Chapter - 1

Seasons and Time

Introduction

The wonders of seasonal change exhibited by the nature are varied. Seasons played an important role to make different colours in this green earth. Science gave new definitions to the many myths that are believed for ages. When the geocentric theory was replaced by heliocentric theory it provided more scientific base for the concept that day and night and seasons are the results of rotation and revolution. This lesson is about seasons and time differences in various parts on earth.

Concepts

1. The apparent movement of the Sun, due to the inclination of axis, is the reason for the occurrence of seasons. There is variation in the sunlight that falls on the Earth due to the apparent movement of the Sun.
2. As a result of the apparent movement of the sun between Tropic of Cancer and Tropic of Capricorn, the different seasons - Spring, Summer, Autumn and Winter get repeated in a cyclic manner.
3. The axis of the Earth is tilted at an angle of $66^0\ 30^0$ from the orbital plane. If measured from the vertical plane this would be $23^0\ 30^0$
4. The Earth maintains its tilt of axis throughout its revolution. This is known as the parallelism of the Earth's axis
5. Northward apparent movement of the Sun from Tropic of Capricorn to Tropic of Cancer is termed as 'Utharayanam'.
6. Southward apparent movement of the Sun from Tropic of Cancer to Tropic of Capricorn is termed as 'Dakshinayanam'.
7. The apparent position of the Sun during the Earth's revolution will be over the Equator on March 21 and September 23. Hence the length of day and night will be equal during these days on both the hemispheres. These days are called equinoxes.

8. From 21 March onwards, the Sun apparently shifts from the Equator northwards and reaches vertically over the Tropic of Cancer (23 ½^{0}•N) on 21 June. This day is known as the Summer Solstice in the Northern Hemisphere.
9. The Sun continues its southward apparent shift from the Equator from 23 September and reaches vertically above Tropic of Capricorn (23 ½^{0} S) on 22 December. This day is known as Winter Solstice in the Northern Hemisphere.
10. Spring is the season of transition from winter to summer.
11. Autumn marks the transition from the severity of summer towards winter.
12. During the period from March to September, as the Sun is in the Northern Hemisphere, the north polar regions experience continuous daylight for six months.
13. During the remaining period, that is from September to March, as the Sun is in the Southern Hemisphere north polar regions experience continuous night for six months.
14. Time estimated at each place, based on the position of the Sun, is termed as the local time.
15. As the Earth rotates from west to east, the Sun rises in the east
16. The angular distance of the Earth is 360^{0}. The time required to complete a 360^{0} rotation is 24 hours. The time required for the Earth to complete the rotation of 1^{0} longitude is 4 minutes. The time required for the rotation of 15^{0} longitudinal area is 1 hour.
17. The zero degree longitude is known as the Greenwich Meridian. Time is calculated worldwide based on the Greenwich Line. Hence this line is also known as the prime meridian.
18. Based on the Greenwich Median, the world is divided into 24 zones, each with a time difference of one hour. These are known as time zones.
19. The local time at the standard meridian is the standard time of that country.
20. The 82 ½^{0} E longitude which passes almost through the middle of these longitudes has been fixed as the standard meridian of India. 180^{0} longitude is known as International date line.
21. The travellers who cross international date line from the West calculate the time by advancing it by one day and those who cross the line from the west deduct one day.

Questions

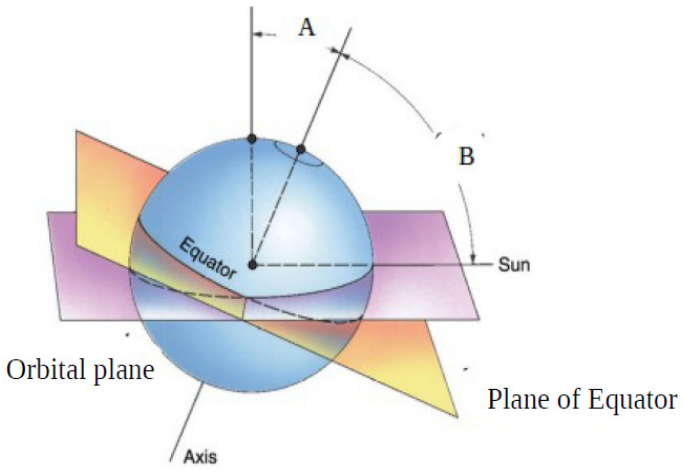
1. Identify the season during which the plants shed their leaves? (Score-1)

   a. Winter b. Spring c. Summer d. Autumn (Score-1)

2. Complete the table given below (Score-3)

Earth	Time required
To rotate 15^0	A .....
To complete one rotation	B. .....
To complete a revolution	C .....

