

PARMAR SSC



A LANDMARK BESTSELLER IN GK

2ND EDITION

PARMAR SSC FAT MAN

GK/GS THEORY BOOK

ENGLISH MEDIUM

WHO IS THIS BOOK FOR?

FOR THE RESTLESS MINDS PREPARING FOR:

SSC CGL (TIER 1 & 2) | CHSL (TIER 1 & 2) | CPO | MTS | STENO |
SELECTION POST | JE | GD | DEFENCE | RAILWAY | PCS | STATE POLICE
& ALL OTHER ONE DAY COMPETITIVE EXAMINATION

WHY FATMAN 2ND EDITION IS A MUST-HAVE?

- 👉 Updated Exam-Specific Content.
- 👉 Designed To Build Strong Conceptual Clarity.
- 👉 Clear, Logical Structure for Easy Learning & Fast Revision.
- 👉 Powered by Concepts, Backed by Memes, Designed to Make You Smile While You Learn.



SSC GK = PARMAR SSC

BY PARMAR SIR

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READ · REVISE · RISE

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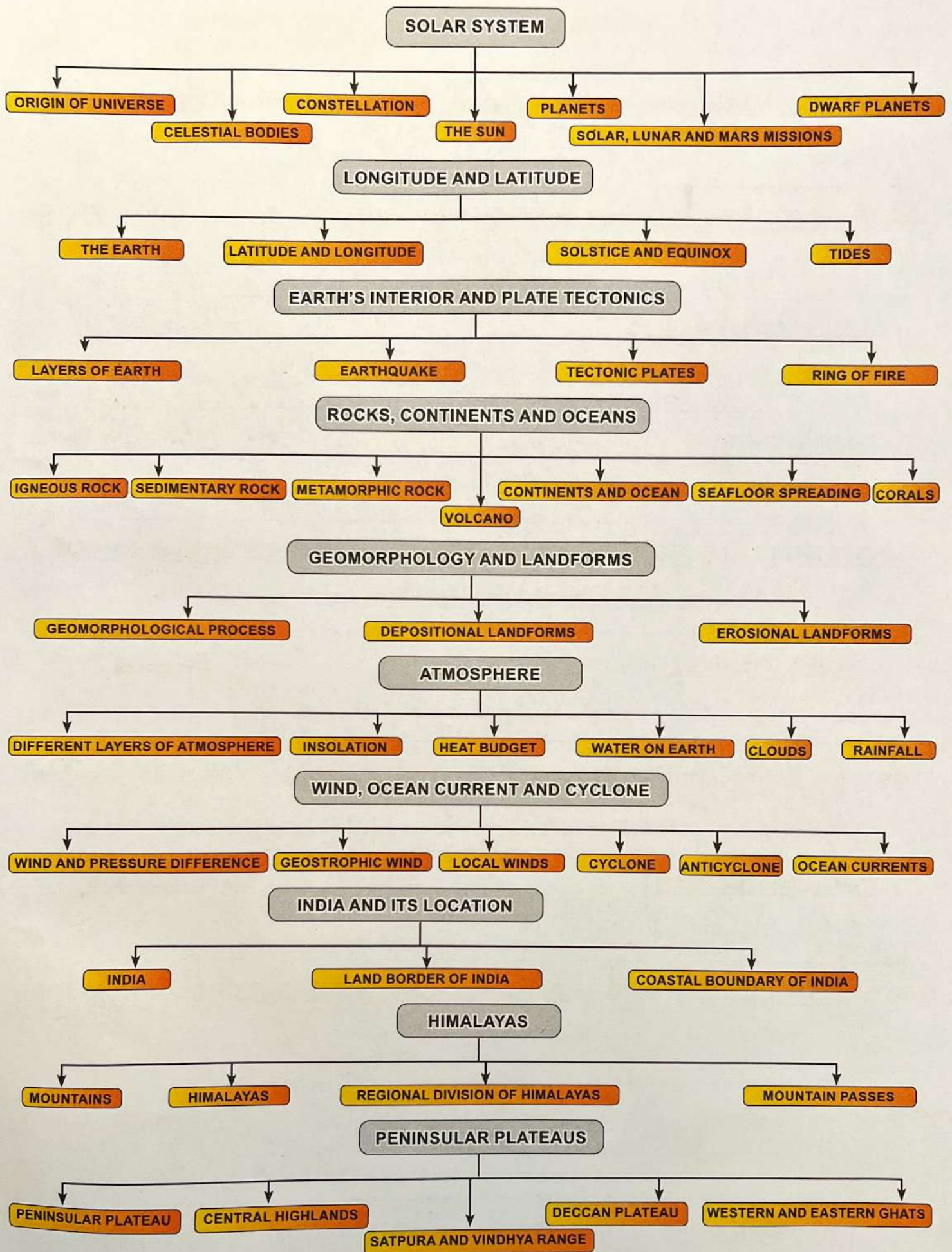
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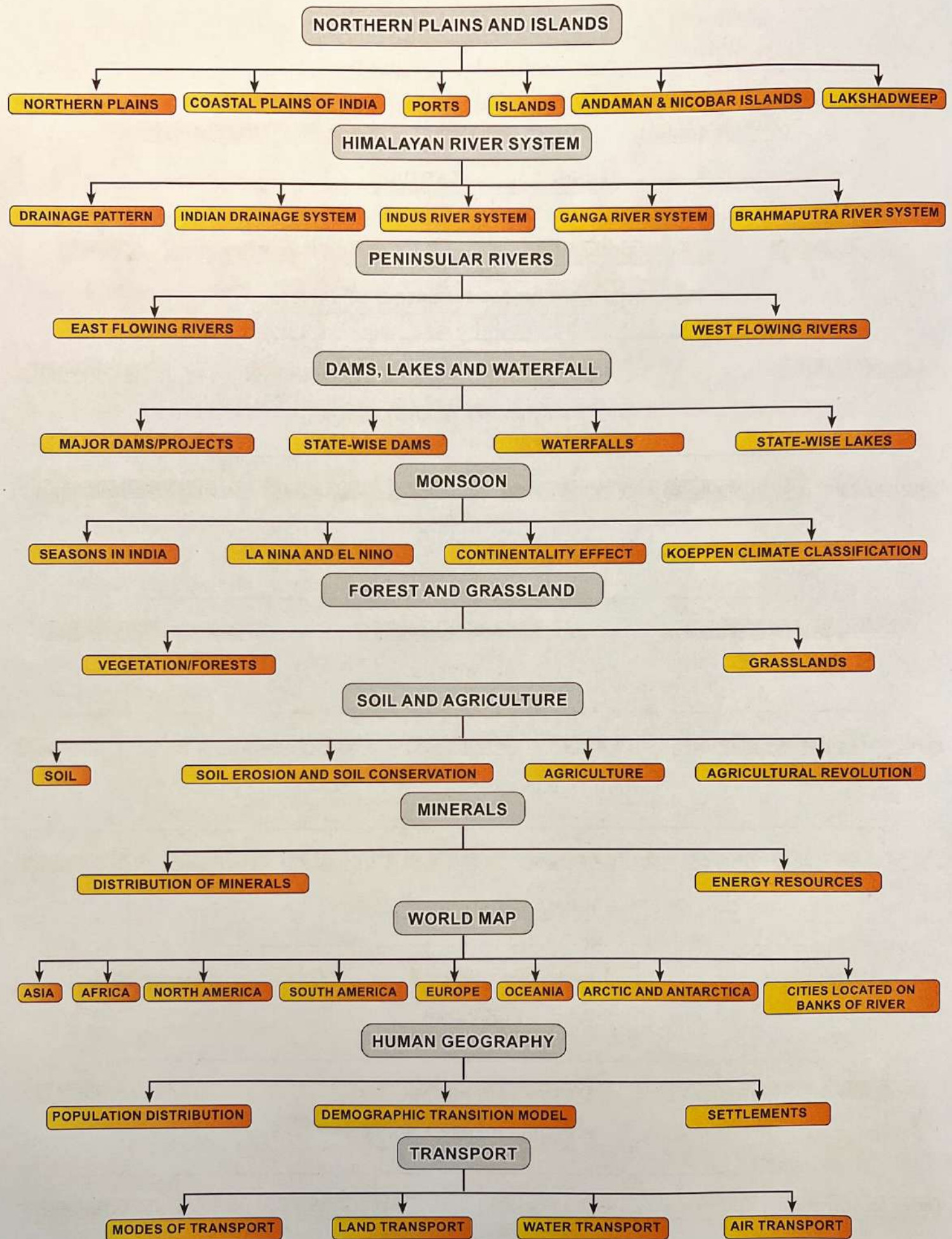
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GEOGRAPHY







