Local Time And Standard Time

Exercise

Q. 1. A. Complete the sentence by selecting the correct option:

The earth requires 24 hours for one rotation. In one hour,
A. 5 longitudes will face the sun

B. 10 longitudes will face the sun
C. 15 longitudes will face the sun
D. 20 longitudes will face the sun

Answer : Longitude is the angular distance of a place east or west of the meridian at Greenwich, England. It is represented in degrees.

One rotation = 360^{o}

The time required for the earth to complete one rotation = 24 hours

Therefore, longitudes covered in one hour = 360/24 = 15°

Q. 1. B. Complete the sentence by selecting the correct option:

To calculate the difference between the local times of any two places on the earth,
A. the noon time at both the places should be known

B. the difference in degrees of their longitudes should be known
C. the difference in standard times of both the places should be known
D. Changes need to be made according to International Date Line

Answer : Local time is the time in a particular region or country. Longitude is the angular distance of a place east or west of the meridian at Greenwich, England. Each region has a particular longitude and latitude. Since, the earth rotates from west to east, the local time changes with respect to longitude. Thus, any difference between the local times of any two places on the earth can be determined by finding the difference in degrees of their longitudes.

Q. 1. C. Complete the sentence by selecting the correct option:

The difference between the local time of any two consecutive longitudes is
A. 15 minutes
B. 04 minutes
C. 30 minutes
D. 60 minutes

Answer : Longitude is the angular distance of a place east or west of the meridian at Greenwich, England. It is represented in degrees.

One rotation = 360^o

The time required for the earth to complete one rotation or 360^o = 24 hours

The difference in degrees between any two consecutive longitudes is 1^o

Thus, the difference between the local time of any two consecutive longitudes = 24/360 hours = 0.066 hour

1 hour = 60 mins

⇒ 0.066 hour = 4 mins

Q. 2. A. Give geographical reasons:

The local time is decided by the noon time.

Answer : Local time is the time in a particular region or country. It is determined on the basis of the apparent movement of the sun. When the sun is exactly over the head, it is noon at that place. The length of the shadow is shortest at noon. The local time of each longitude differs from other. Thus, noon occurs at different times in different longitudes.

Q. 2. B. Give geographical reasons:

The local time at Greenwich is considered to be the international standard time.

Answer : Local time is the time in a particular region or country. It is determined on the basis of the apparent movement of the sun. It is same for a region or country located on the same latitude. However, countries located in different longitudes have different local times. Thus, for an international coordination between countries, the local time at Greenwich (Greenwich Mean Time) in England is considered to be the international standard time. The standard times of various countries are calculated with reference to GMT by calculating the longitudinal difference.

For instance, if it is noon at Greenwich, the Indian standard time would be 5:30 PM

Longitudinal coordinates of Greenwich = 0

Longitudinal coordinates of India = $82^o30'E$

Longitudinal difference = $82^o30'E$

Time taken to cover one longitudinal degree = 4 minutes

Standard time of India = GMT + (82.5) *4 minutes = GMT + 330 minutes = GMT + 5:30 hours

Q. 2. C. Give geographical reasons:

The standard time of India has been decided by the local time at 82.5° E longitude.

Answer : Local time of any place is determined by its longitudinal location. India's longitudinal extent varies from 68°7'E to 97°25'E. It will be cumbersome to have local time based on each longitudinal degree. Thus, to avoid the problems of poor coordination and to maintain uniformity, a standard longitudinal of 82°30'E was taken as a reference to determine the standard time of India. This longitude passes through the middle of the country with reference to its longitudinal extent. When the sun is directly overhead on this longitude, then it is assumed that it is 12 noon everywhere in India.

Q. 2. D. Give geographical reasons:

Canada has 6 different standard times.

Answer : Canada is one of the biggest countries in the world. It ranges from 52° W to 141° W. Thus, the local time in the east is nearly 6 hours ahead of the west. If Canada had selected a time single time zone, then both east and west Canada would be offset from local time by 3 hours. Then, eastern Canada would experience noon by 9:00 AM and 3:00 PM in western Canada. Thus, Canada has gone for multiple time zones. From west to east the time zones are Pacific, Mountain, Central, Eastern, Atlantic, and Newfoundland.

Q. 3. A. Answer in brief:

If it is 12 noon at 60°E longitude, then explain what would be the time at 30° W longitude?

Answer : Local time of any place is determined by its longitudinal location. The time at 30° W longitude can be determined with reference to know the time at any given longitudinal location.

the difference in the longitudinal stretch with known reference = 60°E - 30°W =90°

Time is taken to travel longitudinal degree = 4 minutes

Time taken for 90° = 90*4 = 360 minutes = 6 hours

Thus, if it is 12 noon at 60°E longitude, then time at 30° W longitude would be 6 AM.

