14 Phenomena and exploration associated with solar system

14.1 Solar system

A large number of celestial objects can be observed in the night sky. From ancient time people were curious about those celestial objects. They gathered information by observation of those objects.

Ancient people observed celestial objects with their naked eyes. Later on various instruments were used for this purpose. Telescopes, manned and unmanned space crafts and space stations are some of them.

Due to the information collected since ancient time, now we have the ability of understanding the solar system, which is a large system including the earth. Still the explorations are being carried out about this.

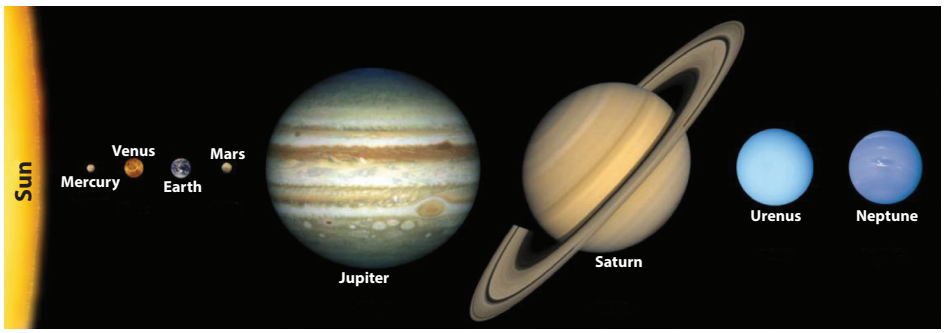


Figure 14.1 ▲ The solar system

Planets rotate around their own axis, while revolving around the sun. Rotational time of a planet is the time taken by the planet to turn once, around its own axis. It is the time span of a day of that particular planet.

e.g.:- The rotational time of the earth is 24 hours. So, that is a day of the earth.

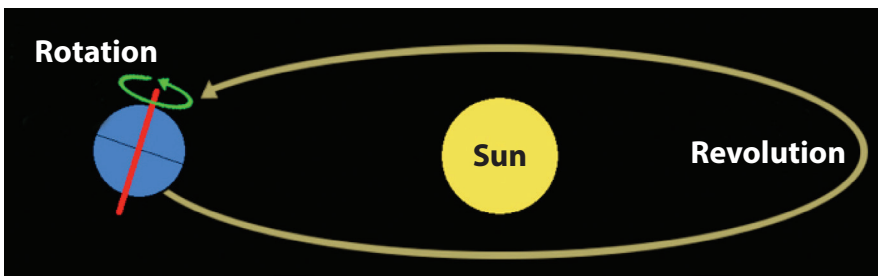


Figure 14.2 ▲ Rotation and revolution of the earth

Time of revolution of a planet is the time taken by the planet to revolve once around the sun. That is the year of that particular planet.

e.g.:- The time of revolution of the earth is 365.25 days. That is the year of the earth.

Figure 14.3

Consider a dancing event by a dancer to understand the concept of rotation and revolution. A dancer rotates around its own axis. It is called rotation. At the same time the dancer revolves around an imaginary point on the stage. This is called the revolution. (Figure 14.3).

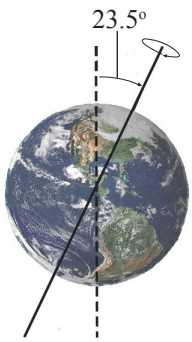


Figure 14.4

A planet rotates around its rotating **axis**. The path, along which a planet revolves around the sun is its **orbit**. All planets have a tilt to its orbital plane, when revolve.

e.g.:- The earth has a tilt of 23.5° the perpendicular axis of its orbital plane (Figure14.4)

There are sub-planets around most of the planets. They also rotate around their axis while revolving around the planet.

Mercury and Venus have no sub-planets. Information about the planets of our solar system are given in Table 14.1.

Table 14.1

Planet	Distance from the sun (million km)	Diameter (km)	Rotational Time (earth days)	Revolutional time (Earth years)	Tilt to the orbital plane (degrees)	No. of sub planets (till 2016)
Mercury	57.9	4 879	58.65	0.24	0.1	0
Venus	108.9	12 104	243.00	0.62	177.4	0
Earth	149.6	12 756	1.00	1.00	23.4	1
Mars	227.9	6 792	1.03	1.88	6.7	2
Jupiter	778.6	142 984	0.41	11.86	25.2	67
Saturn	1433.5	120 536	0.44	29.46	3.1	62
Uranus	2872.5	51 118	0.72	84.01	26.7	27
Neptune	4495.1	49 528	0.72	164.80	97.8	14

Let us do Activity 14.1 to build up a model of solar system and to study about it.

Activity 14.1

You will need:-

Styrofoam balls of suitable sizes to denote planets, suitable paints in given colours to apply on styrofoam balls, wooden strip to the length of 75 cm, black thread, glue, small styrofoam sheet

Method:-

- Select styrofoam balls to the sizes given below and paint them with colours indicated.

Table 14.2

Object	Diameter of the ball (cm)	Colour
Sun	15.0 cm	Yellow
Mercury	1.0 cm	Orange
Venus	2.0 cm	Bluish green
Earth	2.0 cm	Dark blue
Mars	1.5 cm	Red
Jupiter	10.0 cm	Orange
Saturn	9.0 cm ring 12.0 cm	Yellow Orange
Uranus	5.0 cm	Light blue
Neptune	4.0 cm	Dark blue

- Cut a ring for Saturn from the styrofoam sheet.
- When the paint is dry, fix balls to the wooden strip using glue.
- Paint the wooden strip black
- Make the model as shown in Figure 14.5
- Write the names of the planets.

Compare the model which you have made with the model shown in Figure 14.5.

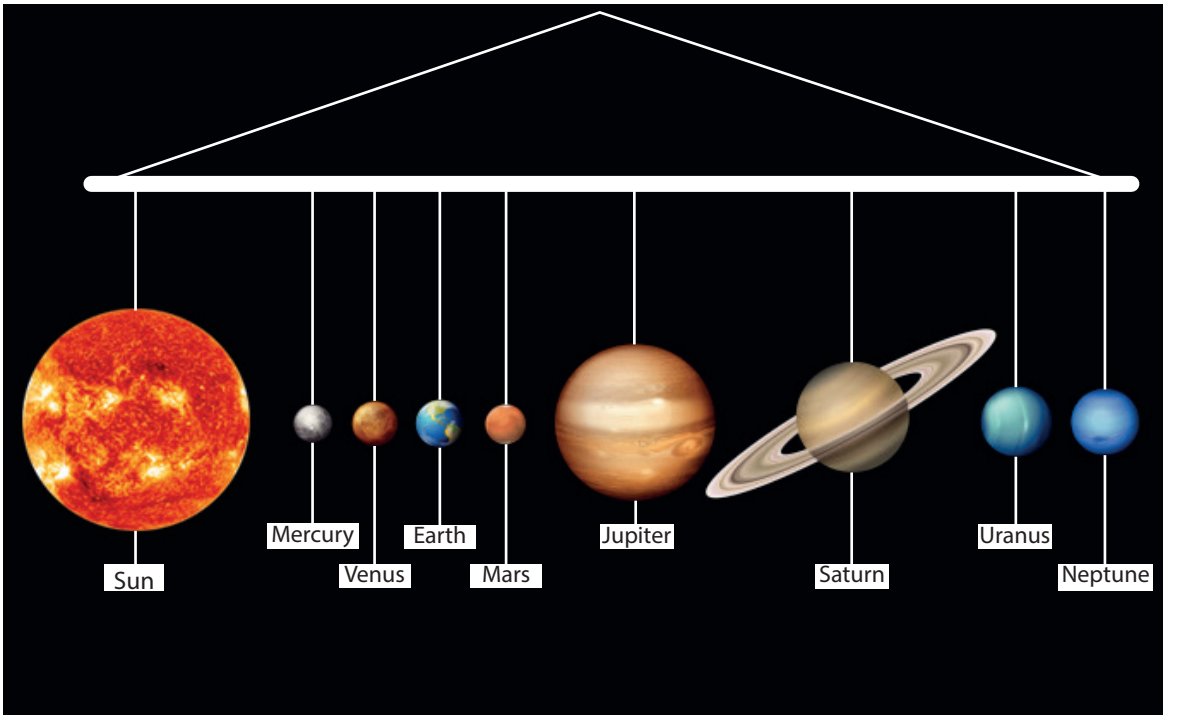


Figure 14.5 ▲ Simple model of solar system

Real ratio of the sizes of planets is not indicated in the model you made in the Activity 14.1. The real ratio of the sizes of them is given in Figure 14.6.

