

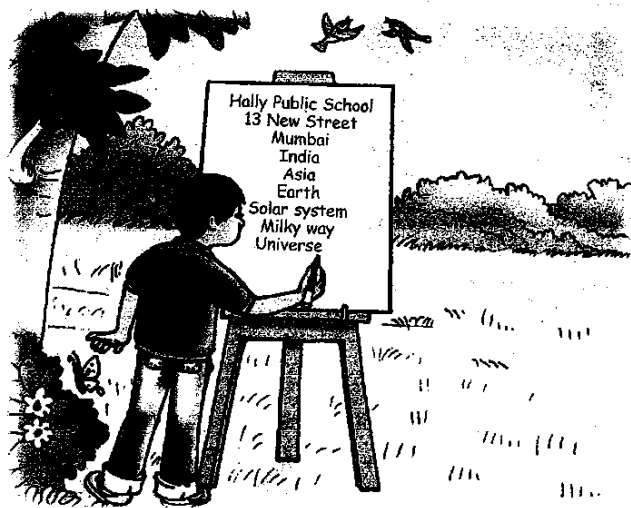
The Universe

1

LEARNING OUTCOMES

- Galaxy
- Constellation
- Solar system: sun and eight planets
- Moon: phases, tides, and eclipses
- Other solar-system bodies
- Artificial satellites

Harry is writing his school address on a chart he is making for his school bulletin board. Have a look at the address. It is so interesting to read. Can you tell what is so special about it?



You will notice that the address ends at the *universe*. This means that our final home is the big universe. Can you tell what universe means? *The sun, the planets, the stars, moon, and all matter, energy, and space that exist constitute this big universe.*

Every time we gaze at the sky, we wonder how the big universe came into existence. Scientists say that it is almost impossible to tell how old the universe is, but they think that there was a time when all matter, energy, and space was condensed into the size of a pinpoint. This was followed by a huge explosion because of which matter got scattered in all directions. This led to the formation of the universe. Scientists refer to this theory as the *Big Bang theory*.

FACT FILE



The **Big Bang theory** is the most widely accepted theory about the origin of the universe. According to this theory, the universe emerged from an extremely dense and hot state. This was followed by a huge explosion, which gave birth to our universe. Some scientists feel that gravity will cause the universe to collapse, while others think it will expand continually.

In this chapter, you will study about galaxies, constellations, planets, and many more things.

GALAXY

The branch of science that deals with the study of the universe is called **astronomy**.

The universe is considered to be made of galaxies, which are the building blocks of the universe. *A galaxy is a vast collection of stars, nebulae, and interstellar material held together by gravity.* (Nebula is a cloud of dust and gas inside a galaxy, in which a star is born.)

As per an estimate, there are probably more than a hundred billion galaxies in our universe! The smallest galaxies contain about 100,000 stars, while the largest contain up to 3,000 billion stars. On the basis of shape, galaxies are classified as *irregular*, *spiral*, and *elliptical*. Figure 1.1 shows the shape of different galaxies.

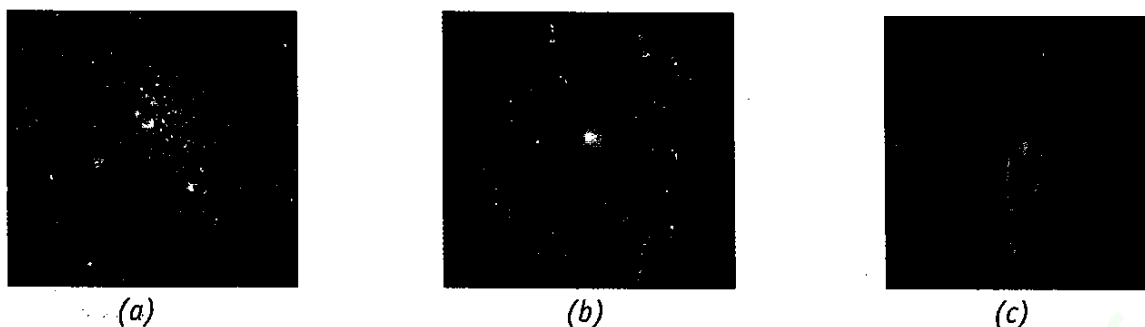


Fig. 1.1 (a) Irregular galaxy; (b) Spiral galaxy; and (c) Elliptical galaxy

FACT FILE

The universe is very vast in respect to the matter it contains. It can be compared to a building 30 km high, 30 km wide, and 30 km long containing a grain of sand. Scientists believe that hydrogen comprises approximately 90–99% of all matter in the universe. They also believe that there are more stars in the universe than all of the grains of sand on the earth.

Milky Way galaxy

Do you know to which galaxy does our solar system belong? *We belong to a spiral-shaped galaxy called the Milky Way galaxy.* When you look up at the night sky, you can see a broad band of light in the sky. This is formed by millions of faint stars that together form the Milky Way galaxy. Have you ever wondered why this galaxy is called the Milky Way? Because it looks like a trail of milk spilt across the sky [Fig. 1.1(b)].

This spiral galaxy is vast, having a diameter of 100,000 light years.