- Study of Universe is known as: **Cosmology**.
- Universe consists of many Galaxies, a galaxy in turn consists of many solar systems.**
- Branch of science that deals with celestial bodies: **Astronomy**.

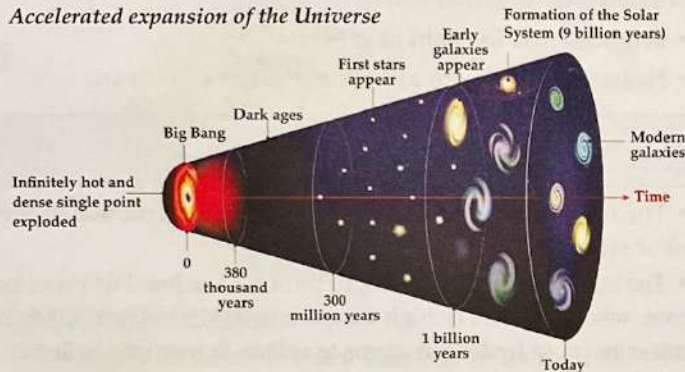
ORIGIN OF UNIVERSE

• Various theories have been given on how the universe came into existence.

Big Bang Theory

- Big Bang was an explosion of concentrated matter in the universe that occurred **13.8 billion years ago**, leading to the formation of galaxies of stars and other heavenly bodies.
- Origin of Big Bang Theory (also known as Big Bang Explosion) was given by **Georges Lemaitre** in **1927** and published in **1931**.

Accelerated expansion of the Universe



Edwin Hubble Theory - (1929)

- Edwin Hubble proposed the expanding universe hypothesis, demonstrating that distant galaxies are moving away from Earth with velocities proportional to their distances (now known as Hubble's Law), which provided the first strong observational evidence that the universe is continuously expanding.

Steady State Theory - (1948)

- It was given by **Fred Hoyle**, Hermann Bondi, and Thomas Gold.
- This theory proposes that the **universe is constantly expanding, but its average properties remain unchanged**.

Galaxy

- A galaxy is a massive collection of stars, gas, dust, and dark matter held together by gravity.
- Our galaxy is **Milky Way Galaxy (or the Akash Ganga/ Mandakini)** formed after the Big Bang.
- **Andromeda/M-31** is the nearest galaxy to the Milky Way.

Our solar system lies in the Orion Spur, a small spiral arm of the Milky Way located between the Sagittarius and Perseus arms.

ORIGIN OF SOLAR SYSTEM

- The formation of Solar System began **4.6 Billion years ago**, while the age of Earth is **4.5 Billion years** old.

Theories related to the origin of solar system

1. Copernicus Theory:

- De revolutionibus orbium coelestium is the Heliocentric theory of **Nicolaus Copernicus, given in 1543**.
- It predicted that the **Sun is at the centre** of the universe, with the Earth and other planets orbiting around it.

2. Nebular Hypothesis:

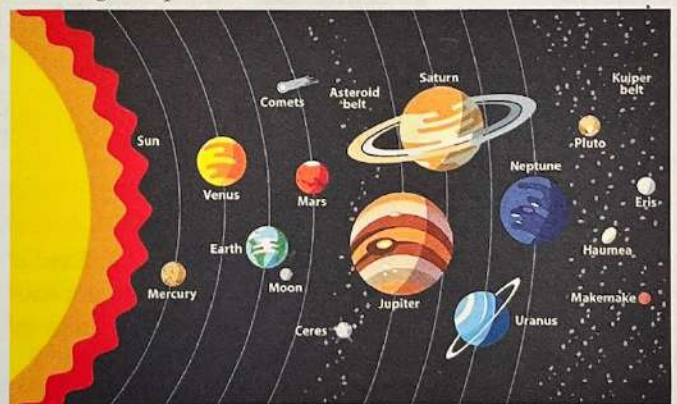
- First proposed by **Immanuel Kant in 1755** and independently expanded upon by **Pierre-Simon Laplace in 1796**.
- The process started when a cloud of gas and dust collapsed, forming a spinning disk called the solar **Nebula**.
- Gravity pulled material to the center, forming the Sun, while the rest flattened into a spinning disk. Dust and gas clumped into planetesimals, which merged to form planets. The Sun formed in the center, and the planets formed in a thin disk orbiting around it → **It is the most widely accepted hypothesis**.

