



KHAN GLOBAL STUDIES

KGS Campus, Near Sai Mandir, Musallahpur Hatt, Patna-6

Mob : 8877918018, 875735880

Geography

By. Ajit Sir

Solar System

Introduction

The Solar System includes the Sun, the Earth, eight planets, satellites, asteroids, meteors, comets, etc. The Sun is located at the center of the Solar System. All the eight planets revolve around the Sun in fixed orbits, the closer the planet is to the Sun, the higher is its revolution speed. Along with this, these planets also rotate on their axis. Planets do not have their own light, while stars have their own light.

- ☛ Mercury, Venus, Earth and Mars are called 'inner planets'. Their size is small and density is high, while Jupiter, Saturn, Uranus and Neptune are called 'outer planets'. Their size is large and density is less.
- ☛ Mercury is the closest planet to the Sun. After this comes the place of Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune respectively. Mercury and Venus are very hot due to their proximity to the Sun, while the other planets are relatively cold.
- ☛ Venus is closest to Earth. After this comes the place of Mars, Mercury, Jupiter respectively.
- ☛ Jupiter is the largest planet. After this comes the place of Shani, Arun, Varun, Prithvi, Venus, Mars, and Mercury respectively.
- ☛ The size of Earth and Venus is almost equal, so both the planets are also called 'Twin Planet'.
- ☛ According to NASA, Saturn has 82 satellites or moons. Jupiter has 79 satellites, Uranus has 27 and Varuna has 14 satellites. Apart from this, there are 27 such satellites, which have not been confirmed yet. Of these, 17 belong to the planet Jupiter and 9 to the planet Saturn. Ganymede, a satellite of Jupiter, is the largest satellite in the Solar System.
- ☛ According to NCERT, Saturn and Jupiter have about 53 satellites or moons, Uranus has 27 and Neptune has 13 satellites. Mercury and Venus do not have any satellite.
- ☛ Phobos and Deimos are two satellites of Mars.

- ☛ Except Venus and Uranus, the direction of rotation of all other planets is from West to East (Anti & Clock Wise).
- ☛ Venus, the brightest planet in the Solar System, is also called the 'Morning Star' and 'Earth's sister'.
- ☛ Mars is also called the 'Red Planet'.
- ☛ The planet Saturn is surrounded by three bright concentric rings. Titan is the largest and Phocbe is the smallest satellite of Saturn.
- ☛ Proxima Centauri is the closest star to Earth after the Sun, it is 4.5 light-years away from Earth.
- ☛ **Note:** A light year is equal to the distance traveled by light in one year.

Celestial Bodies

1. **Galaxy :-** It is a huge cluster of stars. There are 10,000 million galaxies in the universe. There are 100,000 million stars in each Milky Way. Apart from the stars, dust and gases are also found in the Milky Way.
- ☛ Earth is a part of the Milky Way called Airavat Path.
 - ☛ Large Magellanic Cloud, Small Magellanic Cloud, Ursa Minor System, Sculptor System, Draco System etc. are other galaxies. Stars are formed as a result of the simultaneous concentration of different substances in this vast universe. A large group of these stars together form the Milky Way.
 - ☛ This has been estimated on the basis of various observations. That there will be more than 100 billion galaxies in the universe. Of this, 10 billion galaxies can be seen with a telescope.
 - ☛ A team comprising members of the Pune-based Inter University Center for Astronomy and Astrophysics, the Indian Institute of Science Education and Research and two other Indian universities has discovered a supercluster of galaxies about four billion light-years away from Earth. This supercluster has been named Saraswati.

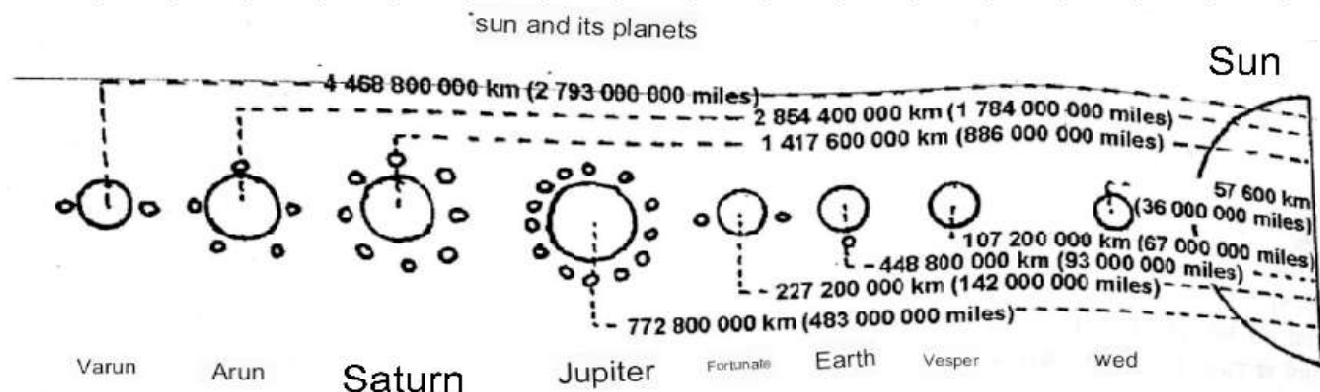
- ☛ Galaxies contain a vast number of stars, which are the basic building units of the universe. A supercluster consists of 40 to 43 clusters, with a cluster containing about 1000 to 10000 galaxies. The Milky Way galaxy, in which Earth is located, is part of the Laniakea Supercluster.
- 2. Nebulae:** – It is a highly luminous celestial body, which is made up of gas and dust particles. The Orion Nebula is located in the Milky Way.
 - 3. Constellation :** – These are groups of stars. In ancient times, they were named on the basis of their specific shapes. In modern times, 89 constellations have been identified. Of these, Hydra is the largest, while Centaurus, Gemini, Leo, etc. are examples of other constellations.
 - 4. Quasars (Quasars or Quasi & Stellar Radio Source):**– These are those celestial bodies, which are smaller in size than the Milky Way, but emit more energy than that. This type of extremely bright ce-

lestial objects were discovered in 1962 AD. In 1983 AD, a quasar was discovered whose luminosity is 1.1×10^{15} times more than that of the Sun.