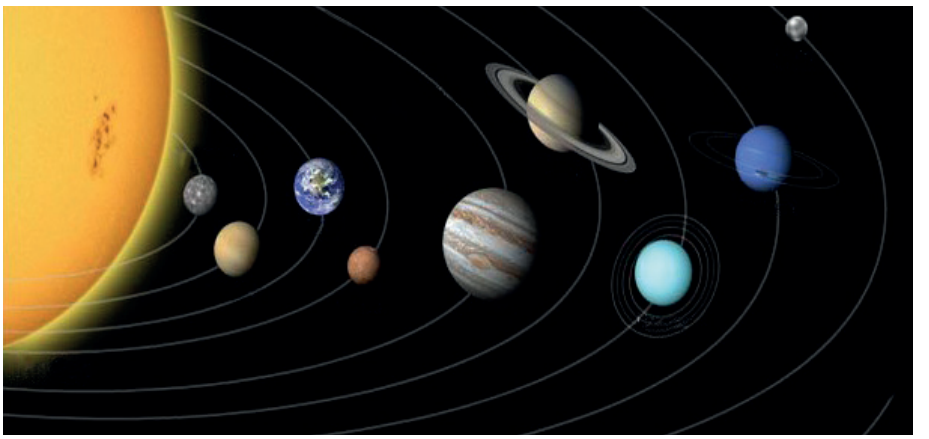


Figure 14.6 ▲ Comparison of the sizes of planets

Carry out Activity 14.2 to understand about the distances of planets from the Sun.

Activity 14.2

You will need :- Name boards of planets, measuring tape (in meters), a large yellow coloured balloon

Method:-

- Mark a point at the centre of the school play ground.
- Take that point as the centre. Draw circles taking the radius according to the ratio given in the table below. (Use the measuring tape for this purpose)
- Get the assistance of your teacher for this.

Table 14.3

Planet	Ratio of distance from the sun
Mercury	0.58 (0.5)
Venus	1.08 (1.0)
Earth	1.50 (1.5)
Mars	2.28 (2.2)
Jupiter	7.78 (7.8)
Saturn	14.24 (14.2)
Uranus	28.67 (28.7)
Neptune	44.89 (44.9)

- Place the inflated yellow balloon at the centre of the ground.
- Apply slaked lime on the circles marked on the ground. Place the name boards of each planet on each circle. Position a student at each name board.
- Give each student at the name board, a leaflet with information of that planet.
- Direct students in your class at a time to each name board.
- Direct the student at the name board to describe about the planet that he is responsible of .

Now you have a comprehensive knowledge about the planets. Figure 14.7 shows a model of solar system in the school laboratory.

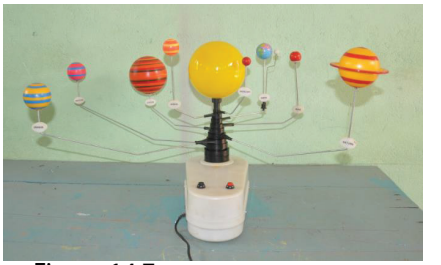


Figure 14.7 ▲ The model of solar system in the school laboratory

Engage in Activity 14.3 to study about the revolution of planets around the sun.

Activity 14.3

You will need :- A ball, a strong string of 50 cm in length

Method :-

- Tie the ball at one end of the strong string of 50 cm long.
- Take the other free end of the string to hand and rotate the ball fast enough above your head.
- Now observe, the manner ball rotates around you without falling, until you rotates it.

In this activity you might have observed that the ball rotates in a circular path without attract towards you.

This rotation can be explained as below.

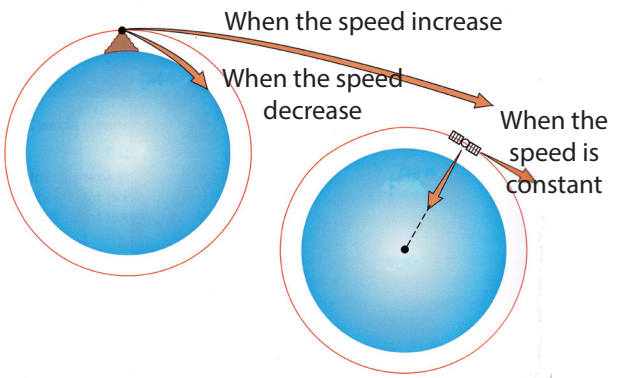


Figure 14.8 ▲ Motion of objects around the earth

Here a force is exerted from your arm to the ball. Therefore, ball is rotating in circular path at a constant speed.

Corresponding to the example given in Figure 14.8, revolution of planets around the sun also, can be explained. Comparative to the force applied by the arm towards the ball, a force is applied by the sun towards the planet that is called **gravitational force**. The planet should fall on the sun and be destroyed, due to this force. But, this does not happen because of the constant speed of revolution of the planet around the sun.

14.2 Occurance of seasonal changes

Seasonal changes is a phenomenon that occur due to the revolution of the earth around the sun, with a tilt to its orbital plane.
When it is winter to England which is in the northern hemisphere of the earth it is summer to Newzealand which is in the southern hemisphere. Let us find out how this happens.

It is known that the earth's axis has a tilt of 23.5° to its orbilal plane. Revolution of the earth with this tilt is the reason for seasonal changes on earth. Let us study how this happens.

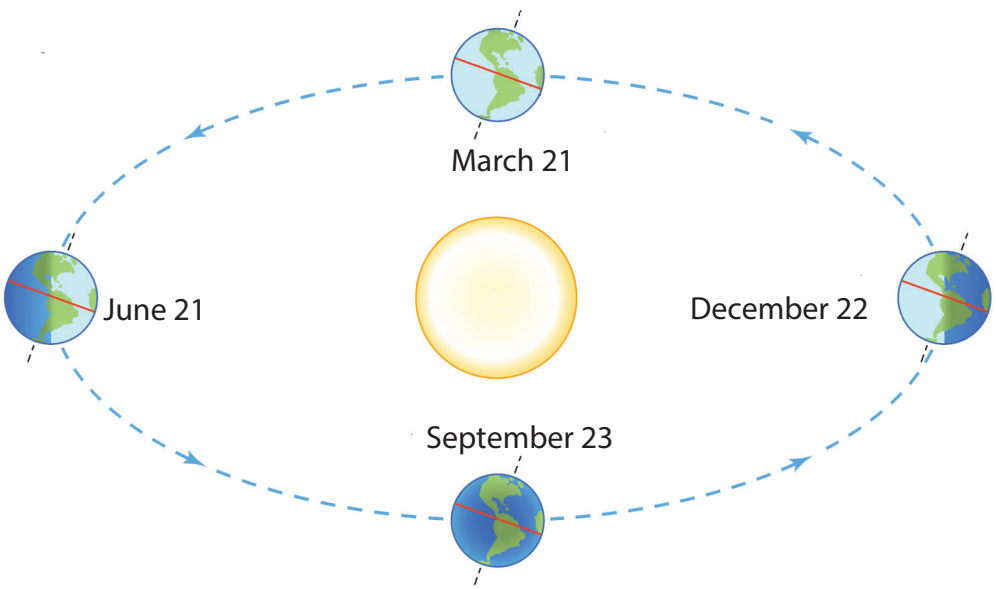


Figure 14.9 ▲ Occurance of seasonal changes on earth

Consider the position of the earth (Figure 14.9) on 21st of June. Here, rays of the sun fall perpendicular to the northern hemisphere.