3. The picture below shows the inclination of the Earth's axis. Observe the picture and write the answers to the following questions.



   a. What is the angle to be recorded in the A and B in the picture? (Score-3)

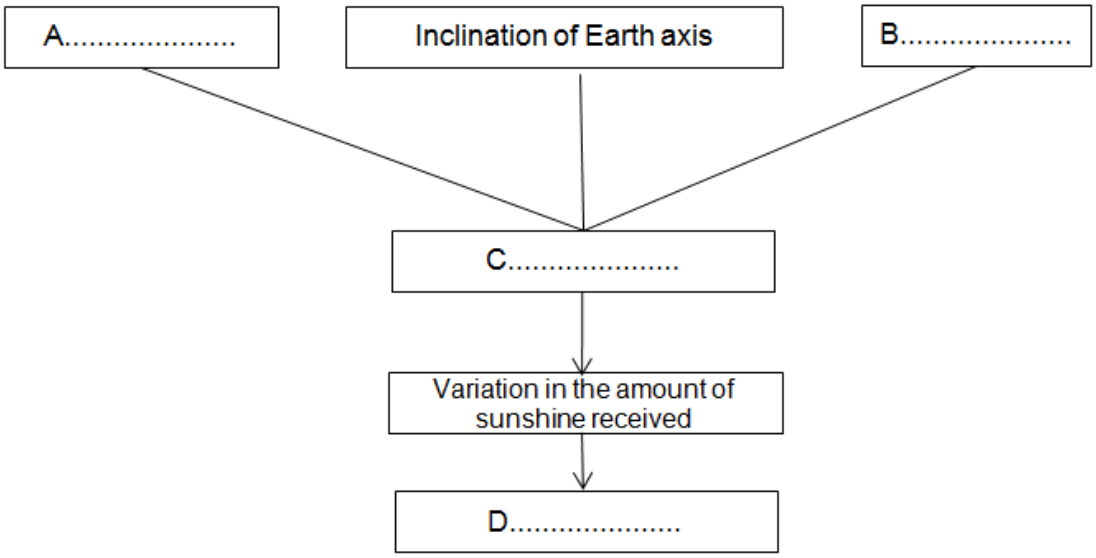
   b. What is the parallelism of the axis?

4. The apparent movement of the sun is caused by the parallelism of the Earth's axis.

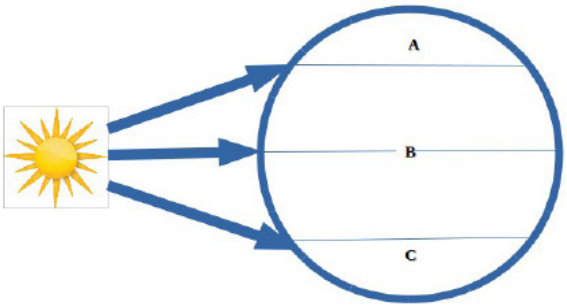
   a. What is apparent movement of sun?

b. What is the result of the apparent movement of the sun? (Score-4)

