INTRODUCTION
Solar system of Class 8
NICHOLAUS COPERNICUS

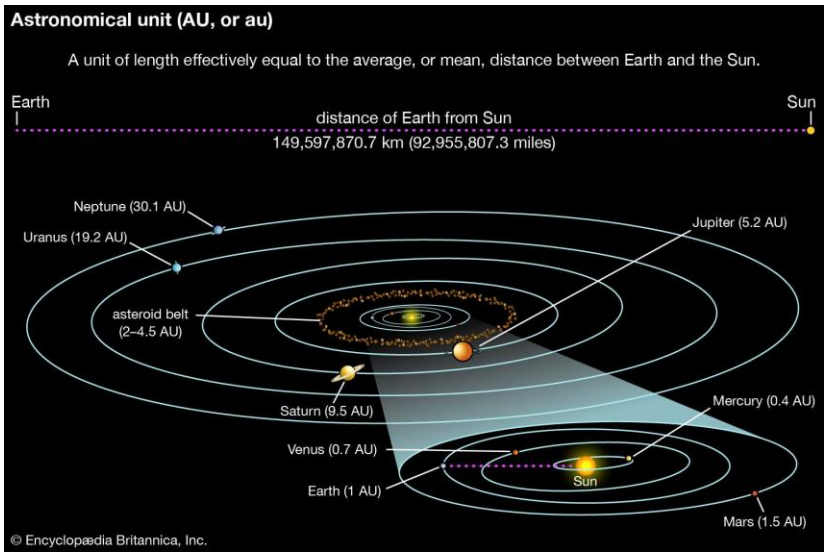
Nicholaus Copernicus (the Latin version of Koppernigk) was a Polish church official whose passion was astronomy, and who actually performed some observations. By that time, all sorts of corrections had to be made to fit the motion of the planets to Ptolemy's ideas.

Copernicus proposed an alternative theory that the Earth was a planet orbiting the Sun, and that all planets moved in circles, one inside the other. Mercury and Venus had the smallest circles, smaller than that of the Earth, and therefore their position in the sky was always near the Sun's.

That made it easy to estimate their distances from the Sun in terms of the Earth-Sun distance. Mars, Jupiter and Saturn moved in bigger circles, and they moved more slowly, so that whenever the Earth overtook them, they seemed to move backwards.

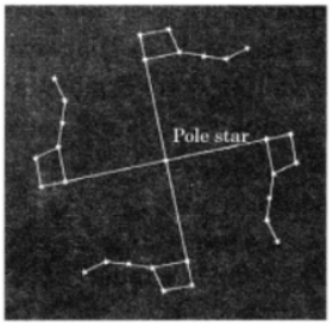
ASTRONOMY

The universe is the vast expanse of space which includes everything that exists-all the stars, planets, satellites and clouds of dust and gases. The branch of science which deals with the study of universe is called astronomy. The study of astronomy involves the methods and instruments used for the study of universe.



THE NIGHT SKY

After sunset, the night sky is dotted with bright stars. These stars are more visible through telescope, most of the stars are yellow in colour and few of them are white or red in colour. The most important property of star is that they appear to twinkle. Another important object visible at night is moon, whose size changes every night. A moon do not appear to twinkle.



Night sky in June 2012

ASTRONOMICAL DISTANCES

The billions of stars and other heavenly bodies in the universe are separated by such a large distances, so the ordinary units for measuring distances on earth i.e. metres, kilometers or miles are not adequate for the purpose.

For measuring these extremely large distances, we use two astronomical units, the light year and the parsec.

A light year is defined as the distance travelled by light in one year.

The speed of light is 300,000 km/s and 1 year has 1 × 365 × 24 × 60 × 60 seconds.

∴ 1 Light year = 300000 × 365 × 24 × 60 × 60 km

1 Light year = 9.46 × 1012 km.

Another unit commonly used for measuring astronomical distances is the parsec.

1 parsec is equal to 3.26 light years.

The distance travelled bythe light at a speed of 300,000 km/s in one minute (60 seconds) is called a light minute.

1 light minute = × 1 minute = 18,000,000 km = 18 × 106 km.

The Stars

Stars are heavenly bodies that are extremely hot and giveout light of their own. Stars are mainly made up of hydrogen. Inside the stars hydrogen is continuously being converted into helium, by fusion reaction and this process releases a tremendous amount of energy which is given out as heat and light. Stars vary in colour depending on their temperatures. The colours are the same as one would observe when a piece of metal is heated. The metal first glows red-hot, then brighter and yellower until it is white-hot. The same happens in the stars but in the reverse order. For example, our sun is a yellow star with a surface temperature of about 6000°C. Stars appear to be moving in the sky from east to west due to the rotation of the earth on its axis from west to east.

Stars twinkle because we look up at the stars through air that is constantly blowing about, so we recieve their light as unsteady and thus they seem to twinkle.

WHY DO STARS APPEAR TO US LIKE POINT OBJECTS ?

The stars, much like our sun are celestial bodies, which continuously emit heat and light. Our sun is a medium size star. It appears bigger to us because it is nearest to the earth. The stars appear to us like points, because they are very far away from the earth. Most of the stars are so much far away, that the light from them takes millions of years to reach the earth.