Light year

You might have measured distances in your day-to-day life in metres or kilometres. But, these units cannot be used to measure distances in space because the distances are extremely large. Therefore, astronomers often measure distances in space in light years. *A light year is the distance travelled by light in one year.*

We know that,

Distance travelled by light in one second = 3×10^8 m,

So, distance travelled by light in one minute = $3 \times 10^8 \times 60$ m,

distance travelled by light in one hour = $3 \times 10^8 \times 60 \times 60$ m,

distance travelled by light in one day = $3 \times 10^8 \times 60 \times 60 \times 24$ m,

distance travelled by light in one year = $3 \times 10^8 \times 60 \times 60 \times 24 \times 365$ m = 9.46×10^{15} m or 9.46×10^{12} km.

CONSTELLATION

We know that a vast collection of stars is called a galaxy. When you look at stars on a clear night, you can see some groups of stars forming recognizable patterns. *Such groups of stars forming recognizable patterns in the sky are called constellations.* These are named after animals and mythological characters.

There are 88 constellations known so far. When any new star is discovered, it is considered to be a part of the constellation it is closest to.

Some constellations that you can easily identify with the naked eye are *Ursa Major*, *Ursa Minor*, and *Orion*.

Ursa Major

This constellation consists of many stars arranged in a pattern resembling a bear [Fig. 1.2 (a)]. Out of these stars, a group of seven stars constitute the brightest and the most recognizable part of the Ursa Major. This group of seven stars is called the *Big Dipper* or *Vrihat Saptarishi*. If these seven stars are joined with imaginary lines, the figure obtained looks like a spoon with a long handle [Fig. 1.2 (b)].

Ursa Minor

Just like Ursa Major, Ursa Minor also consists of many stars, but seven stars called *Little Dipper* or *Laghu Saptarishi* form its most recognizable part (Fig. 1.3). However, the stars here are closer and smaller. At the tail of Ursa Minor is a star, of average brightness, called the *Pole star* or *Dhruv tara*. It appears to be stationary in the sky, and all other constellations appear to revolve around it.

Orion

It is often called the *Hunter* and is one of the most common and easily identifiable constellations in the sky (Fig. 1.4). Orion

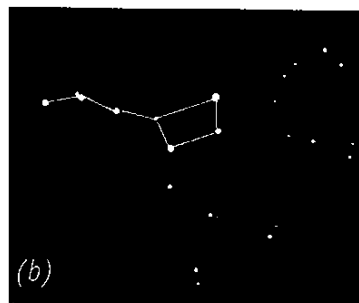
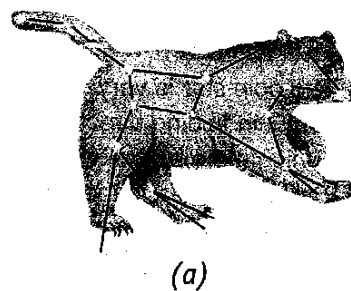


Fig. 1.2 (a) Ursa Major; and (b) Big Dipper

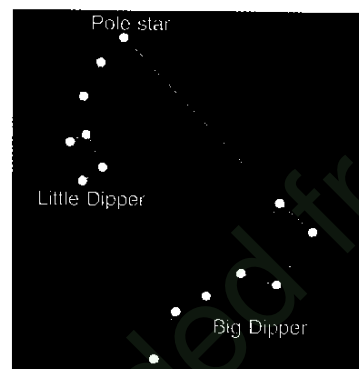


Fig. 1.3 Little Dipper

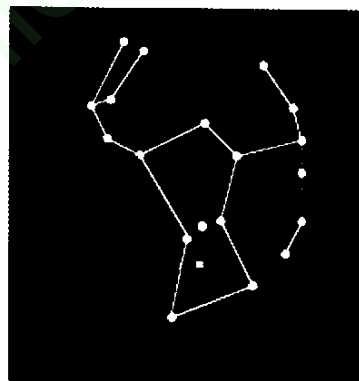


Fig. 1.4 Orion, the hunter

FACT FILE

The pole star is very useful in finding directions at night time by sailors as it always points to the geographic north direction. Early navigators calculated how far north of the equator they were by measuring the altitude of the pole star from the visible horizon.



The sun is a giant, spinning ball of very hot gases. 70% of its mass is made of hydrogen, 28% of helium, and 2% of heavier elements such as carbon, nitrogen, and oxygen. It is about 5 billion years old, and it is believed that the sun will continue to shine for about another 5 billion years.

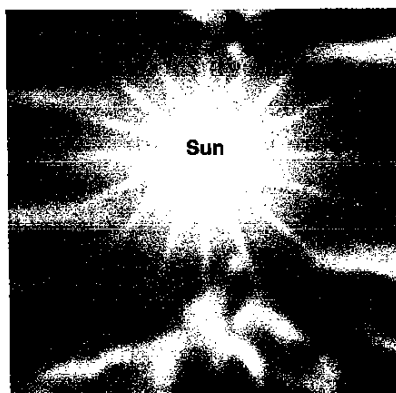
dominates the winter sky, and its name in Indian Astronomy is *Mriga*.

