MOTION OF THE EARTH

INTRODUCTION

In the morning, the sun rises in the east and in the evening it sets in the west. It seems as if the sun travels round the earth. But the fact is otherwise. It is the earth that revolves round the sun. You must have got this experience while travelling in a train. Actually the train moves on and all the things around like poles, trees, If houses, etc. are stationary. But you feel as if you and your train are stationary and the things all around you are moving. This very myth puzzled the astronomers for a very long time. UUimately, it was discovered (by scientists like Galileo, Copernicus etc.) that the sun is stationary and the earth is moving. I·t was a great discovery, which greatly revolutionised our geographical knowledge and led us to the path of progress.

Besides moving round the sun, our earth also moves on its own axis. Thus, our earth has two kinds of motions-one on its axis, which we: call Rotation and the other around the sun, which we call Revolution.

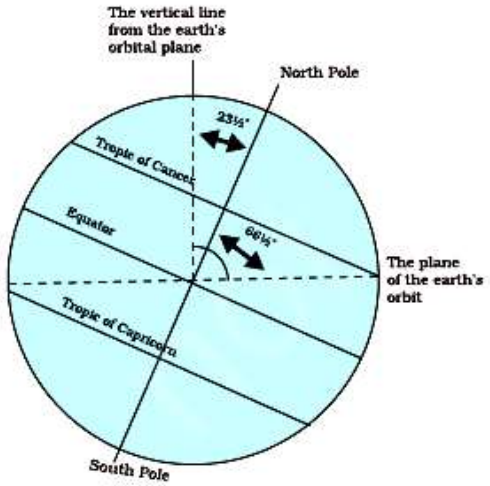
ROTATION

The earth spins on its axis like a top. The earth's axis is an imaginary line that passes through its centre. Its two ends are the North Pole and the South Pole. This axis is inclined to the plane of the earth's orbit at an angle of 66½°.

The earth completes one rotation on its axis in 24 hours. It is because of the earth's rotation that the sun seems to us to be rising and setting. When the earth moves on its axis, half of its surface faces the sun at a time while the other half faces away from the sun. As a result, in that part of the earth that receives sunlight, it is day while in the other part it is night. This phenomenon of alternating day and night is the result of the earth's movement on its axis. We call this movement Rotation, which it completes in 24 hours or in one day.

The circle that divides day and night is called the circle of illumination.

This does not coincide with the axis. This circle divides the earth into day and night.

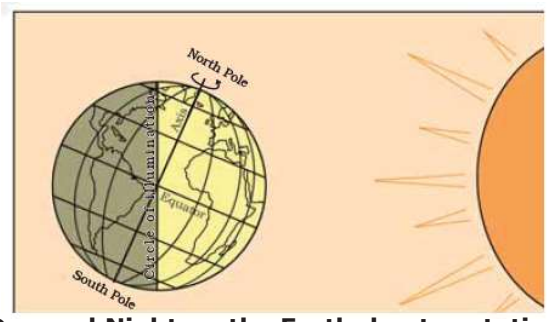


Inclination of the Earth's axis and the orbital plane

Suppose if the earth stops rotating, then one half of its part would be permanently in light, while the other half would have perpetual darkness. Thus, it is because of the rotation of the earth that days and nights are caused and they follow each other in all parts of the earth.

The earth moves from west to east. It is also because of this movement or rotation of the earth that the sun, the moon and the stars appear to us as if they move round the earth from east to west.

Both in the morning and the evening, the rays of the sun are slanting. They fall on a large area of the earth. So there is lesser heat during these timings. But at noon, the rays of the sun are more or less vertical. They fall on a smaller area and make it very hot. So, noons are comparatively hotter as compared to both mornings and evenings.



Day and Night on the Earth due to rotation

◈ HOW ARE DAYS AND NIGHTS CAUSED?

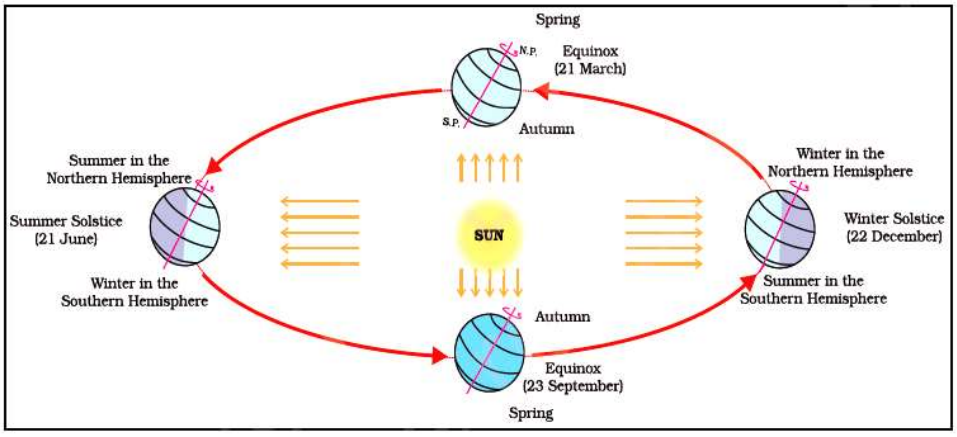
You have already read that the earth's axis is inclined to the plane of its orbit at 66W. The earth remains tilted to one side while it revolves around the sun. This tilt is called the inclination of the earth's axis which inclined in the same direction. As a result, one hemisphere of the earth leans towards the sun for six months. During this period, greater area of this hemisphere receives sunlight for a longer time. Thus, the days are longer In one hemisphere, while in the other hemisphere the days are shorter and the nights are longer. Hence, when the days are longer in the Northern Hemisphere, nights are longer in the Southern Hemisphere and for the next six months when nights are longer in tlie Northern Hemisphere, the days are longer in the Southern Hemisphere.

