



Globe – Latitudes and Longitudes



The centre of attraction of our study is our planet, Earth. From the previous chapter we have already gathered knowledge about the shape of the Earth. The true shape of the Earth is termed as 'Geoid' which means **Earth-shaped**. It bulges at the equator but is slightly flattened at the poles. The diameter of the Earth round the equator is 12,756 km while the polar diameter is 12,712 km. The best proof regarding the shape of the Earth comes from aerial photographs taken from satellites.

Did you know?

The shape of the Earth is also termed as oblate spheroid, which is similar to an orange.

Earth is the only Planet which has living organisms.

To study the shape of the Earth, its various features and characteristics in our geography laboratory and classroom we have devised a Globe. A true three-dimensional model of the Earth or any spherical celestial body is called a 'Globe'. It is a three-dimensional scale model of the Earth.



Fig. 2.1 : A Globe

WORDOLOGY

The word globe comes from the Latin word 'globus' meaning sphere.

When you look at a globe in the classroom or a museum you will notice that it is usually mounted at an angle. The angle of the mounting represents the axis or the angle of the planet in relation to the sun. The axis of the real Earth is an imaginary line passing from North Pole to South Pole, along which the Earth rotates. We can spin the globe because of this mounting to represent the spinning of the Earth on its axis. This makes it easy to visualise day and night and the changing seasons. The axis of the Earth is tilted at an angle of $23\frac{1}{2}^{\circ}$ to the vertical plane.

A key question which comes to our mind whenever we go somewhere is "where am I?" Throughout human experience this question has prompted man to find out some means to find this out. The ancient Greek geographer, Ptolemy, created a grid system of the world in his book 'Geography' for locating places on Earth. In the Middle Ages the present latitude and longitude system was developed and implemented for this purpose.

FACT FILE

The earliest known globe was constructed in 150 BC in Turkey. Eartha, currently the world's largest rotating globe (41 feet in diameter), is at the Delorme Mapping Centre's headquarters in Yarmouth, Maine (USA).

LOCATION OF PLACES ON THE GLOBE

Latitudes and Longitudes

The Earth's surface is so vast that it is impossible for anybody to locate a place on it without the help of mathematical calculations. The location on Earth is done with reference to **imaginary lines**, parallels and meridians, also termed as latitudes and longitudes.

The equator is an imaginary line that passes from east to west through the centre of the Earth. The set of lines running east to west, parallel to the equator, are called lines of latitude. Latitude lines run horizontally.

Another set of lines run north to south converging at the poles. These vertical lines are termed as longitudes.

The intersection of latitude and longitude pin-points the location of a place on Earth. For example, Delhi is located at 28.36°N , 77.12°E .

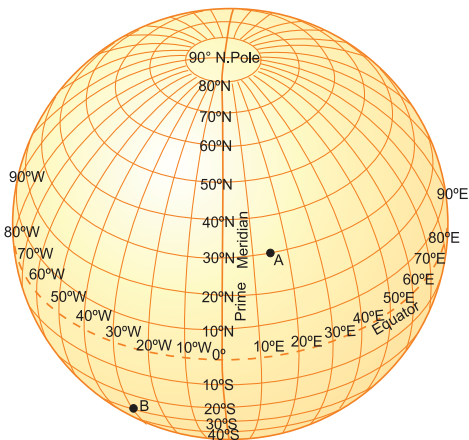


Fig 2.2 : Parallels of Latitude and Meridians of Longitude

Earth Grid

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Location of Point A at 30°N 15°E

Find out Location of Point B. _____

	Place	Latitude	Longitude
1.	Delhi	$28^{\circ} 38' \text{N}$	$77^{\circ} 12' \text{E}$
2.	Kolkata	$22^{\circ} 34' \text{N}$	$88^{\circ} 24' \text{E}$
3.	Chennai	$13^{\circ} 04' \text{N}$	$80^{\circ} 17' \text{E}$
4.	Mumbai	$18^{\circ} 55' \text{N}$	$72^{\circ} 54' \text{E}$

