

# 1. ASTRONOMY

## The Universe

- The great astronomer of Roman school, Egyptian Claudius Ptolemy (140 AD) started the Systematic study of the Universe.
- According to Claudius Ptolemy the Earth is at the centre of the Universe and all the other Celestial bodies like sun and planets are revolving around it.
- Copernicus was the first person to give theory that sun is the center of Universe.
- Age of Universe is about 13.6 Billion Years.

## Origination of Universe

- Big Bang theory is the most acclaimed theory regarding the origin of the universe.
- It was proposed by a Belgian Astronomer and Clergy E. George Lamantere.
- According to him, there was a big heavenly body, which was made up of heavy matters.
- Due to sudden explosion (Big Bang) of this heavenly body galaxies, Stars and the planets were formed.
- The Universe includes all the bodies, matter and complete Solar family which comprises the Sun, Moon, Planets, Comets, Asteroids etc.

## Galaxy

- A Galaxy is an uncountable group of stars.
- Our own galaxy is known as 'Milky Way' which has spiral shape.
- There are about  $10^{11}$  Galaxies in Universe.
- Every Galaxy has  $10^{11}$  Stars.
- Nearest Galaxy to Milky Way is Andromada.

## Units of distances

- Light year-Distance covered by light in an year.
- $1 \text{ LY} = 9.46 \times 10^{12} \text{ KM}$
- Parsec:  $1 \text{ Parsec} = 3.26 \text{ LY}$ .
- Astronomical Unit-Average distance between Sun and Earth. (14.98 Cr KM)

## The Solar System

- The Sun and bodies revolving around it including planets, satellites, comets, meteors and asteroids together constitute the solar system.
- Kepler's theory describes distance between sun and

other planets.

- The Sun is the source of the solar system.
- Sun is also the source of all energy in solar system.
- The source of energy in the Sun is **Nuclear Fusion**.

## The Sun

- Sun is a star. (Young Star)
- Sun revolves round the center of Milky Way Galaxy. Its revolution period is 25 Cr. years, which is also known as Cosmic Year.
- Sun rotates on its own axis from east to west.
- Chemical composition of Sun is : 71% Hydrogen, 26.5% Helium and 2.5% other elements.
- The temperature of the Core of Sun is around  $15000000^\circ\text{C}$ .
- The illuminated part of Sun is known as photosphere. Its temperature is around  $6000^\circ\text{C}$ .
- The outer Hollow of the sun at the time of total solar eclipse is known as Corona.
- Corona emits X-rays.
- Sun has 99.8% of total mass of solar system.
- Its diameter is 110 times that of earth.
- It is the nearest star to the earth.
- The nearest star to sun is proxima centuary.
- Light takes about 8 minutes and 16 seconds to reach the Earth from the Sun.

## Some Important Facts related to Sun

- Minimum distance from the Earth (Perihilion) - 147 Million KM.
- Maximum distance from the Earth (Aphelion) - 152 Million KM.
- Average distance from the earth - 149.8 Million KM.
- Diameter of the sun - 13,92,00 KM.
- Volume of the sun - 1.3 million times that of the Earth.
- Mass of the sun - 3,32000 times that of the Earth.
- Temperature of the Solar-Spots -  $4500^\circ\text{C}$



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- Energy Emission  
-  $10^{26}$  joules/second
- Rotational time period  
- 25.38 days (relative to the equator); 33 days (relative to the poles).
- Composition of the sun  
- Hydrogen (71%), Helium (26.5%) and others (2.5%)
- Age of the sun  
- 5 billion years (approx)
- Estimated life of normal stars  
- 10 billion years.
- Time taken to reach solar light from Sun to Earth  
- 8 Min. 16 Sec.
- Velocity of the light  
-  $3 \times 10^8$  m/s
- 1 light year (distance travelled by the light in one year) -  $9.45 \times 10^{13}$  km
- 1 parsec (largest/biggest unit of distance)  
- 3.26 light years

#### Bodies of Solar System

- **Bodies of solar system are divided in three parts-**
- 1. Traditional planets- Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune
- 2. Dwarf planets- Pluto, Ceres(UB 313)
- 3. Small planets- Comets, Satellites and other small bodies
- All planets revolve from west to east to the sun except Venus and Uranus they revolve from east to west.

#### Planets

*Planets have been divided in two classes -*

- 1. Terrestrial Planet (Inner Planets)-**
  - First four planets Mercury, Venus, Earth and Mars are called terrestrial planets
  - Their structure being similar to that of earth.
- 2. Jovian Planets (Outer Planets)-**
  - Next four planets Jupiter, Saturn, Uranus and Neptune are called jovian planets
  - Their structure being similar to that of Jupiter.