- 5. Stars :** – There are clouds of gas in the Milky Way and stars are formed from these clouds. Energy is continuously emitted from the stars. The Sun is also a star. Some stars in space are found in pairs, which are called 'binary stars'.

The death of stars begins when the fuel in their core starts to run out. The dying star eventually explodes, producing very intense light for a short time. This is called 'Supernova Explosion'. After the explosion, the residual part of the very dense core of the small star is called 'White Dwarf'. The residual part of the highly dense core left after the explosion of a massive star is called a 'Neutron Star'. Due to the small size, the neutron star rotates very fast and radiates electromagnetic rays. Such a star is called a 'Pulsar'. Very massive stars turn into 'Black Hole' after the explosion. Due to excessive gravitational force, no matter or rays can come out of the black hole.

Planets, Satellites and Dwarf Planets of the Solar System								
Body	Average distance from Sun (million km)	Relative mass (Earth = 1)	Revolution period (years)	Rotation period (hours)	Average Density (g/cc)	Relative radius (Earth radius = 1)	Axial tilt (°)	Number of satellites
Sun	–	33,300	–	25-30 days	1.4	109	–	–
Mars	58	0.05	88 days	59 days	5.0	0.38	7°	0
Venus	107	0.82	225 Days	257 days	5.0	0.96	0°	0
Earth	150	1.00	365 days	24 hours	5.5	1.00	23½°	1 (moon)
Jupiter	773	318	12 years	9.8 hours	1.3	11.23	1°	53 (These satellites are called Galilean satellites. The four largest satellites are Io, Europa, Ganymede and Callisto)
Shani	1,419	95	29 years	10.3 hours	0.7	9.41	2½°	53 The largest satellite is Titan)
Uranus	2,854	15	84 years	10.8 hours	1.5	3.98	0°	27
Venus	4,472	17	165 Year	15.7 hours	2.0	3.88	2°	13
Pluto	5,875	0.1	248 years	6.4 hours	5.0	0.50	17°	5
Moon	–	0.01	27.3 Day	27.3 days	3.4	–	–	–



6. **Satellite:** These are small celestial bodies, which revolve around a planet. They do not have their own light, rather they receive light from the stars.
 7. **Asteroid:** These are small celestial bodies, which are situated between Mars and Jupiter. Their number is about 45,000. They are much smaller than the Moon in size. Four Vesta (4 Vesta) is the only asteroid that can be seen with the naked eye.
 8. **Meteors:** They appear like a falling star in the night sky, they are actually solid celestial substances, which burn due to friction on entering the Earth's atmosphere and generate bright light. Sometimes these pieces fall on the earth in the form of meteorites. Heavy substances like iron and nickel predominate in these.
- ☞ The Perseid meteor shower is a unique astronomical phenomenon on Earth. It is a dust particle of comet Swift Tuttle, which passes near the Earth every year.
 - ☞ This meteor shower occurs when dust from Comet Swift Tuttle heats up and burns with a bright light as it enters the atmosphere. When this waste remains in space, it is called a meteoroid, but when it enters the Earth's atmosphere, it is called a meteor.

Swift Tuttle Comet

- ☞ Comet Swift Tuttle is the largest frequent near-Earth object, with a nucleus 26 kilometers (16 mi) in diameter.
9. **Comets:** These are celestial bodies made of celestial dust particles, gas, ice etc., which revolve around the Sun. On coming closer to the Sun, its head is formed by the evaporation of substances from the Sun's further part. Its tail always points away from

the Sun. Temple-1, Hellbop, Forbes, Halley etc. are examples of comets. Halley's Comet appears every 76 years.

10. **Sun:** This is a star, which is about 15 crore km from the earth. It is situated far away. Its light takes about 8 minutes to reach the Earth. Its surface temperature is $6,000^{\circ}\text{C}$. The outer part of the Sun is called the Chromosphere. The central part is called the photosphere and its temperature is $15,000^{\circ}\text{C}$. The surface of the Sun which we can see is called photosphere. It is the surface that separates the Sun's body from its atmosphere.
 11. **Moon:** It is the satellite of the earth, which is located 3,84,365 km away from the earth. The day temperature on the moon is 100°C and the night temperature is -180°C . The gravitational force on the Moon is one-tenth of the Earth's gravity. Due to low gravitational force, there is lack of atmosphere on the moon.
- ☞ **Fraunhofer Lines:** In addition to the 7 colors in the solar spectrum, all black lines are visible, which are called 'Fraunhofer lines'. Each of these lines indicates one or the other element present in the solar atmosphere. The intensity and thickness of these lines gives knowledge of the density and temperature of a particular element.
 - ☞ **Solar Flames:** Massive emissions of protons (nuclei of hydrogen molecules) propelled in all directions from the Sun, sometimes about 700 km. Intensifies up to a speed per second, crosses the corona and goes into space, which is named the solar flare.
 - ☞ **Aurora Borealis** or the northern polar light about 100 to 1000 km at the North Pole. Sometimes colored light is visible at a height of . This is due to solar flares colliding with air particles upon entering the Earth's atmosphere.

- ☞ **Aurora Australis or South Polar Light:** Colorful light seen at the South Pole after collision with air particles when solar flares enter the Earth's atmosphere.
- ☞ **Solar wind** is a continuous stream of less effective protons coming out of the solar system, whose speed is about 640 km. Per second, it is called the solar wind, due to the rotation speed of the Sun, its shape is spiral. They are accompanied by a magnetic field, due to which the Earth's magnetic field makes them special. Sometimes on entering the earth's atmosphere, 'aurora lights' are seen.
- ☞ **Sun Spots :** Sun Spots visible in the Sun's orbit, whose temperature is much lower (about 1,500°C) than the temperature of the Sun's surface (6,000°C). Probably this is the closed area of magnetic lines. At the time of excess of solar spots, magnetic storms are born on the earth, which have an effect on radio, television, wireless etc.
- ☞ **Van Allen Belt or Magnetosphere:** The magnetic circle whose height is 64 thousand km from the earth's surface its called Wayne Allen Belt.
- ☞ It is called This belt is the Earth's magnetic shield, in which the protons and electrons released from the Sun get trapped and bind to the Earth's magnetic force of $66\frac{1}{2}^\circ$.