5. Fill in the blanks (score 4)



6. Analyse the picture below and answer the questions

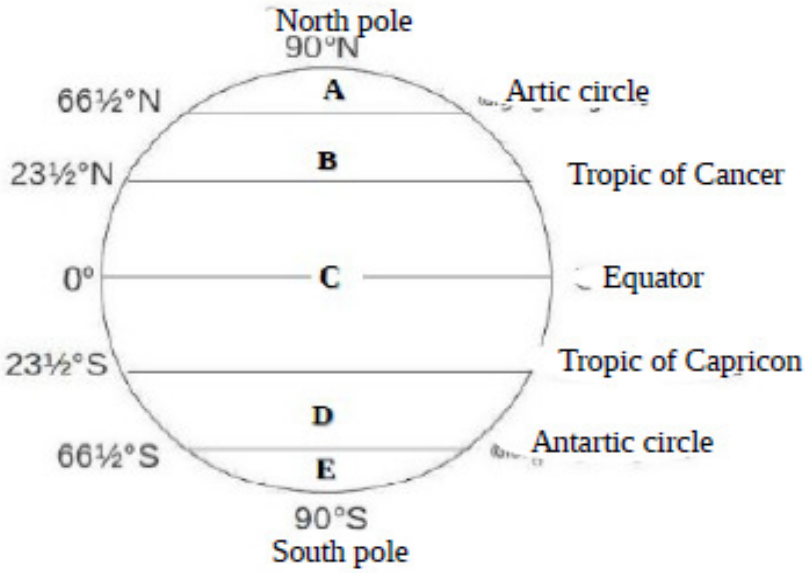


a. What is the variation in the availability of sunlight in the areas marked

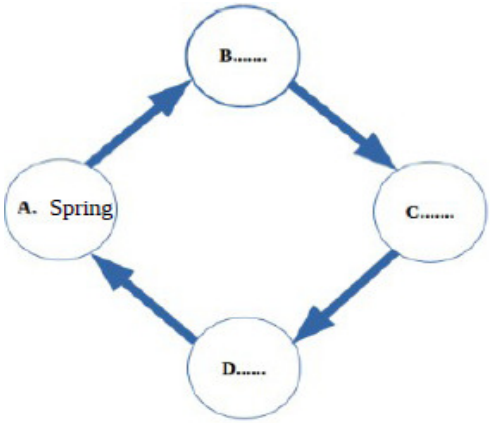
A, B and C (more / less)

b. What is the reason for the variation in the availability of sunlight received in? (Score-3)

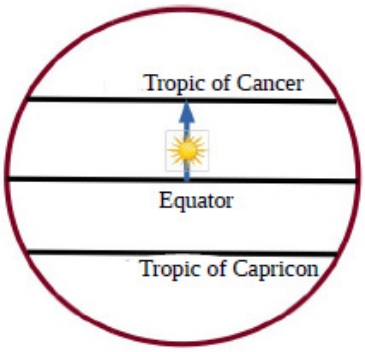
7. In which of the following areas marked in the picture below is the seasonal difference most felt? Why is it that in other areas the seasons do not feel significant? (Score-5)



8. Due to tthe apparrent movement of the sun,, differentt seasons on earth are cyclically repeated. Write the names of the seasons in order in the picture below (Score-3)



9. Which of the following days is a winter solstice in northern hemisphere?
   a) September 23 b) March 21 c) December 22, d) June 21
10. On which days do the sun races fall vertically on equator? What these days are called? What are the significant of these days? (Score-4)
11. On which day does the sun races fall vertically on tropic of cancer? (Score-4)
    By what name is this day known? What are the significant of this day?
12. On which day does the sun races fall vertically on tropic of Capricorn ?
    By what name is this day known? What are the significant of this day? (Score-4)
13. Observe the picture below and write the answers to the questions (Score-4)



   a. Apparent movement of the sun as shown in the figure, What is the season to feel In the Northern Hemisphere ?
   b. What are the characteristics of this season in the Northern Hemisphere?
   c. What is the season in the Southern Hemisphere during the same period?
14. Complete the table

Day	Apparent position of sun	Name of the day	
		Northern Hemisphere	Southern Hemisphere
Mrch 21	A……	Equinox	B……
C……	Tropic Cancer	D……	Winter Solistice
Sep-23	E……	F……	Equinox
G……	Tropic of Capricon	Winter Solistice	H……

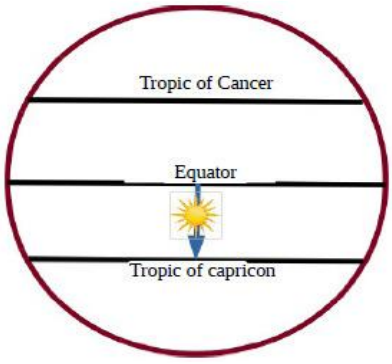
15. Complete the table (score 5)