#### Descending order of Planets:

##### According to distance-

- |            |          |
|------------|----------|
| 1. Mercury | 2. Venus |
| 3. Earth   | 4. Mars  |

- |            |            |
|------------|------------|
| 5. Jupiter | 6. Saturn  |
| 7. Uranus  | 8. Neptune |

##### According to size-

- |            |            |
|------------|------------|
| 1. Jupiter | 2. Saturn  |
| 3. Uranus  | 4. Neptune |
| 5. Earth   | 6. Venus   |
| 7. Mars    | 8. Mercury |

##### According to mass-

- |            |            |
|------------|------------|
| 1. Jupiter | 2. Saturn  |
| 3. Neptune | 4. Uranus  |
| 5. Earth   | 6. Venus   |
| 7. Mars    | 8. Mercury |

#### Important facts related to Planets:

##### Mercury

- This is the nearest planet to the Sun
- This is the smallest planet of the solar-system.
- It takes 88 days to complete one revolution around the sun (shortest duration).
- It has no natural satellite.
- It has no atmosphere.
- Here range of temperature is found maximum.
- Here days are very hot and nights are chilling.

##### Venus-

- Venus is the second closest planet to the Sun.
- Venus is the nearest planet to the Earth.
- It completes revolution of Sun in 225 days.
- It is the brightest planet.
- It is called 'Morning star'.
- It is also called 'Evening star'.
- This planet, unlike other planets, revolves round the Sun clockwise and rotates from East to West.
- It is the brightest object seen in the sky after the Sun and the Moon.
- Being almost similar to the Earth in size and mass it is called the sister planet of the Earth.
- Like Mercury, Venus also has no natural satellite.
- Its atmosphere contains 90-95 % Carbon dioxide.
- It is also known as 'Pressure cooker'.

##### Earth-

- Earth is the fifth largest planet of the solar system.
- Its equatorial diameter is 12,756 KM & polar diameter is 12,714 KM.



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- It is tilted on its axis by  $23\frac{1}{2}^{\circ}$ .
- It is tilted on its orbital plane by  $66\frac{1}{2}^{\circ}$ .
- It rotates on its axis from west to east.
- It takes about  $365\frac{1}{4}$  days to complete one revolution around the sun. (solar year)
- It is also called the 'Blue Planet'.
- It looks blue when seen from the outer space due to the presence of large amount of water.
- Ozone gas present in atmosphere of earth save us from harmful Ultra violet rays.
- It is the only planet with the conditions favorable for life.
- Its average distance from the sun is about 150 million km.
- It looks like planet Venus.
- It has only one Natural Satellite "**Moon**".

### Some Important Facts About Earth

- |                                                     |                                                      |
|-----------------------------------------------------|------------------------------------------------------|
| • Shape                                             | - Geoid                                              |
| • Pole to pole diameter                             | - 12,714 KM                                          |
| • Equatorial diameter                               | - 12,756 KM                                          |
| • Polar circumference                               | - 40,008 KM                                          |
| • Equatorial circumference                          | - 40,075 KM                                          |
| • Water                                             | - 71%                                                |
| • Land                                              | - 29%                                                |
| • Volume                                            | - $10.83 \times 10^{11} \text{ KM}^3$                |
| • Total surface area                                | - 51.1 cr $\text{KM}^2$                              |
| • Average Relative Density                          | - 5.52 (with respect to the density of water)        |
| • Age (estimated)                                   | - 4.6 billion years                                  |
| • Surface area                                      | - 511 million $\text{km}^2$                          |
| • Rotational time                                   | - 23 hours 56 min 4 Sec                              |
| • Revolutionary time                                | - 365 days 5 hours 48 min 46 sec                     |
| • Minimum distance from the sun (Perihelion)        | - 147.0 million km                                   |
| • Maximum distance from the sun (Apehelion)         | - 152.1 million km                                   |
| • Average distance from the sun                     | - 149.8 million km                                   |
| • Time taken by the light of the sun to reach earth | - 8 min 16 sec                                       |
| • Distance from the moon                            | - 384,000 km                                         |
| • Highest point                                     | - Mt Everest (8,848 km from the sea level)           |
| • Deepest point                                     | - Mariana Trench (11,033 km deep from the sea level) |

### Moon-

- Moon is the only natural satellite of the Earth.
- The study of moon is called Celenology.
- "Sea of tranquility" is the plain area of dust particles on surface of the Moon.
- The moon is also known as the fossil planet.
- It has a diameter of 3,475 km.
- It takes 27 days, 8 hours to rotate on its axis.
- It also takes 27 days, 8 hours to revolve around the earth.
- The situation when the earth is at maximum distance from the moon is Apogee.
- Only 59% of the total surface of the moon is visible from the earth.
- Chandrayan I was launched on 22nd October 2008 by PSLVC-11.
- Chandrayan II is a joint programme of India & Russia.
- The moon does not have any Atmosphere.
- The light of the moon takes 1.3 seconds to reach the earth.
- The size of the moon is  $\frac{1}{4}$  the size of the earth.
- Gravitational force of the moon is  $\frac{1}{6}$  that of the earth.