Origin of Earth and Solar System

- ☞ Knowing about the origin of the universe, the solar system and the earth has been part of the central theme of human inquiry since time immemorial. In the early times, the facts related to the origin of the earth or the solar system were entirely based on religious beliefs. Unlike religious concepts, hypotheses based on logic are called scientific concepts.
- ☞ In this context, for the first time in 1749 AD, Caste de Buffon tried to explain the process of origin of the earth on the basis of arguments. At present, many hypotheses and concepts have been proposed in the origin of the Earth or the Solar System, but none has been fully accepted.

- ☞ On the basis of the number of stars participating in the origin of the planets of the solar system, scientific concepts can be placed in two categories: (a) Monistic concept (b) Dualistic concept

- a) **Monistic Hypothesis:** According to this, all the planets including earth originated from a single star, hence it is also called Parental Hypothesis. Kastedbafen, Kant, Laplace Ross, Luckier are related to this concept.
- b) **Dualistic Concept:** According to this all the stars including the earth have been formed by more than one star. Scholars supporting this hypothesis include the names of Chamberlin and Moulton, James Jeans and Jeffries, Russell, Payal and Leet, Autoschmidt, Alfvan and Van Wise Sacker.

Kant's concept of gaseous quantity

- ☞ Kant formulated his hypothesis in 1755 on the basis of Newton's law of gravitation. According to their belief, divinely created primal substances (primordial liquids) were present in a scattered state in the universe. In the beginning these substances were very hard, cold, motionless.
- ☞ According to Kant, due to mutual attraction, the particles began to interact with each other, due to which there was a continuous increase in the temperature and it changed into the north-west direction.

Kant's Gaseous Hypothesis

- ☞ Hence the cold and motionless original fluid was converted into a huge hot nebula and started rotating on its axis, increasing the size of the nebula due to the continuous increase in the number of primitive particles. Thus, due to the continuous increase in the size of the nebula, the speed of rotation became so fast that the centrifugal force became more than the centripetal force. Due to this, a bulge was formed in the center of the gaseous body and this bulge increased in size, then one after another the rings started forming and due to the centrifugal force separated from the central part of the nebula.

Astronomical theories related to the origin of the Earth and the Solar System			
1. gaseous hypothesis (Gaseous Hypothesis)	Kant		
This theory of Newton's gravitation based on rules.			
2. Nebular hypothesis (Hypothesis)	Laplace		
3. Planetary Hypothesis (Planetesimal Hypothesis)	Chamberlin & Moulton		
4. Tidal hypothesis (Tidal Hypothesis)	James Jeans & Jefferies		
5. The Binary Star Hypothesis (Binary Star Hypothesis)	Russell		
6. Supernova hypothesis (Hypothesis)	Hoyle & Littleton		
7. Interstellar Dust Hypothesis (Inter Stellar Dust Hypothesis)	auto schmidt		
8. Inter Stellar Cloud Hypothesis या Electromagnetic Hypothesis Magnetic Hypothesis)	alfven		
9. circulation and tidal hypothesis (Rotational and Tidal Hypothesis)	Rossen		
10. The Jupiter Sun Dvaita Hypothesis (Jupiter Sun Binary System Hypothesis)	E. M. Drobyshevsky		
11. Cepheid hypothesis (Hypothesis)	A.C. Banerjee		
12. The Nebular Cloud Hypothesis	von weizsacker		
13. The Primitive Planet Hypothesis (The Protoplanet Hypothesis)	quiper		
14. Big Bang Theory (latest theory)	george lamenter		

Critical Analysis of Kant's Gaseous Hypothesis

- ☞ In Kant's hypothesis, the speed of rotation of the nebula increased with the increase in the size of the gaseous fluid, which is against the scientific principle of law of motion.
- ☞ According to the law of motion, collision of particles never results in rotational motion.
- ☞ According to Kant, due to the energy of gravity, the particles of the fluid started colliding. But he did not explain how the source of energy, which caused motion in these particles (which were cold and motionless in the initial state), caused these particles to suddenly become active.
- ☞ Kant did not explain about the source of the original liquid.

Critical Analysis of Laplace's Nebula Hypothesis

- ☞ According to Laplace, if the planet is made of nebula, then a part of the nebula i.e. due to reduction in the size of the Sun should rotate at the fastest speed, but this does not happen.
- ☞ Critics say that if the Sun is the rest of the nebula, then there should be a bulge in the central part of the Sun, but it is not.
- ☞ According to Laplace's opinion, the planets were formed from nebulae, then the planets should have been in liquid state in the initial state and hence they were able to revolve around the Sun, because only solid fluid can move in a circular path without losing its shape.
- ☞ The part of the original nebula that remained was converted into a star called the Sun. According to them, satellites were also made by repetition of the above process.

Laplace's nebula hypothesis

Laplace explained his concepts about the origin of the Solar System and the Earth in the year 1796 in his book 'Exposition of the World System'.

His nebula hypothesis is a modified form of Kant's celestial zodiac hypothesis. According to Laplace's belief, there was a huge known nebula presence in the universe. He also believed that this nebula was already dynamic. The nebula was losing heat due to the process of radiation from the outer surface and was cooling and decreasing in size and volume due to contraction due to cooling.

- ☞ On the basis of the above assumptions, Laplace said that due to the decrease in the volume of the nebula, its speed started increasing continuously. An increase in rotation speed increased the centrifugal force. When the centrifugal force exceeded the gravitational force, a ring separated from the nebula and that ring fragmented into many parts. According to Laplace, planets and satellites have been formed only because of the cooling of this ring. The rest of the nebula is our Sun. Later, French scholars revised their hypothesis and told that many rings of different sizes were separated from the nebula and planets were formed due to the condensation of each ring.

Criticism

- ☞ The nebula hypothesis does not explain the sources of origin of the nebula. This hypothesis also does not provide information about the sources of heat and motion of the nebula.