Example- 1 Why does the distance between any two stars does not change when viewed from the earth ?

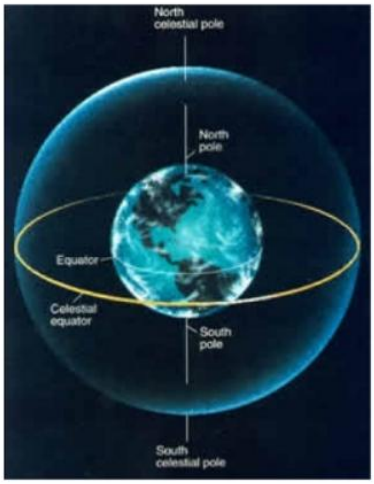
Answer: Stars are moving away from each other at a very high speed. However, when viewed from the earth, the distance between them does not seem to change because they are very far away from us. Hence, any change in the distance between them does not become perceptible in few years or few hundreds of years.

Example 2 Why do the stars appear to move from east to west ?

Answer: It is because the earth rotates about its north-south axis from west to east. Thus, due to relative motion, all heavenly bodies (stars, planets, moon) appear to move from east to west.

Example 3 Why does the pole star (polaris or dhruva tara) not change its position in the sky ?

Answer: The Pole star is situated in the direction which is directly above the geographic north-pole of the earth's axis. Thus, its position relative to the earth does not change and hence, it appears stationary.



Example 4 How does the pole star help travellers and sailors at night ?

Answer: The The pole star always points in the north direction. Thus, looking at the position of the pole star during the night, one can easily find the geographic directions and hence take the correct route.

Example 5 Which is the nearest star to the earth ?

Answer: The The star nearest to the earth is the sun itself. The next nearest star is the Alpha Centauri or Proxima Centauri.

Example 6 How far is the sun from the earth if the light from it reaches us in 8.3 light minutes ?

Answer:1 light minute = 300,000 × 60 km

so, 8.3 light minutes = 300,000 × 60 × 8.3 km

= 149,400,000 km

= 150,000,000 km (approx).

so,**149.4 million km.**

Galaxies

An enormous cluster of billions of star held together by gravitational forces is called a galaxy. A galaxy is the building block of the universe. There are about 100 billion galaxies (1011 galaxies) in the universe and each galaxy has on an average 100 billion stars (1011 stars). So, the total number of stars in the universe are about 1022. The two important galaxies in the universe are :

- Milky Way galaxy
- Andromeda galaxy

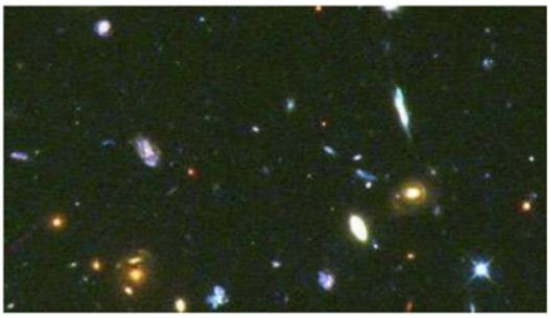
The milky way

Andromeda galaxy

Hubble (American astronomer), made important contribution in the study of galaxies. He divided galaxies into three categories spiral, elliptical and irregular.

(a)Spiral

(b) Elliptical



Spiral Galaxies

Spiral galaxies are spiral in shape. Our own Milky galaxy is an example of spiral galaxy. Approximately 80% of the,total galaxies are of this kind.

Elliptical Galaxies

These galaxies are elliptical in shape as shown in figure. They account for 18% of all the observed galaxies.

Irregular Galaxies:

The small galaxies which lack clear symmetrical form are, called irregular galaxies. They comprise 2% of the observed galaxies. In these galaxies, we find lot of dust and large number of blue stars.

The Milky-Way Galaxy

The name Milky Way comes from a Greek word "gala" which means milk. Milky-Way is the hazy luminous band of white light seen stretched across the sky at night. Its Indian name is Akash Ganga. Our solar system is the part of the Milky-Way. The Milky Way contains more than 100 billion (1011) stars. The Milky Way is called our galaxy. Milky-Way is a spiral galaxy in the form of a disc with a bulge at the centre tapering off towards the edges. Its diameter is about 10^5 light years and central thickness is about 104 light year. The sun is situated at a distance of 2.7×10^4 light years from the galactic centre. The thickness of disc near sun is 1000 light years. The space between the stars in the Milky-Way is filled with dust and gases called interstellar matter. About 90% of the interstellar matter is in the form of hydrogen. The mass of Milky Way is estimated to be nearly 3 × 1041 kg.

As seen from above, the Milky Way galaxy looks like a disc of stars. The stars are not uniformly arranged in the plane of the disc but are arranged in spiral arms.

It is very difficult to find out the shape of our galaxy as earth lies within the galaxy. Astronomers have been able to establish the spiral shape of our galaxy by joining together photographs taken from many different directions over many years. Like other galaxies, Milky-Way is rotating about an axis passing through its centre. All the stars in the Milky-Way revolve slowly around the galactic centre and complete one revolution in 300 × 106 years.

