted.
- **Hargobind Khurana** (1922-2011): Hargobind Khurana was awarded Nobel Prize for research in the field of Medicine in **1968**. He was born in Raipur (now in Pakistan). He earned a doctorate in chemistry from the University of Liverpool. In 1960, he became a professor at the University of Wisconsin. He explained **the genetic code by his discovery and explored its role in protein synthesis**.
- **Chandrasekhar Venkataraman** (1888–1970): The first Indian Dr. Chandrasekhar Venkataraman received Nobel Prize for Physics in 1930. Raman was born in Thiruvanaikkaval near Tiruchirappalli in Tamil Nadu. He studied at the Presidency College, Chennai. Later, he became the Professor of Physics at Kolkata University. He received many awards and honours. He was awarded the title of 'Sir' and received the Nobel Prize for significant research in the field of **optics**. He found from his research how rays of other wavelengths are also present in divergent light. His discovery is known as the **Raman Effect**. This discovery made in 1928 explains the frequency change in light rays passing through a transparent medium.
- **Rabindranath Tagore (1861–1941)**: Rabindranath Tagore was the first Indian to receive the Nobel Prize for Literature. Rabindranath Tagore, known as '**Gurudev**', was born on 7 May 1861 in Kolkata. He was awarded **Nobel Prize in Literature** for his book of poems **Gitanjali in 1913**.

Gitanjali and Sadhana are his important works. Renowned as a great poet, play writer and novelist, Gurudev also composed the National Anthem. Devendra Nath Tagore founded Shanti-Niketan and later the institute converted in Vishwabharati University by Rabindranath Tagore. It is significant to mention here that Bangladesh's national anthem lifted "Amar Shonar Bangla" was penned by Rabindranath Tagore in 1905.

- **Venkataraman Ramakrishnan (born 1952)**: Venkataraman Ramakrishnan was awarded Nobel Prize in Chemistry in 2009 for his study on the structure and function of ribosomes, the molecular machine that makes proteins. He was born in Chidambaram, Tamil Nadu. He did his MS in Physics from the University of Baroda, Gujarat in 1971. He did his PhD in Physics from Ohio University USA in 1976. He studied at the University of California San Diego from 1976 to 1978 as a graduate student in molecular rhodopsin biology.

### Oscar Awards

- The Oscar Awards (Academy Awards) started in 1929.
- The Oscar Awards are presented by the **US National Academy of Motion Picture Arts and Sciences**.
- George Bernard Shaw and famous American singer and songwriter Bob Dillon have received both the Oscar Award and the Nobel Prize (**for Literature**).
- The Oscar Awards nominee for the Best Foreign Language Indian Film (first) was Mehboob Khan's '**Mother India**' (1958).
- Bhanu Athaiya is the first Indian woman to receive an Oscar Award (**for 'Gandhi'**).
- Satyajit Ray was the first Indian to receive the Lifetime Achievement Time Award of Oscar (Honorary Awards) in 1992 for his achievements.
- Significantly in Oscar, 2023 India's 'The Elephant Whisperers' wins Best Documentary Short while RRR song '**NATU-NATU**' gets best Original Song Award.

### Pulitzer Prize:

- Pulitzer Prize was started in **1917**.
- The award is given in the name of American publisher Joseph Pulitzer for his outstanding contribution in the field of Newspaper, magazine, online journalism, literature and musical composition.
- It is awarded by Columbia University, USA.

### Grammy Awards :

- Grammy Awards are given annually by National Academy of Recording Arts and Sciences (The Recording Academy).
- Each year, the prize is awarded to what is in the opinion of the judges, the best novel of the year written in English and published in the UK and Ireland.

### Booker Prize:

- Man Booker Prize was started in 1969.
- The award is being conferred by the Man Group. In February 2019, a charitable organization Crackstart joined as its financial provider. So now, the word 'Man' has been removed from its name.
- Each year, the prize is awarded to what is, in the opinion of the judges, the best novel of the year written in English and published in the U.K. and Ireland.

✎ **Note :** It is noteworthy that "**Kairos**" by Jenny Erpenbeck, translated by Michael Hofmann, has been named the winner of the International Booker Prize 2024.

### Ramon Magsaysay Award:

- Ramon Magsaysay Award is being conferred by the Government of the Philippines from 1958 in memory of Ramon Magsaysay, the former President of the country.
- It was established in year 1957.
- It is called 'Asia's Nobel Prize', Asia's most prestigious award.

✎ **Note :** The 1959 Ramon Magsaysay Award was presented to Tibetan spiritual leader the Dalai Lama in April, 2023.

### Kalinga Award :

- Kalinga Award was first provided in 1952 and established in 1951.
- The award is given by UNESCO for its extraordinary effort to popularize science.

## 6 National Awards and Honours

### Bharat Ratna :

- Bharat Ratna Award was instituted in 1954.
- It is the highest civilian honour of the country.
- It is awarded in recognition of exceptional service/performance of the highest order in any field of human endeavour.
- The medal of Bharat Ratna is of the shape of a peepal leaf, on which the picture of the sun is inscribed.
- Former Prime Minister Indira Gandhi is the first woman to be awarded Bharat Ratna.
- Lal Bahadur Shastri was awarded Bharat Ratna posthumously in 1966.
- The first foreigner awarded Bharat Ratna was Abdul Gaffar Khan.

### Padma Awards :

- One of the highest civilian awards of the country, Padma Award is given in three categories - Padma Vibhushan, Padma Bhushan and Padma Shri.
- These awards are given in Arts, Social Work, Public Affairs, Science and Engineering, Business and Industry, Medicine, Literature and Education, Sports, Administrative Services, etc.

- Padma Vibhushan is given for exceptional and distinguished services. Padma Bhushan is given for distinguished services of higher order and Padma Shri for distinguished services in any field.
- These awards are announced every year on the eve of Republic Day.

### Gallantry Awards :

- The soldiers of the Government of India, who have made incredible contributions or made supreme sacrifices for the defence of the country, are awarded various medals for this valor.
- After Independence, three gallantry awards i.e. Paramvir Chakra, Mahavir Chakra and Vir Chakra were instituted by the Government of India on 26 January, 1950.
- On January 4, 1952, the other three gallantry awards i.e. Ashok Chakra Category-I, Ashoka Chakra Category-II and Ashoka Chakra Category-III were introduced. These awards were renamed as Ashoka Chakra, Kirti Chakra and Shaurya Chakra respectively in January, 1967.
- The order of priority of these awards is Paramvir Chakra, Ashoka Chakra, Mahavir Chakra, Kirti Chakra, Vir Chakra and Shaurya Chakra.

### Important Awards: Field and Prize Money

| Awards                                | Field and Prize Money                                            |
|---------------------------------------|------------------------------------------------------------------|
| 1. Jnanpith                           | Award in the field of literature (Rs 11 lakh)                    |
| 2. Dadasaheb Phalke Award             | in the field of film (Golden Lotus and Rs 10 lakh)               |
| 3. Saraswati Samman                   | in field of literature (Rs. 15 Lakh)                             |
| 4. Vachaspati Award                   | for outstanding contribution to Sanskrit Literature (Rs. 1 Lakh) |
| 5. Vyas Samman                        | in the field of literature (Rs. 3.50 Lakh).                      |
| 6. Kabir Award                        | for Social Harmony (Rs. 1.50 Lakh)                               |
| 7. Major Dhyan Chand Khel Ratna Award | for Meritorious Performance in Sports Games (25 Lakhs Rs.)       |
| 8. Arjuna Award                       | in the field of Sports (Rs. 15 Lakh)                             |
| 9. Dhyan Chand Award                  | for Lifetime Achievements in Sports (Rs. 10 Lakh)                |
| 10. Dronacharya Award                 | in the field of Sports training (15 lakh rupees)                 |
| 11. Dhanvantari Award                 | in the field of Medicine                                         |
| 12. Shanti Swarup Bhatnagar Prize     | in the field of Science (Rs. 5 lakh)                             |
| 13. Borlaug Award                     | in the field of environment and agriculture.                     |

### Paramveer Chakra:

- It is the highest award for bravery.
- Its medal consists of four replicas of 'Indra's Vajra' with bronze built, spherical and embossed state emblem at center. On its backside, the Paramvir Chakra is written in Hindi and English with two Lotus flowers. Its lace is plain and purple in colour.



### **Mahavir Chakra:**

- This medal is made of spherical and standard silver. An embossed star with five corners is engraved on its façade. Its centre piece is engraved with the state emblem (including the motto).
- After this, Mahavir Chakra is written in both Hindi and English with two Lotus flowers.
- Its lace is half white and half orange in colour.

### **Veer Chakra:**

- This medal is made of circular and standard silver.
- A five-pointed embossed star is engraved on its façade. The state emblem (including the motto) is engraved in the central part.
- Veer Chakra is written in Hindi and English with two Lotus flowers in the back.
- Its lace is half blue and half orange in colour.

### **Ashoka Chakra:**

- Circular, a facade of the Ashoka Chakra is engraved in the centre on its obverse, with a lotus garland around it, on the reverse the word Ashoka Chakra in Hindi and English is inscribed.
- Its lace is green and divided into two equal parts by an orange vertical line.

### **Kirti Chakra:**

- It is circular in shape and made of standard silver. Its facade is engraved with a replica of the Ashoka Chakra surrounded by a lotus rosary. It is engraved in Hindi and English on the back.
- Green colour ribbon divided into three equal parts by two orange vertical lines.

### **Shaurya Chakra:**

- It is circular in shape and is made of bronze. Its facade is engraved with a replica of the Ashoka Chakra surrounded by a lotus rosary. The back side has the Shaurya Chakra written in Hindi and English.
- Its lace is green and divided by three orange vertical lines into equal parts.

### **Jawaharlal Nehru Award:**

- This award was instituted in 1965.
- ₹ 25 lakhs and a citation are provided under this award.
- It is administered by the Indian Council for International Cultural Relations.

### **Gandhi Peace Prize:**

- This award is being given since 1995 by the Government of India to a person who played a significant role in **World Peace**.
- One crore and a citation are provided under this award.
- Jnanpith Award is the highest award of India in the field of literature.