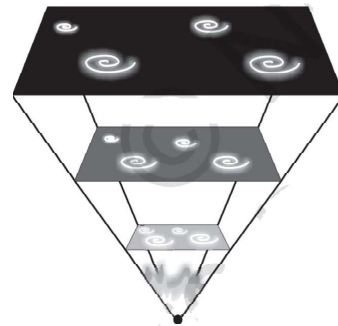
- ☛ According to this hypothesis, the nebula was a gaseous state, so the planets should also be in gaseous form, in fact it is not so.
- ☛ The direction of rotation of all the planets and satellites should be the same as that of the nebula. But it is not so and we see that except the planets Venus and Uranus, all the other planets of the Solar System revolve around the Sun in the anti-clockwise direction.
- ☛ This hypothesis was introduced by Limetere in 1950-60 and was accepted in 1972. According to this theory, all the matter in the universe was found in the form of a dense and huge primitive matter. In modern times, the most accepted theory about the origin of the universe is the Big Bang theory. It is also called the Expanding universe hypothesis.
- ☛ In the year 1920 AD, Edwin Hubble gave evidence that the universe is expanding. Galaxies are moving away from each other with the passage of time. You can experiment to find out what the expansion of the universe means. Take a balloon and put some marks on it, consider it to be galaxies. When you inflate this balloon, these marks on the balloon will appear to move away from each other as the balloon expands. Similarly the distance between the galaxies is also increasing and as a result the universe is expanding.

Big Bang theory

- ☛ In the context of the origin and structure of the Earth, the initial theories/hypotheses focused only on the evolution of the Solar System, but the modern 'Big Bang Theory' has been able to solve problems such as the origin of the universe, the evolution of the Solar System, the evolution of the Earth's crust and atmosphere, etc. tries to

expansion of the universe according to the big bang theory

- ☛ In the beginning, all the matter from which the universe is made was located in one place in the form of a very small ball (single atom), whose volume was very small and temperature and density were infinite.
- ☛ In the process of Big Bang, there was a tremendous explosion in this very small ball. This type of eruption process resulted in large expansion.
- ☛ Scientists believe that the Big Bang event happened 13.7 billion years ago. The expansion of the universe continues even today. Due to expansion some of the energy was converted into matter.

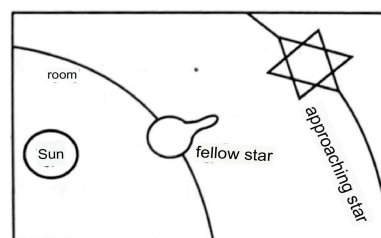


universe as a point

- ☛ Within a fraction of a second after the bang, there was a huge expansion. Thereafter the pace of expansion slowed down.
- ☛ Within the first three minutes of the Big Bang, the first atom was created. During the 3 million years from the Big Bang, the temperature dropped to 4500° Kelvin and atomic matter formed. The universe became transparent.
- ☛ Hoyle presented its alternative in the name of Steady state concept. According to this concept, the universe has remained the same at all points of time. Although the scientific community is now in favor of the expansion theory of the universe after getting many evidences related to the expansion of the universe.

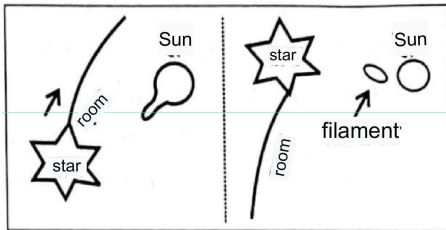
Chamberlain's Planetary Hypothesis

- ☛ In contrast to the hypothesis of the nebula, in 1905, Chamberlin proposed his planetarium in relation to the origin of the earth. Hypothesis Hypothesis presented. According to Chamberlin, the Earth was not formed from only one nebula, from whose residual part the Sun was formed. Rather, it originated from the cooperation of two big stars.



- ☛ According to Chamberlin, in the beginning there were two giant stars in the universe, in which one was the Sun and the other was its companion giant star. Before the formation of the planets, the Sun was in the form of a circular and cold star made of solid particles.

- ☞ While roaming in the universe, due to the passing of the companion star near this Sun, many small particles were separated from the Sun.



- ☞ In the original state, these particles were in the form of dust particles. Chamberlin has called these scattered particles as planetesimals. Some of the planets scattered in the universe were relatively large in size. Chamberlin believes that the present planets have been formed by these large sized planets. According to this hypothesis, the main reason for the separation of Karna from the Sun is said to be the tidal power of the nearby star.

Criticism

- ☞ Certain questions could not be answered by this hypothesis such as:
- ☞ Why aren't there only eight satellites in our solar system? created and of some planets
- ☞ Why are some planets like Earth, Mercury, Venus in solid state and some planets like Saturn in gaseous state?
- ☞ Looking at the distance between the stars in the universe, it seems extremely unfair to say that the planets have been formed by the attraction power of another star.

Tidal Hypothesis of James Jeans

- ☞ This hypothesis was propounded by James Jeans in 1919. And in the year 1929, Jeffrey tried to make it more relevant by amendment. James Jeans believed that the solar system was formed from the Sun and other companion stars.
- ☞ According to this hypothesis, the Sun (Primitive Sun) was rotating in its place. A giant intruding star passed near this star, which was much larger in size and volume than the Sun.
- ☞ Due to the attractive power of this approaching companion star, tides started to arise on the surface of the Sun. When the companion star came to the closest distance to the Sun, due to its attractive power being more than that of the Sun, thousands of kilometer long cigar-shaped tides began to appear

outside the Sun. Woke up from the part. This cigar-shaped part was called filament.

- ☞ Due to the maximum gravitational force produced by the companion star reaching its closest distance to the Sun, the giant filament separated from the Sun and moved towards the companion star. Since the companion star was not on the path of the Sun, the filament could not keep up with the star and it started orbiting around the Sun.
- ☞ James Jeans has told the reason why the filament does not come back to the Sun, because the filament is out of the Sun's attraction area.
- ☞ Again no filament separated from the Sun due to the companion star being too far away.
- ☞ The filament was thick in the middle and thin at the edge in the shape of a cigar. The reason for the thinness of the filament at the edge is said to be the attractive power of the Sun. Due to the cooling and contraction of the filament, it broke into many pieces and became dense and turned into planets.
- ☞ Similarly, due to the attraction power of the Sun, many substances separated from the planets due to the generation of tides condensed and became satellites. This process continued until the centripetal force of tidal material was able to hold them together. Due to the wide middle part of the filament and thin edge part, big planets were formed in the middle and small planets were formed at the edges.