THE SOLAR SYSTEM

You might have studied about the solar system in earlier classes. The solar system consists of the sun at the centre and the bodies that orbit the sun. (Orbit refers to the fixed path in which the heavenly bodies move.) These bodies include planets and their moons, asteroids, comets, and meteoroids. Let us study about them.

Sun

The sun is our nearest star. It is of average size, mass, and brightness; however, it appears bigger, brighter, and hotter than the other stars because it is much closer to the earth. Its distance from the earth is about 1.49×10^8 km. The light from the sun reaches the earth in approximately 8 minutes and 20 seconds. The sun exerts a huge force of attraction to everything within 600 million km. This is the reason why planets, moons, and other celestial bodies orbit the sun.



The internal structure of the sun is made up of four layers. These four layers are namely *Corona*, *Photosphere*, *Chromosphere*, and *Core*. The outer three layers make up the sun's atmosphere; however, the innermost layer, the core, makes up the interior.

Like all stars, the sun produces energy by the process of nuclear fusion, in which small atoms of hydrogen combine to form helium. This releases tremendous amount of energy that we use as *light, heat, and other forms of energy*.

Fig. 1.5 Facts about the sun

The planets

Until 2006, our solar system was believed to consist of nine planets, i.e. Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto.

But, in view of recent discoveries and our changing understanding of planetary systems, the IAU has placed Pluto, after seven decades, into another class of planets called '*dwarf planets*'. Thus, our solar system now consists of only eight planets.

Figure 1.6 shows the solar system with all the planets.

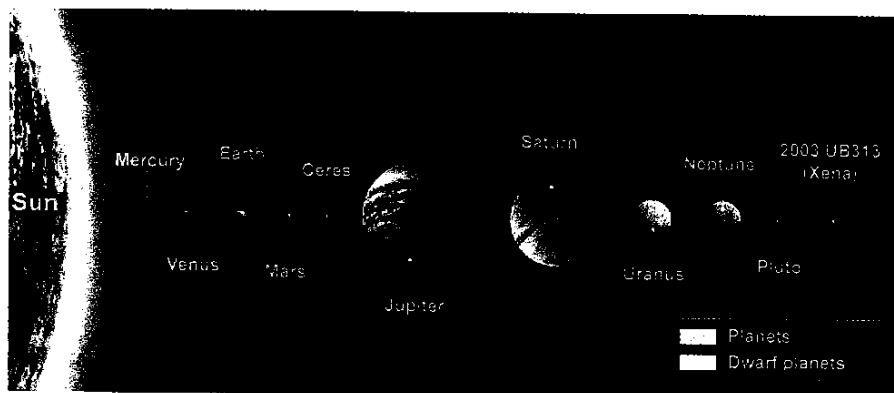


Fig. 1.6 The solar system

Mercury: Mercury is the planet closest to the sun. Its surface is covered with craters. It can be seen as a bright spot of light in the sky before sunrise and just after sunset. Mercury is the smallest planet of our solar system and has no natural satellite.

Venus: Venus is about the size of the earth. It is the third brightest object in the sky after the sun and the moon. It can also be seen before sunrise and after sunset. Hence, it is known as the *morning star* or the *evening star*. Though it is further away from the sun than Mercury, it is the hottest planet of the solar system. Like Mercury, Venus too has no natural satellite.

Earth: Earth is the third planet of our solar system. This is the only known planet which has ideal conditions for life. It has only one natural satellite, the moon. The earth takes $365\frac{1}{4}$ days to complete one orbit around the sun, which is one earth year. It takes 24 hours to rotate about its own axis.

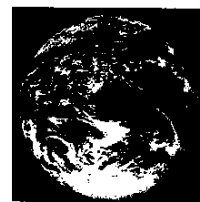
Mars: Mars is seen in the sky as a reddish planet. It is about half the size of the earth. Mars is referred to as the cold planet and has a very thin atmosphere. Space probes sent to Mars prove the existence of water on the planet. Mars has two natural satellites.

Jupiter: Jupiter is the largest planet of our solar system. With a good telescope, we can see the famous *Great Red Spot*, which is a great hurricane on Jupiter, twice the diameter of the earth. Jupiter has the maximum number of natural satellites, i.e., 63*.

* With new discoveries occurring each day, the number of natural satellites of each planet is likely to change in future.

The International Astronomical Union (IAU) is the internationally recognized authority for assigning names and designations to stars and other celestial bodies. The IAU has shifted Pluto (and Ceres and Eris) under a separate class known as 'dwarf planets'.

FACT FILE



Our earth is unique! The composition of its atmosphere and soil, its size, distance from the sun, and the presence of large amounts of water in the liquid form on its surface make it different from any other planet.

TECH FILE

A **space probe** is an unpiloted spacecraft that is used to make observations in space. It has helped scientists get information about our solar system. The information it gathers helps us to understand the weather and other changes, which happen on other planets.