Day	Apparent position of sun	Duration of day		Duration of night	
		Northern Hemisphere	Southern Hemisphere	Northern Hemisphere	Southern Hemisphere
March 21	A……	Equal	B……	Equal	Equal
C……	Tropic of Cancer	D……	Shortest	E……	Longest
Sep-23	F……	Equal	G……	Equal	Equal
H……	Tropic of Capricon	I……	Longest	Longest	j……

16. Complete the table (score 4)

Months	Apparent movement of sun	Season	
		Northern Hemisphere	Southern Hemisphere
From marh 21 to June 21	A	Spring	B
C	From tropic of cancer to equator	D	Winter
From September 23 to December	E	Autumn	F
G	From tropic of cancer to equator	H	Summer

17. Observe the picture below and write the answers to the questions

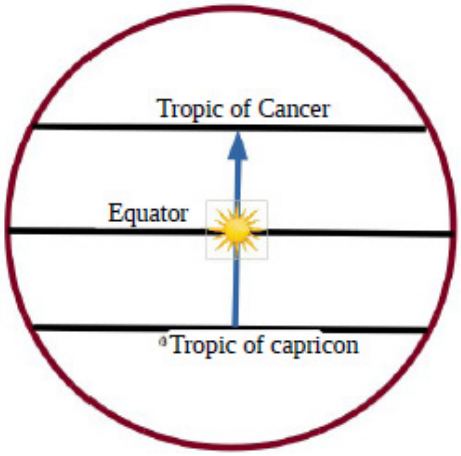


a. Apparent movement of the sun as shown in the figure, What is the season to feel In the Northern Hemisphere ? (Score-4)

b. What are the characteristics of this season in the Northern Hemisphere?

c. What is the season in the Southern Hemisphere during the same period?

18. Observe the picture below and write the answers to the questions. (Score-4)

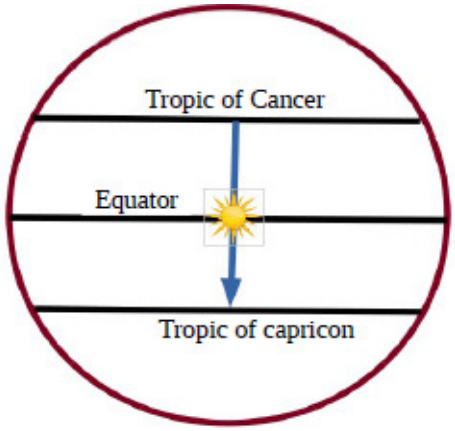


a. What is the name of the apparent movement of the sun mentioned in the picture?

b. When does this apparent movement of the sun begin and end?

c. What is the change in the duration of day during this period in the Northern Hemisphere?

19. Observe the picture below and write the answers to the questions. (Score-4)



a. What is the name of the apparent movement of the sun mentioned in the picture?

b. When does this apparent movement of the sun begin and end?

c. What is the change in the duration of day during this period in the Northern Hemisphere?

20. Select the appropriate ones from the brackets and fill in the blanks in the table below.

(Northern Hemisphere ,Southern Hemisphere,North pole,South pole)

Months	Apparent position of sun	6 months daylight	6 months night
March to september	A.....	B.....	C.....
September to march	D.....	E.....	F.....

(Score-3)

21. Each country considers a fixed longitude as a standard longitude for timing. Why? (Score-3)

22. Explain the importance of the Greenwich median and the International date line in time calculation. (Score-4)

23. Write the metropolitan cities in the picture in the order in which they first appear at sunrise (Score -4)

24. How long does it take for a 30^0 longitudinal area to pass in front of the sun? (Score-2)

25. What are the seasons experienced in India when the apparent position of the Sun is on Tropic of cancer and Tropic of capricon ? (Score-2)

26. Why is the 82^0 30^0 longitude considered to be the standard longitude of India? (Score-3)

27. What are the two transition periods between summer and winter? (Score-2)

28. Which of the following statements is not related to longitude

    a. Used for time calculation

    b. Help to identify time zone

    c. Value increases towards north (Score-1)

29. If two children start their journey from 0^0 longitude, one to east and the other to west up to 30^0 . What will be the time difference between them. (Score-3)