Criticism

- ☞ According to the hypothesis, the material of the planets is formed from the material of the Sun, so these planets should mainly consist of light helium and hydrogen-like substances. But the planets of our solar system are made of heavy nuclear material.
- ☞ The distance between stars in the universe is immense, so it seems improbable for a companion star to follow such a path.
- ☞ Very little information is given in terms of companion date in the hypothesis. Information related to the path and destination of the companion star after passing close to the Sun is not available.
- ☞ According to many astrophysicists, the angular momentum imparted by the star to the planet does not match with the angular momentum present in the planets of the solar system.

Planets of the solar system

- ☛ **Mercury:** It is the closest and second smallest planet to the Sun. It completes one revolution on its axis in a time equal to 59 Earth days (58.65 days). It is clear that the rotation period of Mercury is equal to 58.65 or 59 days of the Earth. It revolves around the Sun once in 88 days. Its average orbital speed is 47.36 km. / sec. Its average density is 5.44 g/cm. There is no possibility of atmosphere here. It has no satellite. Here the days are extremely hot and the nights are snowy. In magnitude, it is 18th part of the Earth and its gravity is 3/8th of the Earth.
- ☛ **Venus:** It is the closest to the Earth among the inner planets. And it is the second closest place to the Sun in the Solar System. It is more famous as evening star and 'morning star'. It is also called the sister planet of the earth. Venus 5 and 6, according to the discoveries of Venera 4, Mariner 2 and 5, is probably the hottest planet. Here the night and day temperatures are almost equal. The atmosphere of Venus is 90-95 percent carbon-di-oxide. There is no ray belt in it. It has no satellite. It appears the brightest after the Sun and the Moon. It is almost equal in size and mass to the Earth. It orbits the Sun in 225 days (224.7 Earth days). Its average density is 5.24 g / cm and the average orbital speed is 35.02 km. It's seconds. It is a hot and sizzling planet. Around it are frozen clouds of sulfuric acid.
- ☛ **Mars :** Mars is the fourth planet from the Sun in the Solar System. It is a bright planet. It has two satellites, which are known as Phobos and Deimos. There are many volcanoes, deep pits and rugged high terrain here. The highest mountain is 'Nix Olympia', which is three times higher than Everest. Known as the 'Red Planet', the distance of this planet from the Sun is 227.9 million kilometers and its equatorial diameter is 6,761 kilometers. It takes 686.9 days to make one revolution around the Sun. Its average density is 3.94 g/cm and average orbital speed is 24.07 km/s. Mars has two poles and here too there is a change of seasons like on Earth. This is due to the tilt of its axis like the Earth.
- ☛ **Jupiter:** It is the largest planet of the solar system. It is fifth from the Sun. Its density is one fourth of the density of the Earth. It takes 11.9 years to orbit the Sun. It has an average density of 1.33 g/cm and an average orbital speed of 13.07 km/s. Its mass is 71 percent and volume one and a half times that of

all the planets of the solar system. Jupiter has two constellational features. It emits twice or thrice the energy it receives from the Sun like stars. It has its own radio energy. Its atmosphere consists mostly of hydrogen and helium gases.

- ☛ Methane and ammonia are also present in the atmosphere during chemical reactions and energy release. Jupiter's atmosphere is marked by stripes around the planet. There are 5 bright stripes, one big red mark and four dark brown stripes. It has 53 known satellites. It is a very hot planet. Due to its axis being inclined at 1° , the weather here is always the same. Some of its satellites (also of Saturn) revolve in the opposite direction, and some in a favorable direction. The presence of complex molecules consisting of carbon and nitrogen has also been detected on two other moons of Jupiter, Ganymede and Callisto. There is also an amount of oxygen in liquid state and hydrogen in gaseous state on Ganymede.
- ☛ **Saturn:** It is the farthest planet visible to the naked eye. It is the second largest planet after Jupiter, with 53 known satellites. Its diameter is 1,20,000 km. Is. It completes its orbit around the Sun in 29.5 years. Its average density is 0.70 g / cm and the average orbital speed is 969 km / s. Only 1/100th part of the Sun's light falls on this planet. 32 km to escape from its gravity. speed per second is required. Its largest satellite is Titan. It is situated in the sixth position from the Sun. Its density is less than that of the Earth. It has white oval and strip-like light and dense clouds like Jupiter. Its ring state is most important. Its satellite 'Titan' has an atmosphere of nitrogen.
- ☛ **Uranus:** This planet is located at the seventh closest position from the Sun. It cannot be seen by naked eyes. It has 27 (approximately) satellites. Surrounding it are five very faint rings, Alpha, Beta, Gamma, Delta and Epsilon. It has methane gas in its atmosphere. Its midline makes an angle of 98° with its orbit, as a result of which it revolves around the Sun and also rotates its limbs. This planet was discovered in 1781 AD by Sir William Herschel. It completes its orbit around the Sun in 84 years. It has an average density of 1.27 g/cm and an average orbital speed of 6.80 km/s. It is the only planet which, in its orbit from one pole to the other, is continuously facing the Sun.

