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Our Earth in the Universe

Do you know?

THE BIG BANG

It is believed that 15 million years ago a hot ball of matter exploded with a big bang. This created matter, energy, space and time. This big bang released gases like helium and hydrogen. Later this created the universe including stars, galaxies, planets etc.

All the objects that we see in the sky are called **heavenly bodies** or **celestial bodies**. They include the stars, planets, satellites, comets, meteors and asteroids. Our own earth is also a part of this system. The word 'celestial' is derived from Latin word 'celestis' which means sky. There are many other celestial bodies that lie far away from us and are, therefore, not visible.

People who study celestial bodies and their movements are called **astronomers**. The branch of science which deals with the study of celestial bodies is called **astronomy**.

UNIVERSE

Most astronomers believe that the universe started about 15 billion years ago, with the gigantic explosion of a cosmic egg—the **Big Bang**. Due to this explosion, atoms and later molecules were formed. These molecules came together and formed giant clouds of gases and dust particles called **nebulae**. Each nebula had its own gravity and a spinning motion. Within the nebula, the atoms were attracted to one another and in the process collided with each other at a tremendous speed. This gave out an enormous amount of heat, so much so that glowing bodies such as the stars were born out of the nebula. Our sun, which is a star, was born about 4.6 billion years ago.

Galaxy

Millions of stars, gas and dust, held together by the force of gravity, form a galaxy. The Universe consists of millions of galaxies. The Universe is still expanding as new stars are being born. Our solar system belongs to one of these



Nebula



Galaxy

galaxies called the Akash Ganga or the Milky Way. This galaxy is named so because it is like a white band. It consists of millions of stars—the sun is one such star.

Stars and Constellations

Stars are huge burning balls of hot gases which glow and shine in space. They are self-luminous. They appear as tiny specks in the sky as they are far away from us. Stars appear to twinkle. This happens because light from the star has to pass through different layers of the atmosphere with varying densities.

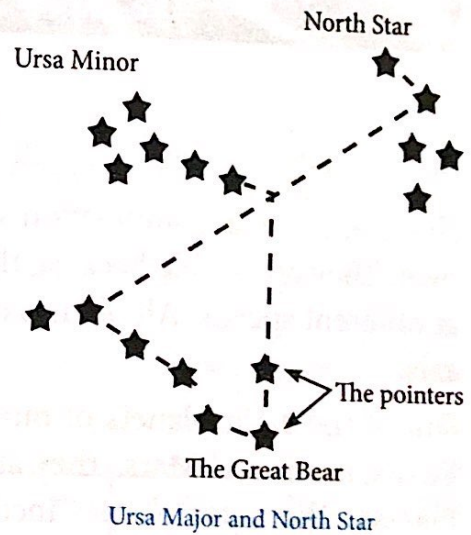
All star except the 'Pole Star' appear to move from east to west, due to the rotation of the earth on its own axis from west to east.

If you look at the night sky closely, you can see clusters of stars. These groups of stars are called **constellations**. Astronomers have joined the stars in a constellation by imaginary lines, giving them different shapes.

One of the constellations is the **Ursa Major** or **Great Bear**, which can be easily recognised in the northern sky. It is called **Saptarishi** (seven sages) in India. The seven stars in this constellation form the shape of a big spoon. The two stars at the ends of this constellation are called pointers. They always point towards the north. The brightest star in the sky is the **Pole Star** or the **North Star**. It appears to remain in the same position in the sky and all other stars and constellations seem to revolve around it. The North Star is almost directly above the North Pole. People in the ancient times used to determine the north direction during the night with the help of the North Star. Ursa Minor, Orion, Canis Major and Hydra are some other well-known constellations.



