

## Geography – Part 1

### 1] The Solar System

#### Notes

##### Universe

- Universe is the name that we use to describe the collection of all the things that exist in space.
- It is made of billions of stars and planets and enormous clouds of gas separated by a gigantic empty space which is called the universe.
- The speed of light is 299,792,458 metres per second (299,792.458 kilometres per second).
- The distance between the earth and the sun is 149.6 million kilometres (that's 92.95 million miles).
- Scientists calculate that the average time it takes for light to reach the earth from the sun is 8 minutes and 20 seconds (approximately 8.33 minutes = 8.4 minutes).
- The planets revolve around the sun in an elliptical orbit due to the gravitational force.

##### Proxima Centauri

Proxima Centauri (meaning 'nearest star to our solar system'), or Alpha Centauri C, is a red dwarf, a small low-mass star, about 4.25 light-years from the Sun in the constellation of Centaurus.

##### Celestial Bodies

- Celestial bodies are objects like Sun, moon, stars and others that shine in the night sky.
- Some celestial bodies are very big and are made up of gases and heat. They have their own heat and light which is emitted in large amounts. These celestial bodies are called stars and our Sun is a star.
- The sun, the moon and all those shining objects in the night sky are called celestial bodies.

##### Constellations

- Stars are having the character of glittering individually.

- Celestial bodies that do not have their own heat and light and lit by the light of the stars are called planets.

### Milky Way Galaxy

- The Milky Way is the galaxy that contains our Solar System.
- The descriptive "milky" is derived from the appearance from Earth of the galaxy – a band of light seen in the night sky formed from stars that cannot be individually distinguished by the naked eye.
- A white streak of light can be seen on a clear night for few days. Our ancestors called this as the ‘Milky Way Galaxy’.
- In India Milky Way Galaxy is called as “Akash Ganga”.
- The Milky Way is a barred spiral galaxy with a diameter between 100,000 and 180,000 light-years.
- It is estimated to contain 100–400 billion stars.
- There are probably at least 100 billion planets in the Milky Way.

### Difference Between Stars And Planets

#### Star

- A star has its own light.
- Stars twinkle at night.
- The relative positions of the stars do not undergo any noticeable change.
- Since the stars are very far away, the telescope can only make them look brighter but not larger.
- A star has very high temperature.
- There are billions of stars in the celestial sphere.

#### Planet

- A planet has no light of its own. It shines by reflecting the light of the sun.
- Planets do not twinkle.
- Since planets are very much closer to the earth than the stars are, their motion around the sun is noticeable as a daily shifting of their relative positions in the sky.
- Most planets on the other hand are near enough to the earth to be magnified by the telescope.
- Planets have low temperatures.
- There are only nine planets in the solar system.

## The Sun

- The sun lies in the centre of the Solar System. It is a yellow dwarf star.
- It has a surface temperature of approximately 6000°C. Its diameter is about 865,000 miles approximately 109 times the diameter of the Earth.
- By mass the sun is made up of 71% Hydrogen, 28% Helium and the remaining 1% mass comprising heavier atoms such as Carbon, Nitrogen, Oxygen, Silicon and Iron.
- The sun contains 99% of the Solar Systems mass. It has no fixed surface and the temperature is too high for the matter to exist as a solid or a liquid.
- Due to this different parts of the sun rotate at different rates.
- The parts of the surface near the equator complete a rotation in 25 Earth days, whereas the parts near the pole take 36 days.

## Planets

- There are eight planets in our solar system.
- The planets are classified into Solid Planets and Gaseous planets
- No planet has the capacity to emit light.
- In order of their distance from the sun, they are: Mercury , Venus ,Earth ,Mars , Jupiter , Saturn , Uranus and Neptune

## Inner Planets

- These planets are very close to the sun.
- They are made up of rocks.

## Mercury

- Mercury is the smallest of the eight planets in the solar system. It is the planet with the closet orbit to the sun.
- Its orbit lies between the sun and the orbit of Venus and it has no known moons. Mercury has a diameter of approximately 3000 miles.
- It is made up of a high percentage of metal making it the densest planet in the solar system.
- It takes Mercury 88 Earth days to orbit the sun. The fast orbit is offset by the planets slow spin.
- It takes Mercury 59 Earth days to complete one rotation about its axis. It is also called as rock planet.

## Venus

- Venus is the second planet from the sun.
- Its orbit lies between the orbits of Mercury and Earth and has no known moons.
- Venus has a diameter of approximately 12,100 km making it slightly smaller than Earth.
- This is because it has a very large atmosphere made up mostly of Carbon Dioxide. This thick, dense atmosphere traps the heat radiated from the planet's surface and the sun (greenhouse effect) making the average temperature on Venus about 460°Celsius.
- Venus spins about its axis very slowly taking 243 Earth days to complete one rotation, which is the length of a day on Venus.
- It completes one orbital revolution of the sun in 225 Earth days making Venus the only planet where a day is longer than a year.
- Venus rotates about its axis in a retrograde motion i.e. in a direction opposite to the other planets.
- Venus and Neptune are the only planets which rotate counter clockwise while the other 6 planets rotate clockwise. It is also called as evening star.

