

Stars And The Solar System

17



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INTRODUCTION

During the day, there seems to exist only the earth and the sun. When we look into the night sky, we see magical lights of thousands and thousands of twinkling, glittering spots.

Everything that exists makes up what we call the universe. It is made up of matter, energy and space. The earth is a very small part of the universe.

Heavenly Bodies

What do we see in the sky during the day ? We see only the sun. Due to brightness of the sun other heavenly bodies are not visible. If you look up the sky in a clear night what do you see. We see the moon and thousands of stars twinkling in the sky. There are many heavenly bodies in the sky. But they do not twinkle. They are the planets. The sun, the moon, the stars and planets in the sky are known as heavenly bodies.



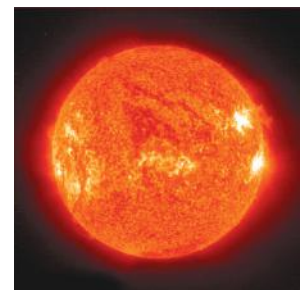
Galaxy

The Sun

The sun is only one of the billions of stars in the universe. It is about 4.5 billion years old. It is the largest body in the solar system. The diameter of sun is about 19 times the diameter of the earth.

It does not appear larger than the moon from the earth because the sun is about 150 million kilometres away from the earth.

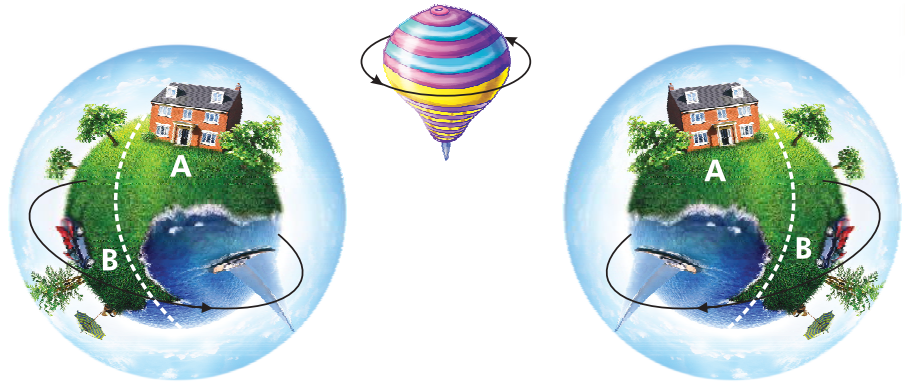
The sun is made up of about 75% hydrogen and 25% helium by mass. The hydrogen is responsible for the tremendous amount of energy that the sun radiates. The surface of the sun is called the photosphere.



Sun

Why does the sun seem to move across the sky during the day ?

During the day, the part of the earth we live on faces the sun and is bright. As the earth rotates, we move away from the sun and so it becomes dark and it is night. After a few hours, the part of the earth which had moved away from the sun returns in front of the sun and the sun appears to rise in the sky.



The earth rotates from west to east

As the earth rotates around itself, the position of the sun in the sky keeps on changing. The earth rotates from west to east due to which the sun appears to rise in the east.



West ← → East West ← → East West ← → East

As the day progresses, the sun seems to move across the sky. The sun does not move across the sky, it is the earth which is rotating.

In the west and goes below the horizon. The rotation of earth not only causes day and night, it also result in the changing position of sun in the sky.

Galaxy

Stars are always found in collections called galaxies, along with gas, dust and large amount of dark matter. Each galaxy is made up of many millions of stars. The galaxy that we live in is called the milky way.



Galaxy



Magellanic clouds

All the stars that we see in the sky belong to the milky sky.

Solar system is a part of milky way. It is very large so it would take you 100,000 years to go across if you could travel at the speed of light. Galaxies are categorised based on three apparent shapes into elliptical, spiral and irregular galaxies.

The elliptical galaxies are ellipse shaped. The spiral galaxies look like giant whirlpools of stars. The milky way and the Andromeda Galaxy are spiral galaxies. Some galaxies do not have any shapes. They are irregular galaxies. The Magellanic clouds are an example of an irregular galaxy.