Q. 3. B. Answer in brief:

How is the standard time of a place determined?

Answer : Local time of any place is determined by its longitudinal location. It varies with different longitudes. As a result, many places within a country can have multiple local times. This could disrupt the coordination in the routine activities in the country. Thus, the local time of a longitude passing through the middle of the country is taken as the standard time for that country. This standard time is used all over the country. Usually, a single standard time is used if the difference between the longitudinal extent of the country is less than 1 or 2 hours, otherwise, multiple standard times are used. For example, Canada has 6 time zones.

At the global level, the world has been divided into 24 time zones. These time zones have been created with reference to the Prime Meridian itself. Thus, the standard time of any country is expressed in terms of GMT.

c) A football match being played at Sao Paulo, Brazil started in India at 6 am IST. Explain what would be the local time at Sao Paulo?

Local time of any place is determined by its longitudinal location. There is a wide longitudinal extent between Brazil and India. Thus, local times of both countries would vary to a large extent.

Longitudinal location of Sao Paulo, Brazil = 46°38'W

India's standard longitudinal location = 82º30'E

Longitudinal Difference = 82º30'E - 46°38'W = 129.13°

Time difference = 129.13° *4 minutes = 516.53 minutes = 8.60 hours

Thus, local time at Sao Paulo, Brazil = 9:24 PM of previous day.

Q. 4. If it is 10 pm on 21st June at Prime Meridian, write the dates and time at A, B, and C in the table.

Place	Longitude	Date	Time
A	120° E	**22 June**	**6:00 AM**
B	160° W	**21 June**	**11:20 AM**
C	60° E	**22 June**	**2:00 AM**

Answer : Date changes post 12:00 AM

Earth rotates from west to east

Earth takes one hour to complete 15°

GMT = 10:00 PM, 21st June

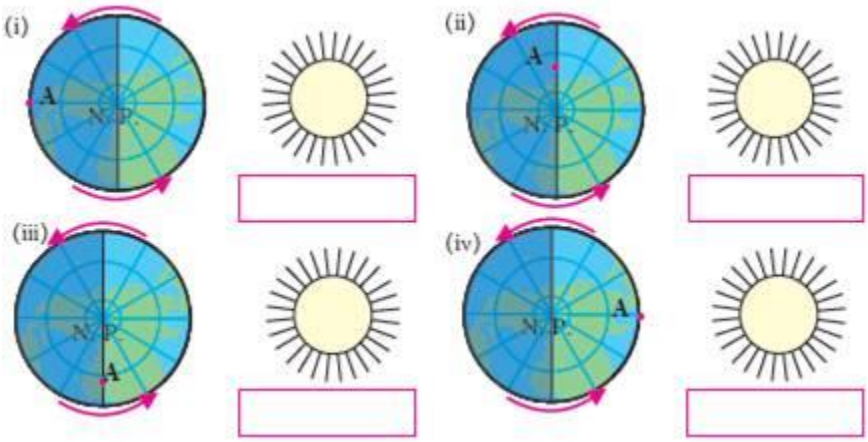
Place A: time difference = GMT + (120° E/15) = GMT + 8 hours

Place B: time difference = GMT - (160° W /15) = GMT – 10.6 hours

Place C: time difference = GMT + (60° E /15) = GMT + 4 hours

Q. 5. Write the situations of place A shown in these diagrams in the boxes below them:

(i) Sunrise (ii) midnight (iii) noon (iv) Sunset



Answer :

i. Midnight. Point A lies in the shadow region. Also, it is located diametrically opposite to the position of noon. Hence, Midnight

ii. Sunset. Point A is about to enter into the shadow region, as indicated from the direction of rotation (counter-clockwise). Hence, Sunset

iii. Sunrise. Point A is about to enter into the sunlight region, as indicated from the direction of rotation (clockwise). Hence, Sunrise

iv. Noon. Point A lies in the sunlight region. Also, the sun is exactly over the head of point A. Hence, Noon.

Activity

Q. 1. A. Look for the actual granny's clock in Shri Acharya Atre's poem: "Aajiche Ghadyal" (granny's clock). Look for this poem on the internet or in reference books.