### **Persons Honoured with Bharat Ratna**

| Person                                                                                                      | Year |
|-------------------------------------------------------------------------------------------------------------|------|
| 1. Chakravarti Rajagopalachari, Dr. Sarvepalli Radhakrishnan and Chandrasekhar Venkataraman                 | 1954 |
| 2. Dr. Bhagwan Das, Dr. Mokshagundam Visvesvaraya and Jawaharlal Nehru                                      | 1955 |
| 3. Pt. Govind Ballabh Pant                                                                                  | 1957 |
| 4. Dr. Dhondo Keshav Karve                                                                                  | 1958 |
| 5. Bidhan Chandra Roy and Rajarshi Purushottam Das Tandon                                                   | 1961 |
| 6. Dr. Rajendra Prasad                                                                                      | 1962 |
| 7. Dr. Zakir Hussain and Dr. Pandurang Vaman Kane                                                           | 1963 |
| 8. Lal Bahadur Shastri*                                                                                     | 1966 |
| 9. Indira Gandhi                                                                                            | 1971 |
| 10. Varahgiri Venkata Giri                                                                                  | 1975 |
| 11. Kumaraswamy Kamaraj*                                                                                    | 1976 |
| 12. Mother Teresa                                                                                           | 1980 |
| 13. Acharya Vinoba Bhave*                                                                                   | 1983 |
| 14. Khan Abul Gaffar Khan                                                                                   | 1987 |
| 15. Marudur Gopalan Ramachandran*                                                                           | 1988 |
| 16. Dr. Bhimrao Ramji Ambedkar* and Nelson Mandela                                                          | 1990 |
| 17. Rajiv Gandhi*, Sardar Vallabhbhai Patel* and Morarji Desai                                              | 1991 |
| 18. Maulana Abul Kalam Azad*, JRD Tata and Satyajit Ray                                                     | 1992 |
| 19. A.P.J. Abdul Kalam, Gulzarilal Nanda and Aruna Asaf Ali*                                                | 1997 |
| 20. M.S. Subbulakshmi and C. Subrahmanyam                                                                   | 1998 |
| 21. Pt. Ravi Shankar, Prof. Amartya Sen and Gopinath Bardoloi*, Jayaprakash Narayan*                        | 1999 |
| 22. Lata Mangeskar, Ustad Bismillah Khan                                                                    | 2001 |
| 23. Bhimsen Joshi                                                                                           | 2009 |
| 24. Sachin Tendulkar and Chintamani Nagesh Ramchandra Rao (CNR Rao)                                         | 2014 |
| 25. Atal Bihari Vajpayee and Madan Mohan Malviya*                                                           | 2015 |
| 26. Pranab Mukherjee, Bhupen Hazarika* and Nanaji Deshmukh                                                  | 2019 |
| 27. Karpooori Thakur*, M.S. Swaminathan*, P.V. Narasimha Rao*, Lal Krishna Advani*, Chaudhary Charan Singh* | 2024 |
| * = Posthumous                                                                                              |      |

### **Jnanpith Award Honoured Litterateur**

| Writer                                | Work & Glory                                    | Year |
|---------------------------------------|-------------------------------------------------|------|
| 1. G. Shankar Kurup                   | Odakkujal (Malayalam)                           | 1965 |
| 2. Tarashankar Bandopadhyay           | Ganadevata (Bangla)                             | 1966 |
| 3. K.V. Puttappa and Umashankar Joshi | Ramayana Darshanam (Kannada) (Gujarati) Nishith | 1967 |



|     |                                                |                                                   |      |
|-----|------------------------------------------------|---------------------------------------------------|------|
| 4.  | Sumitranandan Pant                             | Chidambra (Hindi)                                 | 1968 |
| 5.  | Firaq Gorakhpuri                               | Gul - A - Nagma (Urdu)                            | 1969 |
| 6.  | Vishwanath Satyanarayana                       | Srimad Ramayana Kalpavriksham (Telugu)            | 1970 |
| 7.  | Vishnu De                                      | Smriti Satta Bhavisht (Bangla)                    | 1971 |
| 8.  | Ramdhari Singh Dinkar                          | 'Urvashi (Hindi)                                  | 1972 |
| 9.  | Gopinath Mohanti and D.R. Bendre               | Matimtal (Oriya) Nakutanti (Kannada) respectively | 1973 |
| 10. | Vishnu Sakha Khandekar                         | Yayati (Marathi)                                  | 1974 |
| 11. | P.V. Akilandam                                 | Chittapavai (Tamil)                               | 1975 |
| 12. | Shrimati Ashapura Devi. (First Lady)           | First Prathruti (Bengali)                         | 1976 |
| 13. | Dr. K.Sivaram Karanth.                         | Mookazjia Kansuguv (Kannada)                      | 1977 |
| 14. | Dr. Sachchidananda Hiranand Vatsyayan 'Agyeya' | Kitni Navon Mein Kitni Bar (Hindi)                | 1978 |
| 15. | Dr. Virendra Kumar Bhattacharya                | Mrityunjay (Assamese)                             | 1979 |
| 16. | S.K. Pottetak                                  | Oru Desatinte Katha (Malayalam)                   | 1980 |
| 17. | Amrita Pritam                                  | Kagaz Te Canvas (Punjabi)                         | 1981 |
| 18. | Mahadevi Verma                                 | Yama (Hindi)                                      | 1982 |
| 19. | Venkatesh Iyengar                              | Chikkavir Rajendra (Kannada)                      | 1983 |
| 20. | Thaka-zhi Shivshankar Pillai                   | Kayar (Malayalam)                                 | 1984 |
| 21. | Pannalal Patel (Gujarati)                      | Manavini Bhavai                                   | 1985 |
| 22. | Sachchidanand Rautare                          | Oriya Literature                                  | 1986 |
| 23. | Vishnu Vaman Shirwadkar                        | Marathi Literature                                | 1987 |
| 24. | Dr. C.Narayan Reddy                            | Telugu Literature                                 | 1988 |
| 25. | Qurratulain Hyder                              | Urdu Literature                                   | 1989 |
| 26. | Vinayak Krishna Gokak                          | Kannada Literature                                | 1990 |
| 27. | Subhash Mukhopadhyay                           | Bangla Literature                                 | 1991 |
| 28. | Naresh Mehta                                   | Hindi Literature                                  | 1992 |

|     |                                                          |                                           |      |
|-----|----------------------------------------------------------|-------------------------------------------|------|
| 29. | Dr. Sitakant Mahapatra                                   | Odia Literature                           | 1993 |
| 30. | U.R. Ananthamurthi                                       | Kannada Literature                        | 1994 |
| 31. | M.T. Vasudevan Nair                                      | Malayalam Literature                      | 1995 |
| 32. | Shrimati Mahasweta Devi                                  | Bangla Literature                         | 1996 |
| 33. | Ali Sardar Jafri                                         | Urdu Literature                           | 1997 |
| 34. | Girish Karnad                                            | Kannada Literature                        | 1998 |
| 35. | Nirmal Verma and Gurudayal Singh                         | Hindi and Punjabi Literature respectively | 1999 |
| 36. | Indira Goswami                                           | Assamese Literature                       | 2000 |
| 37. | Rajendra Keshavlal Shah                                  | Gujarati Literature                       | 2001 |
| 38. | D.Jayakantan                                             | Tamil Literature                          | 2002 |
| 39. | Vinda Karandikar                                         | Marathi Literature                        | 2003 |
| 40. | Rahman Rahi                                              | Kashmiri Literature                       | 2004 |
| 41. | Kunwar Narayan                                           | Hindi Literature                          | 2005 |
| 42. | Rabindra Kelekar and Satyavrat Shastri                   | Konkani & Sanskrit Literature             | 2006 |
| 43. | O.N.V. Kurup                                             | Malayalam Literature                      | 2007 |
| 44. | Shaharyar                                                | Urdu Literature                           | 2008 |
| 45. | Amarkant and Shrilal Shukla                              | Hindi Literature                          | 2009 |
| 46. | Chandrasekhar Kambar                                     | Kannada Literature                        | 2010 |
| 47. | Pratibha Ray                                             | Odia Literature                           | 2011 |
| 48. | Dr. Rawuri Bhardwaj                                      | Telugu Literature                         | 2012 |
| 49. | Kedarnath Singh                                          | Hindi Literature                          | 2013 |
| 50. | Bhalchandra Nemade                                       | Marathi Literature                        | 2014 |
| 51. | Raghuveer Chaudhary                                      | Gujarati Literature                       | 2015 |
| 52. | Shankha Ghosh                                            | Bangla Literature                         | 2016 |
| 53. | Krishna Sobti                                            | Hindi Literature                          | 2017 |
| 54. | Amitav Ghosh (First Prize Winner for English Literature) | English Literature                        | 2018 |
| 55. | Akkitham Achuthan Namboothiri                            | Malayalam Literature                      | 2019 |
| 56. | Nilmani Phookan                                          | Assamese Literature                       | 2021 |
| 57. | Damodar Maujo                                            | Konkani Literature                        | 2022 |
| 58. | Swami Rambhadra Charya                                   | Sanskrit Literature                       | 2023 |
| 57. | Gulzar                                                   | Urdu Literature                           | 2023 |

### Dadasaheb Phalke Awardees

| Person                     | Year |
|----------------------------|------|
| 1. Devika Rani Roerich     | 1969 |
| 2. Virendranath Sarkar     | 1970 |
| 3. Prithviraj Kapoor       | 1971 |
| 4. Pankaj Mullick          | 1972 |
| 5. Sulochana (Ruby Myers)  | 1973 |
| 6. B.N. Reddy              | 1974 |
| 7. Dhiren Nath Ganguly     | 1975 |
| 8. Kanan Devi              | 1976 |
| 9. Nitin Bose              | 1977 |
| 10. Raichandra Boral       | 1978 |
| 11. Sohrab Modi            | 1979 |
| 12 P. Jairaj               | 1980 |
| 13. Naushad Ali            | 1981 |
| 14. L.V. Prasad            | 1982 |
| 15. Durga Khote            | 1983 |
| 16. Satyajit Ray           | 1984 |
| 17. V. Shantaram           | 1985 |
| 18. B.Nagi Reddy           | 1986 |
| 19. Raj Kapoor             | 1987 |
| 20 Ashok Kumar             | 1988 |
| 21. Lata Mangeskar         | 1989 |
| 22. Akkineni Nageswara Rao | 1990 |
| 23. Bhalji Pendharkar      | 1991 |
| 24. Bhupen Hazarika        | 1992 |
| 25. Majrooh Sultanpuri     | 1993 |
| 26. Dilip Kumar            | 1994 |
| 27. Dr. Rajkumar           | 1995 |
| 28. Shivaji Ganesan        | 1996 |
| 29. Kavi Pradeep           | 1997 |
| 30. BR Chopra              | 1998 |
| 31. Hrishikesh Mukherjee   | 1999 |
| 32 Asha Bhosle             | 2000 |
| 33. Yash Chopra            | 2001 |
| 34. Dev Anand              | 2002 |
| 35. Mrinal Sen             | 2003 |
| 36. Adoor Gopalakrishnan   | 2004 |
| 37. Shyam Benegal          | 2005 |
| 38. Tapan Sinha            | 2006 |
| 39. Manna Dey              | 2007 |
| 40. V.K.Murthy             | 2008 |
| 41. D.Ramanaidu            | 2009 |
| 42 K. Balachander          | 2010 |
| 43. Soumitra Chatterjee    | 2011 |

|                                  |      |
|----------------------------------|------|
| 44. Pran                         | 2012 |
| 45. Gulzar (Sampurn Singh Kalra) | 2013 |
| 46. Shashi Kapoor (Balbir Raj)   | 2014 |
| 47. Manoj Kumar                  | 2015 |
| 48. Kasinathuni Vishwanath       | 2016 |
| 49. Vinod Khanna                 | 2017 |
| 50. Amitabh Bachchan             | 2018 |
| 51. Rajni Kanth                  | 2019 |
| 52. Asha Parekh                  | 2020 |
| 53. Ms. Waheeda Rehman           | 2021 |