3. Planetesimal Theory:

- **Thomas Chrowder Chamberlin and Forest Ray Moulton concluded (in 1905)** that a passing star came close to the Sun and, due to its gravitational attraction, a portion of the Sun's matter was drawn out.
- This matter gradually cooled and combined to form the planets.

4. Binary Star Hypothesis:

- It was proposed by **H.N. Russell in 1937**.
- The Binary Star Hypothesis proposes that Earth and the other planets formed from debris left behind when the Sun's companion star exploded, with the material eventually coalescing into planets.



- Our Solar System has **8 planets and 5 Dwarf planets**.

CELESTIAL BODIES

- Celestial bodies are objects in space that glow in the night sky, such as planets, stars, moons, asteroids, comets, and galaxies.

They are classified into

Luminous

Those celestial bodies that emit their own light.

Eg. Stars, Firefly

Non-luminous

Those celestial bodies that do not emit their own light.

Eg. Moon, Comets, Asteroids, Meteorites, Meteor, Meteoroid.

Comets

• Comets are **large, icy objects** that orbit the Sun. They are made of dust, rock, and frozen gases like water, carbon dioxide, ammonia, and methane and when it passes near the Sun, its ice starts melting, creating two tails: ion tail & dust tail.

• Comets generally come from the Kuiper belt (short-period comet) or the Oort cloud (long-period comet).

Oort Cloud: Cloud-like form of icy objects and dust particles, beyond the Kuiper belt.

• **Halley's Comet:** It is **seen every 76 years**. It was last seen in 1986 and is expected to return in 2061.

Asteroid

• An asteroid is a **rocky, metallic, or icy object** that orbits the Sun.

Meteoroid

• A meteoroid is a **small, rocky or metallic space rock** that orbits the sun. These are **much smaller than asteroids**, ranging in size from dust grains to objects up to a meter wide.

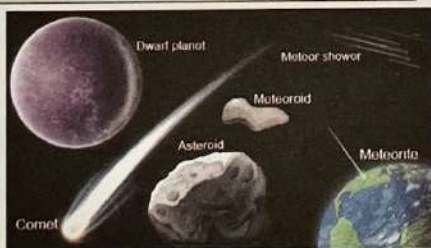
Meteor

• When a meteoroid enters Earth's atmosphere (in Mesosphere), **it burns up and creates a streak of light** called a meteor (also known as **Shooting Star**).

• **Meteor shower name Quadrantids is visible in the early month of January.**

Meteorite

• If the meteoroid survives its trip through the atmosphere, it hits the ground and is called a meteorite.



CONSTELLATION

• A constellation is a group of stars that appear to form a pattern or shape in the night sky. Every constellation forms an asterism which is a group of stars that form a pattern in the night sky.

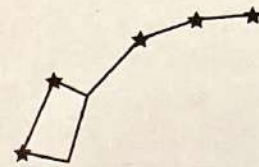
Ursa Major Constellation

• It is also known as the **Great Bear and Saptarishi (in India)**, is a constellation in the northern sky. Big Dipper asterism is seen in Ursa Major (**Brightest star - Alioth**).



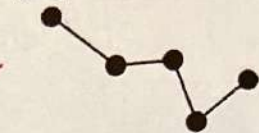
Ursa Minor

• Ursa Minor, also known as the Little Bear, is a prominent constellation in the northern sky (**Brightest star - Polaris**).



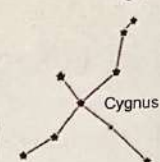
Cassiopeia

• It is a W-shaped constellation. **The brightest star of Cassiopeia is Schedar** (also known as **Alpha Cassiopeia**).



Cygnus

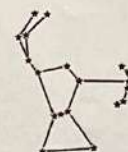
• It is a prominent northern constellation known for its distinctive **cross shape**.



Sagittarius: Bow and cross shaped constellation.

Orion

• Orion (also known as **The Hunter**) is a prominent set of stars visible during winter in the northern celestial hemisphere. The brightest star of Orion is **Rigel**.



• **Brightest star in night sky: Sirius.**

• **Nearest star to Earth after sun: Proxima Centauri.**

THE SUN

- The only star in our solar system and **powerhouse** of the solar system.
- The Sun produces its own light through Nuclear Fusion in its core, where extremely high temperature (~15 million °C) and pressure cause hydrogen atoms to collide & fuse into helium.
- It is composed of **Hydrogen (73%), Helium (25-28%) and other gases.**
- It carries almost **99%** of the mass of our solar system.

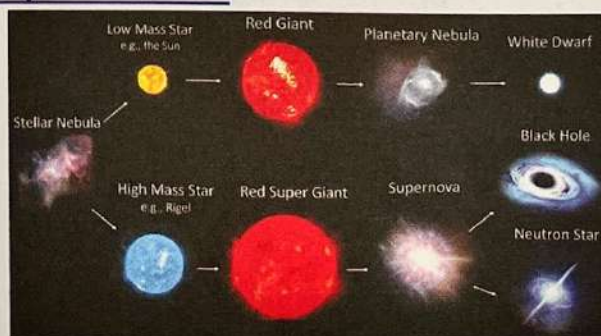
The science of studying the Sun and its influence throughout the solar system is called Heliophysics.

• Approximately **15 crore Kilometre (149.6 Million Km)** further away from Earth. It takes around **8 minutes 20 seconds** for light at the speed of **3 lakh Km/sec** to reach the earth.

- **Temperature at surface = 5800K or 5600°C**
- **Temperature at the center = 15.7 million K**

Note:
*K: Kelvin

Life cycle of a star/Sun

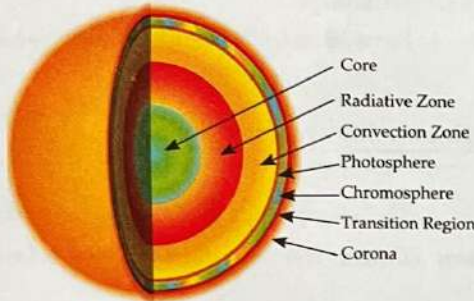


• The life cycle of a star, including our Sun, is determined primarily by its mass: low-mass stars live for tens of billions of years, medium-mass stars (like the Sun) for about 10–12

billion years. Eventually **small stars become white dwarfs**, whereas **massive stars end up** as a neutron star or a **black hole** following a fierce supernova explosion.