	Sun
distance from earth	- 149.8 million km
Diameter	- 13,92,000 kms
core temperature	- 20-15 million °C
photosphere temperature	-6,000°C (approx.)
time taken by sunlight to reach earth -	8 minutes 16.6 seconds
age	- 5 billion years (approx)
rotation period	- 25.38 days (relative to the equator) - 33 days (relative to the poles)
chemical composition	- Hydrogen - 71%, Helium 26.5%, - Other elements - 2.5%
potential of normal star	
Life span	10 billion years (approx)
	Earth
surface area	-51,01,00,500 Sq.Km.
estimated age	- 4,60,00,00,000 years
area of land	-14,89,51,000 sq km.
water area	-36,11,50,000 sq km.
equatorial diameter	-12,756 kms

Pole diameter	- 12,714 km
distance to moon	- 3,84,365 km
earth's satellite	- Moon
mean distance from the sun	- 14,94,07,000 kms
orbiting the sun	365 days, 5 hours, 48 minutes
	moon
distance from earth: low ground or perigee distance	(Perogy - 3,64,000 Km.) Average 3,84,000 Km.
ground high distance :	(Apogee) 4,06,700 kms.
Axial motion	- 3,680 km/h
diameter	-3,476 km (0.27 of Earth's diameter)
Mass. The mass	-0.0123 mass of Earth
Average Density: 3,340 km/cubic meter. (0.60 of average earth	density)
Surface temperature:	- Day 4, 130°C, Night - 1,710°C
Circular speed (on the surface) :	- 17 km/s
Sidereal day sidereal:	orbiting other stars time taken in (Month: 27 days, 7 hours, 43 minutes, 11.5 seconds)

Pluto's expulsion

The planet Pluto, discovered in February 1930 by Clyde W Tombaugh at the American Observatory, was dropped from the ranks of the planets by the world's top astronomers. On August 24, 2006, the International Astronomical Union, the sole authority for space naming, announced that there would be only eight planets left in the Solar System, and that they had removed Pluto's status as the ninth planet. The definition of planets was voted on at the ten-day assembly of the International Aeronautical Union in Prague. More than 2500 scientists from a total of 75 countries participated in this meeting, out of which a total of 424 scientists voted in favor of removing Pluto from the traditional planet.

reason for expulsion

In the absence of a clear scientific definition of a planet, Pluto has been included in the new planets since the 1930s, despite notable differences from the other eight planets. As a result of scientific research, when many new objects were discovered in the solar system, along with their identity, questions were also raised on the planetary hypothesis of Pluto. The only authorized body for space nomenclature is the International Astronomical Union. This institution entrusted a committee with the task of defining the planets. The new definition of planets given by this committee is as follows:

- Only those celestial bodies are called planets, which revolve around the Sun.
- Their minimum mass for their gravity is such that they are almost circular and their orbit does not cross the path of their neighbor.
- Pluto does not meet the above mentioned criteria, hence it is excluded from the category of planets. It is now known as a dwarf planet.

Characteristics of the planet

Planet	Properties	Planet	Properties
Mercury	◆ It can be seen near the horizon at sunset and sunrise. Like the Moon, it also has no atmosphere and its surface is heavily cratered. ◆ Half of this planet is at very high temperature and the other part is at very low temperature, because its rotation and rotation period are almost the same, due to which only one part always remains towards the Sun. ◆ Its surface temperature ranges between + 340°C and - 270°C.	Mars	◆ A day on Mars is 24 hours 37 minutes and a year is 1.88 times the Earth year. ◆ Its rotation axis is inclined by 25 degrees, Due to which seasons and polar caps are made. ◆ Its atmosphere and geology are similar to Earth's atmosphere and geology. Its surface is dotted with numerous craters and volcanoes of various sizes. ◆ Its soil is made of silicate like the earth's soil, but its color is red due to 16 percent iron oxide in its soil. That's why it is also called the Red Planet.
Venus	◆ Due to its proximity to the Earth, it is the brightest planet in the sky except the Sun and the Moon. ◆ Its surface is dry, hot and volcanic. Its atmosphere has 96 percent carbon dioxide, 3.5 percent nitrogen and 0.5 percent water vapor, argon, H, SO, HCL etc. ◆ Its surface temperature is most likely due to the greenhouse effect, which is that the infrared radiation radiated by the planet cannot escape from the planet due to the presence of carbon dioxide in its atmosphere. Therefore, the heat received from the Sun is stopped and the temperature of the planet increases.	Jupiter	◆ It is the largest planet and also has the largest mass. ◆ It is covered by a turbulent gaseous atmosphere. ◆ Its atmosphere contains hydrogen, helium and small amounts of water vapor, ammonia, methane, etc. ◆ There is a red spot in the shape of an egg on its surface. scientists believe that This is the reason for the large cyclone in the atmosphere of the blessed planet. ◆ This planet radiates radio waves.
Earth	◆ Its crust, which extends 10 kilometers under the ocean and 40 kilometers under the continents, mainly consists of silicon (27.7 percent) and oxygen (47.3 percent). ◆ Its rotation axis is tilted 23.5°, due to which seasons change and polar caps are formed. ◆ Its atmosphere is divided into several layers, in which the troposphere contains about 78 percent nitrogen and 21 percent oxygen. ◆ Ozone layer is found in its stratosphere, which absorbs harmful ultra-violet radiation coming from the Sun.	Saturn	◆ It is made of hydrogen and Helium like the planet Jupiter. ◆ A ring is found on it, which can be seen through binoculars. ◆ Its density is less than the density of water. Its shape is flattened due to its mostly liquid material and its fast rotation.
		Uranus	◆ Viewed through binoculars, this planet looks like a green disc with some indistinct markings on it. ◆ Its rotation axis is inclined at an angle of 97.9° to its orbital vertical, due to which its poles point directly towards the Sun. And it appears as if it is moving in its orbit like a wheel. That's why it is also called a lay planet. ◆ Its rings were discovered in the year 1977. It is made of black material like coal.

Neptune ♦ Its color is light blue. This is due to the presence of excessive amount of methane in its atmosphere.

♦ Like Jupiter, it also has rings. Two of its satellites are visible from the earth.

♦ Its largest satellite is Triton, which rotates in the clockwise direction. This direction is opposite to the direction of rotation of the planet. Triton has its own atmosphere, which consists of nitrogen and methane.

☞ **Neptune:** It is the eighth most distant planet from the Sun that can be seen by Earth's binocular telescope. It is a dark green planet. The Voyager 2 campaign detected its 5 rings. It has two main rings. It is currently located at the most distance from the Sun, 'Titan' and 'N' two satellites are among its largest satellites. There is an atmosphere on the 'Titan' satellite. It mainly contains nitrogen. Many active volcanoes have also been found here. It is the third body in the Solar System where active volcanoes have been found. The other two include the satellites of Earth and Jupiter. It completes its orbit around the Sun in 164.8 years. It has an average density of 1.63 g/cm and an average orbital speed of 5.43 km/s.