Hence, it is summer to northern hemisphere. Same time rays of the sun fall with an inclination to the southern hemisphere. Therefore, it is cold and is winter to southern hemisphere.

Consider the position of the earth on 22nd of December (Figure 14.9). Rays of the sun falls perpendicular to southern hemisphere, and with an inclination to nothern hemisphere. Therefore, winter occur in nothern hemisphere and summer to the southern hemisphere.

Seasonal changes are distinct in polar regions. Countries like Sri Lanka, which are closer to equator, have no distinct seasonal changes.

14.3 Occurance of phases of moon

Phases of moon occur because of the revolution of moon around the earth. Half of the moon is always illuminated by the light of the sun. But that half is completely seen from the earth only on a full moon day. The part of the illuminated half of the moon, seen from the earth, changes daily due to its position. Thus, we can see various shapes or the phases of the moon.

Let us do Activity 14.4 to study how phase of moon occured.

Activity 14.4

You will need :- An electric bulb, a styrofoam ball fixed to a rod

Method:-

- Use the electric bulb instead of the sun and the styrofoam ball fixed to a rod, instead of moon. This activity is to be done in a dark room.

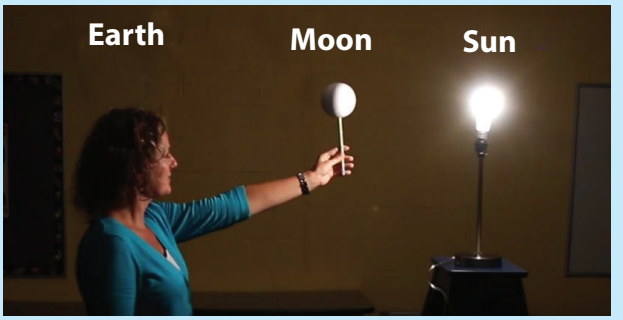


Figure 14.10 ▲ Demonstrating phases of moon

- Holding the styrofoam ball, turn around yourself and observe the illuminated part of the ball as in Figure 14.10.

In a calendar there is only one full moon day for a duration of one month. But sometimes very occasionally, there are two full moon days for some months. Figure 14.11 shows the calendar and the phases of moon during such a month.

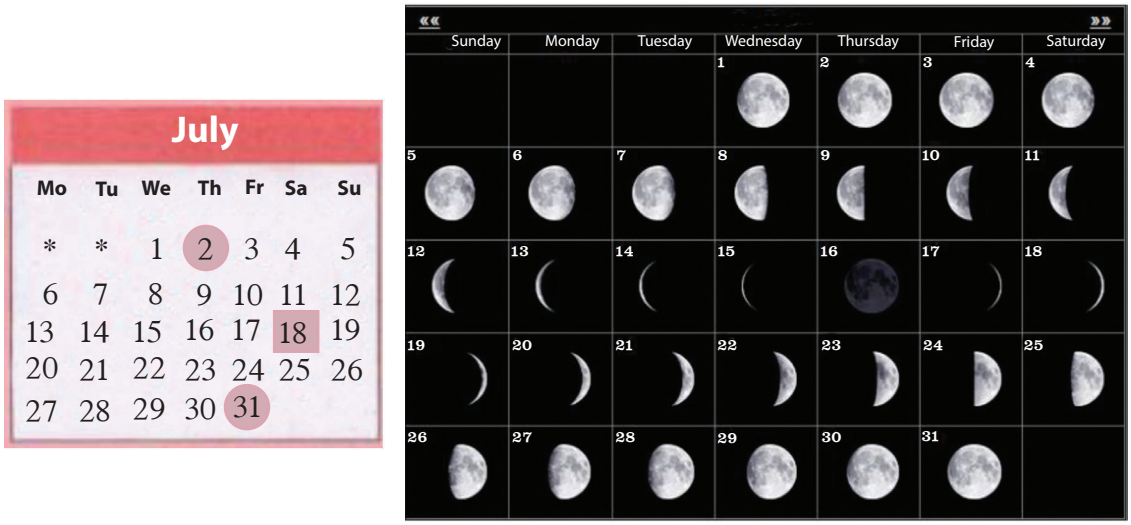


Figure 14.11 ▲ The calendar and the phases of moon during a month that has two full moon days

Answer the questions given below on the Figure 14.11

1. What are the phases of moon on the 2nd and 31st of this month?
2. What is the name used for the phase of moon on the 16th?

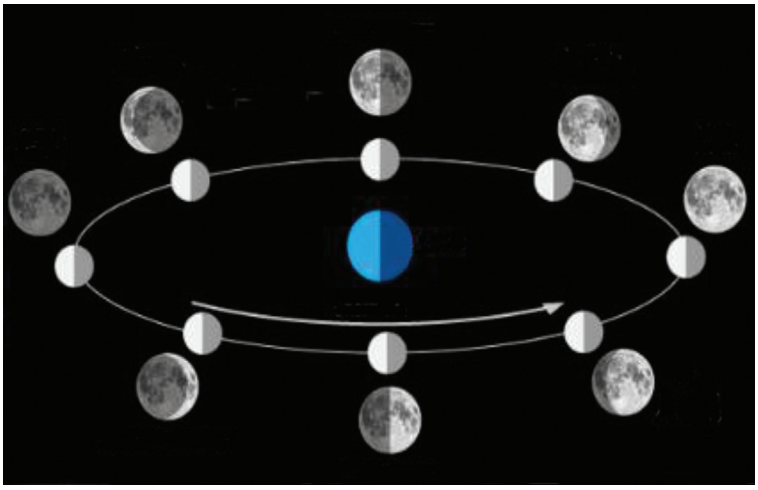


Figure 14.12 ▲ How phases of moon occur

Studying the Figure 14.12 you will understand clearly, how phases of moon occur.

14.4 Important incidents associated with solar system

Eclipses

Marvellous scenes that can be observed in the sky are eclipses. There are two types of eclipses.

- Solar eclipses
- Lunar eclipses

Solar eclipses

The moon revolves around the earth once every 27.3 days. During this journey in some occasions the shadow of the moon falls on the earth. The sun is invisible, fully or partially, to those who are in the shadow area for some time. This is called the solar eclipse. We see the sun and the moon equal in size, in the sky. The sun is a very large object. Moon is very small with respect to the sun. But, the sun is very far away from the earth and the moon. That is why we see them more or less equal in size.

Because of this reason the moon can totally cover the sun during a solar eclipse. Two areas can be identified in the shadow of moon, fallen on the earth. These areas are the umbra and the penumbra. (Figure 14.13)

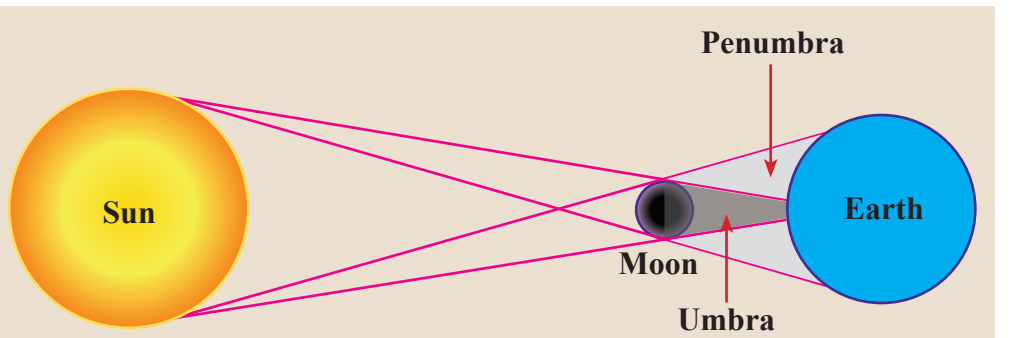


Figure 14.13 ▲ A solar eclipse

Those who are in the umbra can see a total solar eclipse, while those who are in the penumbra can see a partial solar eclipse.