Remember, in the Northern Hemisphere (including India) June 21 is the longest day and December 22 is the shortest day.

Can you imagine what would happen if the earth's axis was really perpendicular to the plane of the earth's orbit instead of inclining at 66'.1,0 ? In such a situation, there would be nights and days of equal duration in both the hemispheres. Moreover, there would be only two seasons, i.e. the summer and winter in the whole year.

Remember, the days and nights are always of equal length at the equator because throughout the year the sun sh.ines vertically on the equator. The lengths of days and nights increase or decrease as we move away from the equator either southwards or northwards.

Due to the inclination of the earth's axis in the Northern Hemisphere from March 21 to September 23, the North Pole receives sunlight continuously 'for six months while on the South Pole, the sun shines continuously for the other six months. In this way, at the poles, there are days and nights of six months' duration each.



Revolution of the Earth and Seasons

Days and nights are equal throughout the world on March 21 and September 23 because on these two days neither of the two poles is inclined towards the sun. These days are called Equinoxes.

REVOLUTION

The motion cf the earth round the sun is called Revolution. While revolving around the sun, the earth follows a fixed route or path which is known as its orbit. This path is not exactly a circle but it is somewhat elongated like an egg. This elongated circle is known as orbit.

The earth revolves round the sun at an enormous speed of 100,000 kilometres per hour. It completes one circle in approximately 365 days and 6 hours. But for the sake of convenience we calculate a year in complete days, i.e. 365 days. In this way, we add one day (6 x 4 = 24 hours) in the fourth year. This year is called a Leap Year. Thus, every fourth year in the Solar Calendar has 366 days. This extra day is added to the month of February. In an 9rdinary year, February has 28 days while in a leap year it has 29 days. Remember a year, divisible by 4, is treated as a leap year. The year 1984 was a leap year. So were 1992 and 1996 and the year 2004 was also a leap year. Find out the next leap year.

The phenomenon or change of seasons is caused chiefly by the revolution of the earth round the sun and the inclination of the earth's axis at an angle of 66W to the plane of its orbit which constantly points to the same direction. It can be understood with the help of the diagram which shows four positions of the earth during its revolution round the sun.

◈ **The Position on June 21**

(1) North Pole is inclined towards the sun and the South Pole is away from it.

(2) The rays of the sun fall vertically on the Tropic of Cancer (23'12" N.

(3) Major parts of the Northern Hemisphere are lit by the sun-rays. As a result of that, the days are long and hot and it is summ er in the Northern Hemisphere. ThIs position on June 21, when the sun shines vertically on the Tropic of Cancer, is called the Summer Solistice.

◈ **The Position on December 22**

(1) The South-Pole is inclined towards the sun and the North Pole is away from it.

(2) The rays of the sun fall vertically on the Tropic of Capricorn (23'12" S). As a result of that the days are long and hot there, it is summer in the Southern Hemisphere. Thus, on Decembe(25 every year, when Christmas is being celebrated, it is winter in the Northern Hemisphere as in England, the U.S.A., India, etc. but il is summer in the Southern Hemisphere as in Australia, South America, etc. Remember, when the sun shines vertically on the Tropic of Capricorn it is called the Winter Solistice.

◈ **The Position on March 21 and September 23**

(1) Both the North Pole and the South Pole are neither inclined towards the sun nor are away from it.

(2) The rays ofthe sun fall vertically on the equator. As a result, days and nights are of equal duration throughout the world on these two days (i. e. March 21 and September 23)

(3) The seasons in both the Northern Hemisphere and the Southern Hemisphere are similar. It is neither very hot nor very cold.

(4) These two days when there are equal days and nights throughout the world are called Equinox.

(5) On March 21, it is spring in the Northern Hemisphere.

(6) It is called the Spring Equinox. On September 23, it is autumn in the Northern Hemisphere. It is called the Autumn Equinox.

(7) In the Southern Hemisphere, the seasons are opposite to the seasons in the Northern Hemisphere.

(8) On the equator, the sun always shines vertically overhead. Therefore, there is only one seasons on the equator. It is a long and hot summer.