### **Earth**

- Earth is the third planet from the sun.
- It is the only planet that hosts all known life.
- Its orbit lies between Venus and Mars and has one moon.
- The Earth has a diameter at the equator of 12,756km. It spins about its axis once every 24 hours (1 Earth day) and takes 365.24 days to orbit the sun.
- The Earth's atmosphere is made up of 78% Nitrogen, 21% Oxygen and the remaining 1% consists of other gases such as Argon, Carbon Dioxide, Methane and Hydrogen.

### **Mars**

- Mars is the fourth planet from the sun.
- The orbit of Mars lies between Earth's orbit and Jupiter's orbit. Between Mars and Jupiter lies the main asteroid belt.
- Mars has two small moons called Phobos and Deimos. Mars is the second smallest planet in the solar system.
- Its diameter at the equator is approximately 6,800km. It takes Mars 687 days to complete one revolution of the sun.
- Thus, one year on Mars is equivalent to almost 2 Earth years.
- Mars is called the red planet due to the reddish brown Iron Oxide on its surface.

- Its atmosphere is made up mostly of Carbon Dioxide, however the atmosphere is very thin making the average temperature on the surface average about -70°Celsius.

## **Outer Planets**

Very-very far from the sun and are huge planets made up of gases and liquids

### **Jupiter**

- Jupiter is the fifth planet from the sun.
- It is the largest planet in the solar system with a diameter at the equator of approximately 143000km. More than 1300 Earths can fit inside Jupiter.
- To date more than 60 known moons orbit Jupiter. It completes one rotation in 9hours 55 minutes, which is the length of a day on Jupiter.
- It takes about 11.9 earth years to orbit the sun. Jupiter has no solid surface.
- It is composed mainly of Hydrogen and Helium. The large pressures in the planets interior account for Hydrogen and Helium in the liquid form surrounded by a gaseous atmosphere.
- The Great Red Spot is a huge oval shape storm system in the planets southern hemisphere.

### **Saturn**

- Saturn is the sixth planet from the sun.
- After Jupiter it is the second largest planet in the solar system. Its diameter at the equator is approximately 75000 miles (120,500 km).
- Saturn's orbit lies between Jupiter and Uranus and it takes about 30 Earth years to complete one revolution around the sun.
- It rotates about its axis in 10.8 hours, which is the length of a day on Saturn. Saturn like Jupiter is one of the gas giants and is composed mostly of Hydrogen and some Helium. Saturn's most famous feature is its ring system.
- This is made up of hundreds of thousands of individual rings held in orbit by the pull of Saturn's gravity. The rings are made up of countless ice chunks and dust particles.
- In addition to the ring system there are more than 50 known moons that orbit Saturn.

### **Uranus**

- Uranus is the seventh planet from the sun. Its diameter at the equator is about 32000 miles (51500 km) making it the third largest planet in the solar system.
- It takes Uranus 84 Earth days to complete one trip around the sun.
- Uranus completes one rotation on its axis in approximately 17 Earth hours, which is a length of a day on Uranus.
- Like Venus it rotates about its axis in a retrograde motion.
- Uranus has a liquid interior due to very high temperatures and pressures inside the planet.
- It is made up of the melted ices of water, methane and ammonia, along with molten rock and metals and small amounts of Hydrogen and Helium.
- Uranus has a massive atmosphere made up of approximately 75% Hydrogen and 25% Helium with small amounts of methane, water and ammonia.
- Uranus has a system of about 12 narrow rings; the rings are made up of countless particles orbiting the planet. Uranus has 5 major moons and more than 20 smaller ones.

### Neptune

- Neptune is the eighth and farthest most planet from the sun and cannot be seen by the unaided eye.
- It has a diameter of approximately 31000 miles (50000 km). It takes Neptune 146 Earth years to orbit the sun.
- Neptune takes 16 hours to complete one rotation about its axis, which is a length of a day on Neptune.
- Like the other gas giants Neptune has a massive atmosphere made mostly of Hydrogen with some Helium and about 2% of Methane.
- It is the Methane in Neptune's atmosphere that makes it appear bluish in color.
- The interior is similar to Uranus being made up of melted ices of water, Methane and Ammonia, along with molten rocks and metals. Neptune has 6 narrow rings composed of dust size particles orbiting the planet.
- Neptune has 13 known moons.

### Pluto

- Pluto was discovered in 1930 and was considered the ninth planet of the solar system up until 2006 when it was classified as a dwarf planet.
- This was due to many other objects of a similar size to Pluto being discovered in a region where it lies called the Kuiper belt.

- Pluto has a diameter of about 1500 miles (2400 km). It takes Pluto 248 years to complete a trip around the sun, which is the length of a year on Pluto. It completes one rotation about its axis in 6.4 Earth days.
- Its atmosphere is composed of Nitrogen with small amounts of Methane and Carbon Monoxide.
- Its interior is thought to be made of rock and ice. Because of its great distance from the sun the surface temperature on Pluto is extremely cold. Pluto has one known moon.