Answer : आजीचे घडयाळ

आजीच्या जवळी घडयाळ कसले आहे चमत्कारिक,

देई ठेवुनि तें कुठे अजुनि हे नाही कुणा ठाऊक;

त्याची टिक टिक चालते न कधिही,आहे मुके वाटते,

किल्ली देई न त्यास ती कधि,तरी ते सारखे चालते

"अभ्यासास उठीव आज मजला आजी पहाटे तरी",

जेव्हा मी तिज सांगुनी निजतसे रात्री बिछान्यावरी

साडेपाचही वाजतात न कुठे तो हाक ये नेमकी

"बाळा झांजर जाहले, अरवला तो कोंबडा,ऊठ की !"

ताईची करण्यास जम्मत, तसे बाबूसवे भांडता

जाई संपुनियां सकाळ न मुळी पत्त कधी लागता !

“आली ओटीवरी उन्हे बघ!” म्हणे आजी,”दहा वाजले !

जा जा लौकर !” कानि तो घणघणा घंटाध्वनी आदळे.

खेळाच्या अगदी भरांत गढुनी जाता अम्ही अंगणी

हो केव्हा तिनिसांज ते न समजे ! आजी परी आंतुनी

बोले, “खेळ पुरे, घरांत परता ! झाली दिवेलागण,

ओळीने बसुनी म्हणा परवचा ओटीवरी येउन !”

आजीला बिलगून ऎकत बसू जेव्हा भुतांच्या कथा

जाई झोप उडून, रात्र किती हो ध्यानी न ये ऎकता !

“अर्धी रात्र कि रे” म्हणे उलटली,”गोष्टी पुरे ! जा पडा !”

लागे तो धिडधांग पर्वतिवरी वाजावया चौघडा

सांगे वेळ,तशाच वार–तिथीही आजी घडयाळातुनी

थंडी पाऊस ऊनही कळतसे सारें तिला त्यांतुनी

मौजेचे असले घड्याळ दडुनी कोठे तिने ठेविले?

गाठोडे फडताळ शोधुनि तिचे आलो ! तरी ना मिळे !

Q. 1. B. Find out the velocity of the earth’s rotation in km/ hour.

Answer : Earth’s circumference = 40,075 km

Time taken for earth to complete one rotation = 24 hours

Thus, velocity of the earth’s rotation in km/ hour = 1669.79 km/hour.

Intext Questions

Q. 1. Why does the duration of day and night keep changing?

Answer : The duration of day and night changes due to the rotation of the earth. The earth takes 24 hours or one day to complete one rotation. The sun rises in the east, and the movement of the earth is from west to east. Hence we experience changes in day and night and other phenomena of sunset, sunrise and midnight.

Q. 2. How many longitudes can be drawn on a world map keeping an interval of 1° each?

Answer : In total there can be 360 longitudinal degrees possible. This is because of the shape of our earth which is quite a circle and in a circle, there are 360 degrees. But when we flatten out the map to a piece of paper, we add the fence post problem. Now there are 361 longitude lines on the paper, but two of them are the same line, the 180-degree line which would appear on each side of the map. Hence there are 360 longitudinal lines.

Q. 3. The apparent movement of the sun from east to west is a result of what?

Answer : This is due to the law of inertia. The earth is considered to be moving from west to east. When we see celestial bodies moving from within a planet already moving, the law of inertia comes to play. Hence we see those bodies moving from east to west. The apparent movement of the sun from east to west is also a result of the same.

Q. 4. What is the direction of the rotation of the earth?

Answer : The movement of the earth is considered to be from east to west. As viewed from the North Pole star Polaris, the earth turns counter clockwise. Hence it is observed that it rotates from east to west.

Q. 5. While the earth rotates, how many longitudes face the sun daily?

Answer : Every longitude on the earth will face the sun at some point. It is due to the rotation of the earth. In any event, all the lines of longitude will face the sun every 24 hours. When the earth rotates and completes a rotation, every twenty-four hours each and every longitude once faces the sun.

Q. 6. At which longitude does the date change?

Answer : Date changes by means of International Date Line as an imaginary line of demarcation that runs from the North Pole to the South Pole. International Date Line was established in 1884 and passes through the mid-Pacific ocean roughly follows a 180 degrees longitude north-south line on the earth.

Q. 7. How was time measured in olden days?

Answer : Time was measured with the help of various tools and depended on natural events for the measurement of time in olden ways. Instruments like Ghatikapaatra (a

bowl with a minute hole at its base which would float in a large water-filled vessel), sand timer, sundials, etc. were used by people in ancient times. A whole day meant the duration from one sunrise to the next.

Q. 8. In present times, what are the instruments used for time measurement?

Answer : In present times clocks and watches are used as instruments for time measurements. Also, gadgets like mobile phones, laptop, computer, digital clocks, etc. are also used. For a very accurate time measurement atomic clocks are also used in present times.

