8. How Seasons Occur -Part 2

Can you tell ?

Discuss the activity you have been carrying out since June. (See Chapter 1.) Make use of the observation tables for the months of June, September and December.

- In which month the duration of the day was around 12 hours?
- What could be the reason behind it?
- Bring out the differences between the duration of daytime in the months of June, September and December.
- What could be the reason for the change in the shadow of the stick?
- What did you observe about the position of the sun at the horizon at the time of sunrise and sunset?
- Which of the following factors could be related with the change in the position of the shadow of the stick and the difference in the duration of daytime?
  - Rotation of the earth
  - Distance between the earth and the sun
  - Revolution of the earth
  - The axis of the earth.

You must have noticed the longest day, the shortest day and the days with the same duration of day and night time with the help of the obervations in the months of June, September and December. Generally, these dates are the same every year. With the help of the shadaw experiment, you must have noted the change in the position of sunrise. Let us study the changes in the position of sunrise and the difference in duration of day and the night time.

Geographical explanation

Apparent movement of the sun:

You must have realized through your observations that the position of the sun, at sunrise appears to change on the horizon every day. Its position appears to move towards the north or south in the course of a year. However, in reality, the sun does not move anywhere. That is why, this movement of the sun towards the north or south in a year is called the apparent movement of the sun. The position of the rising sun keeps on moving towards the south in the period from 21st June to 22nd December. This period is called Dakshinayan. From 22nd December to 21st June, the sun keeps on moving towards the north. This period is called Uttarayan. The revolution of the earth around the sun and the tilted axis of the earth are the two factors responsible for the apparent movement of the sun.

Seasons occur only with reference to the northern and the southern hemispheres.

Think about it.

☞ In which direction will the location of sunrise and sunset appear to move after 22nd of December?

Always remember –

This year you will study the 'apparent motion of the sun' in your science textbook as well. In that book, the sun's east-west motion from sunrise to sunset, that is, its diurnal apparent motion is also considered. In geography, we consider the apparent (north-south) movement of the sun. In both the motions, the sun only appears to move and does not actually move. The diurnal apparent movement of the sun is related to the rotation of the earth whereas its annual apparent movement is related to the revolution of the earth and the tilt of the earth's axis.

Observe fig. 8.1 carefully and answer:

- How is the northern hemisphere in which you live positioned relative to the sun on the dates given in the figure?
- Which season will you experience in the

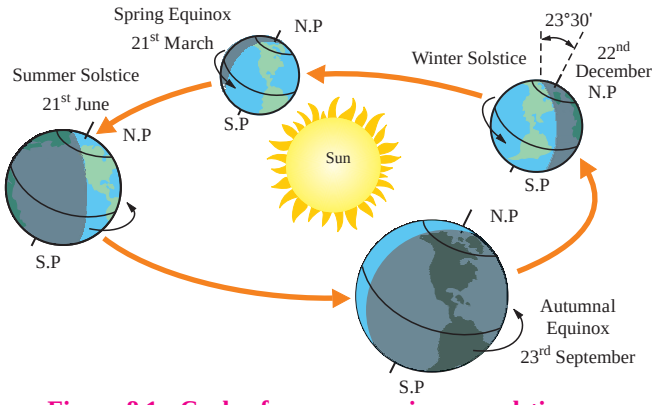


Figure 8.1 : Cycle of seasons, equinoxes, solstices

northern hemisphere around 22nd December?

- What would be the season in the northern hemisphere around 21st June?
- If it is winter in the northern hemisphere, which season will it be in the opposite hemisphere?
- At any given point of time, why are the seasons in the northern and southern hemishpheres different?

Perihelion and aphelion positions of the earth:

The path of the revolution of the earth around the sun is elliptical. The sun is at one of the two centres of the ellipse. The sun does not change its position. As the earth moves in an ellipse, its distance from the sun does not remain the same. It is at its minimum distance in the first week of January. This is called the perihelion position of the earth. In this position, the southern end of the axis is towards the sun. As against this in the first week of July, the earth is at the farthest point from the sun. This is called the aphelion position. In this position, the northern end of the axis is towards the sun. With the help of fig. 8.1 which shows the position of the earth in relation to the sun, you can guess which season prevails in which hemisphere. Seasons occur due to the revolution of the earth, as well as due to the tilt of its axis of rotation.