The Moon

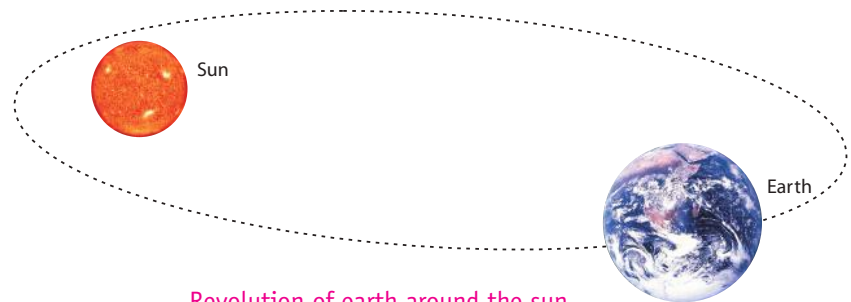
The most prominent celestial object, we see in the night sky is the moon. It is the earth's satellite. It is ball of grey rock. Its surface is made up of mountains and craters. It was Galileo who discovered the craters of the moon using his telescope. The moon does not have any light of its own. The light from the sun illuminates it and gets reflected back to the earth and we can see the bright moon. The moon is spherical but appears to change its shape. The apparent change in the size of the moon is called the phases of the moon.



The moon is the earth's satellite

Planets

The word planet means 'wanderer' and refer to the way a planet moves around a star. You have learnt that the earth rotates around its own axis. It revolves around the sun, as do all the other planets. The movement of a planet around the sun along its orbit is known as revolution. Planets do not have light of their own. They shine with a steady light, reflected from the sun.



Revolution of earth around the sun

In the year 2006, the definition of a 'planet' was revised by the IAU (International Astronomical Union). Now a planet is defined as a nearly round-shaped celestial body that is in orbit around the sun. A planet's gravitational force does not allow any other body except its satellite to go around its orbit.

Terrestrial Planets

Mercury, Venus, Earth and Mars are called terrestrial or rocky planets, because they are composed primarily of rock and metal. They have relatively high densities, slow rotation, solid surfaces, rings and few natural satellites.

Mercury

It is the closest planet to the sun, mercury goes round the sun in the shortest time at the highest speed. It takes 88 days to complete one revolution. The side of Mercury that faces the sun is extremely hot while the side that faces away from it is extremely cold. Mercury has a thin atmosphere made up of hydrogen and helium. It is visible in the night sky.



Mercury

Venus

Venus is probably the hottest planet in the solar system with a surface temperature of 500°C. It



Venus

has a thick atmosphere made up of CO_2 . The high temperature on Venus is attributed to the green house effect due to the high percentage of CO_2 present in its atmosphere. Conditions on the surface of Venus are very hostile with winds of high speed and sulphuric acid rains. Venus reflects about 75% of the sunlight that reaches it that is why it appears very bright. It is one of the first objects to appear in the night sky and is also known as the evening star. It is visible in the night sky.

Earth

From space, our planet earth appears as a bluish globe with dense white clouds. It is made up of distinct layers. The inner core and crust are solid, the outer core and mantle, layers are semi-fluid.

The earth's atmosphere is made up of 77% nitrogen, 21% oxygen, with traces of argon, carbon dioxide and water vapour. The oxygen in the earth atmosphere is produced and maintained by several biological processes, without life there would be no free oxygen. The sun's heat is trapped within the earth's atmosphere by the greenhouse gases, mostly carbon dioxide and water vapour in its atmosphere.



The Earth

The earth has only one natural satellite, the moon. The moon is lifeless, has a very thin atmosphere and is full of craters.



Mars

Mars

It is the fourth planet from the sun, Mars is also called the red planet. It has distinct polar snow caps. It is colder than the earth. Mars has a thin atmosphere made up of CO_2 . It is considered to be the most likely candidate in the solar system to harbour life apart from earth. Several volcanoes are found on Mars, some of which are larger than those found on earth. It is also visible in the night sky.

Gas Planets

Gas planets have low densities, rapid rotation, deep atmosphere, rings and many natural satellites (moons).