Q. 9. At the poles, sunrise occurs on one equinox and sunsets on the next equinox. If you happen to be at any of the poles during this time, then what would be the route of the sun in the daytime?

Answer : Right from the day equinox occurs, constant day and night conditions begin in poles. If one happens to be at the North Pole during an equinox at the time of sunrise, then the route of the sun is negligible. There are no directions. The sun appears above the horizon in summer and makes a 360-degree circle in the sky over a period of 187 days at the North Pole 90 degree north latitude, and in winter the sun is below the horizon for 163 days of darkness and 24 days of semi-darkness when the sun is just below the horizon. The same is the situation on the South Pole which faces darkness when there is sunrise at the North Pole.

Q. 10. On which day would the sun appear at the highest point in the sky?

Answer : During solstice, the tilt of the earth's axis is pointed most directly towards or away from the sun. The summer solstice for the northern hemisphere occurs within a few days of June 21 every year. It is on this day that the position of the sun in the sky at noon is at its highest altitude of the year. The position of the sun at the sunrise and sunset is farthest on this day. Hence on 21 June, the sun appears at the highest in the sky.

Q. 11. We have studied that the local time is different in different parts of the world. The daily routine of the people there is determined according to the local time in those places. Figure 1.3 shows the local times of different longitudes. Study this map and answer the following questions. Use the relationship between degrees and time for this.

A) Between which longitudes do the region experience daytime?

B) Which longitudes experience noon and midnight respectively?

C) Edward from New Orleans is on which longitude?

D) What is the time at Accra city?

E) At the same time, what is Sharad from Patna and Yakaito from Japan doing? What time is it in these cities?

F) Select any one longitude. Calculate the local time of the longitudes lying 1° to the west and east of this longitude.

Answer : A) The region which experiences daytime lies between the longitude 90-degrees East and 90-degrees West.

B) The longitude which experiences noon is the zero degrees longitude which is also called Greenwich Mean Time and the longitude which experiences midnight is 180 degrees east or west longitude. (180 degrees east and 180 degrees west are the same).

C) Edward from New Orleans is located on longitude 90 degrees 04'west in the United States.

D) Accra city is located at latitude 5.55 degree and longitude -0.19 in the northern hemisphere as shown in the map. Hence the time is 12 noon.

E) At the same time Sharad from Patna is going to school as it is early in the morning and Yakaito from Japan is preparing her bed as she is going to bed for sleep because it is night there.

F) Let the selected longitude be 30 degrees. The time at this longitude is two p.m. that is it is the daytime. The difference between two consecutive longitudes is 4 minutes.

So the longitude lying 1 degree east to the 30-degrees longitude is 31-degrees longitude. The time at this longitude will be

2:00 p.m. + 4 minutes (as the difference between two consecutive longitudes is of 4 minutes) = 2:04 p.m.

Similarly, the longitude lying 1 degree west to the 30-degrees longitude is 29-degrees west longitude and the time is calculated as

2:00 p.m. – 4 minutes which would be equal to 1:56 p.m. or 13:56 hours according to the hours of the day.

Q. 12. What is the maximum number of local times that can there be in the world?

Answer : Currently there are 38 different local times in use around the world. Including its overseas territories, France uses ten different time zones, the most of any country.

Q. 13. How many longitudes pass the sun in one hour?

Answer : 15 degree of longitude passes under the sun every hour. By dividing 360 by 24 the answer we get is fifteen degree, in other words, the sun appears to move at a speed of 15 degrees per hour. The change is hardly noticeable in multiple human lifetimes however everything counts in large number.

Q. 14. Look for the map of world time zones from reference books and see in which time zone India falls into?

Answer : There are several time zones in the world. India falls into time zone known as Indian Standard Time (IST) currently. It is five and a half hour ahead of Greenwich Mean Time.

Q. 15. Mumbai is located at 73° E longitude. Kolkata is located at 88° E longitude. Find the difference between the longitudes of these two cities.

Answer : The difference between the two longitudes of Kolkata and Mumbai is 15 degrees. This is calculated as:

Longitude of Kolkata – longitude of Mumbai

As Mumbai is located at 73-degree longitude and Kolkata is located at 88-degree longitude the calculation will be as follows:

Which is, 88 degrees – 73 degrees = 15 degrees.

Q. 16. If the local time at Mumbai is 3 pm then what would be the local time at Kolkata?

Answer : If the local time at Mumbai is 3 p.m. then the time in Kolkata would be 4: 02 p.m. The difference is approximate of an hour and exactly two more minutes. This is calculated using the difference between their longitudes. Mumbai is 72 degree 50'E and Kolkata is 88 degrees 23'E. So the difference between them is 15.5 degree.