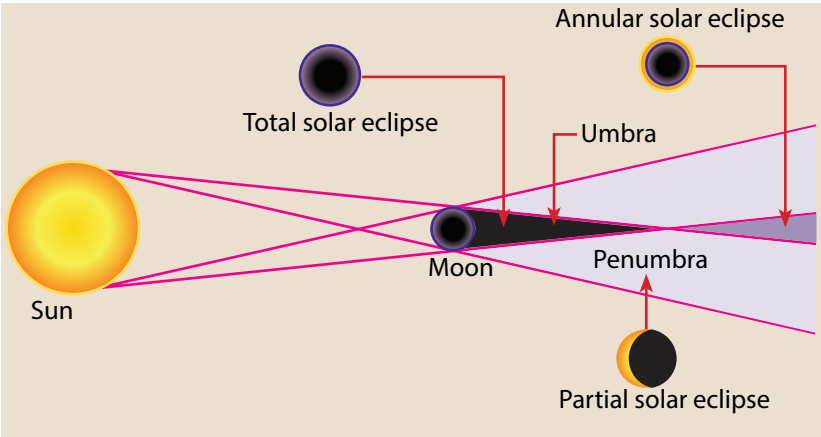


Figure 14.14 ▲ Types of solar eclipse

Umbra of moon covers an area of about 160 km^2 of the earth. This area moves because of the rotation of earth. It means that the umbra travels along the surface of earth. The maximum time duration that a point of earth experiences a total solar eclipse is 7.5 minutes.

Solar eclipse occurs on new moon days.

An experience of a solar eclipse

Sri Lanka experienced a total solar eclipse on 20th June 1955. The eclipse commenced at 8.11 in the morning and after 7 minutes it was over at 8.18.

A person who experienced that solar eclipse described it as follows.

"That day the sun was shining in the morning as usual. After eight in the morning it began to fall dark. Birds flew to their nests. Fowls settle on trees. Environment get cooled. Sky darkened completely. Stars began to twinkle. But moon was not there as it was a new moon day.

After sometime it dawned again. Birds come out of their nests. Fowl got down from the trees. Cattle came out from their lying places.

Meteorological department announced in advance, that a solar eclipse occurs on that day. Therefore, it was declared a school holiday."

I never forget this incident.

Again in 15th of January 2010, Sri Lanka experienced an annular solar eclipse.

Observing solar eclipses

Solar eclipses should never be observed with naked eyes. Eye covers/goggles can be used for this purpose. Welders also use eye covers. Even using those aids, it is advisable not to watch the sun directly for a long time. If do not follow these instructions will result in the blindness of your eyes for ever.

It is safer to watch the image of the solar eclipse taken on to a screen using a mirror or a telescope.

Using goggles

Taking the image on to a screen using a telescope

Figure 14.15

Indicated below are some solar eclipses observable in future in Sri Lanka

December 26, 2019 - An annular eclipse
June 21, 2020 - An annular eclipse

Lunar eclipses

The number of lunar eclipses we can observe is more than the number of solar eclipses. Lunar eclipse occurs on a full moon day. Lunar eclipses occur when the earth comes in between the sun and the moon, and are in a straight line (Figure 14.16).

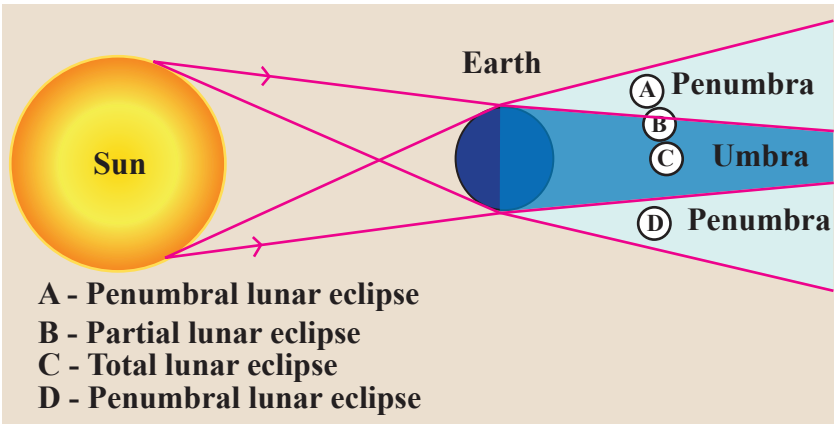
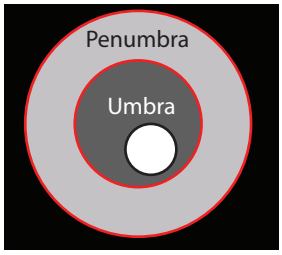


Figure 14.16 Occurance of lunar eclipses

Shadow of the earth also has two areas, named umbra and penumbra. There are three types of lunar eclipses according to the type of shadow fallen on the moon.

- Total lunar eclipse
- Partial lunar eclipse
- Penumbral lunar eclipse

Total lunar eclipse



Total lunar eclipse

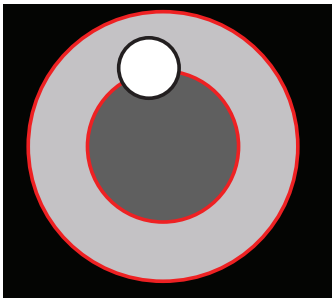

How the moon is seen during a total lunar eclipse

Figure 14.17

Total lunar eclipse occurs when moon enters completely into the umbra of the earth. This incident can be observed with your naked eyes. As a science student, it is very important for you to observe this. During a total lunar eclipse, moon can be observed in reddish brown colour. It lasts more than an hour. (Figure 14.17)

Partial lunar eclipse

Instance in which a part of the moon is in the umbra of the earth and other part is in penumbra is called partial lunar eclipse. Here, the part of the moon in the umbra is seen in reddish brown colour.(Figure 14.18)


Partial lunar eclipse occurs


How the moon is seen during a parital lunar eclipse

Figure 14.18

Penumbral lunar eclipse

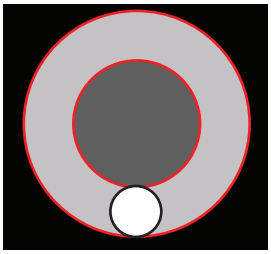


Figure 14.19 ▲ How a penumbral lunar eclipse occurs

When moon moves in the penumbra of the earth a penumbral lunar eclipse occurs. This is not easy to observe as the brightness of the moon does not reduce considerably. (Figure 14.19)

Do Activity 14.5 to demonstrate the solar and lunar eclipses.

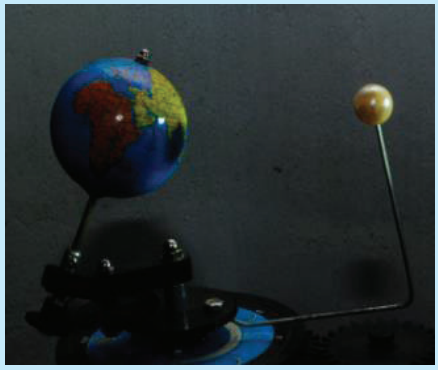
Activity 14.5

You will need :- The sun, earth and moon models in the school (Figure 14.20 and 14.21)

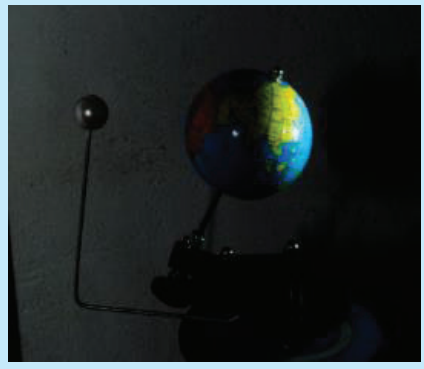
Method :-

- Do this activity in a dark place.
- Demonstrate the motion of the earth and moon, and also the eclipses using the models.
- Get the assistance of your teacher for this.

Figure 14.20 ▲ The equipment to demonstrate the motions of the earth and the moon



Demonstrating solar eclipse



Demonstrating lunar eclipse

Figure 14.21 ▲

The followng motions and phenomena can be demonstrated using this equipment.