☞ **Kuiper's Eddy:** The Kuiper belt and accretion disk are located after the orbit of Neptune. It is 20 times larger than the asteroid belt and contains millions of objects, which are formed from ice molecules. The Kuiper belt has more than ten thousand objects, which are surrounded by their own gravity.

☞ **Pluto:** It is currently recognized as a dwarf planet. Its diameter is 300 km. And it is 586.56 crore km from the Sun. is far. It completes the orbit of the Sun in 248 years and completes one revolution on its axis in 6 days and 9 hours. It was discovered in February 1930 by W Yamvo from the Observatory in Arizona (USA). It has a satellite. Its orbit intersects the orbit of Neptune. There are probably ice bodies and methane in the atmosphere here.

The Earth

☞ The Earth has a specific shape of its own, which is called a geoid. Its shape is also called Oblate Spheroid.

☞ Earth's equatorial diameter is 12,756 km. (7,927 mile) and the polar diameter is 12,714 km (7,900 mile).

☞ Earth's equatorial circumference is 40,075 km. (24,900 mile).

☞ Earth 1,07,160 km 365 days per hour, 5 hours 48 minutes and it orbits the Sun in 46 seconds.

☞ Earth on its axis from west to east and 1610 km. At the speed of per hour, it completes one round in 23 hours 56 minutes and 4 seconds.

☞ 71% of the earth is hydrosphere and 29% is lithosphere. Day and night are formed due to the daily rotation speed of the earth and seasons change due to the annual rotation speed.

☞ The orbit of the Earth is elliptical and the distance between the Earth and the Sun keeps on changing. This distance is minimum (14,70,00,000 km) on 3rd January and maximum (15,20,00,000 km) on 4th July. It is called Aphelion. Therefore the annual insolation received by the earth is more on 3rd January than on 4th July.

☞ Earth makes an angle of 23.5° with its plane of orbit. Due to this inclination of the earth and its elliptical orbit, there are four special conditions of the earth. On June 21, the sun's rays are saved 90° on the Tropic of Cancer, so on this date the duration of the day is the longest in the Northern Hemisphere. This is called Cancer Solstice or Summer Solstice.

☞ Similarly, on December 22, the Sun's rays fall vertically on the Tropic of Capricorn. This is called Makar Sankranti or Winter Solstice and on this date the duration of the day is longest in the Southern Hemisphere.

☞ On March 21 and December 23, the sun's rays fall vertically on the equator. On this day, the duration of day and night is equal (12-12 hours) everywhere on the earth.

☞ The time taken by the Earth to rotate through 360° , when the Earth returns to its position with respect to a given star, is called Sidereal Time.

☞ Its duration is 23 hours and 56 minutes. On the other hand, when the Sun passes twice successively on a certain meridian, then the time taken in this is called Solar Day. Its average duration is 24 hours.

☞ The World Wide Fund for Nature and the Global Footprint Network issue Earth Overshoot Day. This is the date when mankind's demands on the natural resources that the earth can reproduce throughout the year exceed.

☞ According to the report of the Global Footprint Network, the time of Earth Overshoot Day has reduced by two months in the last 20 years.

Earth and Moon

- ☞ The Moon revolves around the Earth in an elliptical direction. When the Moon is closest to the Earth, this state is called Perigee. The farthest position of the Moon from the Earth is called Apogee.
- ☞ The period of both rotation and rotation of the moon is 27.32 days. This is the reason why we always see the same side of the moon. Also, the entire surface of the Moon is not visible from the Earth. Only 59% of the Moon is visible from Earth.

Scientific explanation of eclipse

- ☞ If an object comes in the path of light coming out of a point of light, then a shadow is formed by it. This is called 'Eclipse'.
- ☞ When viewed from any place under the shadow, the light source appears to be extinguished. But if the light source is diffuse rather than a point, then there will be three different areas of shadow of the object coming in its path. First, the dense conical shadow sloping over a nock, which is the shadow.
- ☞ Light is not visible at all in the shadow. On either side of the umbra, there is a less dense shadow bent at a point, which is called the 'upachaya'. There is partial shade in this region, that is, there is partial light also present here.
- ☞ When the Earth comes between the Sun and the Moon, the Moon does not receive the Sun's light, rather the shadow of the Earth falls on the Moon. This is called 'lunar eclipse'.
- ☞ A lunar eclipse always occurs on a full moon, but not on every full moon, because there is an inclination of 54° between the orbits of the Earth and the Moon. Therefore, the Moon is only occasionally in the plane of the Earth's orbit.
- ☞ When the Moon comes between the Earth and the Sun, the shadow of the Moon falls on the Earth and the Sun's light does not reach the Earth completely, it is called a solar eclipse.
- ☞ A solar eclipse always occurs on the new moon day, but not on every new moon day, because due to the inclination of the orbital plane of the Earth and the Moon, the solar eclipse occurs on the same new moon day, on which the Moon comes in the orbital plane of the Earth.
- ☞ When the Moon covers the Sun completely, it is called a 'total solar eclipse', but when the Moon covers

only a part of the Sun, it is called a 'partial solar eclipse'. During the period of solar eclipse, when the Sun appears as a shining ring, it is called 'Diamond Ring'.

- ☞ There can be a maximum of 7 eclipses (including solar eclipse and lunar eclipse) in a calendar year and the occurrence of solar eclipse can happen at least 2 times and maximum 5 times in a year. A total solar eclipse does not occur on every solar eclipse day.

Chandrayaan-1 mission

- ☞ The Moon is the nearest satellite of the Earth, through which space exploration efforts can be made and data related to it can also be collected. The idea was initiated at the meeting of the Indian Academy of Sciences in 1999 under the Indian Scientific Mission to the Moon. Its sequel was discussed in the Astronautical Society of India in 2000. Based on the recommendations made by the learned members of this forum, the National Lunar Mission Task Force was constituted by the Indian Space Research Organization (ISRO). The task force of leading Indian scientists and technologists discussed and assessed the feasibility of an Indian mission to the Moon. provided as well as focused on the possible configuration of such a mission.
- ☞ Subsequently, the Government of India approved ISRO's proposal for the first Indian Moon mission, Chandrayaan-1, in November 2003. Chandrayaan-mission performed high resolution remote sensing of the Moon in the visible, near infrared (NIR), low energy X-ray and high energy X-ray regions of the Moon.
- ☞ Its objective was to conduct a high spatial resolution chemical and mineralogical map of the entire lunar surface for the distribution of mineral and chemical elements such as magnesium, aluminium, silicon, calcium, iron and titanium and high atomic number elements including radon, uranium and thorium. .
- ☞ Chandrayaan was launched on October 22, 2008 onboard PSLV-II, the X variant of ISRO's PSLV. PSLV-II was later used to launch the Mars Orbiter Vehicle in 2003.
- ☞ The missions aimed to build a Deep Space Network (DSN) station with science payloads, Chandrayaan and launch vehicles, suitable ground support systems, which were helpful for future exploration such as the Mars Orbiter Mission.