### Major Indian Writers and Their Books

| Writers              | Books                                                                                             |
|----------------------|---------------------------------------------------------------------------------------------------|
| Asvaghosha           | Buddhachritam                                                                                     |
| Banabhatta           | Kadambari                                                                                         |
| Firdausi             | Shahnamah                                                                                         |
| Shudrak              | Mrichakatikam (Clay Toy)                                                                          |
| Vatsyayana           | Kamasutra                                                                                         |
| Pliny                | Natural History                                                                                   |
| Dandi                | Dashkumarcharitam, Avanti Sundari                                                                 |
| Amar Singh           | Amarkosh                                                                                          |
| Surdas               | Sahitya- Lehri, Sursagar                                                                          |
| Jimutavahan          | Daibagh                                                                                           |
| Gulbadan Begum       | Humayun-nama                                                                                      |
| Bhrartruhari         | Neeti- Shatak                                                                                     |
| Nirad C. Chaudhary   | Hinduism, A Passage to England, The Autobiography of an Unknown Indian, Culture in the Vanity Bag |
| Vishnu Sharma        | Panchatantra                                                                                      |
| Raskhan              | Premavatika                                                                                       |
| Rabindra Nath Tagore | Chitrangada, Geetanjali, Bistarjan, The Gardener, The Hungry Stones, Gora, Chandalika             |
| Maithilisharan Gupta | Bharat - Bharati                                                                                  |
| Amrita Pritam        | Kagaz Te Canvas, Pinjar, Rasidi Ticket                                                            |
| Khushwant Singh      | Indira Gandhi Returns, The Company of Women, Train to Pakistan.                                   |
| Vijay Tendulkar      | Sakharam Binder, Khamosh ! Adalat Jarri Hai                                                       |
| Vedvyas              | Shrimad Bhagvad Gita, Mahabharata                                                                 |
| Indira Gandhi        | Eternal India                                                                                     |
| Jaishankar Prasad    | Kamayani, Aansu, Lahar, Kankal, Titali                                                            |

|                             |                                                                                                                                      |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Arvind Ghosh                | The Life Divine, Essays on Geeta, Letters on Yoga                                                                                    |
| Suryakant Tripathi 'Nirala' | Anamika, Parimal, Kukurmata                                                                                                          |
| Mahadevi Varma              | Yama, Neehar, Neerja, Atit Ke Chalchitra, Smriti ki Rekhayein                                                                        |
| Nayantara Sehgal            | A Vice for Freedom, Rich Like Us                                                                                                     |
| V.S. Naipaul                | An Area of Darkness, In a Free State, A Bend in the River                                                                            |
| Visakhadatta                | Mudrarakshaas                                                                                                                        |
| Panini                      | Ashtadhyayi                                                                                                                          |
| Dr. S. Radhakrishnan        | Indian Philosophy                                                                                                                    |
| Vigyaneshwar                | Mitakshara                                                                                                                           |
| Kalhan                      | Rajatarangini                                                                                                                        |
| Chanakya                    | Arthashastra                                                                                                                         |
| Kalidas                     | Kumarasambhavam, Raghuvansham, Abhigyan Shakuntalam                                                                                  |
| Jayadev                     | Geet Govind                                                                                                                          |
| Bhavabhuti                  | Malati Madhav, Uttararamcharitam                                                                                                     |
| Malik Mo. Jayasi            | Padmavat                                                                                                                             |
| Abul Fazl                   | Aine Akbari, Akbarnama                                                                                                               |
| Kabirdas                    | Bijak, Ramani, Sabad                                                                                                                 |
| Alberuni                    | Kitab-ul-Hind                                                                                                                        |
| Mulk Raj Anand              | Quli, Confession of a Lover, Untouchable                                                                                             |
| Kuldip Nayar                | The Judgment, Distant Neighbours, India-The Critical Years, In Jail, India After Nehru, Beyond the Lines (Auto-biography)            |
| Kazi Nazrul Islam           | Agniveena                                                                                                                            |
| Swami Shivanand             | Practice of Brahmacharya, Philosophy of Dreams, Japyoga                                                                              |
| Prem Chand                  | Godan, Gaban Karmabhoomi, Rangbhumi, Sevasadan, Nirmala                                                                              |
| B.M. Kaul                   | The Untold Story, Confrontation with Pakistan                                                                                        |
| Agyey                       | Kitni Navon men Kitni baar, Shekhar : Ek Jivani, Apne-Apne Ajnabi, Nadi Ke Dweep, Hari ghas par Kshan Bhar, Are yayarwar Rahega Yad? |
| Sarojini Naidu              | The Golden Threshold, The Broken Wing                                                                                                |
| Yashpal                     | Dada Comrade, Jhutha Sach, Meri Teri Uski Baat                                                                                       |
| Sumitranandan Pant          | Kala Aur Budha Chand, Gramya, Pallav, Chidambara                                                                                     |

|                             |                                                                       |
|-----------------------------|-----------------------------------------------------------------------|
| Ramdhari Singh 'Dinkar'     | Kurukshetra, Urvashi                                                  |
| R. K Narayan                | The Dark Room, Malgudi Days, The Guide, My Days, The Financial Expert |
| Devkinandan Khatri          | Chandrakanta                                                          |
| Sarat chandra Chattopadhyay | Devdas, Charitraheen, Srikanth                                        |
| R.C. Dutta                  | The Economic History of India                                         |
| Dr. B.R. Ambedkar           | Waiting for a Visa                                                    |

### Latest Famous Books and Its Authors

| Books                                                                  | Authors                                        |
|------------------------------------------------------------------------|------------------------------------------------|
| The Race of my life                                                    | Milkha Singh                                   |
| Freedom in Exile                                                       | Dalai Lama                                     |
| The Discomfort of Evening                                              | Marieke Lucas Rijneveld                        |
| One Arranged Murder                                                    | Chetan Bhagat                                  |
| Five Point Someone                                                     | Chetan Bhagat                                  |
| Amazing Ayodhya                                                        | Neena Roy                                      |
| Hurda                                                                  | Atharva Pandit                                 |
| Quaterlife                                                             | Devika Rege                                    |
| The winner's Mindset                                                   | Shane Watson                                   |
| India-the Road to Renaissance : A Vision and an Agenda                 | Bhimeswara Challa                              |
| "Knife" - A harrowing Tale of Resilience and the fight for Free speech | Salman Rushdie                                 |
| The conspiracy                                                         | Gotabaya Rajapaksa                             |
| Basic Structure and Republic                                           | P.S. Sreedharan Pillai                         |
| Sculpted Stones : Mysteries of Mamallapuram                            | Ashwin Prabhu                                  |
| Ek Samandar Mere Andar                                                 | Sanjeev Joshi                                  |
| Assam's Brave heart Lachit Barphukan                                   | Arup Kumar Dutta                               |
| Resolved : Uniting Nations in a Divided World                          | Ban-Ki-Moon                                    |
| Cooking to save your life                                              | Abhijit Banerjee                               |
| Lal Salaam                                                             | Smriti Irani                                   |
| Veer Savarkar : The man who could have prevented partition             | Uday Mahurkar and Chirayu Pandit               |
| Actually I Met them : A Memoir                                         | Gulzar                                         |
| Hit Refresh                                                            | Satya Nadella, Greg Shaw, Jill Tracie, Nichols |
| A Century Is Not Enough                                                | Sourav Ganguly                                 |

|                                                                |                             |
|----------------------------------------------------------------|-----------------------------|
| Unstoppable: My Life So Far                                    | Maria Sharapova             |
| Exam Warriors                                                  | Narendra Modi               |
| The English Patient                                            | Michael Ondaatje            |
| Inheritance of Loss                                            | Kiran Desai (SSC CHSL 2017) |
| Golden Girl                                                    | P.T. Usha (MPPCS Pre, 2013) |
| Leila                                                          | Prayaag Akbar               |
| Skyfire                                                        | Arun Raman                  |
| Swapnpash                                                      | Manisha Kulshrestha         |
| India Positive, Half Girlfriend, 2 States, Five Points Someone | Chetan Bhagat               |
| Meluha's Mritunjay, Naga's Secret                              | Amish Tripathi              |
| The Accidental Prime Minister                                  | Sanjay Baru                 |
| We Are Displaced                                               | Malala Yousafzai            |
| The Stolen Light                                               | Veda Mehta                  |
| A River Sutra                                                  | Geeta Mehta                 |
| My Frozen Turbulence in Kashmir                                | Jagmohan                    |
| The Degeneration of India                                      | T.N. Seshan                 |
| Sansad Upanishad                                               | M.F. Hussain                |
| Rajiv                                                          | Sonia Gandhi                |
| Sanskar                                                        | U.R. Ananthamurthy          |
| The Rediscovery of India                                       | Meghnad Desai               |
| A Brush with Life                                              | Satish Gujral               |
| My Country My Life                                             | Lal Krishna Advani          |
| Half a Life                                                    | V.S. Naipal                 |
| Straight From the Heart                                        | Kapil Dev                   |
| A New World                                                    | Amit Chaudhary              |
| Somnath: The Many Vices of a History                           | Romila Thapar               |
| The Namesake, Interpreter of Maladies                          | Jhumpa Lahiri               |
| Burial at Sea                                                  | Khushwant Singh             |
| Fasting, Feasting                                              | Anita Desai                 |
| Let's Kill Gandhi                                              | Tushar A. Gandhi            |
| Ignited Minds                                                  | A.P.J. Abdul Kalam          |
| Heads and Tales                                                | Maneka Gandhi               |
| Towards a Hunger-Free World                                    | M.S. Swaminathan            |
| Seshan: An Antiment Story                                      | K. Govindan Kutty           |
| Sansad Meen Teen Dashak                                        | Atal Bihari Vajpayee        |

|                                                      |                                              |
|------------------------------------------------------|----------------------------------------------|
| Blind Man Of Hindoostan :                            | General K. Sundarji<br>Indo-Pak Nuclear War  |
| The God Of Small Things                              | Arundhati Roy                                |
| Kargil From Surprise to Victory                      | General V.P. Malik                           |
| Rediscovery of India                                 | Meghnad Desai<br>(UPPCS Pre, 2010)           |
| My country my life                                   | Lal Krishna Advani<br>[UK PSC (Mains), 2006] |
| Wings of Fire                                        | Dr. A.P.J. Abdul Kalam<br>(SSC CHSL, 2017)   |
| The God of Small Things                              | Arundhati Rai (CPO SI, 2022)                 |
| Mother Teresa                                        | Naveen Chawla                                |
| Netaji and Gandhi                                    | B.K. Ahluwalia & Shashi Ahluwalia            |
| India Towards Anarchy (1967-92)                      | N.S. Saxena                                  |
| The Golden Gate, A Suitable Boy                      | Vikram Seth                                  |
| The Insider                                          | P.V. Narasimha Rao                           |
| Indian Controversies: Essays on Religion in Politics | Arun Shourie                                 |
| The Brief History of Time                            | Stephen Hawking                              |
| Mission to India                                     | Stanley Kalpage                              |
| Doctor of the East                                   | Benazir Bhutto                               |
| First Person                                         | Vladimir Putin                               |
| Peace has no Alternative                             | Mikhail Gorbachev                            |
| Living History                                       | Hillary Clinton                              |
| Another Life                                         | Derek Walcott                                |
| Lajja                                                | Tasleema Nasreen                             |
| Mother Teresa Down Memory Lane                       | Derek O'Brien, Sunil K. Dutt                 |
| Long Walk to Freedom                                 | Nelson Mandela                               |
| The Satanic Verses, Midnight's Children              | Salman Rushdie                               |
| The Perils of Democracy                              | P.C. Alexander                               |
| Freedom from fear                                    | Aung San Suu Kyi                             |
| The Longest Race                                     | Tom Alter                                    |
| City Of Joy                                          | Dominic Lapier                               |
| How I Play Golf                                      | Tiger Woods                                  |
| The Path To Power                                    | Margaret Thatcher                            |
| Can Pakistan Survive                                 | Tariq Ali                                    |
| The Invisible Man                                    | H.G. Wells                                   |