- Rotation of the earth
- Revolution of the moon
- Lunar eclipse
- Revolution of the earth
- Solar eclipse

For extra knowledge

The lunar eclipses that can be seen in Sri Lanka in the coming years

February 10, 2017	- Penumbral lunar eclipse
January 10, 2020	- Penumbral lunar eclipse
November 30, 2020	- Penumbral lunar eclipse
November 08, 2022	- Total lunar eclipse
October 28, 2023	- Partial lunar eclipse

14.5 Exploring the universe

Air cover around the earth is called the **atmosphere**. The atmosphere extends up to about 500 km from the surface of the earth. But it become very thin after about 100 km. The area that starts about 100 km far from the earth is termed as the **space**.

Since ancient times man has been exploring space. However, the limits of space, what it contains and how much does it contain such things are the questions man has not been able to find answers so far. The objective of science is to find out answers to such questions.

Initially man could reach the higher levels of atmosphere using balloons. Balloons filled with gases like hydrogen or helium which are lighter than air, can rise up into the sky. Balloons filled with hot air also rise up. Both of those can take man higher levels in the sky.

A balloon filled with hydrogen or helium

A balloon filled with hot air

Figure 14.22

Usage of rockets

Later man realised that the only way to reach the outer space is by using rockets. Tsiolkovsky, a Russian and Goddard, an American were the pioneers to work on rockets.

Assignment 14.1

Find the facts about the work done by Tsiolkovsky and Goddard on rockets and make a report.

Let us do Activity 14.6 to make a simple rocket and to study how it works.

Activity 14.6

You will need :- Megabottle of 1.5 l, a rubber stopper, a valve of a bicycle tube, an inflater, water

Method:-

- Bore a hole in the rubber stopper and fix the bicycle valve to it.
- Fill water up to 1/3 of the bottle and fix the rubber stopper with valve to it.
- Place the bottle with water as shown in the figure. Then, pump air into it using the inflater.
- Observe the reaction.

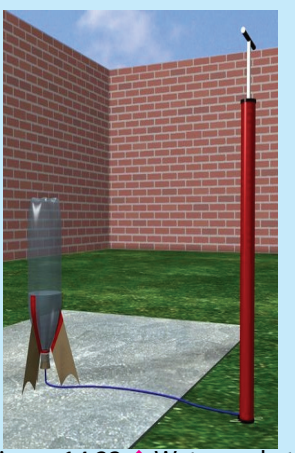


Figure 14.23 ▲ Water rocket

While inflating at a certain moment the bottle with water unplugs and rise up in the air as a rocket.

This water rocket can be modified to rise higher up in the sky.

Figure 14.24 ▲ A modified water rocket

Figure 14.25 ▲ A student preparing to fly up a water rocket

You can obtain more details about water rockets from the Arthur C. Clerke center at Moratuwa. National and international competitions on sending water rockets are also being organised.

The first rocket which used liquid fuel was launched in 1926. The simplest rocket consists of a combustion chamber, a fuel tank, a liquid oxgen tank and a tank containing igniter.

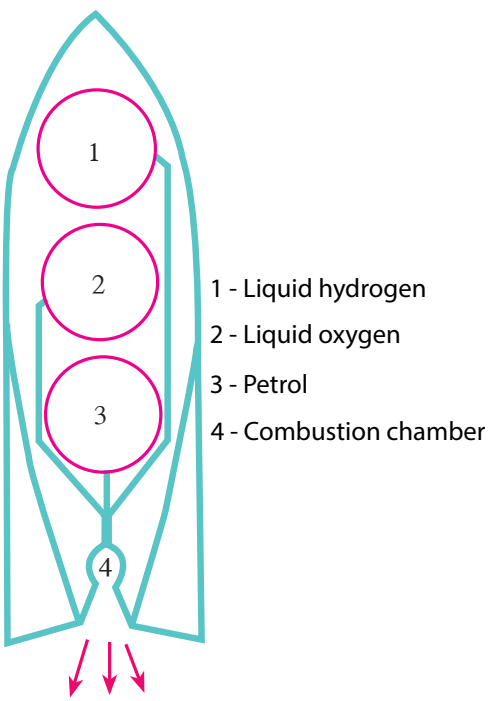


Figure 14.26 ▲ A sketch of a liquid fuel rocket

Liquid hydrogen and liquid oxygen (as fuel) and petrol (as igniter) are well mixed and pumped into the combustion chamber. Gases produced by the combustion were pushed down speedily through the **nozzle,** giving the rocket an upward force. This makes the rocket rise up into the sky.

Rising up of a rocket can be compared with the rising of the fire work called skyer.

14.6 Artificial satellites

The moon is attracted by the earth but moon does not fall on to the earth because it revolves speedily around the earth. Celestial bodies, smaller than the moon, which are orbiting the earth are called satellites.

An object launched to revolve around the earth, using a rocket is known as an artificial satellite. The first artificial satellite named Sputnik-1 which was launched by Soviet union on October 4th, 1957. With this historical victory man entered into the space age. (Figure 14.27)

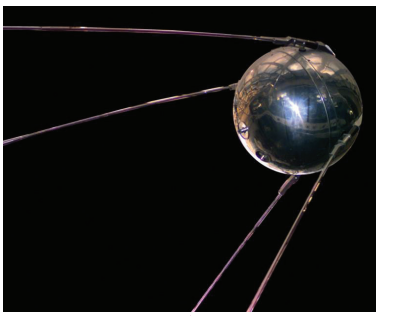


Figure 14.27 The artificial satellite (Sputnik -1)

The first American artificial satellite was Explorer-1 launched on January 31st, 1958.

NASA was established in 1958 to carry out the American space programme.

Assignment 14.2

Make a booklet on the uses obtained by artificial satellites.

Observe the sky in a clear night between 7.00 pm and 8.00 pm. If you see a star-like object moving through the stars, it is a satellite. If you see a falling of star like object it may be a meteor.

Communication satellites

World's first commercial communication satellite was launched on July 10th, 1962. It was the Telstar-1. Until today, there are thousands of communication satellites orbited around the earth to provide telephone, television and web facilities.

Sir Arther C. Clerke came out with a new idea on communication by satellites. He said that if a satellite is orbited around the earth at the same speed as the speed of earth's rotation and at a certain height, it will be seen stationary from the earth. Such a satellite is called a Geo-stationary satellite. Sir Arther C. Clerke clarified that if three of such satellites are positioned around the earth, the whole globe can be covered with communication facilities.

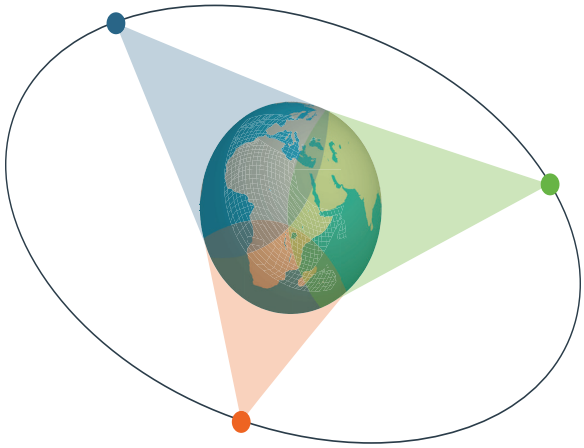


Figure 14.28 ▲ Geo - Stationary satellite network

Now the world is converted to "a global village" by the orbited geo-stationary satellites using the idea presented by Sir Arther C. Clerke in 1945.

For extra knowledge

Space explorations

Launching of artificial satellites was commenced by Russia (then Soviet Union) in 1957 and by America in 1958. Some key points of space era, started since then, are given below.

Name of space craft	Year and country	Relevant historical incident/ importance
Luna - 1 (unmanned)	1959 Russia	• The first moon exploration satellite to travel near the moon. • Space craft that became the first artificial planet around the sun.
Luna - 2 (unmanned)	year 1959 Russia	• The first unmanned space craft to land on moon. • The first artificial object which reached to another world
Luna - 3 (unmanned)	Year 1959 Russia	• Take photography of the other side of the moon's surface for the first time.
Vostoc - 1 (manned)	Year 1961 Russia	• Yuri Gagarin became the first astronaut.
Vostoc - 2 (manned)	Year 1961 Russia	• Consumed food in the space for the first time.