Jupiter, Saturn, Uranus and Neptune are the gas planets.

Jupiter

It is the fifth planet from the sun, Jupiter is the largest planet and is easily visible to the naked eye. It is not solid like the inner four planets and is made of gases. It has a ring system. Jupiter has a very interesting



Jupiter

atmosphere made of hydrogen. Winds with very high speeds blow over it, in fact the red spot is believed to be a storm that has been raging for hundreds of years. It has maximum 29 moons, four of which can be seen from the earth through a light telescope.

Saturn

Saturn is the second largest planet of the solar system. It is visible in the night sky. It is also a gas giant like Jupiter. It has a very complex ring system. The rings are composed of ice and rock particles. It has 30 natural satellites.



Saturn



Neptune

Neptune

The third most massive gas planet in the solar system. Neptune is about the same size as Uranus. It has a ring system and 8 satellites. We use a telescope to see Neptune in the night sky.

Dwarf Planets

Apart from these eight planets three dwarf planets orbit the sun. A dwarf planet is nearly round but does not have a strong gravitational force. Pluto, Eris and Ceres are the three dwarf planets.

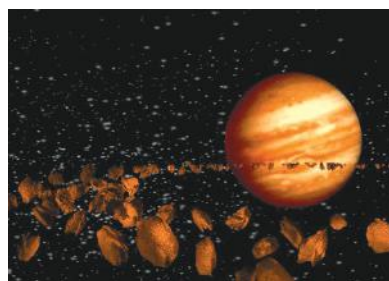
Pluto

It is the largest known dwarf planet in the solar system. It has one moon called Charon.

Ceres is the smallest dwarf planet in the solar system and the only one in the main asteroid belt. Small Solar System Body is a form coined by the international Astronomical Union



Pluto



Asteroids

Asteroids

Asteroids are small irregular-shaped rocky bodies orbiting the sun. They are located mostly between Mars and Jupiter but are also found elsewhere. There are millions of asteroids in the solar system. The number of asteroids between Mars and Jupiter is so large that they appear as belt in this region.

Interesting Facts about the Planets

- Mercury is the smallest planet and Jupiter is the largest planet.
- Mercury is the planet nearest to the sun whereas Neptune is the farthest planet from the sun.
- Mercury and Venus are the planets situated between the sun and the earth
- The planet Mercury and Venus are the planets situated between the sun and the earth.
- The large planets are Jupiter, Venus and Saturn. We can see them by naked eyes.

- Venus is the brightest planet in the sky.
- The second largest planet is saturn.
- Saturn has a system of rings around it.
- The planet with only one moon is the earth.

Constellations

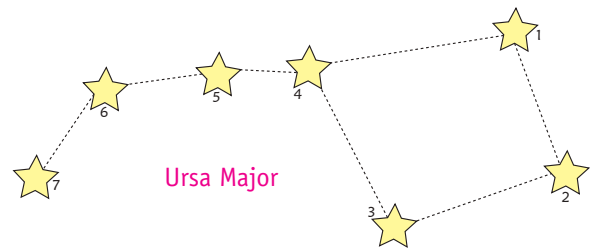
Some stars occur in space in distinct groups, may consist of a few stars and their arrangement can be compared to the shape of some animal or human being. A group of a few stars whose arrangement can be compared to the figure of some animal or any other known thing is called constellation. Following are the important constellations.

1. Ursa Major or Great Bear

This constellation consists of seven bright stars arranged in pattern resembling some what a big bear. The stars marked 1, 2, 3 and 4 represent the body and the stars marked 5, 6 and 7 represent the tail of the great bear. The head and paws of the great bear are formed by some faint stars which are not shown in diagram.

The Ursa Major constellation can also be compared to the following objects.