## Major Foreign Authors and Their Books

| Authors                 | Books                                                                                          |
|-------------------------|------------------------------------------------------------------------------------------------|
| 1. Pliny                | Natural History                                                                                |
| 2. H. W. Longfellow     | The Song of Hiawatha, Poems on Slavery                                                         |
| 3. Dante                | Divine Comedy                                                                                  |
| 4. Homer                | Iliad, Odyssey                                                                                 |
| 5. Albert Einstein      | The World as I See It, Relativity, The Special and the General Theory                          |
| 6. Seymour M. Harsh     | The Price of Power                                                                             |
| 7. Winston Churchill    | The Gathering Storm (The Second World War Volume I)                                            |
| 8. Newton               | The Principia                                                                                  |
| 9. Plato                | The Republic                                                                                   |
| 10. Maxim Gorky         | The Mother, The Life Of a Useless                                                              |
| 11. Adolf Hitler        | Mein Kampf                                                                                     |
| 12. Aristotle           | Politics, Poetics                                                                              |
| 13. Russo               | The Social Contract                                                                            |
| 14. Charles Darwin      | The Descent of Man, On the Origin of Species                                                   |
| 15. Edward Thomson      | A Farewell to India                                                                            |
| 16. Adam Smith          | The Theory of Moral Sentiments, An Inquiry into the Nature and Causes of the Wealth of Nations |
| 17. Arthur Hailey       | Airport, Hotel, Wheels                                                                         |
| 18. Henry Miller        | Tropic of Cancer, Black Spring                                                                 |
| 19. John Milton         | Paradise Lost                                                                                  |
| 20. Gunnar Myrdal       | Asian Drama, An American Dilemma, Against the Stream                                           |
| 21. George Orwell       | Animal Farm, Nineteen Eighty-four                                                              |
| 22. Z.A. Bhutto         | Great Tragedy, The Myth of Independence                                                        |
| 23. Mao - Tse - Tung    | On Contradiction                                                                               |
| 24. A.L. Basham         | The Wonder That Was India                                                                      |
| 25. E.M. Forster        | A Passage to India                                                                             |
| 26. Katherine Mayo      | Mother India                                                                                   |
| 27. Diana Mosley        | A Life of Contrasts                                                                            |
| 28. Harold Macmillan    | Riding the Storm (1956-59), The Middle Way                                                     |
| 29. Leo Tolstoy         | War and Peace                                                                                  |
| 30. J.K. Galbraith      | The Nature of Mass Poverty,                                                                    |
| 31. Charles Dickens     | Oliver Twist, David Copperfield, A Tale of Two Cities.                                         |
| 32. Shakespeare         | Hamlet, Othello, A Midsummer Night's Dream, As You Like It                                     |
| 33. George Bernard Shaw | Caesar and Cleopatra, Man and Superman, Arms and the Man.                                      |
| 34. Herold J. Laski     | A Grammar of Politics                                                                          |

7

## International Organizations

### United Nations :

- Establishment of the United Nations including 51 Countries of the world took place on **October 24, 1945**.
- Therefore, on **24 October every year**, United Nations Day is celebrated across the world.
- The contemporary President of the United States of America, Franklin D. Roosevelt named United Nations.
- Currently, the number of member countries of the United Nations is 193.
- South Sudan is the **193<sup>rd</sup>** member of the United Nations.
- United Nations headquarter is located on Manhattan Island in New York City.
- Working languages of the United Nations are French, English, Arabic, Chinese, Russian and Spanish.
- The flag of the United Nations is light blue, with the symbol of the United Nations in white colour.
- The symbol of the United Nations has two curved olive branches opened upwards and the world map between them.
- The General Assembly approves the budget of the United Nations. This is mentioned in Article 17 of the United Nations' Charter.
- The United Nations regular budget is approved every second year.
- There are 6 parts of the United Nations - General Assembly, Security Council, Economic and Social Council, Trust Council, International Court of Justice and Secretariat.
- The International Court of Justice is located in The Hague, Netherlands.
- Additionally, the offices of all other organs of the United Nations are located in **New York**.

### General Assembly:

- United Nations General Assembly is also called the world's parliament.
- Member States of the United Nations are represented in the General Assembly.
- All member countries of the United Nations can send a maximum of 5 representatives to the General Assembly, but the vote of all the representatives of one country is considered to be the same.
- The regular session of the General Assembly starts on the third Tuesday of September every year.
- At the time of holding the regular session, the General Assembly elects a **Speaker, 21 Deputy speakers**.
- Special sessions may also be organized by the **General Assembly** at the request of the **Security Council**.



- The appointment of the General Secretary of the General Assembly, passing the budget of the United Nations, granting membership to new countries, and the appointment of judges to the International Court of Justice on the recommendation of the Security Council are the functions of the United Nations General Assembly.

#### United Nations Security Council (UNSC):

- The Security Council is the main organ of the United Nations.
- The main function of the Security Council is to maintain international peace and security.
- **Security Council** consists of 5 permanent and 10 temporary members i.e 15 members in total.
- To decide on a subject in the **Security Council**, 9 out of 15 member states should get the support and five out of these 9 supporting members must be permanent members.
- If a permanent member does not want to support a subject, he / she may also be absent at the time of voting.
- Permanent members of the Security Council consensus on any subject is common consent and disagreement on the same is termed as veto power.
- If a permanent member country does not agree on any subject, it can exercise the prohibition and in this case, the proposal will not be accepted.
- **United States of America**, U.K., China, Russia and France are permanent members of the Security Council.
- Elects temporary members of the Security Council for two years by its two-thirds majority by the General Assembly.

#### United Nations Economic and Social Council:

- The Economic and Social Council is a permanent institution.
- The current number of members of the Economic and Social Council is 54.
- The members of the Economic and Social Council have a tenure of 3 years.
- One-third of its members are relieved every year. Released members may also be re-elected.
- The Economic Social Council caters to various standing committees, special institutions and commissions such as the Population and Traffic Commission, the Economic Employment Commission and the United Nations Children's Crisis Fund.

#### United Nations Trusteeship Council:

- It was established in 1945.
- The United Nations had accepted The Trust System.
- The basic principle of the **Trust System** is that the developed countries had to take care of the interests of the residents of the underdeveloped and primitive condition, considering the trust or non-security.

- It is noteworthy that it suspended its operations on November 1, 1994 as the territories included in it were either declared completely independent or merged with other countries.

#### Secretariat:

- The Chief of the United Nations Secretariat is General Secretary.
- The **Secretary-General** is appointed for 5 years on the recommendation of the Security Council. Any person can be appointed to the post of Secretary General more than once.

#### International Court of Justice:

- International Court was established in 1945.
- It is the principal judicial body of the **United Nations**.
- Its headquarter is located in The Hague (**Netherlands**).
- The number of judges in the International Court of Justice is 15. But no member country has more than one judge.
- Judges are appointed for 9 years and 5 judges retire after every 3 years. International Court of Judges among themselves elects one chairman and one vice-chairman for three years.
- The minimum quorum number of judges for conducting proceedings in the International **Court of Justice** is 9.

#### International Organizations, Headquarters and Years of Establishment

| Organization                                                            | Headquarter           | Year |
|-------------------------------------------------------------------------|-----------------------|------|
| International Telecommunication Union (ITU)                             | Geneva (Switzerland)  | 1865 |
| Universal Postal Union (UPU)                                            | Bern (Switzerland)    | 1874 |
| International Labor Organization (ILO)                                  | Geneva (Switzerland)  | 1919 |
| World Health Organization (WHO) World Meteorological Organization (WMO) | Geneva (Switzerland)  | 1948 |
| World Intellectual Property Organization (WIPO)                         | Geneva (Switzerland)  | 1950 |
| World Trade Organization (WTO) Geneva (Switzerland)                     | 1995                  |      |
| International Monetary Fund (IMF)                                       | Washington D.C. (USA) | 1944 |
| World Bank                                                              | Washington D.C. (USA) | 1944 |
| International Atomic Energy Agency (IAEA)                               | Vienna (Austria)      | 1957 |
| United Nations Industrial Development Organization (UNIDO)              | Vienna (Austria)      | 1966 |
| Comprehensive Nuclear Test Ban Treaty Organization (CTBT)               | Vienna (Austria)      | 1996 |

|                                                                 |                         |      |
|-----------------------------------------------------------------|-------------------------|------|
| World Tourism Organization (UNWTO)                              | Madrid (Spain)          | 1975 |
| International Civil Aviation Organization (ICAO)                | Montreal (Canada)       | 1944 |
| United Nations Food and Agriculture Organization (UNFAO)        | Rome (Italy)            | 1945 |
| International Agricultural Development Fund (IFAD)              | Rome (Italy)            | 1977 |
| UNESCO                                                          | Paris (France)          | 1946 |
| International Maritime Organization (IMO)                       | London (UK)             | 1958 |
| Chemical Weapons Prohibition Organization (OPCW)                | The Hague (Netherlands) | 1997 |
| United Nations (UN)                                             | New York (USA)          | 1945 |
| United Nations Children's Fund (UNICEF)                         | New York (USA)          | 1946 |
| United Nations Population Fund (UNFPA)                          | New York (USA)          | 1969 |
| United Nations Trade and Development Conference (UNCTAD)        | Geneva (Switzerland)    | 1964 |
| International Committee of the Red Cross : ICRC)                | Geneva (Switzerland)    | 1863 |
| International Organization for Standardization (ISO)            | Geneva (Switzerland)    | 1947 |
| Organization for Economic Cooperation and Development (OECD)    | Paris (France)          | 1961 |
| Organization of Petroleum Exporting Countries (OPEC)            | Vienna (Austria)        | 1960 |
| Amnesty International (AI)                                      | London (UK)             | 1961 |
| North Atlantic Treaty Organization (NATO)                       | Brussels (Belgium)      | 1949 |
| Transparency International (TI)                                 | Berlin (Germany)        | 1993 |
| International Renewable Energy Agency (IRENA)                   | Abu Dhabi (U.A.E.)      | 2009 |
| South Asian Association for Regional Cooperation (SAARC)        | Kathmandu (Nepal)       | 1985 |
| Association Southeast Asian Nations (ASEAN)                     | Jakarta (Indonesia)     | 1967 |
| Asia-Pacific Economic Cooperation (APEC)                        | Singapore               | 1989 |
| Organization of Islamic Cooperation (OIC)                       | Jeddah (Saudi Arabia)   | 1969 |
| Indian Ocean Rim Association for Regional Cooperation (IOR-ARC) | Eben (Mauritius)        | 1997 |
| International Olympic Committee (IOC).                          | Lausanne (Switzerland)  | 1894 |
| World Economic Forum (WEF)                                      | Geneva (Switzerland)    | 1971 |

|                                                             |                         |      |
|-------------------------------------------------------------|-------------------------|------|
| Federation Internationale de Football Association (FIFA)    | Zurich (Switzerland)    | 1904 |
| International Cricket Council (ICC)                         | Dubai (UAE)             | 1909 |
| International Hockey Federation (FIH)                       | Lausanne (Switzerland)  | 1924 |
| World Chess Federation (FIDE)                               | Lausanne (Switzerland)  | 1924 |
| International Nature Conservation Union (IUCN)              | Gland (Switzerland)     | 1948 |
| Internet Corporation for Assigned Names and Numbers (ICANN) | Los Angeles, (USA)      | 1998 |
| Doctors Without Borders Medecins Sans Frontiers (MSF)       | Geneva (Switzerland)    | 1971 |
| International Shooting Sports Federation (ISSF)             | Munich (Germany)        | 1907 |
| New Development Bank (NDB)                                  | Shanghai (China)        | 2014 |
| United Nations Environment Program (UNEP)                   | (Kenya) Nairobi         | 1972 |
| Asian Development Bank (ADB)                                | Manila (Philippines)    | 1966 |
| International Organization for Migration (IOM)              | Geneva (Switzerland)    | 1951 |
| World Wildlife Conservation Fund (WWF)                      | Gland (Switzerland)     | 1961 |
| Greenpeace                                                  | Amsterdam (Netherlands) | 1971 |

### Indian Judges in the International Court of Justice:

1. Benegal Narasimha Rao (1952-53)
2. Nagendra Singh, Judge of the International Court of Justice 1973–88 as a Vice-chairman, 1976-79 as a Chairman till 1985-88).
3. Raghunandan Swaroop Pathak (1989-91)
4. Dalbir Bhandari (2012-till now)

### United Nations Union Secretary-Generals

| Name                       | Country     | Tenure                          |
|----------------------------|-------------|---------------------------------|
| 1. Trigve Lee              | Norway      | February 1946 to November 1952  |
| 2. Dag Hammarskjöld        | Sweden      | April 1953 to September 1961    |
| 3. U Thant                 | Myanmar     | November 1961 to December 1971  |
| 4. Kurt Waldheim           | Austria     | January 1972 to December 1981   |
| 5. Javier Perez de Cuellar | Peru        | January, 1982 to December, 1991 |
| 6. Boutros Boutros Ghali   | Egypt       | Jan. 1992 to Dec. 1996          |
| 7. Kofi Annan              | Ghana       | Jan. 1997 to Dec. 2006          |
| 8. Ban-Ki Moon             | South Korea | January 2007 to December 2016   |
| 9. Antonio Guterres        | Portugal    | January 2017 till now           |

## 8 World's Major Organizations

### Commonwealth of the World:

- Commonwealth means 'Group of Nations' or 'Union'.
- The Commonwealth is an organization of countries under the British Empire in the past.
- Commonwealth was established in 1926.
- In 1949, the modern Commonwealth was formed and India was made a member of the Commonwealth.
- Currently, the number of member states of the Commonwealth is 56.
- Commonwealth headquarter is located in 'London' (UK).
- India is the largest country of the Commonwealth in terms of population.