- **Stellar Nebula:** Birthplace of stars, clouds of gas and dust.
- **Average Star:** Current stage of the Sun (~4.6 billion years old, halfway through its ~10 billion-year life).
- **Red Giant:** When hydrogen runs out, the Sun will expand enormously and shed its outer layers.
- **Planetary Nebula:** Outer layers drift away, leaving the hot core.
- **White Dwarf:** Dense, faint remnant of the Sun's core.
- **Black Dwarf:** Eventually cools and fades into a cold, dark remnant.

Layers of Sun: Core < Radiative Zone < Convective Zone < Photosphere (Outermost visible part) < Chromosphere < Corona (Outermost layer but not visible with naked eye, extremely hot and only visible during solar eclipses).



Solar flares & Sunspots

Solar flares: These are sudden bursts of radiation caused by magnetic activity on the Sun (short-lived powerful bursts of energy).

Solar wind: It is the continuous flow of charged particles from the Sun's corona (steady, ongoing flow of particles).

Sunspots: These are temporary, planet-sized, darker regions on the Sun's surface caused by intense magnetic activity that inhibits heat transfer, making them cooler than the surrounding photosphere.

Magnetic Cycle: The Sun's magnetic activity peaks every 11 years, increasing the number of sunspots and solar flares.

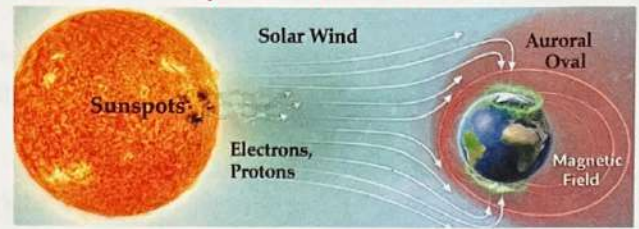
Solar flares effect on Earth: Damage spacecraft electronics, GPS signal disturbance, Geomagnetically induced current in power systems which may cause black-outs, Radiation effects on avionics and communication, induced effects in submarine cables etc.

When solar flares and solar winds interact with Earth's magnetic field, they trap charged particles, forming the Van Allen Radiation Belt around Earth.

Difference between Solar flares and Coronal Mass Ejections (CMEs):

Both phenomena are caused by magnetic reconnection on the Sun, but CMEs involve the expulsion of physical material, whereas solar flares are primarily bursts of light and high-energy particles. While they often occur together, they can also happen independently.

Aurora: As the magnetic field of Earth is lesser in the polar regions, Sun's solar flares hit the atmosphere on poles, creating such light phenomenon in both **north pole (Aurora Borealis)** and **south pole (Aurora Australis)**.



PLANETS

Classification of Planets

Terrestrial Planets	Jovian Planets
They are relatively very small	They are immense in size
They are made of rocky material	They are made of gaseous material
Their surface is solid	They do not have a solid surface
They are nearer to Sun	They are far away from Sun
They have few /no moons	They have multiple moons
They do not have rings	They support ring systems
Eg. Mercury, Venus, Earth, Mars	Eg. Jupiter, Saturn, Uranus, Neptune

Mercury

• It is the **closest planet** to the Sun.

• It is the smallest planet in the solar system with a diameter of **4900Km**.

• It is the fastest planet with speed of **172500 km/h** or **47 km/sec** to complete revolution around Sun in **88 days**.

• It is the only planet that has **no atmosphere**.

• It is a planet with second highest density

Jupiter and Saturn (gas giants), Uranus and Neptune (ice giants)

Venus

• It is the **hottest planet** in the solar system.

• It is also known as **"Earth's Twin"**. It is because of the similarity in size and mass between Venus and Earth.

• **Brightest planet in the Solar system.** It can be seen in the morning and evening with open eyes.

• This planet has the **slowest rotation**. It takes **243 Earth days** to complete one rotation.

• Venus is covered with thick clouds of **Sulfuric acid (H₂SO₄)**.

• **Other names for Venus:** Morning star, Evening star, Lucifer (light bringer).

• All planets have satellites except Mercury and Venus
 • All planets rotate from West to East except Venus and Uranus (they rotate from East to West)

Earth

• The only Planet to give support to life with a pleasant atmosphere.

• It is also known as **"Blue Planet"** because of the presence of water (**70%**) on it.

- It has **one natural satellite** named "Moon".
- It is a planet with **highest density** (5.51 g/cm^3)
- Closest planet to Earth is Venus.

Mars

- It is known as "**Red Planet**" because of **iron-rich red soil**.
- It is the **second smallest planet** in the solar system after Mercury.
- It has two natural moons "**Phobos**" and "**Deimos**".
- It has a thin atmosphere and surface covered with valleys, craters, deserts, and ice caps etc.
- "**Olympus Mons**" (**height: 22–25 km**) is the largest volcano and the tallest mountain in the solar system and lies on Mars.
- Length of a day in Mars equal to **24 hr and 37 minutes**.
- **The asteroid belt is found between the orbits of Mars and Jupiter.**
- **Asteroid Bennu studied by NASA's OSIRIS-REx mission.**

Jupiter

- It is the largest planet of the solar system with **the shortest rotation of 9 hours 55 minutes**.
- It has an atmosphere filled with Hydrogen, Helium and other gases.
- Jupiter is the **third brightest object in the night sky** after the Moon and Venus, but generally three brightest objects in the sky are Sun, Moon and Venus.
- Great Red Spot, a giant storm in the solar system, exists on this planet.
- At present it has **97 moons**, including four large Moons "**Io, Europa, Ganymede, and Callisto (has evidence of Ozone layer)**", also known as **Galilean Moons** because they were discovered by **Galileo**. "**Ganymede**" is the largest among them.
- It has a faint ring system.

Saturn

- It is the **second largest planet** in the solar system.
- It has bright and concentric rings around it which are made up of tiny rocks and pieces of ice.
- Saturn is the planet with **the least density** (0.69 g/cm^3). Apparently, it can float in water.
- At present it has **274 moons and Titan is the largest** among them.
- Satellites of Saturn → **Titan (largest moon) and Enceladus show possibility of life on it.**
- **In 1655: Huygens discovered Saturn's rings.**
- **In 1675: Cassini discovered the gap between rings.**
- **Rotation time- 10.7 hours.**
- **Revolution time- 29.4 Earth years.**

Uranus

- It is greenish in colour, hence known as the "**Green Planet**" **due to the presence of Methane gas in its atmosphere (CH_4)**.
- It was discovered by **William Herschel in 1781**.
- The atmosphere of Uranus is composed of Hydrogen and Helium primarily, but it also contains more water, ammonia etc.