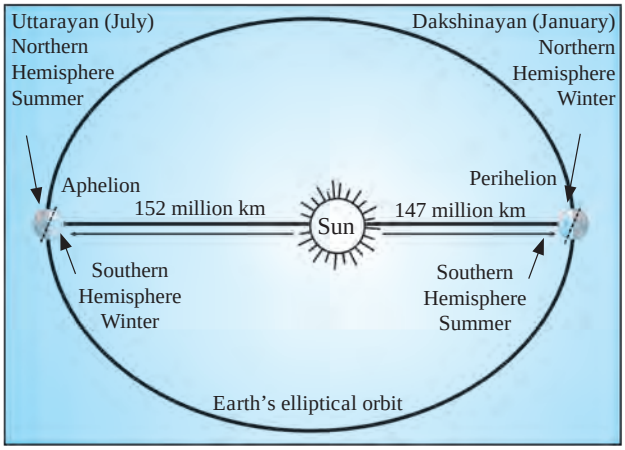


Figure 8.2 : Aphelion and perihelion position

Do you know ?

Due to the gravitational forces of the sun and the earth, the speed of the earth gets reduced, during the aphelion position and increases during the perihelion position. As the difference in the distance of the earth in both these positions is not very great, it does not have any effect on the seasons.

Geographical explanation

As the earth revolves around the sun, the equator receives perpendicular rays on two days in a year. This condition occurs on 21st March and 23rd September. On these days, both the poles are at the same distance from the sun. This is called equinox. (See fig 8.3)

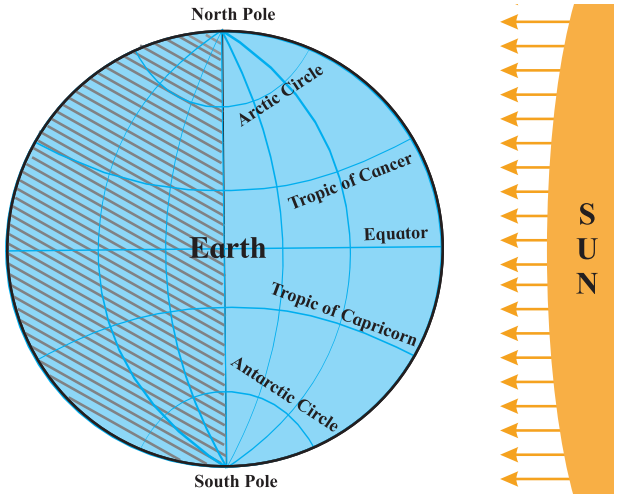


Figure 8.3 : Equinox days

The illuminated and dark portions of all the parallels including the equator are shown in figure 8.3. In the figure, the circle of illumination divides all the parallels from the north pole to the south pole equally. Everywhere on earth nighttime and daytime are of equal duration. This condition is called equinox. On equinox,

the sun's rays are perpendicular on the equator. In this condition, the circle of illumination coincides with the great circle defined by two opposite meridians. In the northern hemisphere spring prevails from 21st March to 21st June while autumn prevails from 23rd September to 22nd December. The southern hemisphere has the opposite seasons during these periods.

In the northern hemisphere, 21st March is called spring or vernal equinox whereas 23rd September is called autumnal equinox.

The equinox or solstice dates can vary by a day or so.

Use your brain power !

☞ On equinox days, the two Poles experience either sunrise or sunset. On which pole will it be sunrise on 21st March?

Figure 8.4 shows the position of the earth with its tilted axis on 21st June and 22nd December. Its also shows its illuminated and dark portions. Observe the figure and answer the following.

- In fig 'A' which pole is receiving sunlight?
- In fig 'B' which pole is not receiving sunlight?
- Which hemisphere has the longest daytime on 21st June?
- Which hemisphere will have the longest night on 22nd December?
- On which date will the Tropic of Cancer receive perpendicular sunrays?
- Considering the position of the north pole, which season will prevail in the northern hemisphere from 22nd March to 23rd September?
- The cricket matches in Australia are generally in summer. When does Australia have summers?
- In which period is the 'midnight sun' observable in Norway? Which season will there be at that time?
- At what time will the midnight sun be visible at the 'Bharati' research station of India at Antarctica? What will be the season there at that time?

Can you tell ?

Geographical explanation

When any one of the poles inclines the most towards the sun, 23°30' parallel of that hemisphere receives perpendicular sunrays. See figure 8.4. The sunrays are perpendicular at the equator on 22nd March and 23rd September which are the days of equinox. After 22nd March, other parallels between the equator and the Tropic of Cancer in the northern hemisphere start receiving perpendicular rays sequentially. Only on 21st June and 22nd December the sunrays become perpendicular on the Tropic of Cancer and Tropic of Capricorn respectively. These two days are called Solstice days.