### The North Atlantic Treaty Organization - (NATO):

- NATO was established on April 4, 1949.
- It was established by Article 5 of the Washington Treaty on the principle of 'collective security'.
- Currently, NATO has 32<sup>nd</sup> independent member countries.
- Sweden is the 32<sup>nd</sup> member country of NATO.
- NATO headquarter is located in Brussels (Belgium).
- An armed attack against one or more NATO members is considered an attack against all member states.

### European Union:

- Inner Six 'countries of Europe (France, Netherlands, Belgium, Italy, Germany and Luxembourg) established the European Economic Community 'on 1<sup>st</sup> January 1958, through the Treaty of Rome.
- The European Economic Community was later renamed the European Union.
- Establishment of the European Union on 1 November 1993 in Maastricht (Netherlands).
- Headquarter of the European Union is located in Brussels (Belgium).
- The total number of member countries in the European Union is 27.
- The European Union started the circulation of the euro currency on 1<sup>st</sup> January 2002.
- Euro currency is prevalent in 20 EU member states (France, Netherlands, Belgium, Italy, Germany, Luxembourg, Cyprus, Austria, Finland, Greece, Estonia, Latvia, Ireland, Malta, Spain, Slovakia, Portugal, Croatia, Lithuania and Slovenia).
- For the circulation of its currency (Euro) by the European Union, the European Monetary Institute was established in January 1994.
- The European Central Bank was established in Frankfurt, Germany on 1<sup>st</sup> June 1998 for circulation and control of the Euro by the European Union.

- The 28th country of the European Union was Croatia which joined the European Union on 1<sup>st</sup> July 2013, but after the expulsion from the membership of this union by the United Kingdom (on 31 January 2020), Croatia is now the 27<sup>th</sup> country of this union.
- It is noteworthy that on 23 June 2016, referendums were held in the United Kingdom and Gibraltar on the question of whether or not to remain in the European Union. The result of which came in favour of being free from the European Union.

### Organizations of the European Union and Their Headquarters

| Organization                            | Headquarter         |
|-----------------------------------------|---------------------|
| 1. European Parliament                  | Strasbourg (France) |
| 2. European Council                     | Strasbourg (France) |
| 3. Council of the European Union        | Brussels            |
| 4. European Commission                  | Brussels            |
| 5. Court of the European Union          | Luxembourg          |
| 6. European Central Bank                | Frankfurt           |
| 7. European Court of Auditors           | Luxembourg          |
| 8. European Economic & Social Committee | Brussels            |

### Organization for Economic Cooperation and Development (OECD):

- European Organization for Economic Cooperation was established in 1948.
- In 1961, the European Organization for Economic Cooperation was converted into an Organization for Economic Cooperation and Development.
- The headquarter of the Organization for Economic Cooperation and Development is located in Paris.
- The Organization for Economic Cooperation and Development has 38 member countries.
- On 25<sup>th</sup> of May, 2021 Costa Rica formally became 38<sup>th</sup> member of OECD.

### Organization of Petroleum Exporting Countries - OPEC:

- OPEC was established in 1960 in Baghdad.
- OPEC's founding member countries are - Iraq, Iran, Kuwait, Saudi Arabia and Venezuela.
- OPEC has its headquarter in Vienna, Austria.
- OPEC's current number of members is 13 - Algeria, Angola, Equatorial Guinea, Gabon, Iran, Iraq, Kuwait, Libya, Nigeria, Congo, Saudi Arabia, United Arab Emirates, and Venezuela.

### (Non-Aligned Movement - NAM):

- In 1961, the first Conference of Non-Aligned Countries was held in Belgrade.
- The Non-Aligned Movement headquarter is located in Jakarta, Indonesia.

- Currently, the number of Non-Aligned Member States is 120.
- The country hosting the Non-Aligned Conference presides the meeting.

#### Red Cross:

- The Red Cross was founded in 1863 by Henry Dunant.
- Its headquarter is located in Geneva (Switzerland).
- The main objective of the Red Cross is to help those who were affected by war or disaster.
- World Red Cross and Red Crescent Day is celebrated every year on 8 May, the birthday of Henry Dunant.
- The Red Cross has received the Nobel Peace Prize three times in 1917, 1944 and 1963.

#### Arab League:

- Arab League was established on 22 March 1945 in Cairo (Egypt).
- Currently, there are 22 member countries in the Arab League.
- Its headquarter is located in Cairo.

#### Association of South - East Asian Nations - (ASEAN):

- 'Association of Southeast Asian Nations' (ASEAN) was established on 8 August 1967.
- Central Secretariat of ASEAN is located in Jakarta, Indonesia.
- Currently, there are 10 countries involved in ASEAN.
- India became a full dialogue partner country of ASEAN in 1996.

#### Asian Development Bank (ADB):

- Asian Development Bank was established in 1966.
- The number of Asian Development Bank member countries is 68.
- The Asian Development Bank's headquarter is located in Manila, Philippines.

#### The South Asian Association for Regional Cooperation (SAARC):

- South Asian Association for Regional Cooperation was established in December 1985.
- Its headquarter is located in Kathmandu, Nepal.
- SAARC has 8 member countries - Nepal, Bhutan, Sri Lanka, Maldives, India, Bangladesh, Pakistan and Afghanistan.

#### G-7 (Group. 7):

- G-7 was founded in 1975.
- Russia joined as the 8th member country at the G-7 summit on June 20-22, 1997 in Denver (Colorado), USA, resulting in its name as G-8.
- But, due to the suspension of Russia from membership in 2014, this organization is again known as G-7.
- The countries included in the G-7 are - America, Canada, the United Kingdom, France, Italy, Germany and Japan.

#### Commonwealth of Independent Nations (CIS) :

- Belarus, Ukraine and Russia jointly established the 'Commonwealth of Independent Nations'. In December 1991.

- Its administrative centre is located in Minsk (Belarus).

#### BRICS (Brazil, Russia, India, China and South Africa) :

- Brazil, Russia, India and China established a new economic organization (BRIC) in 2006.
- On June 16, 2009 in Yekaterinburg, Russia, the first BRIC summit was held.
- South Africa got consent to be a member of BRICS in 2010 in its 2<sup>nd</sup> Summit that was held in Brasilia (Brazil).
- South Africa was included in this organisation on 14 April, 2011 at the 3<sup>rd</sup> BRIC Summit held in China and named 'BRICS'.
- 15<sup>th</sup> BRICS summit was organised in South Africa.
- The theme of this summit was BRICS and Africa : Partnership for mutually Accelerated Growth sustainable Development and Inclusive Multilateralism.
- Significantly BRICS admitted four new member : Egypt, Ethiopi, Iran and UAE.

#### List of First Women in /of India

| First Indian Woman                                               | Name                          | Achievement Year |
|------------------------------------------------------------------|-------------------------------|------------------|
| President                                                        | Pratibha Devi Singh Patil     | 2007             |
| Prime Minister                                                   | Indira Gandhi                 | 1966             |
| Vidyalaya Director (Female Teacher)                              | Savitri Bai Phule             | 1848             |
| Air Force Flight Engineer                                        | Hina Jaiswal                  | 2019             |
| Fighter Jet Pilot to take a solo flight in Mig-21                | Avni Chaturvedi               | 2018             |
| Hawk Advance Jet Pilot                                           | Mohana Singh                  | 2019             |
| Light Sport Aircraft, Who crossed the Atlantic and Pacific Ocean | Arohi Pandit,                 | 2019             |
| Lok Sabha Speaker                                                | Meera Kumar                   | 2009             |
| Rajya Sabha Deputy Speaker                                       | Violet Hari Alva              | 1962             |
| Governor                                                         | Sarojini Naidu (U.P)          | 1947             |
| UPSC Chairman                                                    | Rose Million Bathew           | 1992             |
| Mahila shasika                                                   | Razia Sultan                  | 1236             |
| IAS                                                              | Anna Rajam Malhotra           | 1951             |
| IPS                                                              | Kiran Bedi                    | 1972             |
| Chief Minister                                                   | Sucheta Kripalani (UP)        | 1963             |
| Union Health Minister                                            | Rajkumari Amrit Kaur          | 1947             |
| Indian National Congress President                               | Dr. Annie Besant              | 1917             |
| Supreme Court Judge.                                             | Meera Sahib Fatima Bibi       | 1989             |
| High Court Chief Justice.                                        | Leela Seth (Himachal Pradesh) | 1991             |



|                                                    |                                         |                                     |
|----------------------------------------------------|-----------------------------------------|-------------------------------------|
| Sessions Judge                                     | Anna Chandy (Kerala)                    | 1948                                |
| Ashok Chakra recipient                             | Neerja Bhanot                           | 1987                                |
| India's Ambassador in United Nations               | Vijayalakshmi Pandit                    | 1953                                |
| Cross the English Channel                          | Aarti Saha                              | 1959                                |
| Nobel Award                                        | Mother Teresa                           | 1979                                |
| Everest Victory                                    | Bachendri Pal                           | 1984                                |
| Miss World                                         | Kumari Rita Faria                       | 1966                                |
| Everest Winner Twice                               | Santosh Yadav                           | 1992, 1993                          |
| Miss Universe                                      | Sushmita Sen                            | 1994                                |
| Bharat Ratna Recipient                             | Mrs. Indira Gandhi                      | 1971                                |
| Jnanpith Award Recipient                           | Ashapura Devi                           | 1976                                |
| Train Driver                                       | Surekha Yadav                           | —                                   |
| Miss Asia Pacific                                  | Zeenat Aman                             | 1970                                |
| Man Booker Award recipient                         | Arundhati Roy                           | 1997                                |
| Asian Games wrestling Gold Medal                   | Vinesh Phogat                           | 2018                                |
| Outstanding MP Award recipient                     | Sushma Swaraj                           |                                     |
| Arjuna Award Recipient                             | A. Lumsden                              | 1961 (Hockey)                       |
| Olympic Medal Recipient                            | Karnam Malleshwari                      | 2000, Weight-lifting (Bronze Medal) |
| Both Arjuna and Rajiv Gandhi Khel Award Recipients | Kunjurani (Grand Old Lady)              | 1990, 1996-97                       |
| Female Mayor                                       | Tara Cheria (Chennai)                   | 1957                                |
| Female Graduate (Prestige)                         | Kamini Roy                              | 1886                                |
| Female Graduate                                    | Kadambini Ganguly and Chandramukhi Basu | 1883                                |
| Pilot in Air Force                                 | Harita Kaur Deol                        | 1994                                |
| Lieutenant General                                 | Punita Arora                            | 2004                                |
| Air-Vice Marshal                                   | P. Bandopadhyay                         | 2002                                |
| Chairperson of Indian Airlines                     | Sushma Chawla                           | 2005                                |
| First Indian American to go to space               | Kalpana Chawla (US Citizen)             | 1997                                |
| Oscar Award Recipient                              | Bhanu Athaiya                           | 1983                                |
| Asian Games Gold medal                             | Kamaljeet Sandhu                        | 1970                                |
| Reached the South Pole                             | Reena Kaushal Dhar-mashaktu             | 2009                                |
| Who crossed seven major seas                       | Bula Chaudhary                          | —                                   |
| Crossed Gobi Desert                                | Sucheta Kadethankar                     | 2011                                |
| Rajya Sabha First Woman General Secretary          | V.S. Ramadevi                           | 1993                                |