- It has **coldest planetary atmosphere** in the solar system.
- It has **at least 27 moons**. Famous moons → **Miranda, Ariel, and Umbriel**.
- It is tilted to 98° at the axis, hence called the "**Rolling/ Lopsided Planet**".
- **Rotation time- 17 hours.**
- **Revolution time- 84 Earth years.**

Neptune

- It is the farthest planet from the Sun with the **longest/ slowest revolution of 165 years**.
- Its rotation time is **16 hours**.
- Atmosphere primarily composed of Hydrogen and Helium. It is the windiest planet.
- **It is bluish in colour because of Methane.**
- It was discovered by **Johann Galle and Urbain Le Verrier in 1846**. The only planet in the solar system found by Mathematical Predictions.
- It is known to have **14 satellites** and the most famous moon is **Triton**.

Planets in Decreasing Order of their size

J S U N E V M M

Jupiter Saturn Uranus Neptune Earth Venus Mars Mercury

Moon

- The Moon is Earth's **only natural satellite**.
 - It is **non-luminous in nature**.
 - **Radii = $1.74 \times 10^6 \text{ m}$**
 - Moon's light takes **1.26 seconds** to reach Earth's surface.
 - **Distance between Earth and Moon = 3,84,00km**
 - **Gravity on Moon = Earth's Gravity/6**
 - Only one side (**near side**) of the Moon is visible (roughly of it is visible) and the remaining side (**far side**) is not visible to the naked eye.
- Reason
Rotation time = Revolution time → 27.3 Days
- Highest point on moon: **Mt. Leibniz (Now officially known as Mons Huygens)**.

Thin orbit envelope around the moon is known as Lunar Exosphere.

SOLAR, LUNAR AND MARS MISSIONS

Sun

- **Aditya-L1 Mission:** This is India's first solar observatory mission launched by the **Indian Space Research Organisation (ISRO)** to study the Sun.

L_1 refers to the first **Lagrange Point** on the Sun. There are a total of **5 Lagrange Points (L_1 to L_5)**.

Headquarter of IAU: Paris, France

Moon

Chandrayaan-3:

• It is the third lunar-exploration mission of Indian Space Research Organisation (ISRO).

• **Lander:** Vikram (landed on 23rd August, we celebrate it as National Space Day).

• **Rover:** Pragyaan.

• **Point:** Shiv Shakti Point.

• Chandrayaan-3 landed on the **near side of the moon (Lunar South Pole).**

• **Launch Vehicle:** GSLV-Mk3

The Lagrange Points are positions where the gravitational pull of two large masses precisely equals the centripetal force required for a small object to move with them.

Upcoming missions-

Chandrayaan-4: (mission by ISRO) will carry the lunar samples (regoliths) from Moon back to Earth.

Chandrayaan-5: LUPEX (Lunar Polar Exploration) Mission by ISRO (lander) and JAXA (rover and vehicle), explore the southern pole on moon for a longer time.

Artemis II:

Agency: NASA

- Artemis I- tested systems,
- Artemis III- will land humans on the Moon.

Launch Date: April 1, 2026, from Kennedy Space Center.

Crew: Reid Wiseman, Victor Glover, Christina Koch, Jeremy Hansen.

• First crewed mission; astronauts orbited the Moon for 10 days, studied lunar features, and tested life-support systems.

Mars

Mars Orbiter Mission (MOM): (Mangalyaan) is a space probe sent by ISRO, orbiting Mars since 24 September 2014. With this ISRO became the first agency in the world to land on Mars successfully on its first attempt, without any country's help.

Upcoming mission-

MOM-2 is expected to carry a rover and even a pioneering helicopter, making it India's most ambitious Mars project yet.

DWARF PLANETS

Kuiper Belt

• It is a **ring of bodies beyond Neptune** containing a number of asteroids, rocks, and comets.

Pluto

• As per the new definition of Planets determined by International Astronomical Union (IAU), **Pluto has been omitted from the list of planets in 2006** as it was not be able to clear its orbit of debris.

• Pluto is considered as a dwarf planet (size between planets and asteroids) now and it is now a member of **Kuiper Belt**.

• Pluto's largest moon: **Charon (out of 5 moons of Pluto).**

Pluto was discovered by Clyde Tombaugh.

- 1 revolution of Pluto = 248 Earth years.
- Pluto's oblong orbit overlaps with that of Neptune.

Largest Dwarf Planet



Pluto 1475 mi (2374 km) Eris 1445 mi (2326 km) 2007 Or₁₀ 955 mi (1535 km) Haumea 1195×615 mi (1920×990 km) Makemake 890 mi (1430 km)

- **Pluto:** Largest and brightest dwarf planet.
- **Eris:** Second largest dwarf planet.
- **Makemake:** Third largest and it orbits in 310 years.
- **Haumea:** Fastest rotating dwarf planet in Kuiper Belt.
- **Ceres:** This dwarf planet is present in Asteroid Belt.

} Located in Kuiper Belt

Three Characteristics of Planets

1. To be around the Sun.
2. To have a nearly spherical shape.
3. They should be able to clear their orbit of debris

The International Space Station (ISS)

- It is the largest man-made object in Space and a collaborative project of 5 space agencies: NASA, Roscosmos, JAXA, ESA, and CSA.
- The first module of the ISS Zarya control module was launched in 1998 & the station was fully assembled in 2011.
- The ISS is in orbit about 400 kilometre above Earth (at an inclination of 51.6°) and travels around Earth at a speed of about 28000 Km/h. This means that it orbits Earth about every **90 minutes**.

India aims to build Bhartiya Antariksh Station by 2035 in a 400 km Orbit above the Earth.
Tiangong is China's self-built space station.

The Chandrasekhar limit

- Proposed by **Subrahmanyan Chandrasekhar** in 1930, earning him the **1983 Nobel Prize in Physics**.
- It is the maximum mass a white dwarf star can have before collapsing under its own gravity—about 1.44 times the mass of the Sun. Beyond this limit, electron degeneracy pressure can no longer resist gravitational collapse, leading to a supernova and the formation of either a neutron star or a black hole.

Terms to Understands

- **Supernova:** Explosion of star.
- **Pulsar:** A neutron star.
- **Black Hole:** A place in space with immense gravity.
- **Van Allen Radiation Belts:** These are two concentric rings of charged particles that surround the Earth.