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## Some Important facts about

### MOON

- Average distance from the earth - 3,84,365 km.
- Maximum distance from the earth (Apogee) - 4,06,000 km.
- Minimum distance from the earth (Perigee) - 3,64,000 km.
- Orbital time around the earth - 27 days 7 hours 43 min 11.47 sec.
- Rotational time - 27 days 7 hours 43 min 11.47 sec.
- Atmosphere - Absent.
- Diameter - 3,476 km.
- Mass (compared to the earth) - 1:81,30
- Density (relative to that of water) - 3,34.
- Density (relative to that of the earth) - 0,6058.
- Hidden part of Moon's surface - 41%. (shown part to earth -59%)
- Highest point on the Moon of - Mt Leibnitz (35,000 ft.) situated on the south pole the moon.

### Mars

- It is also called 'Red Planet' because of its red appearance.
- Its red colour is due to iron-oxide present in its soil.
- It is the only planet, besides earth, where the possibility of life exists.
- It has two natural satellites-
  - (a) **Phobos**
  - (b) **Demos** - (This is the smallest satellite of solar system)
- The highest point on this planet is Nix Olympia
- Nix Olympia is three times as high as Mt. Everest.
- The atmosphere on this planet is very thin.
- Its rotation is like as earth rotation.
- It takes 24 hr. in a single rotation on its axis.
- It's Revolution around the sun is West to East.
- It take approx. 687 days for single revolution around the sun.
- It takes only around 10 hrs. to complete a rotation (fastest & least time).
- It takes 11.9 years to complete one revolution around the Sun.
- Ayo, Europa, Calisto, Almethia, etc. are other satellites of Jupiter.
- The atmosphere of this planet is composed of hydrogen, Helium, Methane and Ammonia.
- Its density is less than water.

### Saturn

- It is the second largest planet of the solar family.
- Phobe revolves in opposite direction to it.
- It appears yellow in the sky.
- The atmosphere of Saturn is also composed of Hydrogen, Helium, Methane and Ammonia Like Jupiter.
- So it is also called a gaseous sphere.
- It has atmosphere as well as gravitation.
- It has maximum no. of satellites.
- Titon is the largest Satellite of the saturn.
- Titon having the size comparable to Mercury.
- Other satellites of Saturn include- Mimansa, Ensiladu, Tethys, Dion, Riya, Hyperion, Ipapetus and Phobe.
- Saturn is the last planet of the solar system that can be seen through the naked eyes.
- Its most spectacular and mysterious characteristic is the presence of fully developed rings around it.

### Jupiter

- This is the largest planet of the solar system.
- It has maximum equitorial radius.
- It is 1300times the size of Earth.
- Ganimade is the largest satellite of this planet.
- It is the also the largest satellite of the solar system.
- This is known as mini solar system.



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## Uranus

- Uranus was discovered in 1781 AD by Sir William Herschel.
- This is the seventh planet from the sun.
- It rotates on its axis from east to west while other planets from west to east.
- Its atmosphere is very thick.
- Its atmosphere is composed of Hydrogen, helium, Methane and Ammonia like Jupiter and Saturn has.
- It has least orbital inclination.
- It is also called as tilted planet.
- Ariel and Miranda are main satellites of this planet.
- It is the third largest planet of the solar system.
- It has rings around it like Saturn.
- The Sun rises in its west and sets in its east.

## Neptune

- It was discovered by a German astronomer Johan Galle in 1846.
- It is green in colour.
- Its atmosphere is very dense.
- Its atmosphere consists of Hydrogen, Helium, Methane and Ammonia.
- Its main satellite is Triton.
- Its orbital time is 165 years.
- It has 8 natural satellites.
- It is the last planet of our solar system.

## Dwarf planets

### Pluto

- Pluto was discovered in 1930.
- It was discovered by Clyde Tombaugh.
- It also known as a "Kuber".
- This planet was given status of Dwarf Planet at Prague Summit in 2006.
- Now there are only eight planets in the solar system.

### UB-313

- It was discovered in 2003.
- It is also named as Arice.

## Asteroids

- These are situated between Mars and Jupiter.
- Asteroids are also known as minor planets.
- These revolve round the sun.
- These are approximately 40000.
- Four Vesta is the only Asteroid which we can see through naked eyes.

## Comets

- These are the celestial bodies composed of dust, ice and gases.
- Comets come from the colder and darker areas, away from the sun.
- They revolve around the sun in large and irregular orbits.
- They start glowing with a bright gaseous tail always pointing **away from the Sun**.
- Many a times, comets are visible to the naked eye and present a very spectacular sight.
- Comet Halley was discovered by Edmund Halley.
- Comet Halley returns after every 76 years.
- It was last time seen in 1986.
- Now it will be seen again in 2062 ( $1986+76=2062$ ).
- According to the astronomers there are about 1 lakh comets wandering in the solar system.

## Meteors and Meteorites

- Meteors and Meteorites are also called shooting star.

### 1. Meteors

- Meteors are the celestial bodies composed of dust and gases.
- Meteors are usually small and due to heat produced by air resistance, burn up before they reach the Earth's surface called meteors.

### 2. Meteorites

- Meteorites are large in size.
- Meteorites do not burn completely.
- Meteorites reach the surface of the earth.