30. Which of the following days is a winter solstice day in northern hemisphere?

    a. September 23, b. March 21.

    c. December 22, d. June 21. (Score-1)

31. In which time in India we could see the live broadcast of a cricket match that started at 8. am in England.? Give reasons. (Score-4)

32. What are the factors that cause seasons? (Score-4)

33. What is the difference in duration of days and nights in the Northern Hemisphere on solstice days and equinoxes? (Score-4)

34. What is local time? (Score-1)

35. What time is at International date line when it is 12 noon at Greenwich meridian? (Score-1)

36. There are 365 days in a year. But some years include 366 days. What these years are called? Why are there 366 days in such years? (Score-3)

37. If you look at the calendar, it shows different sunrise times on different days. What is the reason? (Score-3)

38. Fill in the blanks in the table.

The season between winter and summer	**A**.....
The season between summer and winter	**B**.....
The season after spring	**C**.....
The season after Autumn	**D**.....

(Score-4)

39. The time difference between each degree longitude is 4 minutes.
    How is this calculated? (Score-2)
40. The earth is divided into 24 time zones.
    a. What is the longitudinal difference of each time zone?
    b. What is the time difference in each time zone? (Score-2)
41. There is an increase in time towards the east and decrease in time towards the west of all the longitude other than 180^0 longitude (Score-2)
42. Why do certain countries consider more than one longitude as their standard meridians? Give an example for such a country. (Score-2)
43. Which of the following is a longitudinal line drawn completely excluding land area?
    a. Equator
    b. Greenwich Meridian
    c. International Date line
    d. 82^0 30^0 East longitude (Score-2)
44. International date line is drawn deviated to avoid the land areas and to pass entirely through the ocean. What is the reason? (Score-2)
45. What is the standard meridian of India? What is the time difference between Indian Standard time and Greenwich time ? (Score-2)

Supporting Matrial

1. Which of the following statement is false?
    a. Earth rotates from west to east.
    b. Earth takes 24 hours to complete one rotation.
    c. In one hour, the sun passes over 4^0 longitudes
    d. The sun rises in the east.
2. On which day does the sun race fall vertically on tropic of cancer ?
    What is the name of this day?
3. What are the features of winter in the Northern Hemisphere?
4. Which of the following days is a summer solstice in southern hemisphere?
    a. September 23 b. March 21. c. December22 d. June 21.

5. Why is $82\frac{1}{2}^0$ E longitude considered as the standard meridian of India?
6. Time estimated based on the apex position of the Sun, is termed as .....
7. What is the parallelism of the axis?
8. What are the reasons for the variation in the amount of sun shine received on earth?
9. What are the features of spring in the Northern Hemisphere?
10. Which longitude is considered to be the standard median of India?
11. . ……. is drawn deviated to avoid the land areas and to pass entirely through the ocean.
12. What are the factors that cause seasons?
13. Why is the Greenwich Line called the Prime Meridian?

Answer key

1. d. Autumn
2. A. 1 hour B. 24 hour C. 365 Days 6 Hours
3. a) A- $23^0\ 30^0$, B- $66^0\ 30^0$

   b) The axis of the Earth is tilted at an angle of $66\frac{1}{2}^0$ from the orbital plane. If measured from the vertical plane this would be $23\frac{1}{2}^0$. The Earth maintains this tilt throughout its revolution. This is known as the parallelism of the Earth's axis.
4. a) Since the parallelism is maintained same throughout the revolution, the position of the Sun in relation to the Earth varies apparently between Tropic of Cancer and Tropic of Capricorn . This is known as the apparent movement of the Sun.

   b) The apparent movement of the Sun, due to the inclination of axis, is the reason for the occurrence of seasons.
5. a) Revolution of earth

   b) Parallelism of earth Axis

   c) Apparent movement of the sun

   d) Seasonal changes
6. a) Less, b) More c) Less

   b. Temperature will be higher over those places where the vertical rays of the sun fall. The temperature will be low at places where the sun's rays are slanting.