CONSTELLATION

A group of stars which are arranged in a pattern resembling some recognizable figure is called a constellation. There are about 88 constellations that we know. All the stars in a constellation appear to stay together, so its shape remains the same. Four of the well-known constellations are Orion, Ursa Major, Ursa Minor and Cassiopeia.

ORION:

Orion is one of the magnificent constellations in the sky. It has seven bright stars. Four of these appear to be arranged in the form of a quadrilateral and the other three form a straight line in the middle. One of the largest star known as Betalgeuse is situated on one corner of this quadrilateral while another bright star called Rigel, is located on its opposite corner. The arrangement of stars in this constellation resembles a hunter with a belt and a sword. This constellation is visible during the winters in the northern hemisphere.

URSA MAJOR:

It is also known as the Great Bear, the Big Dipper or Saptarishi. Ursa Major contains seven stars making the pattern of a plough. A line drawn through the pointers of the plough leads us to the Pole star or Polaris (Dhruv Tara). The Pole star always appears in the same position in the sky as it is directly above the north pole. This constellation is visible during the summers.

URSA MINOR:

It is also known as the Little Bear or Little Dipper. Ursa Minor also consists of seven stars arranged in a similar manner to those to Ursa Major, but the stars in this constellation are closer together and less brighter than in the Ursa Major. The last star in the handle of the Little Dipper is the Pole star itself. Ursa Minor is also known as the Pole star constellation. This also is visible in the summers.

DIFFERENCES BETWEEN A GALAXY AND A CONSTELLATION

Galaxy	Constellation
1. It is a group of billions of stars.	1. It is a group of only a few stars.
2. It does not form a definite pattern.	2. The stars are arranged in definite, recognizable patterns.
3. There are billions of galaxies in the universe.	3. At present we know of only about 88 constellations.
4. Very few galaxies are visible to the naked eye.	4. Many constellations are visible to the naked eye.

THE SOLAR SYSTEM

The sun and all bodies in orbit around it make up the solar system. The centre of the solar system is the sun. The other members of the solar system include the eight planets, their moons or satellites, a large number of asteroids, thousands of comets and innumerable meteors. These other members of the solar system also revolve around the sun and are bound to it by strong gravitational forces.

SUN:

The sun is the star closest to the earth at a distance of 150 million km from the earth. Light from the sun takes 8minutes 20 second to reach the earth. The diameter of the sun is over 109 times the diameter of the earth and it is 333,000 times as heavy as the earth. The sun is made up of hydrogen gas that is continuously being converted into helium at extremely high temperature. The centre of the sun is thus extremely hot at about 14 million degrees Celsius, while its surface temperature is about 6000 degrees Celsius. Compared to the other stars the sun looks enormous to us as it is so close to the earth. The next nearest star, Alpha Centauri, is several times bigger than the sun, but it appears tiny as it is much away from us. Sometimes, from some areas on the surface of the sun, hot gases shoot outward.

These are called prominences. There are also some darker, relatively cooler patches (of about 4000°C) on the surface of the sun. These spots are called sunspots and are of interest to scientists as they are found to interfere with radio and wireless transmission from the earth. They also produce change in weather on the earth.

PLANETS:

The planet are those (bright) heavenly bodies that revolve round the sun. They look like stars but they do not twinkle. Their observed brightness is only due to the light of the sun reflected by them. There are eight planets now in our solar system. They move in elliptical shaped paths called orbits around the sun. The eight planets of our solar system, in increasing order of their distances from the sun are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune . The planets, relatively nearer to the sun have features that are quite different from those which are `far off'. We can divide the planets into two categories :

(i) The terrestrial planets, and

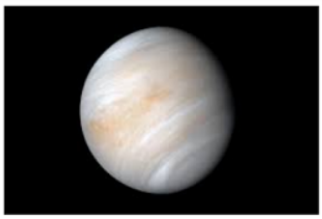
(ii) The Jovian planets.

Mercury, Venus, Earth and Mars are the terrestrial planets. They have solid and rocky surfaces.

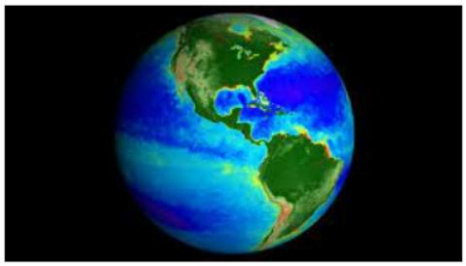
The Jovian planets are Jupiter, Saturn, Uranus and Neptune. These planets are very large in size and are made up largely of gases.

- **Mercury (Budh):** Mercury lies closer to the sun than any other planet. It is a dry, hot and virtually airless planet. It has craters like the moon, but its interior is similar to that of the earth. Like the earth, its interior contains iron and other heavy elements. Mercury is much smaller in size than the earth. It is occasionally visible just before sunrise or immediately after sunset. Hence, it is often known as morning or evening star. Being close to the sun, it takes only 88 earth days to go once around the sun.