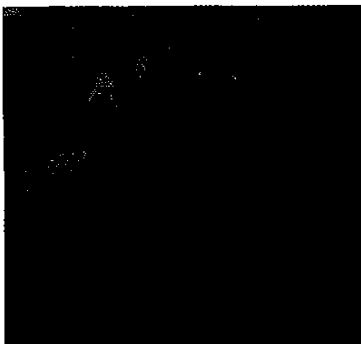


Fig. 1.7 The Great Red Spot on Jupiter

THINK QUEST

Based on your understanding of the planets, answer the following questions.

- Name the red planet.
- Name a gaseous planet.
- Name a planet that does not have a natural satellite.
- Name the planet that has the maximum number of satellites.
- Name the largest planet.

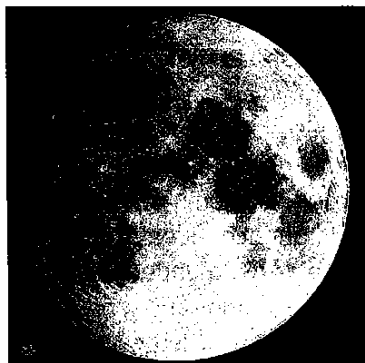


Fig. 1.8 The moon

Saturn: Saturn is the second largest planet in the solar system. The distinctive feature of the planet is the rings made of ice and dust that surround it. This is the reason why Saturn is also known as the '*ringed planet*'. The number of natural satellites of Saturn is 56.

Uranus: Uranus is a very cold planet, much bigger than the earth. Uranus has a strange spin, i.e., it is the only planet in the solar system that spins on its side! Uranus has 27 natural satellites.

Neptune: Being very far away from the sun, this planet is very cold. It looks like a small bluish circle through a powerful telescope. Neptune has 13 natural satellites. The planets Jupiter, Saturn, Uranus, and Neptune are called *gaseous planets*.

Dwarf planet

Any celestial body qualifies as a dwarf planet if (i) it is in orbit around the sun; (ii) it is nearly spherical in shape; (iii) its orbit around the sun overlaps with that of any other heavenly body; and (iv) it is not a satellite. Since the highly elliptical orbit of Pluto overlaps with that of Neptune, it is classified as a dwarf planet.

NATURAL SATELLITES

The heavenly bodies that revolve round a planet are called satellites. Satellites that are natural are called *natural satellites*, and the ones that are man-made are called *artificial satellites*. The natural satellites are commonly referred to as *moons*.

Moon

Can you tell which is the natural satellite of our earth? The moon that we see in the night sky is the natural satellite of our earth.

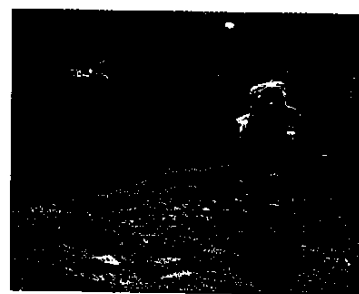
The moon is the second brightest object in the sky after the sun. It is held in orbit around the earth because of the earth's gravitational pull. The moon does not have its own light and reflects the light of the sun. When we look at the moon, we are looking at that part of the moon that is reflecting the light from the sun. It is dry and barren, with no atmosphere or water. It mainly consists of solid rock although its core may contain molten rock or iron. The surface is dusty with highlands covered in craters caused by meteorite impacts. As the moon orbits around the earth once per month, the angle between the earth, the moon, and the sun changes, and we see the different *phases of the moon*.

Phases of the moon

We know that the moon has no light of its own, and it gets lit by the light from the sun. As the moon revolves round the earth, only some part of it receives the light from the sun, and we see only that part of the moon. This results in the changed shapes of the moon called the *phases of the moon*. Figure 1.9 shows the phases of the moon.

When the moon is between the sun and the earth, it becomes totally invisible. This phase is called the *new moon* phase. After a day or two, the moon starts getting visible and we see some part of the moon. This phase is called the *crescent moon*, which is smaller than half moon. After a week, half of the moon is visible, which is called the *first quarter*. After this the moon keeps on increasing in size and is referred to as the *waxing gibbous moon*.

Finally, we see the *full moon* when the earth comes in between the moon and the sun, on the 15th day. After the full moon, the moon starts getting smaller in size and is called the *waning gibbous moon*. Gradually half of the moon becomes visible (*last quarter*), then a part of it (*crescent moon*), and finally the moon again becomes invisible and we call it the *new moon phase*. The time between two successive new moons or two successive full moons is 29.5 days.



Craters on the moon

FACT FILE

Do you know that you always see the same side of the moon? Yes! This is true.

Both the rotation and the revolution of the moon around the earth take 27 days, 7 hours, and 43 minutes. This is the reason why we always see the same side of the moon.