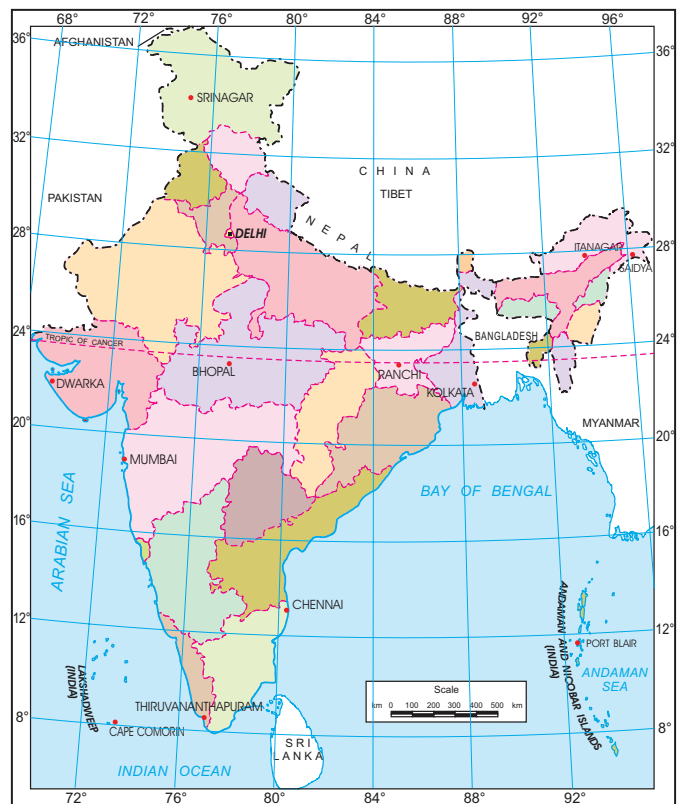


Fig 2.3 : India — Location of important cities of India

5.	Thiruvananthapuram	$8^{\circ} 29' \text{N}$	$76^{\circ} 59' \text{E}$
6.	Srinagar	$34^{\circ} 06' \text{N}$	$74^{\circ} 51' \text{E}$
7.	Dwarka	$22^{\circ} 14' \text{N}$	$69^{\circ} 01' \text{E}$
8.	Itanagar	$27^{\circ} 08' \text{N}$	$93^{\circ} 40' \text{E}$
9.	Sadiya	$27^{\circ} 05' \text{N}$	$95^{\circ} 42' \text{E}$
10.	Cape Comorin	$8^{\circ} 04'$	$77^{\circ} 36' \text{E}$

Find out

Places	Latitude	Longitude
Bhopal		
Ranchi		
Kohima		
Port Blair		

The latitudes and longitudes are measured in degrees like that of a circle. For precise location of places on the Earth's surface, the degrees are further divided into minutes and seconds (e.g. $28^{\circ}38'$).

Table 2.1 : Important Latitudes and Their Importance

Most important parallels of latitude	Degrees	Importance
North Pole	90°N	Receives slanting rays of sun and, therefore, has extremely cold climate. Sun's rays last continuously for six months in summer. For the other half of the year, it is in complete darkness.
Arctic Circle	66½°N	Receives slanting rays, therefore, has cold climate with long winters and short summers. Sun does not set on 21st June.
Tropic of Cancer	23½°N	Sun shines vertically overhead on 21st June. Northern Hemisphere experiences summer and Southern Hemisphere has winter.
Equator	0°	Most important parallel, divides the Earth into two equal halves. Receives direct rays of the Sun. Hot climate throughout the year.
Tropic of Capricorn	23½°S	Sun shines vertically overhead on 22nd December. The earth has Summer in Southern Hemisphere, winter in Northern Hemisphere.
Antarctic Circle	66½°S	Receives slanting rays. It has cold climate with short summers and long winters. Sun does not set on 22nd December.
South Pole	90°S	Six months of daylight and six months of darkness — extremely cold.

The Earth's grid is a network of parallels of latitudes and meridians of longitudes.

LATITUDE

Latitude is the angular distance of a point on the Earth's surface, measured in degrees from the centre of the Earth, north or south of the equator.

Characteristics of latitudes

- Latitudes are also known as parallels as they are circles parallel to the equator.
- They are at equidistant from each other. The distance between two parallels is approximately 111 km.
- All parallels except the poles are complete circles (Fig. 2.4).
- Their circumference decreases gradually from the equator to the poles, where they are simply points — the North Pole and South Pole.
- The equator is the largest parallel latitude.