- **Venus (Shukra):** Venus is the brightest object in our sky after the sun and the moon. Its bright appearance is due to its cloudy atmosphere which reflects almost three-fourth of the sunlight falling on it. Venus is almost of the same size as the earth but rotates relatively slowly around its axis. It has no moon or satellite of its own. Venus is even hotter than mercury though it is relatively farther away from the sun. This is because of the high percentage of carbon dioxide in its atmosphere. This gas traps most of the sun's heat falling on it. This is due to an effect called the greenhouse effect. Venus is also known as morning or evening star as it is usually visible only during these times.



- **Earth (Prithvi):** The earth is a very unique and special planet of our solar system. Like the other planets, the earth not only revolves round the sun but also rotates about an (imaginary) axis of its own. The portion of the earth facing the sun at any time has day, the other portion facing away has night. As the earth rotates on its axis, day & night follow one another. The axis of rotation of the earth is known to be tilted with respect to its orbit. It completes one revolution around the sun in nearly 365.24 days. When the northern hemisphere is tilted towards the sun, it is summer there. At that time, it is winter in the southern hemisphere. The reverse happens when the northern hemisphere is tilted away from the sun. Autumn and spring occur when the earth is in between these two extreme positions in its orbit.

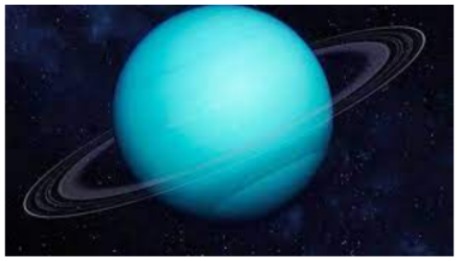


- **Mars (Mangal):** Mars usually appear reddish in colour, hence it is also often known as the red planet. Its surface resembles a cold, high altitude desert. Its atmosphere consists primarily of carbon dioxide, along with small amount of nitrogen, oxygen, water vapour and other gases. Its surface temperature and surface pressure are both very low. These conditions make it unlikely for water to exist in a liquid state on this planet. The diameter of mars is only a little more than half of that of earth. Its mass is, however, only one-tenth of that of earth. Mars, therefore has a low average density as compared to the earth. Mars has two natural satellites or moons named Phobos and Deimos.

- **Jupiter (Brihaspati):** It is the largest of all planets. Its volume is 1,300 times more than that of the earth. It has its own colourful bands. These are believed to be due to its strong atmospheric currents and the dense cloud cover around it. Jupiter consists mainly of hydrogen and helium in gaseous form. Its cloud cover is made up of methane in gaseous form, with some ammonia in crystalline form. Jupiter is known to have 28 moons or satellites.

- **Saturn (Shani):** Saturn is quite similar to Jupiter in size, mass and composition. It is the second largest planet of the solar family. It is distinguished by its very unique and special system of rings. These rings give it a beautiful appearance. There are three distinct rings surrounding this planet. These rings can be seen clearly only with the help of a telescope. Galileo was the first to observe these rings with the telescope. Saturn is known to have 30 natural satellites or moons of its own. This planet has the largest number of moons amongst all the planets.

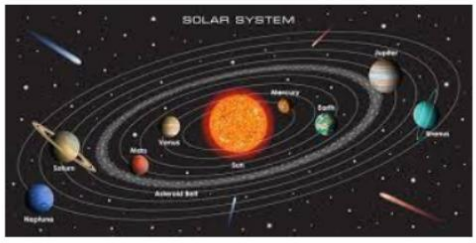
- **Uranus (Arun):** This is also a very large planet. It, infact is the third largest planet of the solar system. Its diameter is almost four times than that of the earth. It can contain as many as (nearly) 64 earths in it. Hydrogen and methane have been detected in the atmosphere of this planet. This planet is observed to have bluegreen colours. This is believed to be because of the presence of methane gas in its cold, clear atmosphere. Its northern hemisphere remains in a four-decade long period of darkness because of the way the planet rotates. So far 21 satellites or moons of uranus have been discovered.



- **Neptune (Varun):** It is very far away from the sun and is visible only through a telescope. It has been named after the Roman sea god Neptune. Neptune has 8 satellites revolving around it.

ASTEROIDS:

These are very small planets or planetoids that are found mainly in a belt between the orbit of Mars and Jupiter. Each asteroid has its own orbit and the orbits of all of them are spread over a large distance, forming a band. Astronomers have discovered more than 500 asteroids which are larger than 48 km in diameter. Ceres is the largest of the asteroids discovered till now.



COMETS:

The name comet means a 'hairy star'. Comets are relatively small and icy celestial bodies revolving round the sun. When a comet comes near the sun, some of the 'ice' in it turns into gas. The gas and loose dust, free from ice, create a long illuminating tail that streams behind the comet. The tail of the comet could be as long as 800 million kilometres. Comets are visible only when they are near the sun. This is because the intense solar heat then vaporises parts of their icy matter. There are a few `periodic comets 'that appear again and again after a regular (nearly, constant) interval. One of such periodic comet is the Hailey's comet. It appears approximately after every 76 years. It was last seen in the year 1986. It is, therefore, next expected to `pass by' the earth in the year 2062.