THE EARTH

• **Geodesy** is the science of accurately measuring and understanding the Earth's geometric shape, orientation in space, and gravity field.

Shape of Earth

• Shape of Earth is **Geoid or Oblate Spheroid** (a little flat from top and bottom) and bulged at the centre.

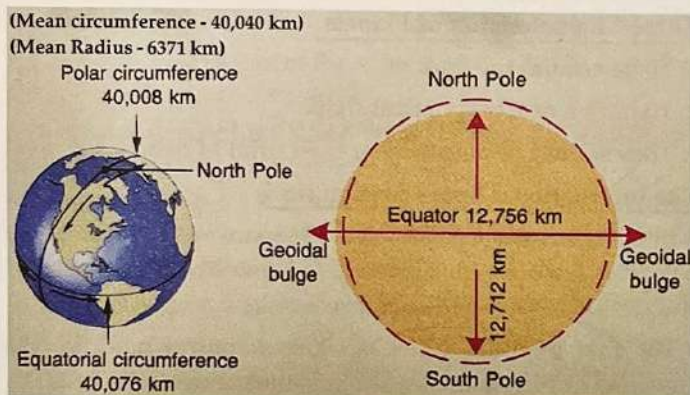
Reason: Centrifugal force (due to rotation of Earth)

• **Equatorial radii (6378 km) > Polar radii (6357 km).**

Difference between ER and PR is about 21-22 km.

• **Equatorial circumference > Polar circumference.**

(All because the Earth is bulged at the equator and fattened at the poles).

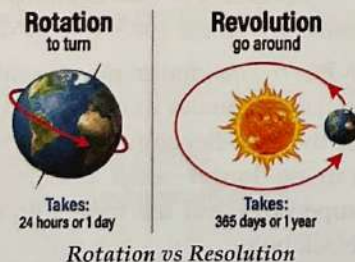


Rotation of Earth

- Earth rotates on its own axis, from West to East (Anti-clockwise).
- One rotation of Earth = 23 hour 56 minutes 4 seconds.
- Rotational speed is maximum at the equator (Equatorial Speed) and minimum at the poles (Polar Speed).
- **Day and night are caused by the Earth's rotation on its axis.**

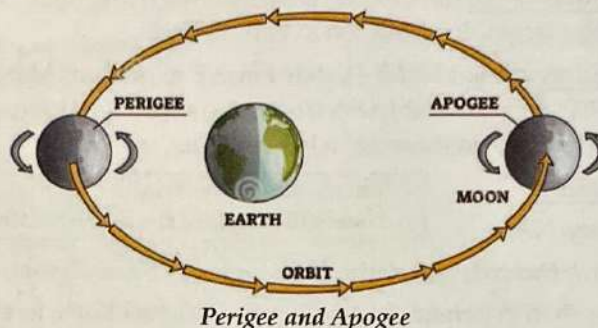
Revolution of Earth

- Earth revolves around the Sun in an elliptical orbit.
- One revolution = **365 days 5 hours 59 minutes and 16 seconds.**
- Orbital speed = 29.8 km/s.
- Mercury has the maximum orbital speed 47.87 km/s at perihelion.
- Neptune has the minimum orbital speed 5.43 km/s.
- **The Earth's revolution around the sun and the tilt of its axis (23.5°) together cause the seasons.**



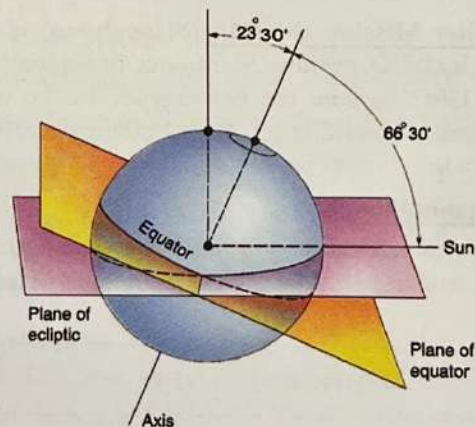
Distance of Earth from Sun and Moon

Sun	Moon
<ul style="list-style-type: none"> • The point in a planet's orbit when it is closest to the Sun is called Perihelion. On January 3rd, the Earth is nearest to the Sun (147 million km). • The point in a planet's orbit when it is farthest from the Sun is called Aphelion. On July 4th, the Earth is farthest from Sun (152 million km). 	<p>The point in the moon's orbit when it is closest to Earth is called Perigee. At perigee, the moon appears larger in the sky.</p> <ul style="list-style-type: none"> • The point in the moon's orbit when it's farthest from Earth is called Apogee. At apogee, the moon's tidal-raising force is smaller, and the tidal ranges are less than average.



Inclination of Earth's Axis

- **Axial inclination:** Inclination of Earth on its axis = 23.5°.
- **Orbital inclination:** Inclination of Earth on its orbital plane = 66.5°.



LATITUDE AND LONGITUDE

Latitude

- They are imaginary horizontal lines on the globe that run from **East to West**.
- It is the angular distance of a place from the equator.
- The number of total latitudes is 181 but latitude circles are 179 in number (as 90°N & 90°S are only points, not circles)
- Distance between each latitude is same.
- **1° of latitude = 111 km.**

Important Latitudes

• 0°: Equator (divides Earth into two equal parts) → Northern and Southern Hemisphere.

• $23\frac{1}{2}^{\circ}$ N: Tropic of Cancer.

• $66\frac{1}{2}^{\circ}$ N: Arctic Circle.

• $23\frac{1}{2}^{\circ}$ S: Tropic of Capricorn.

• $66\frac{1}{2}^{\circ}$ S: Antarctic Circle.

• All parallel circles from the equator to the poles are known as "Parallels of Latitude".

• Largest latitude: Equator.
• Smallest latitude: Poles (North and South).

Longitude

• They are **imaginary vertical lines** (also called Meridians) over the globe that run North to South.

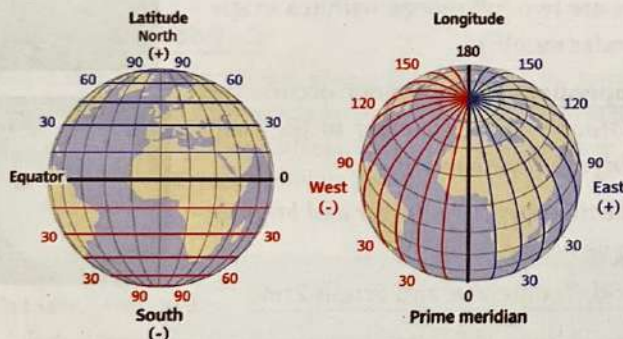
• It is an angular distance of a place from Prime Meridian.