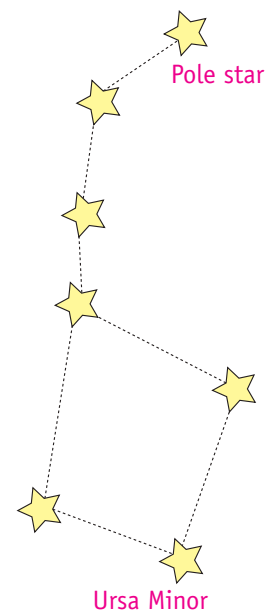
- It looks like an oversized ladle or large cup shaped spoon in which star marked 1, 2, 3 and 4 form the cup of ladle, whereas the stars marked 5, 6 and 7 form the handle.
- It looks like a question mark suspended across the sky, whereas stars marked 1, 2, 3 and 4 form the curved part and stars marked 5, 6 and 7 represent the straight line part of the question mark.
- It also resembles to a kite having a long tail. This constellation is clearly visible in northern part of sky in summer months from April to September. Its Indian name is Saptarishi Mandal.

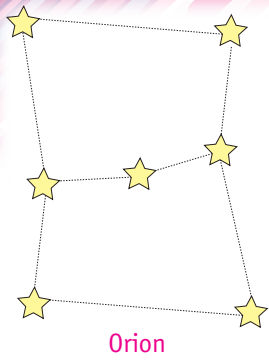


2. Ursa Minor or Little Bear

The Ursa Minor constellation is also a group of seven stars, similar to Ursa Major constellation. However, the stars of Ursa Minor are closer and smaller as compared to the stars in Ursa Major. The form is as an outline of small bear or ladle or a kite with a long tail or a question mark. At the tail of Ursa minor, is a star of average brightness. It is called the Pole star or Polaris. In Indian astronomy, this star is called Dhruva Tara. Pole star or Dhruva Tara appears stationary in the sky and all other constellations appear to revolve around it. It points to geographic north direction and is very useful in finding the direction at night by sailors.

In Indian astronomy, Ursa Minor is called Laghu Saptrishi or Dhruva. It can be seen in July during Summer.



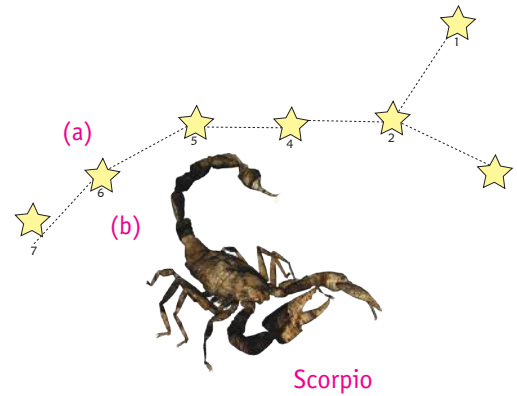


3. Orion or Hunter

Orion is well known constellation which dominates the winter sky. Its name in Indian astronomy is Vyadha or Mriga. It looks like a hunter with shield and club upraised. The major stars of the Orion form the body of a hunter. The head and limbs are formed by other faint stars.

4. Scorpio

It is constellation of seven stars, commonly called Vrishchika in Indian astronomy. The stars 5 and 6 form the body and star marked 7 form the tail of Scorpio as in figure. It is usually visibly in winter months.



5. Cassiopeia



It is a group five stars arranged in the form of W. Its name in Indian astronomy is Sarmishtha. It is seen near the Pole Star and is best visible in the month of October in northern sky.

6. Pleides

Pleides is an important constellation in the sky. The stars in this constellation do not have any particular arrangement and hence, do not resemble any recognizable shape or figure with which we are familiar. It looks like a cluster of stars in this constellation are called globular clusters. It is best visible in the winter months. Its name in Indian astronomy is Kruttika.

Do You Know ?

Swarms of meteor can be seen when the earth crosses the tail of a comet, these are known as meteor shower.



Pleides

Meteors and Meteorites

You must have seen that some stars appear to fall from the sky leaving behind a long streak of light. They are commonly called shooting stars. In fact, these so called shooting stars are not even distantly related to the stars but they are chunks of rocks floating in the space. When these rocks enter the earth's atmosphere they experience a lot of friction of air and, hence, get heated to look white. Thus they appear like stars. However, as the earth's gravitational force pulls them they fall towards the earth with great speed. This in turn makes them burn giving a large amount of heat and light energy, which appears as a streak of light.