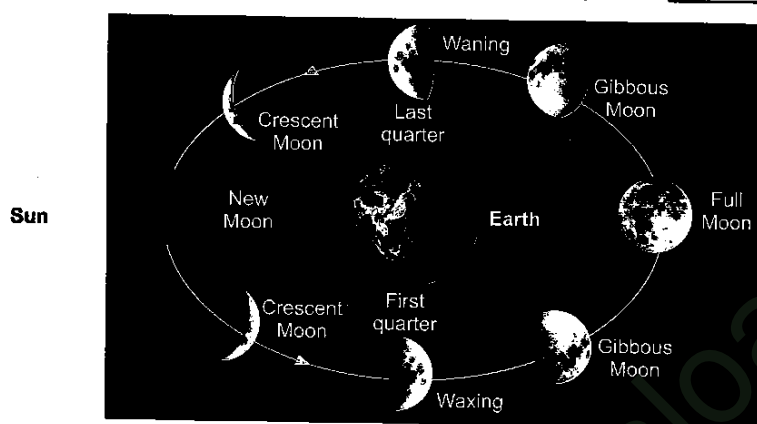


Fig. 1.9 Phases of the moon

ACTIVITY

Aim: To record the phases of the moon.

Materials required: A diary and a pencil.

Procedure: 1. Go out at night and watch the moon carefully.

2. Draw its shape in your diary and note the date. Do this everyday or once in two days for a month.

3. Observe the interval between two successive new moons, successive full moons, and between a new moon and a full moon.

Conclusion: You will see that the time taken between two successive new moons or two full moons is 29.5 days, and between a new moon and a full moon is approximately 15 days.

How are tides useful?

- The tides move a huge amount of water each day, and harnessing it could provide a great amount of energy.
- Tidal power is free.
- It produces no greenhouse gases or other waste.
- It needs no fuel.
- Tides are totally predictable.

Tides

The gravitational forces between the earth and the moon cause some interesting effects. The most interesting one is the occurrence of tides. *Tides are periodic rise and fall of the water level in large water bodies, like seas, oceans, etc.* The moon's gravitational attraction is stronger on the side of the earth nearest to it and weaker on the opposite side.

This variation in moon's gravitational force over the volume of the earth causes stretching of the earth. This stretching is mainly in its oceans, which causes bulges on both the sides. We call these bulges *high tides*. In between the two high tides on both sides are two *low tides*. Generally, at any place on sea shore, two high tides and two low tides happen in a day.

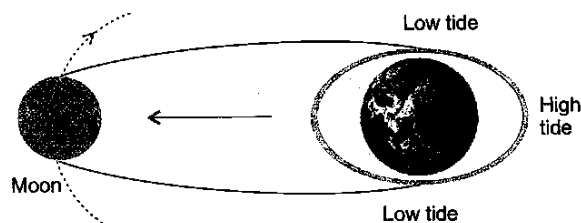


Fig. 1.10 Occurrence of tides

FACT FILE

The sun also pulls on the water, but since the sun is so much farther away, the pull is not as strong as the pull of the moon. There are two types of tides: *spring tides* and *neap tides*. Spring tides occur when the sun and the moon pull the sea in the same direction, making the water rise and fall more than normal. Neap tides occur when the sun and the moon pull the sea in different directions, so the difference between the high and the low tides is less.

Eclipse

You have learnt in class 7 that opaque objects cast shadows.

Eclipses are caused by shadows cast by heavenly bodies. Eclipse means hidden. We know that the earth revolves round the sun, and the moon revolves round the earth. At times, it happens that the sun, the moon, and the earth lie in a straight line. In such a case, the heavenly body which is in between obstructs the sunlight and casts a shadow on the other body. This phenomenon is called an eclipse.

When the moon is hidden due to the shadow of the earth, we call it a *lunar eclipse*, and when the sun is hidden due to the shadow of the moon, we call it a *solar eclipse*.

Lunar eclipse

A lunar eclipse occurs when the moon passes into the earth's shadow. When the earth comes in between the moon and the sun, and all three lie in the same plane, the earth's shadow completely cuts off the sun's light from reaching the moon (Fig. 1.11).

Thus, we do not see the moon. This happens on a full moon day. If the entire moon is invisible, we call it a *total lunar eclipse*. If some part of it is visible, we call it a *partial lunar eclipse*.

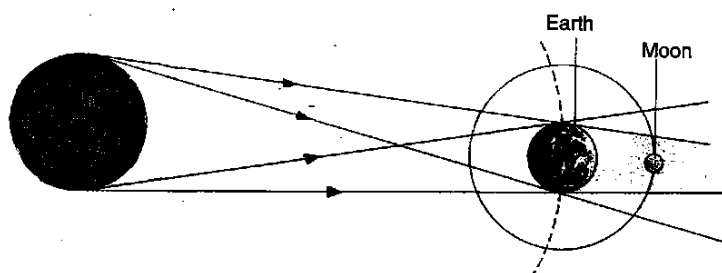


Fig. 1.11 A lunar eclipse

Solar eclipse

A solar eclipse occurs when the earth passes into the moon's shadow. It happens only during a new moon day when the moon is directly between the sun and the earth, and all three lie in the same plane (Fig. 1.13).

When a *total solar eclipse* occurs, the moon's shadow completely cuts off the sun's light from reaching the earth. During this the sun appears as a black circular disc with a ring of light. On the other hand, during a *partial solar eclipse* the moon only partially cuts off the light of the sun.