Chandrayaan-2 mission

- ☛ Chandrayaan-2 is the Indian lunar mission, under which an attempt was made to land in the South Pole region, where no country has tried so far. The objective of Chandrayaan-2 is to gather information about the moon and to make such discoveries, which will benefit the entire humanity along with India.
- ☛ **Scientific objectives of Chandrayaan-2:** The Moon can provide incredible insights into the evolution of the Earth and the environment of the Solar System. Broadening the Moon's surface will help study changes in its composition. Many important information can also be gathered about the origin and development of the Moon. The evidence of water on the moon was discovered by Chandrayaan-1, but from Chandrayaan-2 it will be possible to find out that what part of the moon's surface and subsurface has water.
- ☛ The Moon's south pole is particularly interesting, as a larger portion of its surface remains in shadow than the north pole. There is a possibility of water around it and in these permanently shadowed areas. The cold craters of the Moon's south polar region contain the lost fossil record of the early Solar System.
- ☛ Chandrayaan-2 used the Vikram ladder and the Pragyan rover, which was attempted to successfully land on the plain between the two craters, Manginus C and Simpelius N, at about 70° south latitude, which was partially unsuccessful.
- ☛ **Note:-** Chandrayaan-2 is the first space mission, which attempted to land on the south polar region of the Moon.
- ☛ It was the first Indian mission to collect information about the lunar surface with indigenously developed technology.
- ☛ India became the fourth country to land a rocket on the surface of the Moon.
- ☛ On September 18, 2008, the then Prime Minister Manmohan Singh approved the Chandrayaan-2 mission.

Black hole

- ☛ A black hole is a dense place from which nothing (not even light) can escape. A black hole has a halo around it, from which hot gases are emitted, which rotate under the influence of strong gravity around the event horizon.

- ☛ On April 10, 2019 International scientific group discovered black hole or black hole at the center of Mandakini or galaxy named Messian 87, about 55 million light-years away from Earth.
- ☛ The presence of charged particles such as electrons and protons in the space between the stars blurs the view of black holes.
- ☛ The black hole is six and a half billion times the mass of the Sun, five and a half million light years away from Earth.
- ☛ According to the theory of general relativity, a black hole is a celestial body whose gravitational field is so strong that nothing, including light, can escape its pull. It absorbs all the light that falls on it and does not reflect or emit anything.
- ☛ Black holes can be of four types: stellar mass, intermediate, supermassive and miniature black holes.

Black hole formation

- ☛ Black holes can be the stage after the death of a star. Stars shine due to the fusion of hydrogen into helium in their center. As long as the star is alive, the process of nuclear fusion creates a constant outward pressure, allowing the star to balance the inward pull of gravity with its own mass.
- ☛ The structure of black holes is calculated by Albert Einstein's general theory of relativity.
- ☛ The luminosity in stars results from a balance of two constant forces, the gravity of the star's material, which tends to compress it, and the radiation emanating from the center of the star, which tends to expand it.
- ☛ As stars reach the end of their lives, most stars lose their gas and their central mass, the inner thermonuclear fuel, is destroyed. The stellar core thus becomes unstable, causing a gravitational self-collapse inward and blowing away the outer layers of the star.
- ☛ Stars about the same mass as the Sun cool down to become white dwarfs, but the supermassive ones, which can be many times more massive than our Sun, undergo a rapid explosion upon death. Which is called 'supernova explosion'.

- ☛ Due to this explosion, the matter is scattered in the space and a very dense stellar center (core) is left, which is called a neutron star.
- ☛ Neutron stars condense In stellar remnants of a supernova explosion In a neutron star, there is no force left to oppose gravity, so the stellar center (core) continues to contract in on itself.
- ☛ In this way, a dense and super-gravitational body is formed, from where the ray of light cannot escape. This condition is called a stellar mass black hole.
- ☛ In the center of the galaxy (Milky Way) in the direction of Sagittarius is the supermassive black hole known as 'Sagittarius A Star'. This black hole is at a distance of 26 thousand light years from the Earth and its size is about 60 million kilometers.

Theory related to the formation of black holes

- ☛ Subrahmanyan Chandrasekhar, born 1910 in Lahore, British India, was an important 20th-century astrophysicist who pioneered the integration of the study of physics with astronomy.
- ☛ Chandrasekhar proved that there is an upper limit to the mass of a white dwarf star. This range is known as 'Seema' after Subrahmanyan Chandrasekhar.
- ☛ Stars with a higher mass than the Sun, as indicated by the Chandra limit, explode upon their death and form black holes.
- ☛ During the death of a star, gravity stops the release of light. The state before this is called the event horizon.
- ☛ The event horizon is an imaginary shell around a black hole, beyond which no light or other radiation can escape and nothing can be seen. The event horizon is known as the 'point of no return'.
- ☛ The eight radio telescope observatories that networked around the world in the Event Horizon Telescope project included the Atacama Large Millimeter/submillimeter Array, Chile; Atacama Pathfinder Experiment, Chile Institute de Radioastronomy Millimeter, Spain Large Millimeter Telescope, Mexico Submillimeter Telescope, Arizona; The James Clerk Maxwell Telescope, Hawaii Submillimeter Array, Hawaii and the South Pole Telescope, Antarctica.
- ☛ Kip Thorne, an astrophysicist at the California Institute of Technology, was awarded the 2017 Nobel Prize for his discovery of gravitational waves produced by colliding black holes.