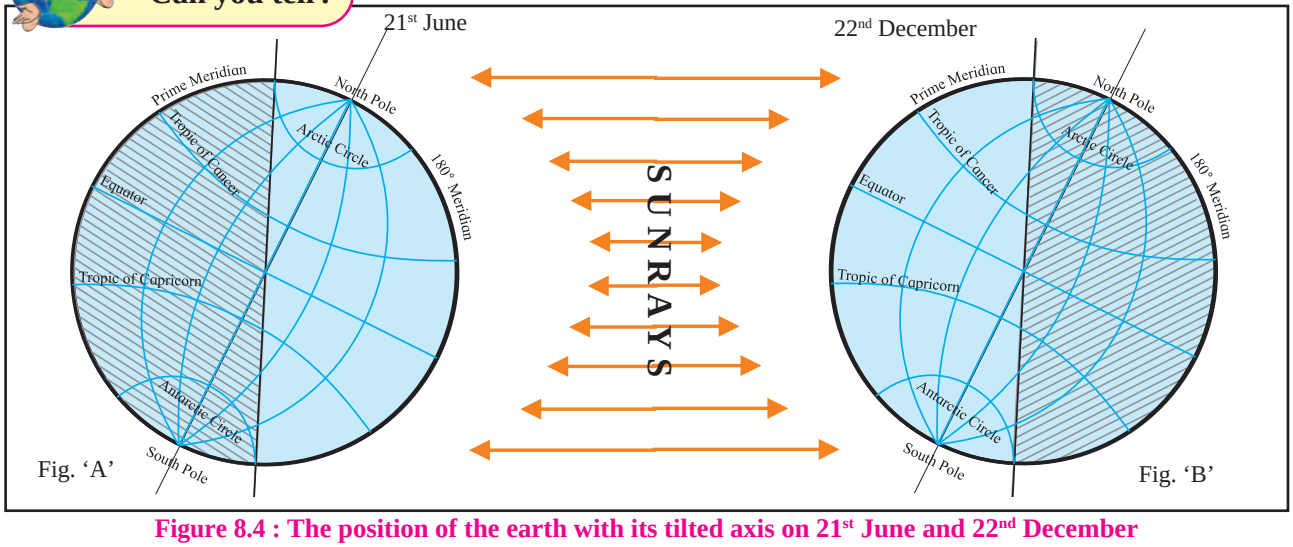


Figure 8.4 : The position of the earth with its tilted axis on 21st June and 22nd December

Sunrays are never perpendicular on any of the parallels between Tropic of Cancer and the North Pole or between Tropic of Capricorn and the South Pole. 21st June is the longest day and it marks the shortest night in the northern hemisphere. Similarly, 22nd December marks the longest day and the shortest night in the southern hemisphere. 22nd December is the shortest day in the northern hemisphere.

In the region from the Arctic Circle to the north pole, the sun remains visible for 24 hours or longer. At the north pole, the sun is visible in the sky from 22nd March to 23rd September, i.e., for six months. Similar situation prevails in the region between the Antarctic Circle and the South Pole in the period from 23rd September to 21st March. Note that on the equator, the duration of day and night is same throughout the year. (i.e.,12 hours each).

Seasons have been decided on the basis of the duration of sunlight, equinoxes and solstices. The equatorial region does not experience any change of season. Hence the climate in that region does not change at all in the year. In places beyond the equatorial region in either hemispheres, summers or winters are experienced one after the other, within a year. The occurrence of seasons one after the other in a year leads to the 'cycle of seasons'. Generally, there are two seasons, summer and winter, on the earth. However, in some places, seasons are taken to be four in all.

The changes in the atmosphere, vapour in the air, the wind and the precipitation also influence the seasons. Continuous occurrence of rain in a specific period gives rise to an additional season besides summer and winter. Due to the local conditions, seasons other than summer and winter are seen to occur in different parts. For example, rains occur in India in a specific period. Therefore we consider four seasons : such as summer, the rainy season the period of retreating monsoon and winter. There are four seasons in Europe and North America too. They are summer, autumn, winter and spring.

The cycle of season and the living world:

If the earth's axis were not tilted, the same climatic conditions would have prevailed throughout year. The seasons would not have occurred. One and the same type of climatic conditions would have prevailed on each of the different parallels. It is the tilt of the axis that leads to occurrence of seasons, change and diversity on the earth. The living world on the earth is affected by the cycle of seasons. For example, in the region between 66°30' and 90° in both the hemispheres, even the mild sunlight available for a part of the year gives rise to certain flora and fauna. In the Antarctic region, at the southernmost part of the earth, birds like penguins, fish like seal and animals like walruses are found. In the polar region of the northern hemisphere animals like reindeer, polar bears, Arctic foxes etc. are found. People living in this region too have adapted to the natural conditions prevailing in that region. Our adaptation to climatic conditions is possible only up to a certain limit. That is why organisms prefer a certain habitat. During extreme cold climatic conditions when the food supply becomes scarce, a number of birds and animals migrate temporarily. Trees bear fruit in a particular season. Therefore, agricultural seasons also depend on to the local climatic conditions. In polar areas, snowline shifts north or south according to seasons. This affects migration of birds and animals.

Use your brain power !