Mercury -1 (manned)	Year 1961 America	• Allen shephard became the first American astronaut.
Mercury - 2 (manned)	Year 1962 America	• John Glenn became the first American astronaut to orbit completely around the earth.
Vostoc - 3 Vostoc - 4 (manned)	Year 1962 Year 1962 Russia	• Two space crafts came closer to each other in the space.
Vostoc - 6 (manned)	Year 1963 Russia	• Valentina Thereshkva became the first female astronaut.
Ranger - 7 (unmanned)	Year 1964 America	• Sent detailed photographs of the moons surface for the first time.
Ranger - 8 (unmanned)	Year 1965 America	• Sent photographs of a sea of tranquility which was a place expected to land appolo space crafts
Voscod - 2 (manned)	Year 1965 Russia	• First man to walk in the space (Alex Liyanof)
Gemini - 3 (manned)	Year 1965 America	• First computer to be taken to the space.
Luna - 9 (unmanned)	Year 1966 Russia	• Soft landing of a moon exploring craft on moon for the first time.
Gemini - 8 (manned)	Year 1966 America	• A manned space craft to join with a rocket in the orbit for the first time.
Surveyer - 1 (unmanned)	Year 1966 America	• Soft landing of the first American moon craft on moon.
Luna orbiter - 1 (unmanned)	Year 1966 America	• The first moon exploring craft to map the moon.
Appolo - 8 (manned)	Year 1968 (America)	• The first manned moon exploring craft to orbit the moon.
Appolo - 11 (manned)	Year 1969 July 21 (America)	• Neil Armstrong landed on moon. Michael Collins and Edwin Aldrin also joined this journey.

Neil Armstrong declared this statement after landing on the moon.

"This is a small foot step for a man but a giant leap for man-kind."

Astronauts of Appolo-11 placed a memorial plate on the moon. It says;

Figure 14.29 ▲ The memorial plate placed by Appolo - 11 astronauts on moon

"We are men from the planet earth, placed out foot on the moon. We came in peace for all mankind."

Appolo program was over in 1972. Twelve astronauts landed on various locations on the moon under this programme.

Mentioned below are some victories, in the field of space exploration, gained after landing on the moon.

- An unmanned space craft was sent to the moon and rocks from its crust were brought to the earth by Russia.
- Important information on Jupiter, Saturn, Uranus and Neptune was gathered by the space ships Voyages and Pioneer. Information on Mars and Mercury was collected by Marriner crafts.
- Various space crafts were landed on Mars and information on its crust was gathered.
- 'Hubble' space telescope was launched to observe celestial bodies which are difficult to observe from the earth.
- Earlier Russia and America established space stations separately. But, now both above countries in collaboration with some other countries maintain the International Space Station jointly.

Figure 14.30 ▲ International space station

Assignment 14.3

Prepare a booklet on the recent victories of space explorations.

14.7 Constellations

Ancient people who were watching stars in the night sky, imagined various star patterns by joining them.

Those ancient star patterns identified earlier and those named recently are called constellations. There are 88 constallations identified so far. Let us learn about a few of them.

It is important to identify the directions when observing the stars at the night sky. In the day time, directions can be found, using the direction of sun rise. Stretch your hands apart, and stand facing the direction of sun rise. Then, the front side is the east and back side is the west. Your right hand side is the south and left hand side is the north.

The buildings and tall trees can be used to find the directions at night, when you are watching night sky. The directions you identify in the day time will help you in this regard.

In the night sky, we see all the stars other than one star, apparently move from east to the west. But, actually what happens is that the earth rotates from west to the east. The star that does not change the position is the **Polaris**.

The position of Polaris does not change because it is located in line with the axis of the earth.

Figure 14.31 shows some constellations that can be seen in February - March in the sky about 8.00 pm.

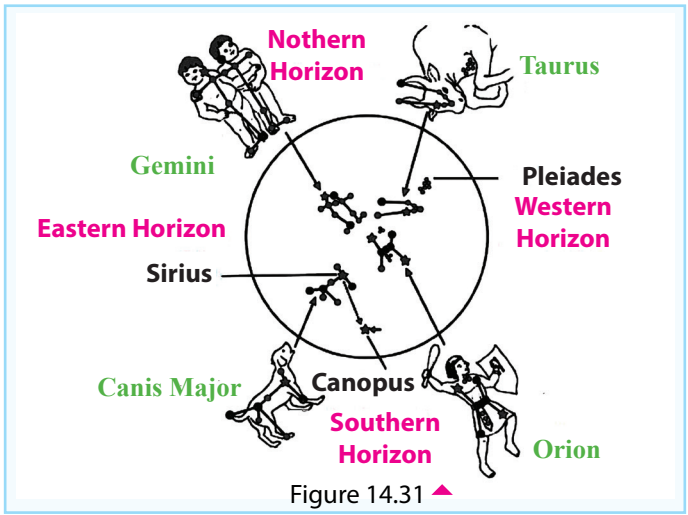


Figure 14.31

Orion or the hunter is a very popular constellation. Here, the head of the hunter is directed towards the north. So, it is useful to find north at night.

We see that all the stars in a constellation are in the same plane. But, the distance to each star from the earth are greatly varing.

The unit used to measure the distance between stars is light year. Light travels 300 000 km per second. Light year is the distance that light travels during a year.

The constellation Orion, and the distances to some stars of it from the earth are given in Figure 14.32.

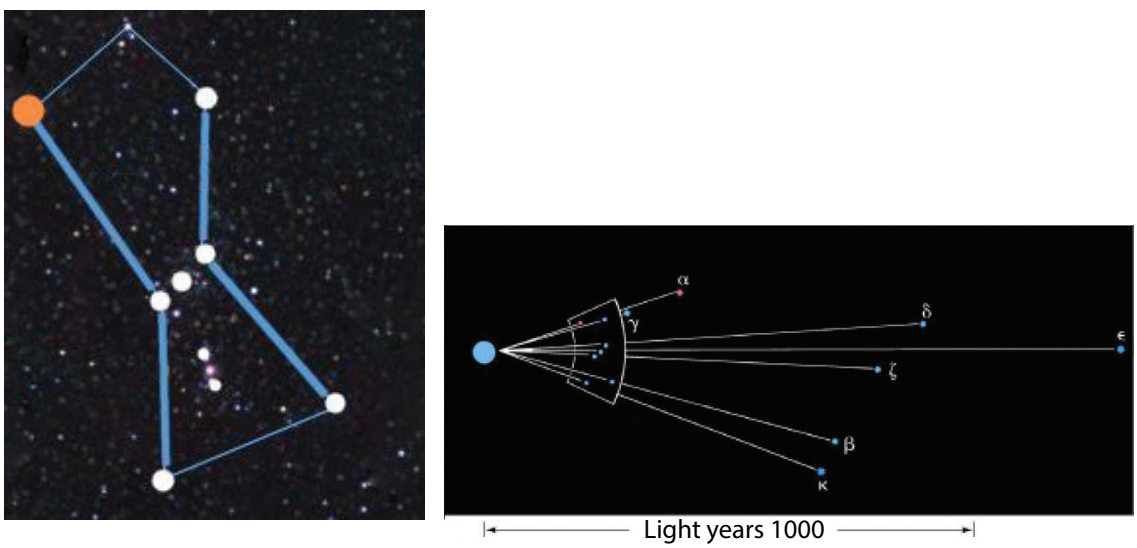


Figure 14.32 Constellation orion and the position of some of its stars

The constellation Orion is given with many other names.

Assignment 14.4

Find out the other names given for the constellation Orion.

Constellation Canis major can be found close by to Orion. The brightest star in the night sky, Sirius is found in this.