METEORS:

Meteors are pieces of stony or metallic rock widely scattered throughout the solar system. They travel at high speeds around the sun. When meteors come close enough to the earth, they are pulled towards the earth by its gravitational force. As the meteor passes through the earth's atmosphere, it gets burnt due to the immense heat produced by friction with the atmosphere, leaving a brilliant trail of light behind it. Such a meteor is also called a shooting star. Most of the meteors are so small that they burn up completely in the upper atmosphere, but some of the larger meteors may land on the surface of the earth producing craters. Such meteors which land on the earth are called meteorites.

REVISE BACK

11. How much time take the sun to reach the earth.
12. Earth are jovian planet (True and False)
13. Mercury takes ..... days to go once around the sun
14. Autumn and spring occur when the earth is in between these two extreme positions in its orbit. (True or False)
15. ..... is also known as red planet.
16. Mars has two natural satellites or moons named .....
17. Jupiter consists mainly of nitrogen and helium in gaseous form.(True or False)
18. ..... satellites or moons of uranus have been discovered.
19. Name the largest of the asteroids discovered till now.
20. Meteors which land on the earth are called meteorites.(True or False)

ANSWERS

11. 8.25 minutes
12. False
13. 88
14. True
15. Mars planet
16. Phobos and Deimos.
17. False
18. 21
19. Ceres
20. True

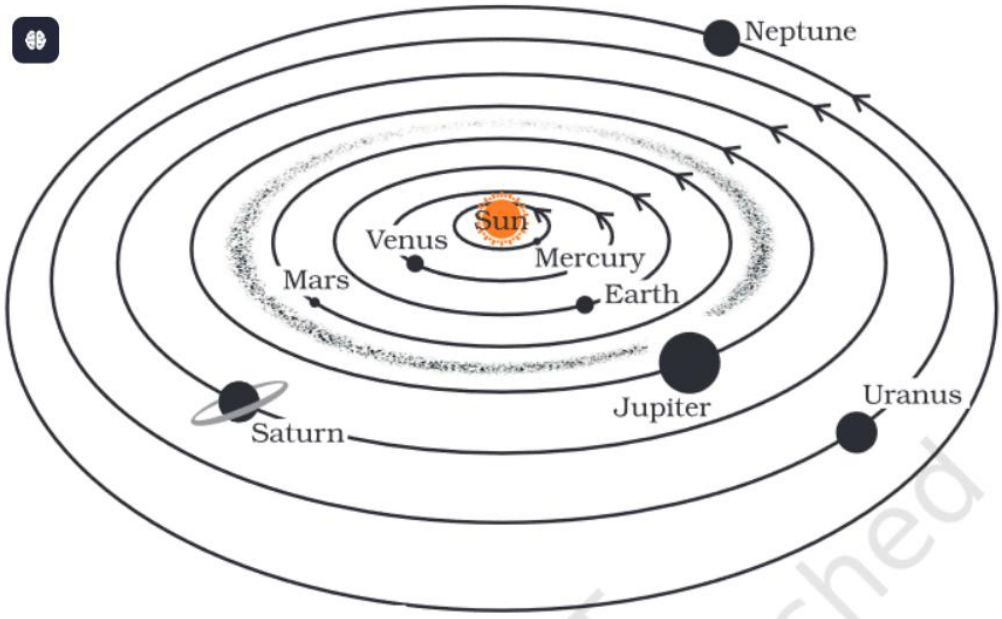
MOTION OF EARTH

The earth has two types of motion:

- The earth rotates about its own axis
- The earth revolves around the sun

THE EARTH ROTATES ON ITS AXIS:

The earth rotates (or spins) on an imagniary axis-which passes through its north and south poles. The earth completes one rotation on its axis in 24 hours which we call one day. The earth rotates (or spins) on its axis from west to east. The axis of rotation of earth is not perpendiucualr to the plane of the earth's orbit.



Earth's rotation around its axis

The axis of rotation of earth is slightly tilted with respect to the plane of its orbit (or path) around the sun. In fact, the axis of earth is tilted at an angle of 23.5 degrees to the perpendicular plane. The earth rotates on its axis in the tilted position and it also revolves around the sun in the same tilted position throughout. The earth is spherical in shape. We can divide the earth into two half spheres called two hemispheres. The two hemispheres of earth meet at the equator (which is an imaginary line running around the middle part of the earth between the north pole and south pole). The upper half part of the earth below the north pole and above the equator is called Northern Hemisphere. The lower half part of the earth below the equator and above the south pole is called Southern Hemisphere. We (in India) live in the Northern Hemisphere of the earth. On the other hand, Australia is in the Southern Hemisphere of the earth.

The rotation of earth on its axis causes day and night.

An important consequence of the rotation of earth on its axis is that it causes day and night on the earth. The formation of day and night can be explained as follows:

The earth recieves its light from the sun. The light of sun always falls on that half part of earth which is facing the sun.