Stars

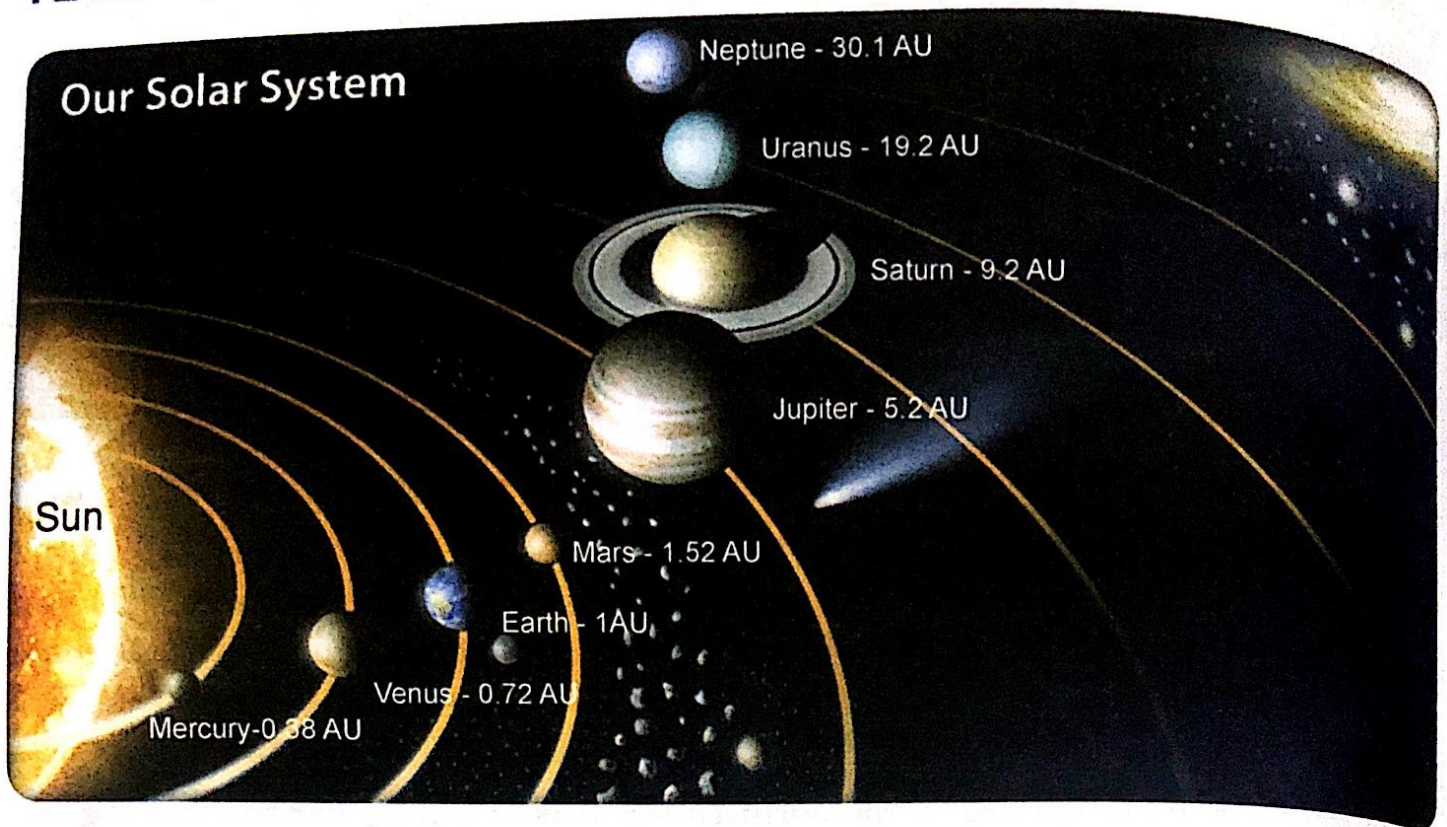


THE SOLAR SYSTEM: THE SUN AND ITS FAMILY

The word 'Solar' is related to the sun. The family of the sun is called the solar system which includes eight planets and their satellites. Besides, there are many comets, countless asteroids and meteors. The movement of a celestial body around a host is called 'revolution'. All planets revolve around the sun in elliptical paths called **orbits**.

Originally, our solar system included nine planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto. However, in 2006, the International Astronomical Union (IAU) reclassified Pluto as dwarf planet. Hence, our solar system now has eight planets.