|                                                      |                     |                      |
|------------------------------------------------------|---------------------|----------------------|
| Rajya Sabha Nominated (Film Actress)                 | Nargis Dutt         | 1980                 |
| Sahitya Akademi Award Winner                         | Amrita Pritam       | 1956                 |
| Who reached Antarctica                               | Meher Moose         | 1976                 |
| Participate in the Olympic Games                     | Mary Leela Rao      | 1956                 |
| First Female Actress to get Dada Saheb Phalke Award  | Devika Rani Roerich | 1969                 |
| National Women's Commission Chairman                 | Jayanti Patnaik     | 1992                 |
| Doordarshan News Reader                              | Pratima Puri.       | 1959                 |
| Olympic Badminton (Women's Category) Silver Medal    | P.V. Sindhu         | 2016 (Rio Olympic)   |
| Olympic Badminton (in Women's category) Bronze Medal | Saina Nehwal        | 2012 London Olympics |
| Olympic Women's                                      |                     | 2016                 |
| Wrestling Bronze Medal                               | Sakshi Malik        | (Rio Olympics)       |
| Women's Foreign Secretary                            | Chokila Iyer        | 2001                 |
| Qualifier in Olympic Gymnastics                      | Deepa Karmakar      | 2016                 |
| International Olympics Committee Member              | Nita Ambani         | 2016                 |

### Renowned Persons in India

| India's First Male                                            | Name                          | Achievement Year |
|---------------------------------------------------------------|-------------------------------|------------------|
| Governor-General of India                                     | Lord William Bentinck         | 1834             |
| First Viceroy                                                 | Lord Canning                  | 1858             |
| Last Viceroy in India Name                                    | Lord Mountbatten              | 1947             |
| First Governor of Achievement Year                            | Lord Mountbatten              | 1947             |
| First and last (Indian) Governor-General of Independent India | Chakravarathi Rajagopalachari | 1948             |
| First President                                               | Dr Rajendra Prasad            | 1950             |
| First Muslim President                                        | Dr Zakir Hussain              | 1967             |
| First Vice President                                          | Dr Sarvepalli Radhakrishnan   | 1952             |
| First Prime Minister                                          | Pt. Jawaharlal Nehru          | 1947             |
| First Deputy Prime Minister and Home Minister                 | Sardar Vallabh-bhai Patel     | 1947             |



|                                                                                                 |                                   |           |
|-------------------------------------------------------------------------------------------------|-----------------------------------|-----------|
| First Education Minister                                                                        | Abul Kalam Azad                   | 1947      |
| First Indian Minister to Resigns from Union Cabinet                                             | Shyama Prasad Mukherjee           | 1950      |
| First Air Commander in-Chief, Air Marshal                                                       | Sir Thomas Amherst                | 1947      |
| First Chief of Army Staff                                                                       | General M.Rajendra Singhji Jadeja | 1955      |
| First Speaker of Lok Sabha                                                                      | Ganesh Vasudev Mavalankar         | 1952      |
| First Chief Election Commissioner                                                               | Sukumar Sen                       | 1950      |
| First Chief Justice                                                                             | Harilal J. Kania                  | 1950      |
| First Chief Justice of India,                                                                   | Justice Sarosh Homi               | 2010      |
| Born in Independent India                                                                       | Kapadia                           |           |
| First Indian judge in International Court (Chairman)                                            | Dr Nagendra Singh                 | 1985      |
| First in the International Court of Justice                                                     | Sir Benegal Narsing Rao           | 1952      |
| First President of Indian National Congress                                                     | Vyomesh Chandra Banerjee          | 1885      |
| First Muslim President of the Indian National Congress                                          | Badruddin Tyabji                  | 1887      |
| First person to present freedom of India proposal in the conference of Indian National Congress | Hasrat Mohani                     | 1921      |
| First Nobel Prize Indian Recipient                                                              | Rabindranath Thakur               | 1913      |
| India's First Nobel Laureate Scientist                                                          | C.V. Raman (Physics)              | 1930      |
| First Indian Magsaysay Award Recipient                                                          | Acharya Vinoba Bhave              | 1958      |
| Stalin Shanti Award recipient First Indian                                                      | Saifuddin Kitchlu                 | 1952      |
| Golden Globe Award Winner First Indian                                                          | A.R. Rahman                       | 2009      |
| Bharat Ratna Awarded to First Foreign Citizen                                                   | Khan Abdul Ghaffar Khan           | 1987      |
| First Indian, honoured with Jnanpith Award                                                      | G.Shankar Kurup                   | 1965      |
| First Person to be successful in I.C.S.                                                         | Satyendra Nath Tagore             | 1863      |
| First Indian born person to reach in space                                                      | Rakesh Sharma                     | 1984      |
| First Indian to cross the English Channel                                                       | Mihir Sen                         | 1958      |
| First Indian Palk Strait Swimming Competition Winner                                            | Baidyanath                        | 1967      |
| The first Chinese Traveller to visit India                                                      | Fa Hien                           | 405-411AD |

|                                                                                         |                                 |                       |
|-----------------------------------------------------------------------------------------|---------------------------------|-----------------------|
| First British to visit Mughal Court                                                     | Sir William Hawkins             | 1609                  |
| First American President to visit India                                                 | Dwight David Eisenhower         | 1959                  |
| First British Prime Minister to visit India                                             | David Harold Macmillan          | 1958                  |
| First Russian Prime Minister to visit India                                             | Nikolai Bulganin                | 1955                  |
| First Indian Pilot                                                                      | J.R.D. Tata                     | 1929                  |
| Olympics Personal Competition (10m Air Rifle, 2008) Medal Winner for India (in Beijing) | Abhinav Bindra                  | 2008 Beijing Olympics |
| First Indian to be British Member Of Parliament                                         | Dadabhai Naoroji                | 1892                  |
| The first Hindi Press Operator in India                                                 | Pt. Jugal Kishore Shukla        | 1826                  |
| World Badminton Championships First Indian Medal Winner                                 | Prakash Padukone (Bronze Medal) | 1983                  |

| First in India                                               |                     |                  |
|--------------------------------------------------------------|---------------------|------------------|
| India's First                                                | Name                | Achievement Year |
| Nuclear Reactor                                              | Apsara              | 1956             |
| Nuclear Submarine                                            | INS Chakra          | 1987             |
| First Submarine                                              | I.N.S. Kalvari      | 1967             |
| Aircraft Carrier                                             | I.N.S. Vikrant      | 1961             |
| Short Distance Missile                                       | Prithvi             | 1988             |
| Asian Games Organized                                        | Delhi               | 1951             |
| Doordarshan Kendra                                           | New Delhi           | 1959             |
| Doordarshan for the first time Broadcasted coloured programs | —                   | 1982             |
| Silent Film                                                  | Raja Harishchandra  | 1913             |
| Talkie (Sound) Film                                          | Alam Ara            | 1931             |
| India's First Technicolor Film                               | Jhansi Ki Rani      | 1953             |
| First Sponsored Serial                                       | Hum Log             | 1984             |
| First 3-D Film                                               | My Dear Kuttichatan | 1984             |
| India's First Newspaper                                      | Bengal Gazette      | 1780             |
| First Women's Employment                                     | Office Jaipur       | —                |
| India's First Highspeed Rural Broad Band Network Launched    | Idukki (Kerala)     | 2015             |

| India's Biggest, Largest and Tallest Dams, Parks, etc. |                                                   |
|--------------------------------------------------------|---------------------------------------------------|
| Longest Road Bridge                                    | Bhupen Hazarika Setu (Assam)                      |
| Largest Animal Fair                                    | Sonpur (Bihar)                                    |
| Highest Tower                                          | Fateh Burj (Punjab)                               |
| Highest gravitational dam                              | Bhakra Dam (Punjab)                               |
| Largest Desert                                         | Thar (Rajasthan)                                  |
| Largest Cave Temple                                    | Kalash Temple (Ellora, Maharashtra)               |
| Largest Zoo                                            | Arignar Anna Zoological Park (Chennai)            |
| Largest Masjid                                         | Taj-ul- Masjid (Bhopal) Sonpur                    |
| The Highest Peak                                       | Godwin Austin (K - 2)                             |
| The Longest Tunnel (Road)                              | Chenani - Nashri tunnel (9.28 km) Jammu - Kashmir |
| Longest Tunnel (Railway)                               | Pir Panjal (11.215 km) Jammu Kashmir              |
| The Largest Delta                                      | Sundarbans Delta (West Bengal)                    |
| The Largest State of Forests                           | Madhya Pradesh                                    |
| The Largest Corridor                                   | Ramanathaswamy Temple (Rameswaram Tamil Nadu)     |
| The Highest Waterfall (width)                          | Jog or Garasoppa (Karnataka)                      |
| Highest Darwaza                                        | Buland Darwaja (Fatehpur Sikri)                   |
| Longest River                                          | Ganga River                                       |
| Largest Museum                                         | Kolkata Museum                                    |
| Largest Gumbad                                         | Gol Gumbad (Bijapur)                              |
| Tallest Statue                                         | Statue of Unity (Gujarat)                         |
| Highest Rainfall Place                                 | Masynram (Meghalaya)                              |
| Longest Canal                                          | Indira Gandhi Canal (Rajasthan)                   |
| Largest Stadium                                        | Narendra Modi Stadium, Ahmedabad (Gujarat)        |
| Most Populous City                                     | Mumbai (Maharashtra)                              |
| State with the most urban area                         | Maharashtra                                       |
| Longest Rail Route                                     | Dibrugarh to Kanyakumari.                         |
| Largest Natural Port                                   | Mumbai (Maharashtra)                              |
| Longest National Highway                               | National Highway (NH - 27 EW)                     |
| State with the Longest Coastline                       | Gujarat                                           |
| Largest-Coastal Saltwater Lakes                        | Chilka Lake (Odisha)                              |
| Sweet Water Largest Lake                               | Wular Lake (Jammu and Kashmir)                    |

|                                                   |                                                                                            |
|---------------------------------------------------|--------------------------------------------------------------------------------------------|
| India's Longest Tributary                         | Yamuna River                                                                               |
| South India's Longest River                       | Godavari                                                                                   |
| Longest Dam                                       | Hirakud Dam (Odisha)                                                                       |
| India's Highest Gallantry Award                   | Paramveer Chakra                                                                           |
| India's Highest Honour                            | Bharat Ratna                                                                               |
| Largest Gurdwara                                  | Golden Temple, Amritsar                                                                    |
| Largest Church                                    | Se Cathedral (Goa)                                                                         |
| Tallest T.V. Tower                                | Rameswaram (Tamil Nadu)                                                                    |
| Longest Coastline                                 | State of South India, Andhra Pradesh                                                       |
| Longest Beach                                     | Marina Beach (Chennai)                                                                     |
| The most diverting river                          | Kosi River                                                                                 |
| The largest artificial lake                       | Govind Ballabh Pant Sagar                                                                  |
| Deepest river valley                              | Bhagirathi and Alaknanda                                                                   |
| The highest altitude battle ground is situated at | Siachen Glacier                                                                            |
| Largest River Island                              | Majuli (Brahmaputra river, Assam)                                                          |
| Largest Planetarium                               | Birla Planetarium (Kolkata)                                                                |
| Largest State (area)                              | Rajasthan                                                                                  |
| Largest District (area)                           | Kutch (Gujarat)                                                                            |
| Fastest Running Train                             | Vande Bharat (express)                                                                     |
| Largest Fort                                      | Chittaurgarh Fort (Rajasthan)                                                              |
| Longest Electrified Rail                          | Built between Cherlopalli in Tunnel Nellore District and Raipuru Stations (Andhra Pradesh) |
| Radio Station at the Highest Altitude             | All India Radio's Leh Station                                                              |
| Biggest Bhawan                                    | Rashtrapati Bhavan (New Delhi)                                                             |
| Largest Exhibition Ground                         | Pragati Maidan Complex (New Delhi)                                                         |
| Largest Post Office                               | Mumbai G.P.O.                                                                              |
| The Highest Located Post Office                   | Hikkim (Himachal Pradesh)                                                                  |
| The longest distance covering train               | Vivek Express (Dibrugarh to Kanyakumari)                                                   |