Geosynchronous satellite launch vehicle (GSLV)

Pol satellite launch vehicle (PSLV)

The process of rocks floating in space which get heated up on entering into earth's atmosphere and thus, appear like stars are called meteors. However, some meteors are so large that they do not completely burn in the atmosphere. Thus, a part of rock reaches the earth. This unburnt part is called meteorite. Thus, a part of meteor which fails to burn in the earth's atmosphere and hence reaches the surface of the earth is called meteorite.

Satellites

A satellite is an object that orbits another object in space. For example the moon a satellite of the earth. The satellite can be natural or man made the moon is a natural satellite where as APPLE was the name given to the first communication satellite launched by India in June 1981. An artificial satellite is a man-made object that has been purposely placed into orbit around earth or other planets. Artificial satellite are machines that perform specific functions from space. They are used to study the universe, forecast weather, track cyclones, make long distance telephone calls, assist in navigation of ships and aircraft, survey land and to support military activities. The Indian space programme was initiated by the great Indian scientist Dr Vikram Sarabhai.

India has one of the largest domestic communication satellite systems. It is known as the INSAT. The INSAT system provides services in the areas of telecommunication, radio broadcasting, and business communication.

Aryabhata was the first satellite that was fully made in India. It had 26 flat faces and most of its outer surface was used to mount solar cells. The cells generated electric power for the satellite It also had a nickely-cadmium battery and tape recorder to store and play back data. It had three scientific instruments to carry out experiments in space. They were X-ray astronomy instrument, aeronomy instrument and solar neutron and gamma ray instrument.

Natural Satellites

A heavenly body which revolves around a planet is called a natural satellite. Till today 91 natural satellites are known to us. Some planets do not have any satellites whereas some have many.

The earth has one natural satellite-the moon. It completes its revolution around the earth in 27.3 days. Its distance from the earth is about 384,400 kilometers, it has only $\frac{1}{4}$ th of the earth's diameter and is 18 times lighter than the earth.

Artificial Satellites

You see the weather forecast on television through INSAT 1-B. It is one of our prestigious artificial satellites which is continuously orbiting the earth and helps in the forecasting of the weather.

India sent its first earth satellite Aryabhata on 19th April 1975. Some other Indian Satellites are Bhaskara, Rohini, Apple, INSAT 1-B and INSAT 2-B.

Uses of artificial Satellites

- Weather forecasting.
- Radio and television transmission.
- Long distance communication through telephones.
- Locating mineral resources.



Know the Keywords :

Universe : The total composition of galaxies and their stars planets and everything known to human kind..

Astronomy : The science of studying the universe.

Galaxy : A huge group of stars.

Asteroids : Large number of rocks that lie between the orbits of Mars and Jupiter.



Point to Remember

- Stars are always found in collections called galaxies, along with gas, dust and large amount of dark matter.
- A dwarf planet is nearly round but does not have a strong gravitational force.
- Asteroids are small irregular-shaped rocky bodies orbiting the sun.
- A group of a few stars whose arrangement can be compared to the figure of some animal or any other known thing is called constellation.

EXERCISE TIME

A. Answer the following questions :

1. What are heavenly bodies ?
2. Write a short paragraph about the sun.
3. What is a planet ?

B. Write 'T' for true and 'F' for false statement :

1. The sun is the closest star to the earth.
2. A comet revolves around the planet.
3. All planets move around the sun in an elliptical orbit.

C. Tick (✓) the correct option :

1. The universe is made up of :
 - (i) every thing that exists on earth and in space.
 - (ii) many millions of stars only.
 - (iii) all the planets
2. A galaxy is made up of :
 - (i) large amount of gas and a few stars.
 - (ii) thousands of stars, gas and dust.
 - (iii) stars and planets.



Creative Work

- **Recently, much progress has been made in successfully sending un-manned space vehicles to different planets. Landing a probe on the Martian landscape is a great success story. Another recent achievement has been the landing of a probe on an asteroid of the solar system. Collect information about these achievements and paint a colourful imaginary picture to depict any one of these events.**