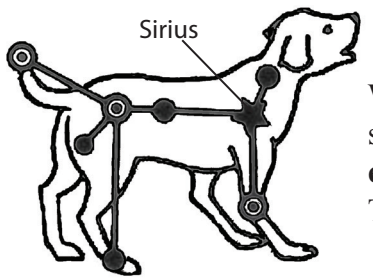


Figure 14.33

When you are learning about constellations it is not sufficient to study the diagrams in this book. **It is essential to observe night sky for constellations.** The book is only a guide line for that purpose.

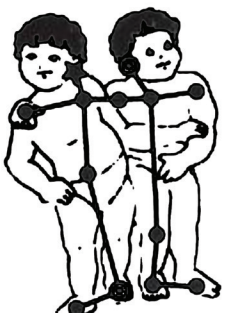


Figure 14.34

If you observe towards north-east from Orion, another constellation, Gemini can be found. It denotes twins. The brightest star in it is Pollux.

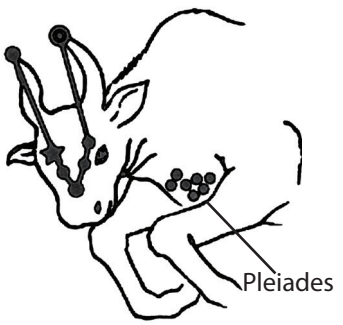


Figure 14.35

At this time the constellation Taurus can be seen in the north-west direction. There is a red star named Aldebaran for one of this bulls eyes.

Near the Taurus there is another constellation named Pleiades. Figure 14.35 shows some constellations that can be observed in the midnight during the February and March. All these constellation can be see in May and June nearly 8.00 pm in the night.

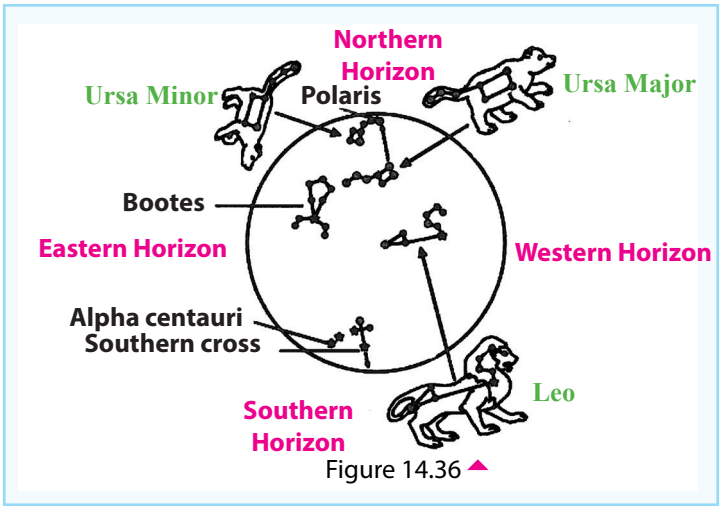
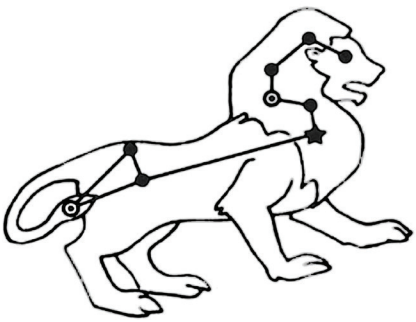


Figure 14.36



During this period constellation Leo can be seen near the Zenith. Brightest star in this constellation is Regulus.

Figure 14.37

During the same period constellation Ursa major can be observed 45° above northern horizon. This constellation helps to find the north at night. Seven sages and plough are two other names for the same constellation. There are seven bright stars in this.

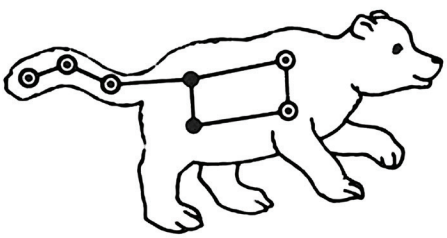


Figure 14.38

Ursa minor can be seen below the Ursa major closer to its northern horizon. Polaris is at the tail end of this bear. This star is closer to the horizon, when watched in Sri Lanka. Therefore, it can be watched only in a large plain, sea shore or on a hill top.

Assignment 14.5

Find out about the importance of the star Polaris and make a report.

During this period another constellation with the shape of tilted cross, can be seen in the southern sky towards the horizon. This is called the Southern cross. According to Figure 14.39, to the left of this constellation there are two bright stars, which are closer to each other. Out of these two, one which is very far away from the southern cross is called **Alpha Centauri.**

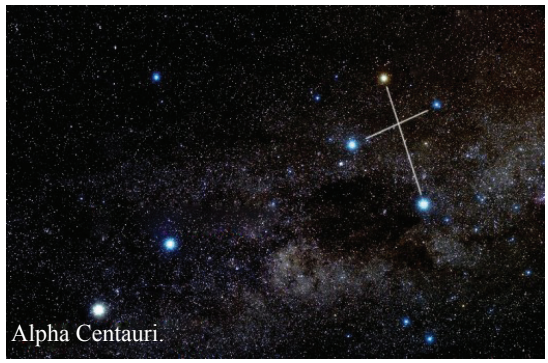


Figure 14.39

Assignment 14.6

Find out about the importance of the star Alpha Centauri and make a report.

Constellation Southern cross can be used to find south and north directions

Zodiac

The earth and the other planets revolve around the sun. Twelve signs in the outer space which are named as the zodiac from ancient times. Those 12 signs in the zodiac are as follows.

1. Aries
2. Taurus
3. Gemini
4. Cancer
5. Leo
6. Virgo
7. Libra
8. Scorpio
9. Sagittarius
10. Capricorn
11. Aquarius
12. Pisces

Assignment 14.7

There are 12 stamps in current usage which contain the diagrams of signs of the zodiac. Collect them and exhibit on a board.

When the earth is revolving around the sun, we see that the sun is apparently moving from sign to sign in the zodiac.

e.g.:- In the instance given in Figure 14.40 people on the earth see as the sun is in the sign Aries of zodiac

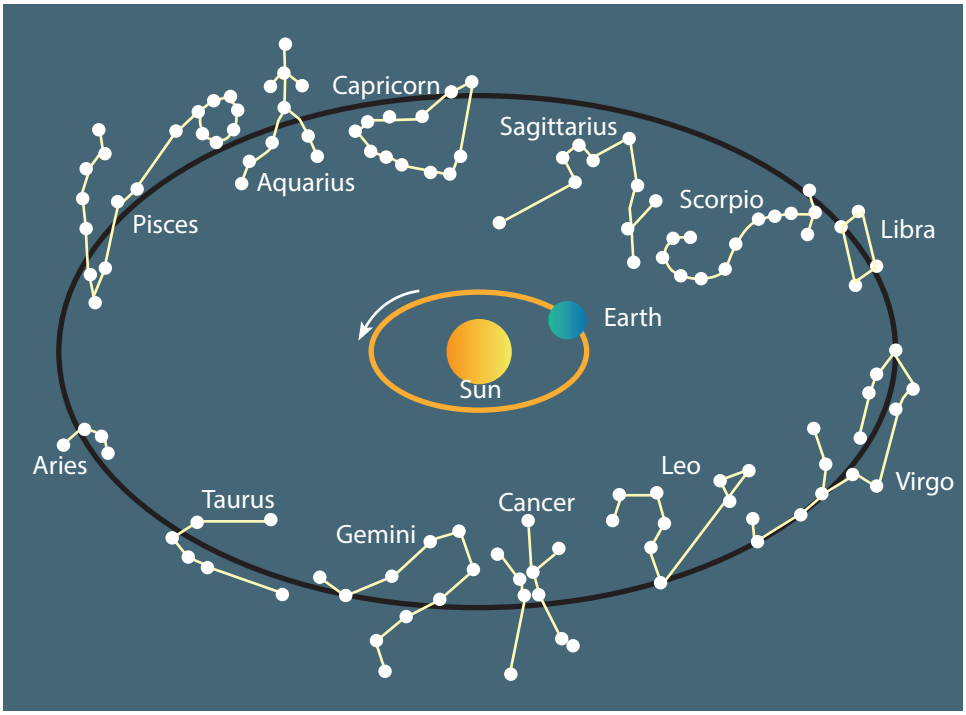


Figure 14.40 ▲ The Zodiac

According to the revolution of earth, the sun's next apparent destination is the sign Taurus.