• Distance between each longitude decreases from Equator towards poles, at the poles it is 0, while it is maximum at the equator (**111.32 Km**), but length of each longitude is same.

• Total longitudes 360°.

Gore: A sector of curved surface of earth that lies between two longitudes, in simple words, Gore is the distance between two consecutive longitudes.

Note - We need both latitude and longitude for the location of a place.



Important Meridians (Longitude)

• Prime Meridian-0° longitude (passes through Greenwich, London).

• 180°E & 180°W are the same longitude (unlike latitudes), that's the opposite of 0° or prime meridian. This 180° meridian is the International Date Line.

• Prime Meridian also known as **International Meridian or Greenwich Meridian**. It passes through

- Burkina Faso → B
- Spain → S
- Ghana → G
- Algeria → A
- Mali → Me
- Togo → In TOGO
- UK → KINGDOM

TRICK TO REMEMBER
BSF GAME in TOGO
KINGDOM

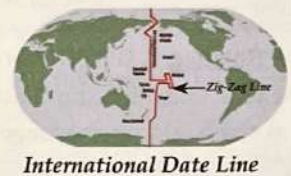


Concept of Time using Longitude

• 360° – 24 hours

• 15° = 1 hour

• $1^{\circ} = \frac{60^{\circ}}{15} = 4 \text{ minutes}$
(Time taken in each 1°)



Question - If it is 12 noon at 60°E longitude, then explain what would be the time at 30° E Longitude?

Answer. Difference in longitude: 60°E – 30°E = 30°

Time difference: 30° × 4 minutes = 120 minutes = 2 hours

Since 30°E is west of 60°E, it will be earlier in time.

• Moving **East away from Prime Meridian**, the time will **increase** by an **hour** for **every 15°**, consecutively if we **move to West** from the **Prime Meridian**, the time will **decrease** by an **hour** for **every 15°**.

• Entire earth is divided into **24 Time Zones**. **France** has the **most number** of Time Zones (**13**) **Russia** (11 time zones), **US** (6 time zones).

International Date Line (180 E/W)

• It is the **imaginary zig-zag line** passing through the Pacific Ocean from where the date changes.

• While crossing International Date Line eastbound i.e. from **East to West** (Eg. **Japan to USA**) → Date is subtracted by 1 or in other words, **the person gains a day** and vice versa.

Concept of Great Circle

• A great circle is the largest possible circle that can be drawn around a sphere.

• **Isochrones:** They are lines joining points located at equal travel time from a common centre.

• It divides the Earth into **two equal parts called Hemispheres** (Northern and Southern).

• **All longitudes are considered great circles**, but only one latitude is considered a great circle and that is **Equator** (0° latitude).

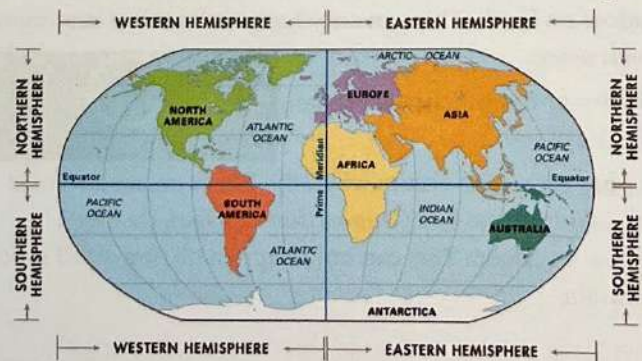
Hemisphere

• Equal division of Earth in two parts.

• **Equator:** It divides the globe horizontally into two equal parts: **Northern and Southern hemisphere**.

• **Prime Meridian:** It divides the globe vertically in two equal parts: **Eastern and Western Hemisphere**.

• India is located in the Northern part of Equator and Eastern part of Prime Meridian, so it's in the North Eastern hemisphere.



SOLSTICE AND EQUINOX

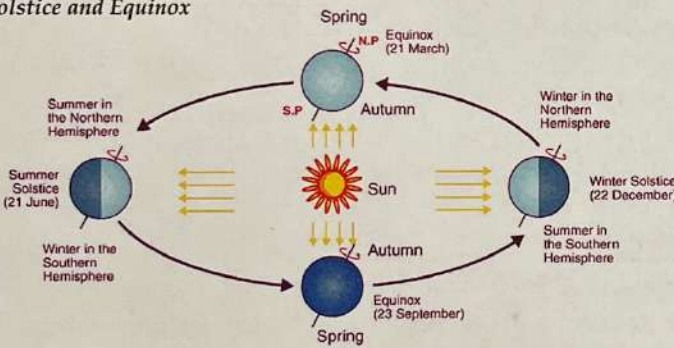
• **Solstice:** A solstice is an astronomical event that occurs twice a year when the sun reaches its highest or lowest point in the sky, resulting in the longest day or shortest day of the year.

Summer Solstice	Winter Solstice
It occurs on 21st June	It occurs on 22nd December
It is the longest day of the year in Northern Hemisphere	It is the shortest day and longest night of the year in Northern Hemisphere
The vertical rays of Sun are directly overhead on Tropic of Cancer	The vertical rays of Sun are directly overhead on Tropic of Capricorn
Northern Hemisphere gets more heat	Southern Hemisphere gets more heat
Continuous sun rays fall on the North Pole for 6 months	Continuous sun rays fall on the South Pole for 6 months

• **Equinox:** An equinox is a time when the *Sun's apparent path in the sky crosses the equator, making day and night approximately equal in length.* At this position, neither of the poles is tilted towards the Sun.