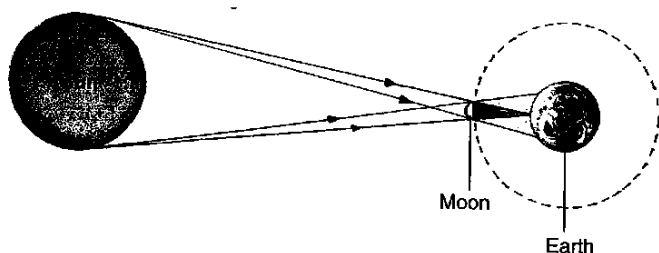


Fig. 1.13 A solar eclipse

Gather information about when the last solar and lunar eclipse occurred. Also, find out the places where they were best seen. Do the same for future occurrences.

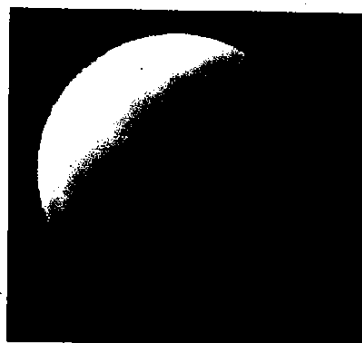
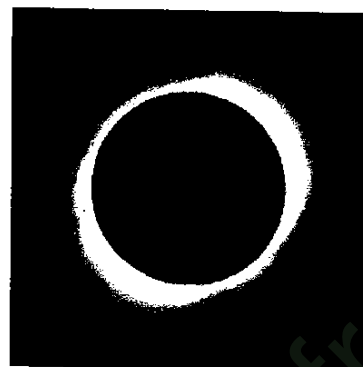


Fig. 1.12 Partial lunar eclipse



(a)



(b)

Fig. 1.14 (a) Total solar eclipse; and (b) Partial solar eclipse

Note that watching the sun directly, or even through a darkened glass, during a solar eclipse can seriously damage your eyes. To observe a solar eclipse, it can

be projected through a pinhole on a wall or a reflected image can be obtained using a mirror!

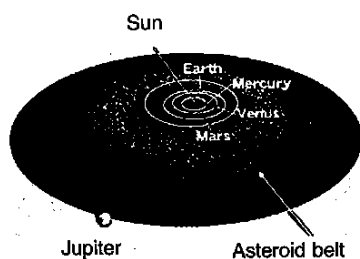


Fig. 1.15 Asteroid belt



Fig. 1.16 A comet



Edmund Halley
(1656–1742)

Edmund Halley was an English astronomer. He once stated that the comet sightings of 1456, 1531, 1607, and 1682 related to the same comet, which he predicted would return in 1758. When it did, it came to be known as Halley's comet.

In addition to the planets and moons, the solar system also contains millions of smaller objects called asteroids, comets, meteoroids, etc. They are pieces of debris left over from the birth of the universe. Let us study about them.

Asteroids

Asteroids mean '*star-like*'. These are large pieces of rock or rock and metal. They are believed to be the pieces of a much larger planet, which broke up due to the gravitational pull of Jupiter. Thus, most of them orbit the sun between Mars and Jupiter in an area called the '*Asteroid belt*' (Fig. 1.15). Jupiter holds clusters of asteroids in its gravity. These asteroids are called *Trojans*.

The first and the largest asteroid to be discovered in our solar system is *Ceres*, which is now classified as a *dwarf planet*.

Comets

Not many sights in the night sky are as awesome as a bright comet! A *comet* is a luminous heavenly body that revolves around the sun in an elliptical orbit. When a comet is close to the sun, its nucleus which consists of frozen gases, ice, and dust melts and emits a large amount of gas and dust, which appears as a luminous long tail (Fig. 1.16). This tail is always directed away from the sun.

One of the best known comets is the Halley's comet. It is named after Edmund Halley, who calculated its orbit. Halley's comet comes close to the sun once in every 76 years. If Halley's comet was last seen in the year 1986 when do you think it would be next seen?

Meteoroids, meteors, and meteorites

Meteoroids are very small pieces of space debris. They may be grains of dust from comets, chunks of rock, or even bits of shattered asteroids. Small pieces of space debris that are on a collision course with the earth are called *meteoroids*.

When a meteoroid enters the earth's atmosphere, we call it a *meteor* or a *shooting star*. Most meteors are tiny specks of dust and rapidly burn up in the atmosphere. Some are large and produce spectacular fireballs that are very bright and may even explode.

If a meteor survives the frictional heating and strikes the surface of the earth, it is called a *meteorite*.

ARTIFICIAL SATELLITES

We have already studied about what satellites are. We know of natural satellites as well. There are many man-made devices orbiting the earth, the moon, and the sun. These are known as *artificial satellites*. Such satellites mainly gather information about the bodies they orbit.

There are now about 5,000 artificial satellites orbiting the earth. Some of these satellites are still hard at work, and some of these have significantly changed our outlook pertaining to the earth and space. Satellites are positioned at different heights above the surface of the earth in order to do different jobs.

Have you ever wondered how you can watch so many channels on your television sets while sitting in your living rooms? This is made possible with the help of an artificial satellite called a *geostationary satellite*. The dish of your television sets receives signals from a geostationary satellite, which makes it possible for news from all over to reach you. These satellites are in orbit above the earth to match the earth's speed as it rotates on its own axis. Therefore, this satellite always stays above the same point on the earth's surface. Hence, the name geostationary satellite.