- While India and England are located in the same hemisphere, why are the cricket matches in these two countries arranged in different months?
- On 21st March and 23rd September, daytime and nighttime are same all over the earth. But why do some parts experience summer and some parts winter on these days?
- Mention any two countries in the world where one needs woollen clothing in the month of May. Also mention their latitudinal positions.

Do you know?

Arctic tern

Once the winter at the North Pole becomes severe, this bird travels southwards. When it is summer in the northern hemisphere, it flies back towards the North Pole. It has to travel in search of food. In the course of one year, it travels around 70,000 km. It might be the only species in the world that experiences summer twice in a year.

Siberian Crane

Due to severe winter and lack of food, cranes from the cold northern regions visit India travelling around 8 to 10 thousand kilometres. Once summer starts in India, they migrate back to the north.

Think about it.

☞ What effects do the seasons have on the biodiversity in India? Write briefly about it.

Give it a try.

Regarding daytime and the cycle of seasons, what conditions would have prevailed at the following place, if the earth's axis were not tilted? Use the Globe to answer the question.

(Canada, Tasmania, Nigeria, West Indies, Peru, Borneo.)

Use your brain power!

☞ The summer capital of Jammu and Kashmir is Srinagar and the winter capital is Jammu. What could be the reason?

Look for me elsewhere!

☞ Class Seven– Science– Adaptation, Apparent motion

☞ Class Seven– Geography– Natural Regions.

☞ Class Six– Geography– Chapter 5

☞ Class Five– Environmental Studies- Part One– Chapter 2

☞ Class Three– Environmental Studies- Part One– Chapter 24

Exercises

Q. 1. Complete the statements using correct options:

(1) The apparent movement of the sun means .....

(a) The sun revolves around the earth in a year

(b) It appears that the sun moves to the north or south in a year.

(c) The earth keeps on changing its position.

(2) If the axis of the earth were not tilted .....

(a) The earth would not have rotated around itself.

(b) The earth would have revolved around the sun with greater velocity.

(c) Different parallels on the earth would have experienced the same climate throughout the year.

(3) 21st June and 22nd December are solstice days, that is, ...

(a) The sun starts its southward journey from Tropic of Cancer on 21st June and northward journey from Tropic of Capricorn on 22nd December.

(b) The Dakshinayan of the sun takes place between 21st June and 22nd December.

(c) The Uttarayan of the earth takes place between 21st June and 22nd December.

(4) The revolution of the earth around the Sun and the tilt of the axis of the earth together are responsible for the following seasons.

(a) Summer, rainy season, Retreat of Monsoon and winter,

(b) Summer, winter and spring

(c) Summer and winter.

Q. 2. Answer the following questions.

(1) What leads to the occurrence of seasons?

(2) What is the duration of the day on equinox?

(3) Why is the effect of the seasons not experienced in the equatorial region?

(4) Why is the sun visible for more than 24 hours during Dakshinayan in the region between the Antarctic Circle and the South Pole?

(5) Why are penguins not found at the North Pole?

Q. 3. Rewrite the following statements after correcting them.

(1) The earth's velocity varies according to the period of revolution.

(2) If we observe from the northern hemisphere, we see the apparent movement of the sun.

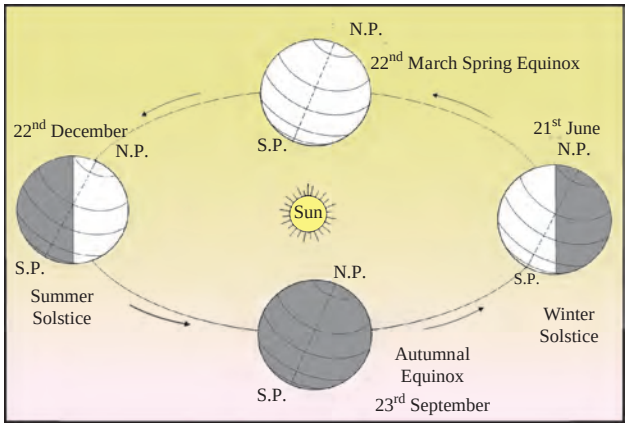
(3) The dates of equinox change every year.

(4) North Canada experiences summer from September to March.

(5) When it is summer in South Africa, Australia has winter.

(6) Duration of daytime is less on the vernal and autumnal equinoxes.

Q. 4. Spot the error in the diagram given below.



Q. 5. Draw a diagram showing the cycle of seasons in the southern hemisphere.

ICT Question :

(1) Using the internet sites or a calendar, find and note the duration of the day for specific dates between 22nd March and 23rd September. Calculate the duration of the nights too. Using this information draw a compound bar graph.

(2) Draw a diagram of aphelion and perihelion positions of the earth on the computer.

Activity :

Using the internet, collect pictorial information of any four migratory birds/animals.

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