### **Dwarf Planets**

- There are 5 officially recognized dwarf planets in our solar system, they are Ceres, Pluto, Haumea, Makemake and Eris.
- Dwarf planets share many of the same characteristics as planets though there is one significant difference.
- A “dwarf planet” is a celestial body that
  - (a) Is in orbit around the Sun,
  - (b) Has sufficient mass for its self-gravity to overcome rigid body forces so that it assumes a hydrostatic equilibrium (nearly round) shape,
  - (c) Has not cleared the neighbourhood around its orbit, and
  - (d) Is not a satellite.

### **Moon**

- The moon is the easiest celestial object to find in the night sky — when it's there.
- Earth's only natural satellite hovers above us bright and round until it seemingly disappears for a few nights.
- Though a satellite of Earth, the moon, with a diameter of about 2,159 miles (3,475 kilometers), is bigger.

### **Phases of the Moon**

- The phases of the Moon are the different ways the Moon looks from Earth over about a month.
- As the Moon orbits around the Earth, the half of the Moon that faces the Sun will be lit up.
- The different shapes of the lit portion of the Moon that can be seen from Earth are known as phases of the Moon. Each phase repeats itself every 29.5 days.

- The same half of the Moon always faces the Earth, so the phases will always occur over the same half of the Moon's surface.
- A phase is an angle of the moon to the earth so it appears differently every day.
- There are 8 major phases that the moon goes through.
  - ✓ A new moon is when the Moon cannot be seen because we are looking at the unlit half of the Moon. The new moon phase occurs when the Moon is directly between the Earth and Sun. A solar eclipse can only happen at new moon.
  - ✓ A waxing crescent moon is when the Moon looks like crescent and the crescent increases ("waxes") in size from one day to the next. This phase is usually only seen in the west.
  - ✓ The first quarter moon (or a half moon) is when half of the lit portion of the Moon is visible after the waxing crescent phase. It comes a week after new moon.
  - ✓ A waxing gibbous moon occurs when more than half of the lit portion of the Moon can be seen and the shape increases ("waxes") in size from one day to the next. The waxing gibbous phase occurs between the first quarter and full moon phases.
  - ✓ A full moon is when we can see the entire lit portion of the Moon. The full moon phase occurs when the Moon is on the opposite side of the Earth from the Sun, called opposition. A lunar eclipse can only happen at full moon.
  - ✓ A waning gibbous moon occurs when more than half of the lit portion of the Moon can be seen and the shape decreases ("wanes") in size from one day to the next. The waning gibbous phase occurs between the full moon and third quarter phases.
  - ✓ The last quarter moon (or a half moon) is when half of the lit portion of the Moon is visible after the waning gibbous phase.
  - ✓ A waning crescent moon is when the Moon looks like the crescent and the crescent decreases ("wanes") in size from one day to the next.
  - ✓ An old moon is a moon with only a tiny bit of it seen in the corner, about to turn into a new moon.

### **Blue moon**

A second full moon in one calendar month is usually called a "blue moon" and this occurs approximately every 3 years.

### **Comet**

- A comet is an icy ball of rock that grows a tail when it travels close to the Sun.
- It grows a tail because as comets heat up, gas and dust are forced from the body and trail behind it. The Sun illuminates this trail, which causes it to glow.
- Coma and comet material is extremely thin, its quality only the total mass of 1 to 5%, or even small
- The way a comet orbits - and the length of its orbit - varies greatly from one comet to another.
- They can have a short period and orbit every few years, or a very long period and orbit every 100,000 years.
- Most of the shorter-period comets come from the Kuiper belt, a massive region of small objects (including Pluto) out beyond Neptune.
- The best-known comet is Halley's Comet. It last appeared in 1986 and will appear again in 2062. Halley's Comet has been seen every 76 years since 240 BC.

### **Asteroids**

- Asteroids are small objects that orbit the sun.
- Some of the largest asteroids are so big they've been called planetoids. The largest asteroid known so far is named Ceres and it is 950 kilometers wide.
- There are millions of asteroids in the universe. The majority of them live in the asteroid belt between Mars and Jupiter.
- Most believe asteroids are leftover pieces of matter from the formation of our solar system that are kept in the belt area due to Jupiter's gravitation pull.
- Others think the asteroid belt is a planet that was broken apart during a collision. There are other small groups of asteroids in the solar system, too; one of them is near Earth.
- Asteroids need to be very big and close enough to Earth to be seen with binoculars or a small telescope. Since Earth was first formed, asteroids have slammed into it. Fortunately for us, though, dangerous asteroids, like the one that probably killed off the dinosaurs, are extremely rare.
- When an asteroid, or a part of it, crashes into Earth, it's called a meteorite.

### **Meteorite**

- Meteorite is a solid piece of debris from an object, such as a comet, asteroid, or meteoroid that originates in outer space and survives its passage through the atmosphere to reach the surface of a planet or moon.

- When the object enters the atmosphere, various factors like friction, pressure, and chemical interactions with the atmospheric gases cause it to heat up and radiate that energy.