| First Country/Person in the World   |                                                               |
|-------------------------------------|---------------------------------------------------------------|
| First                               | Name in the World                                             |
| Everest - Summit winner             | Sherpa Tenzin Norgay (India) and Edmund Hillary (New Zealand) |
| First person to reach North Pole    | Robert Pieri (U.S.A.)                                         |
| First-person to reach Southern Pole | Roald Amundsen (Norway)                                       |

|                                                                |                             |
|----------------------------------------------------------------|-----------------------------|
| The world's first religion                                     | Sanatan Dharma              |
| The first woman to reach the North Pole                        | Ann Bancroft                |
| The first country to print a book                              | China                       |
| The first country to issue paper currency                      | China                       |
| The first country to start a civil service competition         | China                       |
| The first President of the United States of America            | George Washington           |
| Britain's first Prime Minister                                 | Robbert Walpole             |
| United Nations first Secretary-General                         | Trygve Lie (Norway)         |
| The first country to make education mandatory                  | Prussia                     |
| The first country to win Football World Cup                    | Uruguay                     |
| The first country to make Constitution                         | United States of America    |
| First Governor-General of Pakistan                             | Mohammed Ali Jinnah         |
| The first conference of the Non-Aligned Movement               | Belgrade                    |
| The first European to reach China                              | Marco Polo                  |
| The first person to fly in the world                           | Right Brothers              |
| The first person to travel by sea around the world             | Ferdinand Magellan          |
| The first country to send humans to the moon                   | United States of America    |
| The first country to launch an artificial satellite into space | Prime Minister Soviet Union |
| The first country to host the modern Olympic Games             | Greece                      |
| The first President of the Republic of China                   | Dr. Sun Yat-sen             |
| The first city on which the atomic bomb was dropped            | Hiroshima (Japan)           |
| The country with the most animals                              | India                       |
| The world's first university                                   | Taxila University           |
| The first person to land on the moon                           | Neil Armstrong (U.S.)       |
| The first person to reach space                                | Major Yuri Gagarin (Russia) |
| First-person to float in space                                 | Alexey Leonov (Russia)      |
| The first space shuttle to be sent into space                  | Colombia                    |
| The first woman Prime Minister of England                      | Margaret Thatcher           |

|                                                                            |                                                    |
|----------------------------------------------------------------------------|----------------------------------------------------|
| The first woman Prime Minister of a Muslim country                         | Benazir Bhutto (Pakistan)                          |
| The first woman Prime Minister of any country in the world                 | S. Bandaranaike (Sri Lanka)                        |
| The first woman to go to space                                             | Valentina Tereshkova (then the Soviet Union)       |
| The first woman to reach the summit of Everest                             | Junko Tbei (Japan)                                 |
| The first person to invade India                                           | Alexander                                          |
| The first woman President of any country                                   | Maria Estella Martinez Cartes de Peron (Argentina) |
| The first woman to reach the continent of Antarctica                       | Carolyn Mickelson                                  |
| The first person to draw a map of the Earth                                | Anaximander                                        |
| The oldest first person to reach the summit of Everest                     | Richard Bass                                       |
| The first Asian to win Wimbledon Boys' Singles title                       | Ramanathan Krishnan                                |
| The first Nobel Prize to be awarded in literature                          | Sali Prudhomme                                     |
| The first Nobel Prize in the field of peace was awarded to                 | Henry Dunant and Frédéric Passy                    |
| The first Nobel Prize in Physics awarded to                                | W.W. C. Röntgen                                    |
| The first Nobel Prize in Chemistry awarded to                              | J.H. Vant Hoff                                     |
| The first Nobel Prize in Economics awarded to                              | Reigner Frisch and John Tinbergen                  |
| First Woman to swim English Channel                                        | Gertrude Ederle                                    |
| The first country in the world where the person was given the right to die | Netherlands                                        |
| The first country to issue Bank Note                                       | Sweden                                             |
| The first country to provide citizenship to Robot (Sofia)                  | Saudi Arabia                                       |
| First country to legalise equal pay                                        | Iceland                                            |

### World's Largest, Smallest, Longthiest and Highest

|                                     |                        |
|-------------------------------------|------------------------|
| The Largest Continent in the World  | Asia                   |
| The Smallest Continent              | Australia              |
| The Largest Ocean                   | Pacific Ocean          |
| The Deepest Ocean                   | Pacific Ocean          |
| The Largest City (in terms of area) | Tokyo-Yokohama (Japan) |

|                                         |                                                              |
|-----------------------------------------|--------------------------------------------------------------|
| The Largest Country (in terms of area)  | Russia                                                       |
| The Smallest Country (in terms of area) | Vatican City                                                 |
| Most Populous Country                   | China                                                        |
| Highest Electoral Number                | India                                                        |
| Minimum Population Density              | Antarctica                                                   |
| Highest population density country      | Monaco                                                       |
| Most Populous City                      | Tokyo (Japan)                                                |
| Least Populous City                     | Vatican City                                                 |
| The country with longest shared border  | Canada                                                       |
| Shortest Border Country                 | Vatican City                                                 |
| Maximum Boundary Country                | Russia                                                       |
| Largest Island                          | Greenland                                                    |
| Largest Peninsula                       | Arab Peninsula                                               |
| Largest Island - Group Country          | Indonesia                                                    |
| Largest River - Island                  | Majuli (Brahmaputra River, Assam)                            |
| Largest Delta                           | Sundarbans (India)                                           |
| Longest River                           | Nile river (Egypt)                                           |
| Largest River (wide and volume)         | Amazon (South America)                                       |
| Largest Sea                             | South China Sea                                              |
| Largest Sub-sea                         | Hudson sub-sea                                               |
| Smallest Bird                           | Humming bird                                                 |
| Longest tributary                       | Medira (a tributary of Amazon)                               |
| Busiest Commercial River                | Rhine river                                                  |
| Busiest Canal                           | Kiel canal                                                   |
| Largest Lake                            | Caspian Sea                                                  |
| Largest Freshwater Lake                 | Superior lake (U.S.)                                         |
| Deepest Lake                            | Baikal lake (Russia)                                         |
| Most High Altitude Lake (sailing)       | Titicaca (S.America)                                         |
| Highest Waterfall                       | Salto Angel (Venezuela)                                      |
| The Widest Waterfall                    | The Khon Falls (Laos)                                        |
| The Largest Gulf                        | The Gulf of Mexico                                           |
| The Highest Mountain Peak               | Mount Everest                                                |
| The Highest Mountain Ranges             | The Himalayas (Asia)                                         |
| The Longest Mountain Range              | The Andes (South America)                                    |
| The Highest Plateau                     | Pamir (Tibet) Plateau                                        |
| The Highest Volcano                     | Ojos del Salada (Argentina - Located on the border of Chile) |
| Most Massive Active Volcano             | Mauna - Kea (Hawaiian Islands)                               |

|                                              |                                                                |
|----------------------------------------------|----------------------------------------------------------------|
| Highest Dam                                  | Nurek (Tajikistan)                                             |
| Largest Dam (concrete)                       | Jinping Eye Dam (China)                                        |
| Longest Railway Platform                     | Siddharoodha Swamiji Railway Station (Karnataka)               |
| Largest Railway                              | Station Grand Central                                          |
| Terminal                                     | (New York)                                                     |
| Longest Railroad                             | Trans Siberian Railroad                                        |
| The High Altitude Railway Station            | Tanggula (China)                                               |
| Largest Rail Tunnel                          | Goatyard Basetnal (Switzerland)                                |
| Longest Road Tunnel                          | Laerdal (Norway)                                               |
| Highest Road                                 | Umling La Pass (India)                                         |
| Longest Road Bridge                          | Bang na Expressway (Thailand)                                  |
| Longest Highway                              | Pan - American highway                                         |
| Highest Capital                              | La Paz (Bolivia)                                               |
| Largest Desert                               | Sahara (Africa)                                                |
| Asia's Largest Desert                        | Gobi (Mongolia)                                                |
| Coldest Territory                            | Vostok (Antarctica)                                            |
| Largest Mosque                               | Mosque Al-Haram (Mecca, Saudi Arabia)                          |
| Highest Masjid                               | Jama el-Jazeera (Djamaa- el-Djazair) Algeria'                  |
| Largest Cathedral                            | Vesilica of St. Peter's Vatican City (Italy)                   |
| Tallest Building                             | Burj Khalifa (Dubai)                                           |
| Longest Wall                                 | China Wall                                                     |
| Largest Stadium                              | Rungrado1stof May Stadium (North Korea)                        |
| Largest Clock Tower                          | Abraaj Al Bait                                                 |
| Largest Seaport                              | Shanghai (China)                                               |
| Bigger Airport based on Number of Passengers | Heartsfield - Jackson Atlanta International Airport            |
| Largest Airport                              | King Fahd, Dammam (Saudi Arabia)                               |
| Most Intelligent Animal                      | Chimpanzee                                                     |
| Most Gigantic Temple                         | Temple of Angkor wat (Cambodia)                                |
| Largest Library                              | Library of Congress (Washington (U.S.A.) Establishment - 1800) |
| Largest Epic                                 | Mahabharata                                                    |
| Largest Park                                 | North-East Greenland National Park                             |

|                     |                                |
|---------------------|--------------------------------|
| Largest Planetarium | Shanghai (China)               |
| Largest Castle      | Forbidden City Beijing (China) |
| The Tallest Tree    | Sequoia Tree California        |
| The Tallest Animal  | Giraffe                        |
| The Largest Animal  | Blue whale                     |
| The Largest Bird    | Ostrich                        |

| International Boundaries |                         |
|--------------------------|-------------------------|
| McMahon Line             | India and China         |
| Radcliffe Line           | India and Pakistan      |
| 38th Parallel Line       | North Korea and Korea   |
| Maginot Line             | Germany & France        |
| 49th Parallel Line       | U.S.A. & Canada         |
| Mannerheim Line          | Russia & Finland        |
| Durand Line              | Pakistan & Afghanistan, |

| Political Parties of Various Countries |                                                                                            |
|----------------------------------------|--------------------------------------------------------------------------------------------|
| U.S.A.                                 | Republican Party, Democratic Party                                                         |
| Israel                                 | Meretz Party, Labor Party, Likud Party, Hadash Party, Shas Party, Blue and White Party     |
| France                                 | The Republics. Socialist Party, LA REPUBLICEN MARCHE!                                      |
| Australia                              | Liberal Party of Australia, National Party of Australia, Liberal National Party            |
| Bangladesh                             | Bangladesh National Party, Awami League, Jatiya Party                                      |
| Nepal                                  | Communist Party, Nepali Congress Party, Rashtriya Janata Party Nepal                       |
| China                                  | Chinese Communist Party, China Democratic League                                           |
| Sri Lanka                              | United National Party, Freedom Party                                                       |
| S. Africa                              | African National Congress, National Party, Inkatha Freedom Party, Economic Freedom Fighter |
| U.K                                    | Conservative and Unionist Party, Labor Party, Liberal Democratic Party                     |
| Russia                                 | United Russia Party, Rodina, Communist Party, Liberal Democratic Party                     |
| India                                  | Indian National Congress, Bharatiya Janata Party, All India Trinamool Congress             |
| Pakistan                               | Muslim League, Pakistan People's Party                                                     |