PLANETS (AN OVERVIEW)



The Solar System

The word 'planet' is originally a Greek word which means 'wanderer'. Planets are spherical in shape but vary in composition and size. They are opaque bodies with no heat or light of their own. They are visible because they reflect the light of the sun. They also 'rotate on their axis' at different speeds. All planets except Venus and Uranus spin in the same direction on their axis.

Out of the eight planets of our solar system, the first four are **inner planets**, i.e., Mercury, Venus, Earth and Mars. They are made up of rocks, which is why, they are called **Terrestrial Planets**. The **outer planets** include Jupiter, Saturn, Uranus and Neptune. They are mainly gaseous in nature and are called **Jovian planets**.

Mercury is the smallest planet in the solar system. It does not have an atmosphere. It lies closest to the sun and has the shortest orbit around the sun. It takes only 88 days to complete one revolution and nearly 59 days to complete one rotation. Its surface has many craters like those on our moon.

Venus is the hottest planet. It has carbon dioxide in its atmosphere that hides its surface from view. A blanket of sulphuric clouds and gases in its atmosphere trap its heat just as the glass roof of a greenhouse prevents the heat accumulated in the day. It is the brightest object in the sky seen without a telescope and often referred to as **Morning Star** or **Evening Star**. Venus is identical to the earth in size. So, it is called **earth's twin**.

•Do you Know?•

On April 24, 2007, astronomers discovered the most earth-like extra solar planet called Gliese 581c. The planet revolves around its sun-Gliese 581.

Earth is our home planet. Its atmosphere is rich in oxygen and nitrogen. 71% of it is covered with water, and it is the only planet which is known to have life on it. Earth is the third nearest planet to the sun and fifth largest in size in the solar system.

Mars looks red as it has red oxide in its soil and is called the **Red Planet**. Its atmosphere is very thin, mainly carbon dioxide with traces of water vapour and other gases. Its surface is pockmarked with volcanic craters. A year on Mars is equal to two earth years.

Jupiter is the largest in size. Its mass is twice that of all the other planets put together. Jupiter spins much faster than any other planet, i.e., once in 9 hours and 55 minutes. Ganymede is one of the Jupiter's moon.

Saturn has beautiful rings that can be seen through a telescope. They are made of dust particles, rock and ice. It is such a light planet that it is said if this ringed planet fell into a huge body of water, it would float!

Uranus and **Venus** rotate from east to west unlike other planets which rotate from west to east. The sun as seen on these planets rises in the west and sets in the east.

Neptune is the eighth planet from the sun and the farthest. It is the fourth largest planet in the solar system. Its atmosphere contains hydrogen, helium and some methane which gives it a bluish colour.

A comparative study of planets.

Planet	Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune
Average distance from the sun (in million km)	57.9	108	150	228	778	1427	2,870	4,497
One revolution (rounded to days/years)	88d	225d	365d	687d	12y	30y	84y	165y
Average diameter (km)	4,880	12,100	12,750	6,790	142,800	120,700	50,800	48,600
One rotation (hours/days)	59d	243d	24h	24h	9h 50 min	10h 39 min	17h 18 min	15h 40 min
Average surface temperature (°C)	-170 to 400	475	-85 to 65	-120 to 30	-160	-180	-197	-220
Number of moons	0	0	1	2	62	33	21	11

OUR UNIQUE EARTH

Look at the photograph of the Earth taken from space. It is a colourful planet, with shades of blue, white, and green. The oceans and seas make our Earth look blue when seen from space. The white colour represents the clouds. Green shows the vegetation. Why do you think we see so little of the green colour? Thirty per cent of our planet is covered by land and 70 per cent by water. Can you identify your country in the image?

The Earth is surrounded by an **atmosphere** of nitrogen, oxygen, and water vapour. It also has a **layer of ozone**, which absorbs some of the



Earth as seen from space

damaging radiation from the Sun.

Most importantly, the Earth has **water**. These conditions support life. Besides, our planet has **soil**, which allows plants to grow.