Obervation of stars and planets

When the night sky is being observed it is realised that the relative position of stars does not change daily or monthly. But, there are some objects among the constellations in the zodiac the position of which changes with respect to the stars. Those objects are planets.

There are five planets which are observable with the naked eyes. They are mercury, venus, mars, jupiter and saturn. Mercury, venus, earth and mars are planets in solid nature and other planets occur in gaseous nature.

A star twinkles in the sky. But planets do not twinkle. Star is a bright point, even when observed through a telescope. But, when a planet is observed through a telescope it is seen as a disc.

Assignment 14.8

Select a planet in the background of a certain sign in the night sky. Get the assistance of your teacher or an adult for this. (Planets jupiter, saturn or mars is more suitable for this.) Note down how the position of the planet changes in the background of the sign, for about a month.

Let us do Activity 14.7 to construct an instrument to measure the altitude to a star or planet.

Activity 14.7

You will need :- A protractor, a cardboard tube/ PVC tube

Method :-

- Using a tube and a protractor, make the following instrument. It is called the clinometer.

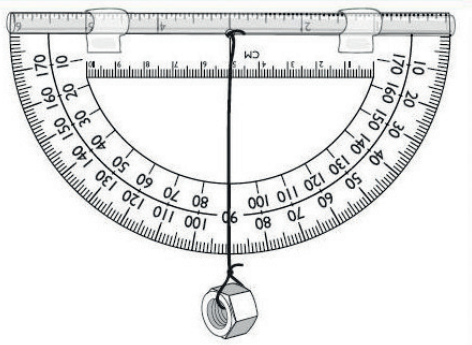


Figure 14.41 ▲ Simple clinometer

The way of measuring the altitude to a star, using the clinometer is shown in Figure 14.42. The clinometer can be fixed as shown Figure 14.43 to turn on a horizontal plane.

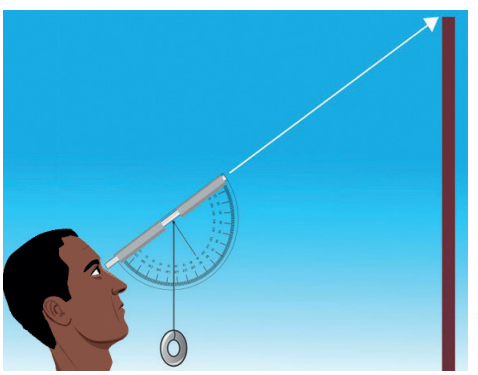


Figure 14.42 ▲ Measuring the altitude to a star using clinometer

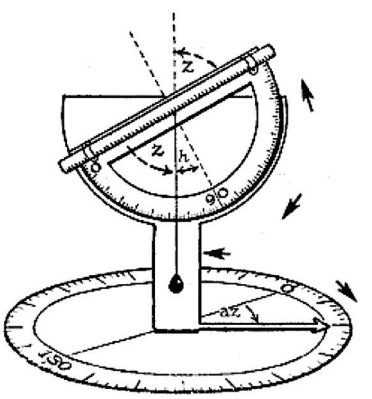


Figure 14.43 ▲ A clinometer that can be turned on a horizontal plane

Summary

- Planets in the solar system show two types of motions, rotation and revolution.
- Seasonal changes occur because of the tilt of the earth's axis to its orbital plane.
- Illuminated portion of the moon, viewed from the earth changes while it revolves around the earth. Because of this incident phases of moon occur.
- Lunar eclipse occurs on a full moon day when the moon enters into the shadow of the earth.
- Solar eclipse occurs on a new moon day, when the shadow of the moon falls on the earth.
- Rockets and space crafts are used for this explorations of the space.
- Constellations are the imaginary patterns constructed in mind, connecting the stars in the night sky.

Exercise

Select the most suitable answer.

1. What is the most suitable statement below to describe a solar system?

    1. A cluster of stars revolving around an object.
    2. A star revolving around a number of objects
    3. A number of objects revolving around a star.
    4. An object revolving around a cluster of stars.

2. Select the **false** statement about our sun.

    1. Sun is smaller than the moon.
    2. Sun is a source of energy.
    3. Planets revolve around it.
    4. Situated 150 million kilometers away from the earth.

3. In which constellation is the star Polaris that helps to find the north.

    1. Ursa major
    2. Ursa minor
    3. Sign Leo
    4. Orion

4. What is the **false** statement given below?

i. The brightest star in the sky, Sirius can be found in constellation Canis major.

ii. Venus can be observed with naked eye.

iii. Sun is the nearest star to the earth.

iv. Polaris belongs to the constellation Ursa major.

5. What is the **false** statement given below?

i. The seasonal changes occur due to the earth's revolution.

ii. The phases of moon occurs due to the moon's revolution.

iii. Solar eclipse occur when the moon stays in between the earth and the sun.

iv. Partial lunar eclipse occurs when moon enter to the penumbra of the earth.

Give short answers.

1. After observing the night sky, two students in grade eight came out with the following ideas.

Student A - When I was watching the night sky yesterday, I saw a star passed very speedily increasing its brightness and vanished at once.

Student B - I was watching the night sky yesterday at about 7.00 p.m. I saw a star travelling fast between other stars. It travelled from north to south.

In the above discussion;

i What can be the object that A student observed?

ii What can be the object that B student observed?

2. i Fill the blanks of the following diagrams with the given terms.

Sun, Moon, Earth, Umbra, Penumbra

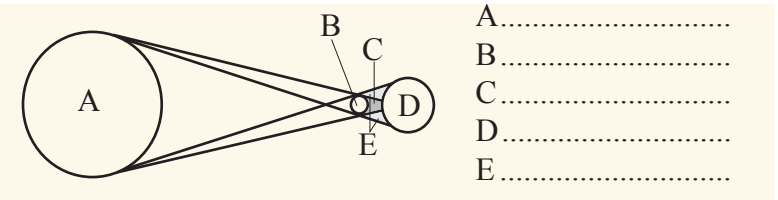


Diagram - 1

ii

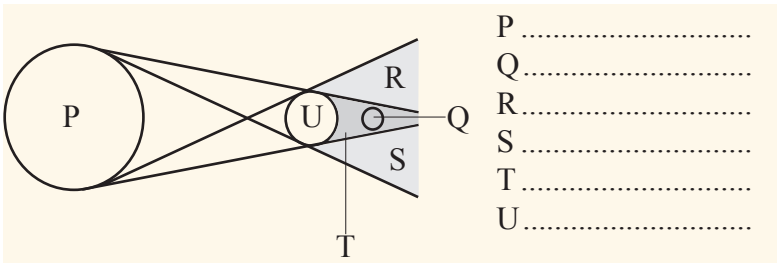


Diagram - 2

Technical Terms

Rotation	-	භ්‍රමණය	-	சுழற்சி
Revolution	-	පරිභ්‍රමණය	-	சுற்றுகை
Seasons	-	ඍතු	-	பருவங்கள்
Lunar eclipse	-	චන්ද්‍ර ග්‍රහණය	-	சந்திர கிரகணம்
Solar eclipse	-	සූර්ය ග්‍රහණය	-	சூரிய கிரகணம்
Solar system	-	සෞරග්‍රහ මණ්ඩලය	-	ஞாயிற்றுத் தொகுதி
Constellations	-	තාරකා මණ්ඩල	-	உடுத் தொகுதி
Zodiac	-	රාශි චක්‍රය	-	இராசி வட்டம்
Space explorations	-	අභ්‍යවකාශ ගවේෂණ	-	விண்வெளி ஆய்வு
Satellites	-	කෘත්‍රිම චන්ද්‍රිකා	-	செயற்கைக் கோள்கள்