Artificial satellites are classified into many types based on their function in space: (i) scientific research, (ii) weather, (iii) communication, (iv) navigation, (v) earth observation, and (vi) military.

Some of the most common uses of artificial satellites are as follows:

Weather

Have you ever wondered how people living near the coastal areas are warned beforehand of an approaching cyclone or a storm? This is made possible by the weather satellites that warn us of impending disasters.

They help in forecasting weather, identifying crops, finding natural resources, etc. Farmers and foresters specially benefit from such satellites.

Find out from the internet, the names of the latest satellites that have been sent into space. Also, find out their respective purposes in space.

TECH FILE



The first man-made object ever to go into space was a satellite named **Sputnik 1** (meaning "a fellow traveller"), launched by the Soviet Union in 1957. It could not take pictures or record information, but it proved that man-made structures could be launched successfully into space. This truly marked the beginning of the space age.

Aryabhata was the first Indian artificial satellite sent into space. Others to follow were **Bhaskara**, **Apple**, **INSAT 1**, **INSAT 11**, and **INSAT 3B**.

Find out from various resources like library or internet what remote-sensing satellites are. Also find out which is the latest Indian Remote Satellite (IRS) sent by the Indian Space Research Organization.

FACT FILE



Advances in technology through the 1950s led the Russian astronaut **Yuri Gagarin** to become the first man in space (in 1961). His flight lasted for 1 hour and 50 minutes. In 1969, **Neil Armstrong** and **Edwin Aldrin** were the first to land on the surface of the moon in Apollo 11 spacecraft.

Communication

A *communication satellite* (commonly called *comsat*) is an artificial satellite stationed in space for the purpose of relaying (passing on) all kinds of communication signals to the earth, which include TV programmes, telephone calls, e-mail messages, internet, etc. These pick up communication signals from one place on the earth and send them back down to some other place on the earth. These man-made satellites have made communication across the globe possible. Today, as many as 100 communication satellites are orbiting the earth.

Navigation

Years ago, sailors at sea used to find their way around by looking up at the sky to check the position of stars. Today, other objects in the sky help them navigate. These objects are *navigation satellites*.

Navigation satellites help ships to travel across the oceans, giving them aid by locating icebergs and mapping the ocean currents. They also help aircrafts in finding their way in the sky.

Military

Military satellites are used in Air force, Navy, and Military detection. Some of them are called *spy satellites* that can detect the launch of missiles, the course of ships at sea, and the movement of equipment on the ground. Military satellites also take pictures using powerful cameras.

Space stations

Space stations are large satellites where astronauts can live for months. You might have heard of the International Space Station (ISS) whose first module was launched on November 20, 1998. Other modules are currently being assembled in orbit around the earth. They are scheduled to be completed by 2010.

Sunita Williams (of Indian origin) left for ISS on December 10, 2006 for 7 months to rewire the space station. It is surprising to know that after launch, it takes only 5 minutes for the shuttle to reach its final orbit around the earth, and it circles the earth in about 90 minutes (as long as a game of football).

KEYWORDS

Universe The sun, planets, the stars, moon and all the matter, energy, and space

Galaxy Vast collection of stars

Constellation Groups of stars forming recognizable patterns in the sky

Asteroid Large pieces of rock or rock and metal

Comet Luminous heavenly bodies revolving round the sun

Meteoroid Very small pieces of space debris

Geostationary satellite Satellite that orbits at the same speed as the earth rotates on its axis

SUMMARY

- A galaxy is a vast collection of stars, nebulae, and interstellar material held together by gravity. We belong to a spiral-shaped galaxy called the Milky Way.
- A light year is the distance travelled by light in one year, which is equal to 9.46×10^{12} km.
- Group of stars forming recognizable patterns in the sky is called constellation.
- The sun is our nearest star. It is made up of four layers called Corona, Photosphere, Chromosphere, and Core.
- The solar system consists of the sun at the centre, the planets and their moons, asteroids, comets, and meteoroids which orbit the sun.
- We have eight planets in our solar system—Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. Pluto has recently been grouped under dwarf planets.
- Moon is the second brightest object in the sky, and it is the natural satellite of the earth.
- Tides are periodic rise and fall of the water level in large water bodies. They are caused by the gravitational interaction between the earth and the moon.
- At times when the sun, the moon, and the earth lie in a straight line, the object which is in between obstructs the sunlight from reaching the other object. This phenomenon is called an eclipse.
- Artificial satellites gather information about the bodies they orbit.