Though the temperature on the Earth vary a lot (-85°C to 65°C), we have more or less **constant temperatures** between day and night. Our planet is about 14,591,000 km away from the Sun. Therefore, it is neither too hot nor too cold and can support life.

The Earth takes $365\frac{1}{4}$ days to complete one revolution around the Sun. It completes one rotation in 24 hours, resulting in day and night.

You will learn about these movements in the next chapter. The Earth has one moon.

The Moon

Our Moon is a natural **satellite** of the Earth. Satellites are smaller celestial bodies which revolve around the large bodies—generally the planets. As planets move around the Sun, their satellites accompany them in their revolution. Satellites may be natural or human-made. Human-made satellites are sent to space to collect information for scientists.

The Moon is about 3,84,400 km away from the Earth. It completes one revolution around the Earth in about 27 days. It takes almost the same time to complete a rotation on its axis.

The Moon has no light of its own. It reflects the light of the Sun. Since the Moon is much closer to us than the Sun, it looks almost as big as the Sun.

We can see the Moon in different shapes on different days of the month. These are called the **Phases of the Moon**.

The moon has no atmosphere and no water. Its surface is covered by hills, valleys, and craters. It is the only satellite that is close enough to have allowed human visits and to have been studied through a telescope.

American astronaut Niel Armstrong was the first man to step on the surface of the Moon on July 29, 1969.

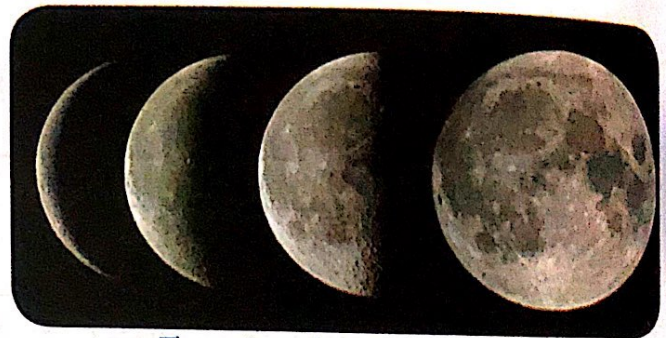
OTHER CELESTIAL BODIES

Asteroids

These are a swarm of rock pieces that lie in the belt between the orbits of Mars and Jupiter. Like the planets, they also revolve around the sun. They are believed to be fragments of a planet which exploded and disintegrated after its birth. Out of over 1,00,000 asteroids, nearly 4,000 have been identified. However, their total mass is not more than a few hundredth of the



The Earth's Moon



The various phases of the Moon

mass of the Moon. Ceres is the largest asteroid nearly 700 km across in diameter.

Meteoroids

You must have noticed that sometimes, at night, a streak of light flashes across the sky and vanishes almost immediately. You may even have made a wish thinking that it is a falling star! It is actually a burning meteor. Meteoroids are small pieces of rocks which revolve around the Sun. Some of these particles enter the Earth's atmosphere with great velocity. Due to friction with the atmosphere, they get heated up and start glowing. Most meteors burn out, but some are quite large and fall on the Earth's surface, creating a hole or a crater. They are then called **meteorites**. The Meteor Crater in Arizona, USA has been formed by a large meteorite.

Comets

Comets are glowing heavenly bodies revolving around the Sun in elongated orbits. They are mostly made up of dust, ice particles and gases. Most comets have a head, a nucleus and a tail. When they approach the Sun, the gases get heated up and start glowing.

Comets may be **periodical** or **non-periodical**. Periodical comets can be seen at fixed intervals. **Halley's Comet** is a good example of a periodical comet. It appears after every 76 years. It was last sighted in 1986. Can you say when it will be sighted again? Non-periodical comets appear for a short period and then disappear suddenly.