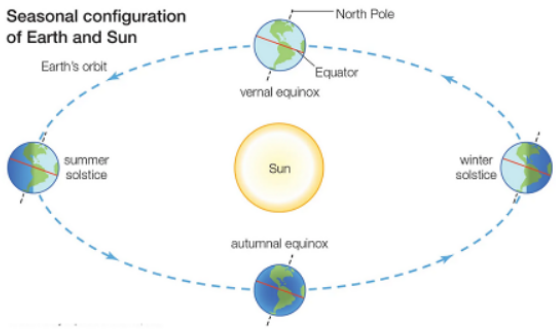
As the earth continues to rotate (or turn) on its axis, almost every 12 hours, a day changes into a night and a night changes into a day. Since the earth's axis is tilted at an angle, therefore, the length of day and night actually changes throughout the year. From the above discussion we conclude that the day and night are caused by the daily rotation of the earth on its axis. The change in the length of day and night is, however, caused by the tilted of earth's axis.

There are four seasons in a year: summer, winter spring and autumn. The hot season of the year is called summer. The coldest season of the year is called winter. The season after winter and before summer is called spring. And the season after summer and before winter is called autumn. The spring and autumn seasons are neither very hot nor very cold, they have a moderate weather. We will now describe how the different seasons on the earth are formed.

THE MOTION OF TILTED EARTH AROUND THE SUN CAUSES SEASONS:

An important consequence of the revolution of the earth around the sun is that it causes seasons on the earth such as summer, winter, spring and autumn. Two factors are responsible for causing different seasons on the earth are:

- Motion of the earth around the sun once every year.
- Tilting of the earth's axis to the plane of its orbit around the sun.



The earth and the start of four seasons

The earth and the start of four seasons

The earth rotates (or spins) on its axis and also revolves (or moves) around the sun. The earth takes 1 year (or 365 1/4 days) to complete one revolution around the sun. The north-south axis on which the earth spins is not at right angles to the earth's orbit around the sun. The earth's axis is tilted at an angle of 23.5° to its orbit around the sun. When the earth moves around the sun in its orbit, it remains tilted to its orbit throughout. As the tilted earth orbits the sun every year, it causes different seasons during the different times of the year. Actually, when the tilted earth moves around the sun in its annual orbit, then first its one pole (or other hemisphere) tilts towards the sun. This one by one tilting of the two poles (or two hemispheres) of the earth towards the sun causes the change in the strength of sun's rays reaching on an area of earth's surface and produces different seasons. It also causes the change in the length of day and night. The formation of seasons will become more clear from the following discussion

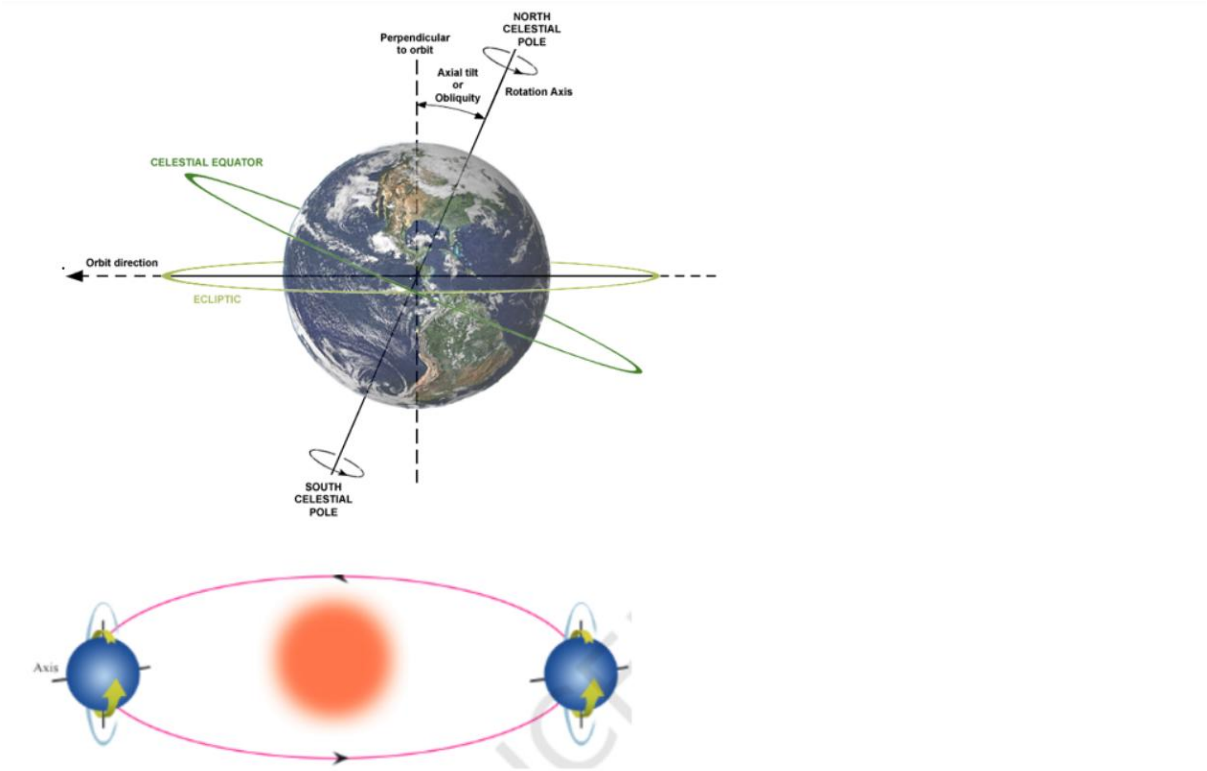


Fig. 1

(A) When the earth is at position A(see fig.1) in its orbit around the sun, then the Northern Hemisphere of the earth tilts towards the sun. When the Northern Hemisphere of the earth tilts towards the sun, it gets more heat and light from the sun and has summer season. During this period, at noon, the sun's rays fall almost perpendicularly in the Northern Hemisphere, they have more heating effect and hence the atmosphere becomes very hot. So, it is summer season in the Northern Hemisphere of earth (as in India). The peak summer season occurs around the month of June in the Northern Hemisphere.