7. Characteristics of different seasons are clearly felt in the mid latitude or temperature zones. Marked as B and D in the frigid zone (A,E) the seasons do not feel significant as the sun's rays are inclined and availability of solar energy is less. Seasonal changes are not usually very obvious in the tropical regions because of the incidence of large amount of sun's rays throughout the year. Marked as - C
8. B. Summer C. Autumn D. Winter
9. December 22
10. The apparent position of the Sun during the Earth's revolution will be over the Equator on March 21 and September 23. Hence the length of day and night will be equal during these days on both the hemispheres. These days are called equinoxes
11. From 21 March onwards, the Sun apparently shifts from the Equator northwards and reaches vertically over the Tropic of Cancer on 21 June. This day is known as the Summer Solstice in the Northern Hemisphere. On this day the Northern Hemisphere experiences its longest day and shortest night.
12. The Sun continues its southward apparent shift from the Equator from 23 September and reaches vertically above Tropic of Capricorn ($23\frac{1}{2}^0$S) on 22 December. This day is known as Winter Solstice in the Northern Hemisphere. On this day the Northern Hemisphere experiences its shortest day and longest night.
13. a. Spring Season

    b. The period of transition from winter to summer

    Plants sprouting, mango trees blooming and jackfruit trees bearing buds
14. A. Equator

    B. Eqonox

    C. June 21

    D. Summer solstice

    E. Equator

    F. Equnox

    G. December 22

    H. Summer Solstice
15. A. Equator

    B. Equal

    C. June 21

D. longest

E. shortest

F. Equator

G. Equal

H. December 22

I. Shortest

J. Shortest

16. A. From equator to tropic of cancer

B. Autumn

C. From June 21 to September 23

D. Summer

E. From Equator to tropic of capricone

F. Spring

G. From December 22 to March 22

H. Winter

17. a. Autumn

b. Autumn marks the transition from the severity of summer towards winter. During this period, the atmospheric temperature decreases considerably. There is shortening of day and lengthening of night during the period. This is the season during which the trees generally shed their leaves. The shedding of leaves is a form of adaptation to survive the forthcoming dry winter.

c. Spring

18. a. Utharayanam

b. Northward apparent movement of the Sun from Tropic of Capricorn to Tropic of Cancer is termed as 'Utharayanam'. (from December 22 to June 21) (From winter solstice to summer Solstice)

c. The duration of day in the northern hemisphere gradually increases during this Utharayanam

19. a. Dakshinayanam

b. Following the summer solstice, the Sun sets its southward apparent movement from Tropic of Cancer and it culminates on Tropic of Capricorn on 22 December. This southward apparent movement of the Sun from Tropic of Cancer to Tropic of Capricorn is termed as 'Dakshinayanam'. (From summer solstice to winter Solstice)

c. The duration of day in the northern hemisphere gradually decrease during this Dakshinayanam

20. A. Northern hemisphere

    B. North Pole

    C. South pole

    D. Southern Hemisphere

    E. South pole

    F. North Pole

21. The local time would be different at each longitude. If we start calculating the local time at different places based on the longitude there, it would create a lot of confusion. To solve this, the local time at the longitude that passes through the middle of a country is selected as thecommon time for the whole country. Each country in the world considers the longitude that passes almost through its middle as the standard meridian. The local time at the standard meridian is the standard time of that country.

22. Greenwich Meridian. The zero degree longitude is known as the Greenwich Meridian. Time is calculated worldwide based on the Greenwich Line. Hence this line is also known as the prime meridian. The local time at the prime meridian is known as the Greenwich Mean Time. International date line - 180^0 longitude If 180^0 longitude passes through a country, the places situated East and West of this line will be having two different days. To avoid practical difficulties, certain necessary adjustments have been effected in this line with the result that it doesn't pass through the corresponding land areas. The travellers who cross this line from the West calculate the time by advancing it by one day and those who cross the line from the west deduct one day.

23. Calcutta, Chennai, Delhi,Mumbai

24 The time required for the Earth to complete the rotation of 1^0 longitude is 4 minutes.
Time required to cross the 30^0 longitudinal are is 30 X 4 = 120 minutes -2 hours

25 Tropic of Cancer – summer , Tropic of capricon -winter

26. The longitudinal extent of India is from 68^0E to 97^0E. The $82½^0$E longitude which passes almost through the middle of these longitudes has been fixed as the standard meridian of India.