As

1 degree equals to 4 minutes. This means that for each degree of longitude, the local time differs by 4 minutes.

Therefore, converting 15.5 degrees into minutes, we get 62 minutes

Which is two minutes more than an hour.

Adding 62 minutes into 3 p.m., we get 4: 02 p.m.

Q. 17. Look at figure 1.4 and answer the following questions:

Considering the longitudinal extent of India, how many longitudes with a difference of 1° can be drawn on the map?

Answer : The longitudinal extent of India is 68 degrees 7'E and 97 degrees 25'E. Considering the longitudinal extent of India 28 Longitudes can be drawn on the map of India.

Q. 18. Look at figure 1.4 and answer the following questions:

By how many minutes do two consecutive longitudes differ?

Answer : The difference between two consecutive longitudes is of 1 degree, and one degree is equal to 4 minutes. Hence the difference between any two consecutive longitudes is for four minutes.

Q. 19. Look at figure 1.4 and answer the following questions:

What is the value of degrees of longitude at Mirzapur?

Answer : The value of degrees of longitude at Mirzapur is 82 degree 30 East. The Indian Standard Time is calculated on the basis of this longitude only in Mirzapur, Uttar Pradesh which is nearly on the corresponding longitude reference line.

Q. 20. Look at figure 1.4 and answer the following questions:

If it is 8 a.m. at 82° 30' E, what would be the time in their clocks at the following places?

- **Jammu**
- **Madurai**
- **Jaisalmer**
- **Guwahati**

Answer : The time will remain the same everywhere because there is only one -time zone across the whole of India. The time zone is calculated according to the longitude of 82.5 degrees E. at Shankar garh Fort in Mirzapur (in Allahabad district of Uttar Pradesh) which was picked as the central meridian for India.

Q. 21. Look at figure 1.4 and answer the following questions:

Though the distance between them is more why doesn't the standard time differ in these places?

Answer : This is because of the adoption of the central meridian of India located in Mirzapur. The time zones were officially established in 1884 during the British Rule. Indian Standard Time was introduced on January 1, 1906. According to this timezone,

all the activities official or unofficial take place. The government chooses to keep a single time zone across the whole country despite various requests and proposals to change it.

Q. 22. If it is 8 a.m. in India, what is the time in Greenwich?

Answer : India is five and a half hours ahead of Greenwich Mean Time. So if it is 8 a.m. in India, then it would be 2:30 p.m. in Greenwich which is calculated by adding five and a half hour to Greenwich Mean Time.

Q. 23. When it is 2 p.m. in India, in which countries would it be 2 p.m. too?

Answer : The countries which use the same longitude to calculate their mean time would follow the same time zone and have equal time to that of India. There is no other country which uses the same longitude to measure the time. Hence when it is 2 p.m. in India, there is no other country in which it would be 2 p.m.

Q. 24. When it is 9 a.m. in India, what would be the time at 82° 30' W longitude?

Answer : The places which are located on 82 degrees 30'W longitude are Southampton Island, Canada, United States, Cuba, and Panama. The time when it is 9 a.m. in India in these countries will be 10:30 p.m.

Q. 25. What would be the time at Prime Meridian when a new day starts at 180° longitude?

Answer : When a new day starts at 180-degree longitude the time at the prime meridian will obviously be noon. It is 12 hours earlier when a new day starts at the International Date Line.

It's 00:00 on the Date Line. There are 24 hours in a day. On the prime meridian which is half the world away the time would be 24 divided by half which will come equally to 12.

Hence 12:00 would be the time on the Prime Meridian.

Q. 26. In which of the following countries, does only one standard time exist?

- **Mexico**
- **Sri Lanka**
- **New Zealand**
- **China**

Answer : From the following countries China is the country which has only one standard time zone which is followed by easternmost China and westernmost China. This was the Communist Party decision to use Beijing time across the country to

enhance national unity. From most people in China, the single time zone is at most mild inconvenience a scheduling quirk that simply requires a little adjustment.

Q. 27. Why does a country having a large latitudinal extent have only one standard time?

Answer : A country of large latitudinal extent should have only one standard time because there should be no confusion of time, so the standard time is taken from a particular place for a whole country. If the country does not have a standard time, all the functions will take place at the different time which might lead to a hectic schedule. It is difficult to rule with two or more times. This type of variations can cause several differences in official and another job which are depending on proper time accuracy. For example, in Russia, there are eleven-time zone so a person standing at one end will have to call in the night to reach another end in midday

That's why these countries follow an average standard time of all time ranges to avoid any time-related confusions.