When the Northern Hemisphere of earth tilts towards the sun, then at the same time, the Southern Hemisphere tilts away from the sun. When the Southern Hemisphere of the earth tilts away from the sun, it gets less heat and light from the sun and has winter season. During this period, even at noon, the sun's rays fall obliquely in the Southern Hemisphere, they have less heating effect and hence the atmosphere gets very cold. So, it is winter season in the Southern Hemisphere of earth (as in Australia). The peak summer season occurs around the month of June in the Southern Hemisphere. From the discussion we conclude that when it is summer in the Northern Hemisphere of earth, it will be winter in the Southern Hemisphere of earth. Now, India is in the Northern Hemisphere whereas Australia is in the Southern Hemisphere. This means that when it is summer in India, it will be winter in Australia.

(B) The earth is moving continuously in its orbit around the sun. So, after 6 months, the earth travels from the position A to position B(see fig.1) on the other side of the sun and the Northern Hemisphere now tilts away from the sun. When the Northern Hemisphere of the earth tilts away from the sun, it gets less heat and light from the sun and has winter season. The peak winter season occurs around the month of December in the Northern Hemisphere of earth.

When the Northern Hemisphere of earth tilts away from the sun, then at the same time, the Southern Hemisphere tilts towards the sun. When the Southern Hemisphere tilts towards the sun, it gets more heat and light from the sun and has summer season. The peak summer season in the Southern Hemisphere occurs around the month of December. From the above discussion we conclude that when it is winter in the Northern Hemisphere of earth, it will be summer in the Southern Hemisphere of earth. This means that when it is winter in India, it will be summer in Australia.

There are two times in a year when the Northern Hemisphere and the Southern Hemisphere of the earth are neither tilted towards the sun nor tilted away from the sun (see positions C and D). This gives us two other seasons: spring and autumn. When the earth is at position C in its orbit around the sun, then it is spring season in the Northern Hemisphere but autumn season in the Southern Hemisphere. This happens around the month of March. On the other hand, when the earth is at position D in its orbit around the sun, then it is autumn in the Northern Hemisphere but spring in the Southern hemisphere. This happens around the month of September. During spring and autumn seasons, both the hemispheres of the earth get almost equal amounts of heat and light from the sun. At positions C and D, day and night are equal in both the hemispheres.

Please note that the seasons on earth are determined by the angle at which the sun rays fall on its surface and not bythe distance of the earth from the sun. During the summer, at noon time, the sun rays fall almost perpendicularly on the earth's surface due to which the sun appears very hot. On the other hand, during winter even at noon time, the sun rays are inclined at a considerable angle to the earth's surface due to which the sun appears less hot. It is a surprising fact that in India the earth is nearer to the sun during our winter and farther from the sun during our summer. In general, we can say that:

IN THE NORTHERN HEMISPHERE:

- It is winter when the earth is closer to the sun.
- It is summer when the earth is farther from the sun.

IN THE SOUTHERN HEMISPHERE:

- It is summer when the earth is closer to the sun.
- It is winter when the earth is farther from the sun.

Another point to be noted is that due to the tilted axis to the earth, the sun rays fall on the earth for a longer time during summer and for shortertime during winter. Due to this, the days are longer in summer but shorter in winter. Please note that when the day is long then the night is short and when the day is short then the night is long.

REVISE BACK

21. The axis of earth istilted at an angle of ..... degrees to the perpendicular plane.
22. The upper half part of the earth below the north pole and above the equator is called Southern Hemisphere. (True and False)
23. It is winter when the earth is .....
24. When the Northern Hemisphere of the earth tilts away from the sun, it gets less heat and light from the sun and has winter season. (True or False)
25. The peak summer season occurs around the month of June in the .....

ANSWERS

21. 23.5
22. False
23. closer to the sun
24. True
25. Southern Hemisphere

Types of satellites

A satellite is a small body revolving around a planet.

Satellites are of two types:

(a) Natural satellite (b) Artificial satellite

NATURAL SATELLITE (MOON):

The moon, our nearest neighbour in space, is a natural satellite of the earth. A satellite is a heavenly body that revolves around a planet. Of the nine planets, only mercury and venus have no satellites or moons associated with them. **Mars is believed to have 2 moons, jupiter 28 moons, saturn 30 moons, uranus 21 moons, neptune 8 moons of their own.** The earth, of course, has only one moon and that, being our nearest neighbour, has been explored and studied the most by the astronomers.