27. Spring Season and Autumn Season.

28. c. Value increases towards northwards

29. The longitudinal difference between the places where the children stand is 68^0

There is a time difference of 4 minutes for one degree longitude.

60 X 4 -240 minutes (4 hours)

Time difference 4 hours

30. c. December 22

31. Standard Meridian of England - 0^0

    Standard Median of India - $82\ ½^0$ E

    Longitudinal Difference - $82\ ½^0$

    There is a time difference of 4 minutes for one degree longitude.

    Time difference - 82 ½ x 4 = 330Minutes = 5hours 30minutes (5 hours)

    Indian time is five and a half hours ahead of Greenwich Mean Time. Therefore, the live broadcast of the match in England at 8 am will be telecast in India at 1.30 pm.

32. There is variation in the sunlight that falls on the Earth due to the apparent movement of the Sun Revolution of Earth Inclination of earth Axis Parallelism of the Earth's axis

33. Length of day and night will be equal during Equinox. On summer solstice, the Northern Hemisphere experiences its longest day and shortest night.On winter solstice, the Northern Hemisphere experiences its shortest day and longest night.

34.Time estimated at each place, based on the position of the Sun, is termed as the local time.

35.12 p.m.

36. The earth takes 365 days and 6 hours to complete one revolution. 365 days are included in a normal year and by adding the rest 6 hours together one additional day is included in the fourth year which is in February (29 days).

37. When the sun is over the northern hemisphere northern hemisphere, experiences longer days and shorter nights. When the sun is over the southern hemisphere, thenorthern hemisphere experience shorter days and longer nights. This causes variations in the time of sunrise and sunset.

38. A. Spring

    B. Autumn

    C. Summer

    D. Winter

    The time required for the rotation of 15^0 longitudinal area is 15 X 4 = 60 minutes (1 hour).

39. The angular distance of the Earth is $360^{0.}$ We will get 360 longitudes if we draw one longitude

each for each degree of angular distance. The time required to complete a 360^0 rotation is 24 hours. On converting 24 hours into minutes 24 X 60 = 1440 minutes That is, the time required for the completion of one rotation = 1440 minutes The time required for the Earth to complete the rotation of 1^0 longitude is 1440/ 360= 4 minutes.

40. a. 115^0

    b. 1 hour

41. The Earth rotates from west to east. so the Sun rises in the east and sets in the west. So the time incidences towards east and decreases towards west

42. The countries with large longitudinal extent estimates more than one local time by considering more than one standard meridian. Example - Russia, China, United States.

43. c. International date line

44. There is a time difference of 24 hours between east and west of the international date line. If this line passes through the land, two different days will be experienced in the same populated area.

45. $82^0\ 30^0$ East longitude India's time is 5 hours and 30 minutes ahead of Greenwich Mean Time

Supporting Material

1. c. In one hour, the sun passes over 4° longitudes
2. Sun rays reaches vertically over the Tropic of Cancer (231D 2•‹N) on 21 June. This day is known as the Summer Solstice in the Northern Hemisphere.
3. The northward apparent shift of the Sun begins by 22 December and again reaches vertically above the Equator on 21 March. This period marks the winter season in the Northern Hemisphere.
4. c. December22
5. The $82\ ½^0$ East longitude passes almost through middle of India
6. Local time
7. The axis of the Earth is tilted at an angle of $66\ ½^0$ from the orbital plane. If measured from the vertical plane this would be $23\ ½^0$ (Fig.1.1). The Earth maintains this tilt throughout its revolution. This is known as the parallelism of the Earth's axis.
8. The Earth's revolution and the tilt of the axis are the reasons for the variation of sunshine received.
9. The Northern Hemisphere generally experiences spring season between 21 March and 21

June. Spring is the season of transition from winter to summer. Plants sprouting, mango trees blooming and jack fruit trees bearing buds are the characteristics features of this season.

10. 82^0 30^0 E longitude
11. International date line (180^0 longitude)
12. Apparent movement of the sun.

    Earth's Revolution.

    Inclination of the axis.

    Parallelism of earth axis
13. Time anywhere in the world is calculated based on the Greenwich Line.