- **Vernal or Spring equinox:** **21st March.**
- **Autumnal or Fall equinox:** **23rd September.**

Solstice and Equinox



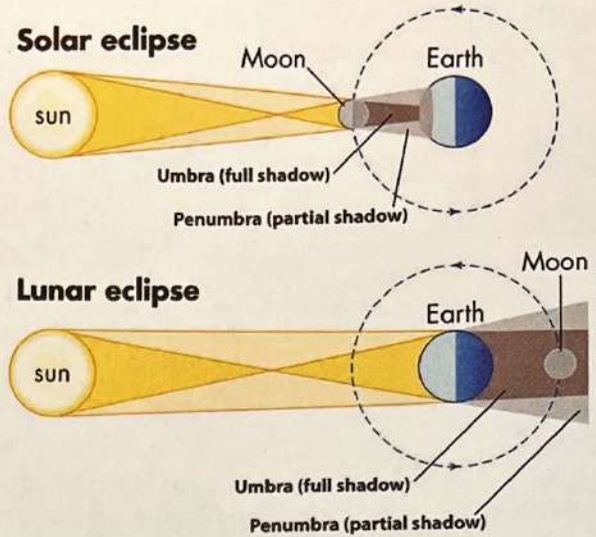
• **Syzygy:** When the Sun, Moon and Earth, all are aligned in a straight line, the alignment is known as Syzygy.

• **Solar eclipse:** It occurs when the *Moon passes between the Earth and the Sun (Conjunction Syzygy),* casting a shadow on Earth. This can only happen during a *new moon (Amavasya).*

• **Types of Solar Eclipse:** Partial, Annular, Total



• **Lunar eclipse:** It occurs when the *Earth passes between the Moon and the Sun (Opposition Syzygy),* casting a shadow on Moon. This can only happen during a *full moon (Purnima).*



• **Umbra & Penumbra:** During a solar or lunar eclipse, the darkest, innermost central part of shadow is called Umbra, and lighter, diffused outer part of the shadow that surrounds the umbra, is known as Penumbra.

• **Red moon:** When Earth blocks the Sun's light (light refraction), it causes *blue colour (scatters more) light to vanish and red light to reach moon (scatters less).*



• **Blue moon:** Blue moon (occurs when there are two full moons within a single calendar month).



• **Supermoon:** A supermoon occurs when the *Moon's orbit is closest to the Earth during a full/new moon.*

• The moon appears *larger and brighter* than its normal size.



Torrid, Temperate, and Frigid Zone

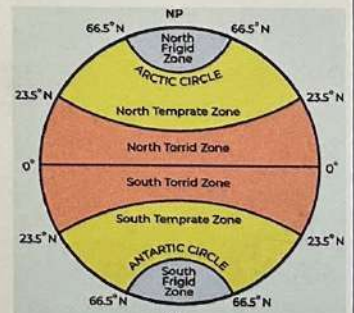
Perigee + Lunar Eclipse

• **Torrid Zone:** Receives direct overhead rays of the Sun due to which it is the *hottest zone.* It is located between the Tropics.

• **Temperate Zone:** Region between Tropic of Cancer & Arctic Circle or Tropic of Capricorn & Antarctic Circle. It receives slanting rays of the Sun.

• **Frigid Zone:** *Coldest region* on Earth which experiences daylight for 6 months and 6 months of night (due to the tilt of Earth). Located beyond the Arctic $\left(66\frac{1}{2}^{\circ}\text{N}\right)$ &

Antarctic Circle $\left(66\frac{1}{2}^{\circ}\text{S}\right)$.

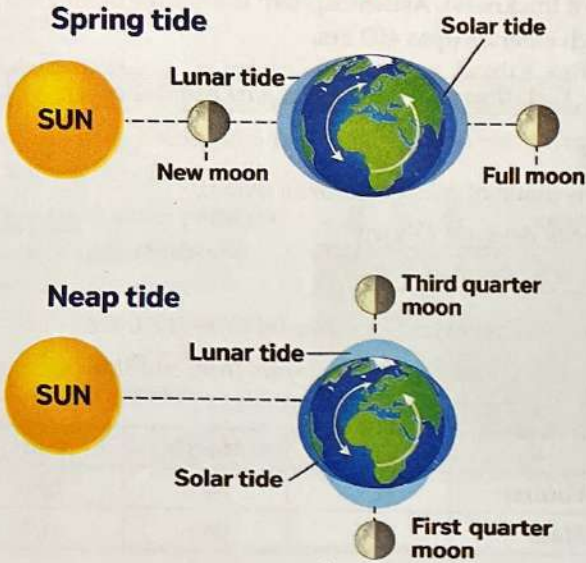


Frigid, Temperate and Torrid Zone

TIDES

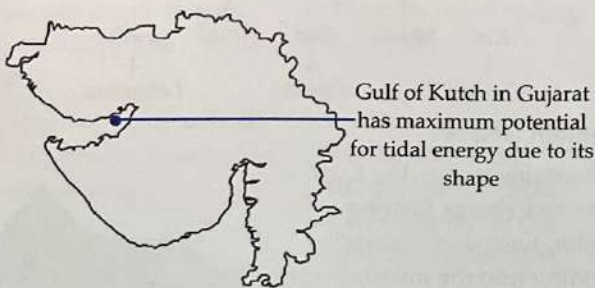
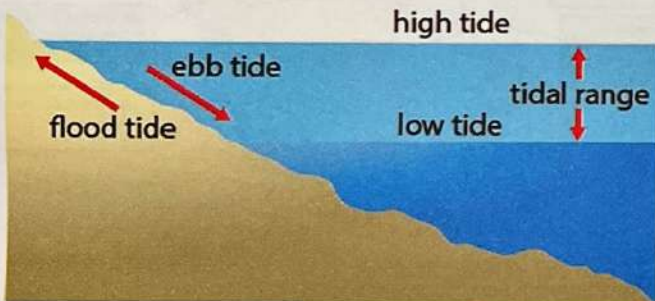
• **Tides:** Tides are the periodic rise and fall of the ocean's water levels. They are caused by the gravitational pull of the moon and the sun on the Earth's oceans. They are of two types:

- **Neap Tides:** They occur when Earth, Moon, and Sun are in *perpendicular alignment (Quadrature)*.
- **Spring Tides:** They occur when the Earth, Moon, and Sun are in *straight line alignment (Syzygy)*.



Flood Tide and Ebb Tide

• Flood tide is the *incoming, rising tide that moves toward the coast*, increasing the water level to high tide. Conversely, ebb tide is the outgoing, *falling tide that recedes from the land*, lowering the water level to low tide.



• **Diurnal tides:** Tidal cycles with *one high tide and one low tide each lunar day*, commonly found in the Gulf of Mexico and parts of Alaska.

- **Semi-Diurnal tides:** Tidal cycles with *two nearly equal high tides and low tides every lunar day*.
- The difference of time between two successive High tide and low tide is approximately *6 hours and 12 minutes*.
- The difference of time between two successive high tides is approximately *12 hours and 26 minutes*.