| Major Signs and Symbols                                     |                                                  |
|-------------------------------------------------------------|--------------------------------------------------|
| Red Cross                                                   | Medical Assistance and Symbol of Hospital        |
| Red Flag                                                    | Revolution or Danger                             |
| Black Flag                                                  | Protest Flag                                     |
| Yellow Flag                                                 | Vehicle Carrying People with Infectious Diseases |
| Inverted Flag                                               | Symbol of Crisis                                 |
| Tilted Flag                                                 | National symbol of mourning                      |
| White Flag                                                  | Agreement or Dedication symbol                   |
| Red Triangle                                                | Family Planning Symbol                           |
| Pigeon Birds                                                | Peace Symbol                                     |
| Red Light                                                   | Danger or Traffic Stop Symbol                    |
| Green Light                                                 | Traffic Go Sign Symbol                           |
| Blindfold and Black Stripe on Female Arm for Scales in Hand | Justice Symbol                                   |
| Blackfold on Arms                                           | Mourning, protest and grief symbol               |
| The two bones crossing each other and the skull above it    | Lightening the threat                            |
| Chakra                                                      | Symbol of progress                               |

| Major Countries and Their National Symbols |                                  |
|--------------------------------------------|----------------------------------|
| Country                                    | Symbol                           |
| India                                      | Sarnath Ashoka Pillar Front Part |
| Belgium                                    | Golden Lion                      |
| Sri Lanka                                  | Lion                             |
| Turkiye                                    | Moon- Star                       |
| Denmark                                    | Lion                             |
| Norway                                     | Lion                             |
| Bangladesh                                 | Water Lilly                      |
| Netherlands                                | Lion                             |
| U.K.                                       | Rose Flower                      |
| USA                                        | Eagle                            |
| Japan                                      | Chrysanthemum                    |
| Canada                                     | Maple Leaf                       |
| Australia                                  | Kangaroo                         |
| Russia                                     | Double Headed Eagle              |



### Government Documents of Major Countries

|             |                                                                   |
|-------------|-------------------------------------------------------------------|
| Green Book  | Government Publication of Italy and Iran                          |
| Orange Book | Government of Netherlands, Report                                 |
| White Book  | Government of Portugal, China and Germany, Government Publication |
| White Paper | UK and Government of India Report on a special subject            |
| Blue Book   | Official Report of the British Government                         |
| Gray Book   | Official Report of Belgium and Japan Government                   |
| Yellow Book | Report of the Government of France                                |
| Joint Paper | Report of two or more Governments Joint Paper or Publication      |

### Important Word Abbreviations

|        |                                                     |
|--------|-----------------------------------------------------|
| ITLU   | : ISRO Technical Liaison Unit                       |
| LMTPA  | : Lakh Metric Tonne Per Annum                       |
| PMBJP  | : Pradhan Mantri Bhartiya Janaushadhi Pariyojna     |
| MEIS   | : Merchandise Exports from India Scheme             |
| FFS    | : Fund of Funds for Startups                        |
| GSLV   | : Geosynchronous Satellite Launch Vehicle           |
| IMD    | : India Meteorological Department                   |
| HADR   | : Humanitarian Aid Distress Relief                  |
| NCMC   | : National Crisis Management Committee              |
| SME    | : Small and Medium Enterprises                      |
| CDSCO  | : Central Drugs Standard Control Organization       |
| GCNEP  | : Global Centre for Nuclear Energy Partnership      |
| AI     | : Artificial Intelligence                           |
| ITSSO  | : Investigation Tracking System for Sexual Offences |
| ERSS   | : Emergency Response Support System                 |
| PMJVK  | : Pradhan Mantri Jan Vikas Karyakram                |
| NMF    | : National Maritime Foundation                      |
| NDDTS  | : National Drug Dependence Treatment Centre         |
| PRIs   | : Panchayati Raj Institutions                       |
| PM-JAY | : Pradhan Mantri Jan Arogya Yojana                  |
| IBBI   | : Insolvency and Bankruptcy Board of India          |
| DDRS   | : Deendayal Disabled Rehabilitation Scheme          |
| DRDO   | : Defence Research & Development Organization       |
| CEA    | : Central Electricity Authority                     |
| IIP    | : Index of Industrial Production                    |
| IPR    | : Intellectual Property Rights                      |
| RIDF   | : Rural Infrastructure Development Fund             |
| HDL    | : High Density Lipo protein                         |

|        |                                                         |
|--------|---------------------------------------------------------|
| MIBOR  | : Mumbai interbank offered Rate                         |
| MEDP   | : Micro Enterprise Development Programme                |
| FDI    | : Foreign Direct Investment                             |
| NEIDS  | : North East Industrial Development Scheme              |
| AKIC   | : Amritsar Kolkata Industrial Corridor                  |
| NIMZs  | : National Investment and Manufacturing Zones           |
| DMIC   | : Delhi-Mumbai Industrial Corridor                      |
| EPS    | : Employee Pension Scheme                               |
| UTs    | : Union Territories                                     |
| DIPP   | : Department of Industrial Policy & Promotion           |
| IIUS   | : Industrial Infrastructure Upgradation Scheme          |
| MIIUS  | : Modified Industrial Infrastructure Upgradation Scheme |
| SPVs:  | : Special Purpose Vehicles                              |
| CLE    | : Council for Leather Exports                           |
| CPCB   | : Central Pollution Control Board                       |
| GSDP   | : Green Skill Development Programme                     |
| UNFCCC | : United Nations Framework Convention on Climate Change |

### Important Indices and India's Performance

| Indices                           | Top Country | India's Ranking   |
|-----------------------------------|-------------|-------------------|
| World Press Freedom Index, 2024   | Norway      | 159 <sup>th</sup> |
| Economic Freedom Index, 2024      | Singapore   | 126 <sup>th</sup> |
| Global Food Security Index, 2022  | Finland     | 68 <sup>th</sup>  |
| Global Hunger Index, 2022         | Belarus     | 111 <sup>th</sup> |
| Global Innovation Index, 2023     | Switzerland | 40 <sup>th</sup>  |
| Global Peace Index, 2023          | Iceland     | 116 <sup>th</sup> |
| World Competitiveness Index, 2024 | Singapore   | 39 <sup>th</sup>  |

### India : As Sovereign Country

India is a Sovereign Socialist Secular Democratic Republic with a Parliamentary form of government which is federal in structure with unitary features. There is a Council of Ministers with the Prime Minister as its head to advise the President who is the constitutional head of the country. Similarly in states there is a Council of Ministers with the Chief Minister as its head, who advises the Governor. This section provides insight of Indian governance and administration at the Central, State as well as local level. Information about the Constitution of India, Parliament and Legislature, Union administration, State, District and Local Administration is given.

| States Governors, Chief Ministers and Capitals |                                             |                           |                    |
|------------------------------------------------|---------------------------------------------|---------------------------|--------------------|
| (1 August, 2024)                               |                                             |                           |                    |
| State                                          | Governor                                    | Chief Minister            | Capital            |
| Andhra Pradesh                                 | Justice (Retd.) S. Abdul Nazeer             | Nara Chandrababu Naidu    | Hyderabad          |
| Arunachal Pradesh                              | Lt. General Kaiwalya Trivikram Parnaik      | Pema Khandu               | Itanagar           |
| Assam                                          | Lakshman Prasad Acharya                     | Shri Himanta Biswa Sarma  | Dispur             |
| Bihar                                          | Rajendra Vishwanath Arlekar                 | Nitish Kumar              | Patna              |
| Chhattisgarh                                   | Ramen Deka                                  | Vishnu Deo Sai            | Raipur             |
| Goa                                            | P.S. Sreedharan Pillai                      | Pramod Sawant             | Panaji             |
| Gujarat                                        | Acharya Dev Vrat                            | Bhupendra Patel           | Gandhinagar        |
| Haryana                                        | Bandaru Dattatraya                          | Nayab Singh Saini         | Chandigarh         |
| Himachal Pradesh                               | Shiv Pratap Shukla                          | Sukhvinder Singh Sukhn    | Shimla             |
| Jharkhand                                      | Santosh Kumar Gangwar                       | Hemant Soren              | Ranchi             |
| Karnataka                                      | Thaawarchand Gehlot                         | Siddharamaiah             | Bengaluru          |
| Kerala                                         | Arif Mohammed Khan                          | Pinarai Vijayan           | Thiruvananthapuram |
| Madhya Pradesh                                 | Mangubhai Chhaganbhai Patel                 | Mohan Yadav               | Bhopal             |
| Maharashtra                                    | C.P. Radhakrishnan                          | Eknath Shinde             | Mumbai             |
| Manipur                                        | Lakshman Prasad Acharya (Additional Charge) | N. Biren Singh            | Imphal             |
| Meghalaya                                      | C.H. Vijayashankar                          | Conrad Kongkal Sangma.    | Shillong           |
| Mizoram                                        | Dr. Kambhampati Haribabu                    | P.U. Lalduhoma            | Aizawl             |
| Nagaland                                       | La. Ganesan                                 | Neiphiu Rio               | Kohima             |
| Odisha                                         | Raghubar Das                                | Mohan Charan Manjhi       | Bhubaneswar        |
| Punjab                                         | Gulab Chand Kataria                         | Bhagwant Mann             | Chandigarh         |
| Rajasthan                                      | Haribhau Kisanrao Badge                     | Bhajan Lal Sharma         | Jaipur             |
| Sikkim                                         | Om Prakash Mathur                           | Prem Singh Tamang (Golay) | Gangtok            |
| Tamil Nadu                                     | R.N. Ravi                                   | M.K. Stalin               | Chennai            |
| Tripura                                        | Indra Sena Reddy Nallu                      | Manik Shaha               | Agartala           |
| Telangana                                      | Jishnu Dev Varma                            | A. Revanth Reddy          | Hyderabad          |
| Uttar Pradesh                                  | Anandiben Patel                             | Yogi Adityanath           | Lucknow            |
| Uttarakhand                                    | Lt. Gen. Gurmit Singh                       | Pushkar Singh Dhami       | Dehradun           |
| West Bengal                                    | Dr. C.V. Ananda Bose                        | Mamta Banerjee            | Kolkata            |

| Union Territories : Governors / Administrators, Chief Ministers and Capitals |                                     |                 |                                   |
|------------------------------------------------------------------------------|-------------------------------------|-----------------|-----------------------------------|
| Union Territories                                                            | Lt. Governors / Administrators      | Chief Minister  | Capital                           |
| Jammu and Kashmir                                                            | Manoj Sinha (Lt. Governor)          | —               | Srinagar (Summer), Jammu (Winter) |
| Ladakh                                                                       | B.D. Mishra (Lt. Governor)          | —               | Leh                               |
| Delhi (N.C.T.)                                                               | Vinay Kumar Saxena (Lt. Governor)   | Arvind Kejriwal | New Delhi                         |
| Puducherry                                                                   | K. Kailashnathan (Lt. Governor)     | N. Rangasamy    | Puducherry                        |
| Andaman and Nicobar Islands                                                  | Devendra Kumar Joshi (Lt. Governor) | (Lt. Governor)  | Port Blair                        |
| Chandigarh (UT)                                                              | Gulab Chand Kataria (Administrator) | —               | Chandigarh                        |
| Dadra and Nagar Haveli and Daman and Diu                                     | Praful Patel (Administrator)        | —               | Daman                             |
| Lakshadweep                                                                  | Praful Patel (Administrator)        | —               | Kavaratti                         |