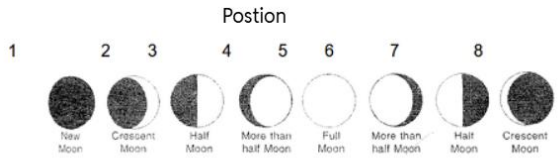
The moon has no air or water on it. Its diameter is about (1/4th) of the diameter of the earth and its mass is about (1/81th) that of the earth. It has no light of its own. Its observed silver glow is only due to the light of sun reflected by its surface.

The moon is very much smaller than stars but it appears bigger because of its nearness. This near neighbour is, however, still about three lakh eighty four thousand and four hundred kilometers (3,84,400 km) away from us. Its surface is covered with hard and loose dirt and it has many uplands (mountains) and valleys that are filled with dry rock materials.

The moon has a very interesting feature associated with it. It takes same time (27 days and 7 hours) to revolve around the earth as well as to spin, or rotate, once about its own axis. We on the earth, therefore, always seen only one side (the `front' side) of the moon. Its other; or `black' side is not seen from the earth.

Phases of moon:

Moon has no light of its own. Moon shines and becomes visible to us because it reflects sunlight falling on it towards the earth. At any point of time, half of the moon's surface is in direct sunlight and the other half is in shadow. But since the moon revolves around the earth and the earth (alongwith moon) revolves around the sun, we cannot see all of the sun-lit surface of moon from the earth all the time. We can see only that part of the sun-lit surface of moon which is towards us (on the earth). Thus, we see different amount(or portions) of the sun-lit surface of the moon from the earth depending upon the relative positions of the sun, the moon and the earth. Thus, sometimes we see almost no face of moon (called new moon); sometimes we see less than half the face of moon (called crescent moon); sometimes we see half of moon; sometimes we can see more than half of moon; and sometimes we see the whole circular face of moon (called full moon). So, as moon revolves around the earth once every month, the moon's appearance varies according to how much of its illuminated surface is turned towards the earth (from where we see it). **The different views of the moon (as seen from the earth) are called phases of the moon.** Some of the phases of the moon are shown below in the figure.



On a new moon night, the moon is a dark bail and hence the new moon is not visible to us in the night sky. On a full moon night, the moon appears to be a bright bail of light. In-between a new moon and full moon, and then between the full moon and the next new moon, we see different shapes of the moon which are called phases of the moon.

Formation of the various Phases of the Moon:

(A) When the moon is on the side of earth nearest to the sun (see position 1 in the figure), then the side of moon which is lit by sun is away from earth. And the side of moon which is towards the earth is in darkness, in this position, moon appears to be in darkness from earth. This is called new moon. The new moon day is called `Amavasya'. In fact, we cannot see the moon at all on the new moon day (or Amavasya). So, the new moon night (or Amavasya Night) is very dark having no moonlight at all.

(B) As the moon moves in its orbit around the earth from position 1 to 2, we can see a small sun-lit portion of its surface. This is called crescent moon. As the moon moves further from position 2 to position 3 and 4, the sun-fit portion of moon facing the earth becomes bigger and bigger giving us half moon and more than half moon. This is called the waxing phase (increasing phase) of the moon.

(C) After two weeks time from new moon day, the moon reaches in position 5 which is on the side of the earth farthest from the sun. In this position whole sun-lit side of the moon is towards the earth, and we see the moon as a full round disc of bright light. This is called full moon. The full moon day is called `Purnima'. The full moon night (or Purnima Night) is very bright because we have the maximum moonlight on that night.

(D) As the moon moves around the earth further from position 5 to positions 6, 7 and 8, the sun-lit portion of moon facing the earth becomes smaller and smaller. This is called the waning phase (decreasing phase) of the moon. And ultimately moon completes the revolution around the earth and again reaches position 1. So, we have new moon once again. Pfease note that we can have one new moon and one full moon during a month (which is the time taken by moon to complete one revolution around the earth).

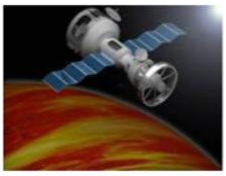
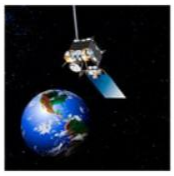
From the above disscussion we conclude that we have 'Amavasya' on the new moon day which changes in two weeks' time into Purnima. And during the next two weeks, Purnima changes into Amavasya again. This process is repeated again and again.

ARTIFICIAL SATELLITE:

A man-made space-craft placed in orbit around the earth is called an artificial satellite. The artificial satellites are also known as man-made satellites. An artificial satellite is placed in orbit around the earth with the help of a launch vehicle called rocket.

India has built and launched several artificial satellites. Aryabhatta was the first Indian satellite. Some other Indian satellites are INSAT, IRS, Kalpana, EDUSAT, etc.

Artificial satellites have many practical applications. They are used for forecasting weather, transmitting television and radio signals. They are also used for telecommunication and remote sensing.

GOES-N SPACECRAFT

REVISE BACK

26. Name the types of Satellites.
27. The moon has no air or water on it. (True and False)
28. The new moon day is called .....
29. A man-made space-craft placed in orbit around the earth is called an artificial satellite. (True or False)
30. The full moon day is called .....

ANSWERS

26. Natural satellite and Artificial satellite
27. True
28. Amavasya
29. True
30. Purnima