Halley's Comet

Points to Remember

- All objects in the sky are called celestial bodies.
- Our solar system consisting of the Sun, eight planets, their satellites, asteroids, meteoroids, etc, belong to the Milky Way Galaxy.
- The Sun is made up of hot, burning gases, it is 150 million km away from the Earth.
- Planets rotate on their own axis and also revolve around the Sun in their respective orbits.
- Our planet Earth is unique because it is the only planet where life is known to exist.
- Satellites revolve around the planets and accompany them in their revolution around the Sun.
- The Moon is the only satellite of the Earth.
- Asteroids, meteoroids and comets are other celestial bodies in the universe.



- Asteroids** : Small pieces of rocks.
- Celestial Bodies** : Bodies which we see in the sky, like stars, planets, comets, satellites, meteors, etc.
- Comets** : These are icy, rocky masses surrounded by glowing gases.
- Constellation** : Group of stars that cluster to form patterns in sky.

- Galaxy : A vast cluster of billions of stars.
- Meteors : These can be dust or chunks of rock from comets or asteroids.
- Nebula : Clouds of dust and gas held together by gravity.
- Planets : Objects in space that rotate around their own axes and orbit around a star.
- Stars : Balls of hot gases which glow in space.
- Satellites : Celestial bodies which revolve around planets, without any heat and light of their own.



A. Choose the correct option.

1. Which of the following was declared a 'dwarf planet' in 2006 and lost the coveted honour of a planet?
 - a. Venus
 - b. Earth
 - c. Pluto
 - d. Jupiter
2. The Pole Star indicates the direction to the
 - a. South
 - b. North
 - c. East
 - d. West
3. What is the shape of the paths taken by planets to revolve around the Sun?
 - a. Rectangular
 - b. Circular
 - c. Zigzag
 - d. Elongated
4. The planet that has the natural satellite in the solar system is
 - a. Earth
 - b. Mars
 - c. Jupiter
 - d. Uranus
5. Halley's Comet visits our solar system once in every..... years.
 - a. 15
 - b. 76
 - c. 20
 - d. 330

B. Match the following columns.

Column A	Column B
1. Meteors	(a) Milky Way
2. Sun	(b) Small Bear
3. Big Bear	(c) Ursa Major
4. Saptarishi	(d) Star
5. Akash Ganga	(e) Shooting stars

C. State true or false.

1. Comet Klemola visits the solar system little over every 3 years or so.
2. The gravity of the earth keeps all the planets in their orbits.
3. Ganymede is also known as Akash Ganga.
4. All planets revolve on their axis from west to east except Uranus and Venus.

D. Very Short Answer Questions.

1. Which planet is nearest to the Sun?
2. Which planet is farthest from the Sun?

3. Which planet has a ring around itself?
4. What is the source of heat and light for all the planets?
5. How many natural satellites do Jupiter and Saturn have?

Short Answer Questions.

1. What are celestial bodies? Give examples.
2. Write few characteristics of each planet in the solar system.
3. Why do stars twinkle?
4. What do you mean by term phases of moon?
5. How are we able to see the moon?

Long Answer Questions.

1. Explain why is the earth called a unique planet?
2. Write few characteristics of each planet in the solar system?
3. Write a short note on each of the following:
(a) Comets (b) Meteors (c) Meteorites
4. Which is the natural satellite of earth? What do you mean by the term phases of moon?
5. Why is there no life on the Moon? How are we able to see the moon?

HOTS

1. How do we measure distances in space?
2. Why do we always see the same side of the Moon?

ACTIVITY CORNER

Project work

Do you know how and when the Earth was formed? Search the Internet or read relevant books to understand how the planet was formed, how old it is, the distance between the Earth and the nearest planet and other fascinating facts. Present your work in class in the form of a chart.

Find out

You must have heard of the terms lunar and solar eclipse. Some of you might have witnessed the event too. Write how the lunar and solar eclipses occur and draw appropriate diagrams to show the event. Explain it to your class.

Model making

Imagine how humans could tell time before the invention of clocks and watches. They did it by looking at the Sun. Sun dials helped humans know what time of the day it was. Make a sundial using any material you can find at home or at school.

Connect to Life

The earth is the only planet that is believed to support life. Life exists on Earth because everything is in balance here. It is neither too hot (like the planet Mercury) nor too cold (like the planet Neptune). What values can you learn from this?