EXERCISES

I. Review questions

A. Choose the correct answer

1. The shape of the Milky Way galaxy is
(a) elliptical (b) spiral (c) irregular (d) spherical
2. Group of stars forming recognizable patterns in the sky is called
(a) galaxy (b) Orion (c) constellation (d) universe
3. Like all stars, the sun produces energy by the process of
(a) nuclear fission (b) nuclear fusion (c) ionization (d) vaporization
4. The innermost layer of the sun's atmosphere is called
(a) Corona (b) Chromosphere (c) Photosphere (d) Core
5. The pole star is found in constellation.
(a) Ursa major (b) Ursa minor (c) Orion (d) Scorpio

B. Fill in the blanks

1. Scientists refer to the formation of the universe as the (evolution/Big Bang) theory.
2. We belong to a galaxy called (regular/Milky Way) galaxy.
3. 1 light year = ($9.46 \times 10^{12}/9.46 \times 10^{15}$) m.
4. (Uranus/Saturn) is called a ringed planet.
5. (Venus/Eris) is called a dwarf planet.
6. Asteroid belt is found between (Mars/Mercury) and Jupiter.
7. The phase when the moon is totally invisible is called (full/new) moon phase.
8. When the meteoroids travel all the way through the atmosphere and land on the earth, we call them (meteorites/meteors).
9. (Natural/Geostationary) satellites are in orbit above the earth to match the earth's speed as it rotates on its own axis.

10. When the moon is bigger than a quarter, we call it (crescent/gibbous).

C. Match the following

- | | |
|--------------|-----------------------|
| 1. Sun | (a) Natural satellite |
| 2. Milky Way | (b) A star |
| 3. Orion | (c) Sun's atmosphere |
| 4. Corona | (d) Galaxy |
| 5. Moon | (e) Constellation |

D. Answer the following questions

1. What do you mean by galaxy? Name the different kinds of galaxies.
2. What are constellations? Name any three.
3. Draw a well-labelled diagram of the phases of the moon.
4. Define the following:
 - (a) asteroids
 - (b) comets
 - (c) meteoroids
5. What are artificial satellites? What are the areas in which a satellite helps you (name any four)?

II. Skill-based questions



E. Observe the data given and answer the following questions

Planet	Diameter of planet (in km)	Average distance from the sun (in million km)	Length of one year (in earth days)	Number of moons
Mercury	4,880	58	88 days	0
Venus	12,104	108	225 days	0
Earth	12,756	150	365 days	1
Mars	6,787	228	687 days	2
Jupiter	143,000	778	12 years	63
Saturn	120,000	1,427	30 years	56
Uranus	51,100	2,875	84 years	27
Neptune	49,500	4,497	165 years	13

Use the above table to answer the following questions:

1. Write the names of planets in the ascending order of their sizes.
2. Name the planets that have no natural satellite.
3. Which is the largest planet?
4. Which planet takes almost 12 earth years to revolve round the sun?
5. Name the planet that has the largest number of moons.



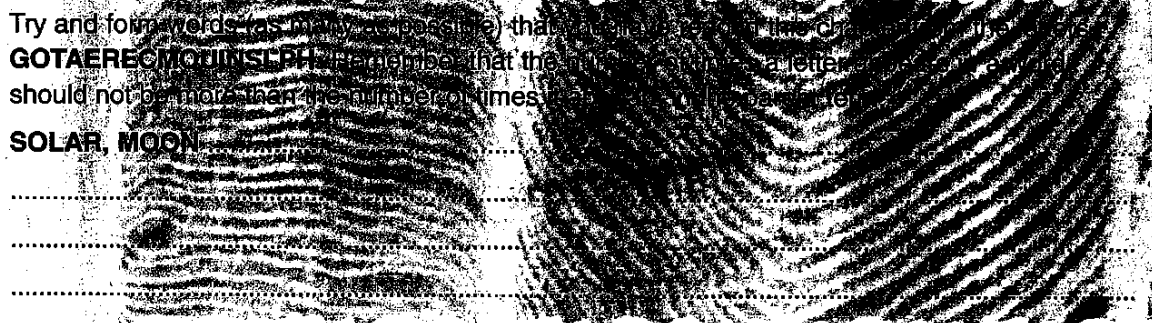
F. From the list of words given below, which is the best match for each of the following descriptions?

Meteoroids	Galaxy	Comet	Asteroid
Big Bang	Constellation	Solar system	

1. A rocky object orbiting a planet

2. The sun, its planets, and other objects in orbit
3. A small rocky object which collides with a planet, or maybe a fragment from an asteroid
4. A huge group of millions of stars
5. The explosion which led to the formation of the universe
6. Recognizable patterns in the night sky

III. Fun time



Try and form words (as many as possible) that contain letters in the character set: **GOTAEREOMUNSLPH**. Remember that the number of times a letter occurs in a word should not be more than the number of times that letter occurs in the character set.

SOLAR, MOON

.....

PROJECT IDEAS

- Look for constellations like Orion, Big Dipper, Small Dipper, etc. in a field guide or an encyclopaedia. Find out the stories related to them and make a chart.
- Explore the internet to gather information about famous space persons of Indian origin, like Kalpana Chawla, Sunita Williams etc. and write a report based on your finding.
- Make a chart on Stephen Hawking, a living legend.

TEACHER'S NOTES

- Students could be made aware of particular times of the year when some constellations, planets, etc. could be spotted.
- Some visit to a local planetarium could be organized to make students better understand the occurrence of eclipses, tides, etc.

Website references

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