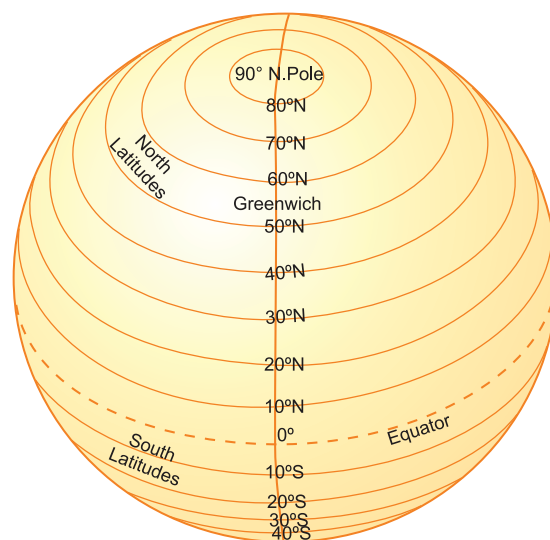


Fig. 2.4 : Parallels of Latitude

The portion of the Earth to the north of the equator is termed as Northern Hemisphere while that to the south of the equator is termed as Southern Hemisphere.

The equator is the only Great Circle. It divides the Earth in two equal halves. All the other parallels are small circles.

The distance from equator to the poles is one-fourth of a circle. So the poles are actually points perpendicular to the equator and located at an angle of 90°.

With equator as 0° latitude we have 90° parallels of latitude to the north of equator and 90° parallels to the south of it. So, the value of each latitude is followed with either North or South.

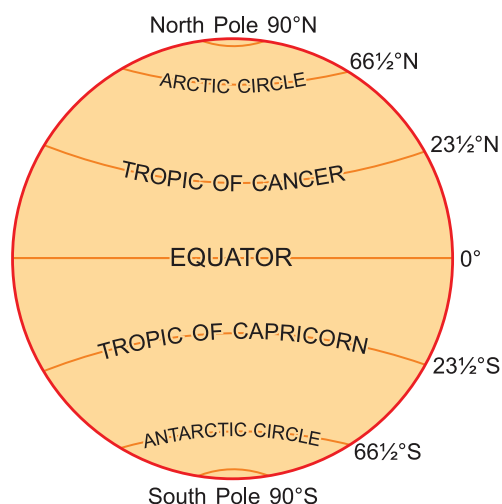


Fig. 2.5 : Important Parallels

Table 2.2 : Heat Zones of the Earth

Latitude	Heat Zones	Location	Characteristics
66½°N to 90°N	Frigid Zone	Arctic Circle to North Pole	Coldest Zone. In winter sun does not rise for six months at poles and does not set for six months in summer.
23½°N to 66½°N	North Temperate Zone	Tropic of Cancer to Arctic Circle	Zone of Moderate climate. Sun's rays are slanting, hence, it is neither very hot nor very cold.
23½°N to 23½°S	Torrid Zone	Tropic of Cancer to Tropic of Capricorn	'Torrid' means 'Hot'. Areas within this zone experience vertical rays of the midday sun at least once a year. Temperatures are high throughout the year with very little difference between summer and winter.
23½°S to 66½°S	South Temperate Zone	Tropic of Capricorn to Antarctic Circle	Moderate climate. Both in North and South Temperate Zones, days become longer in summers and shorter in winters.
66½°S to 90°S	Frigid Zone	Antarctic Circle to South Pole	Coldest Zone. Rays of the sun are always slanting.

WORDOLOGY

Lines of longitude are also called **meridians**, derived from the Latin word "meri" – a variation of "medius" which denotes 'middle', and "diem" meaning day. The word once meant 'noon' or midday.

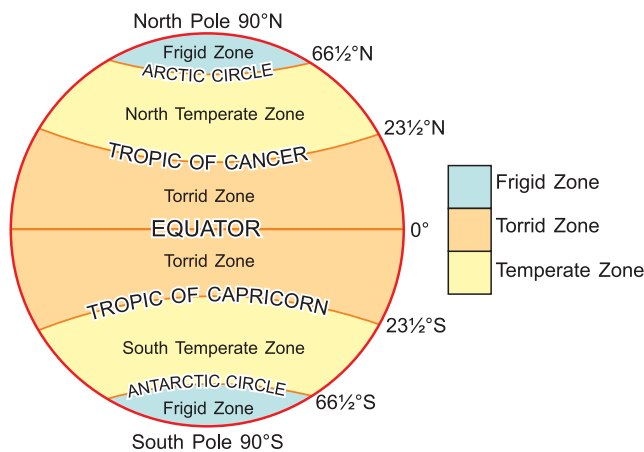


Fig. 2.6 : Heat Zones of the Earth

Importance of latitudes

- Latitudes help us to determine location of places and their relative distances.
- Latitudes help us to demarcate the Earth into Heat Zones, based on similar temperature conditions between the latitudes.
- We can determine the general temperature and climate of a place with the help of latitudes.
- It helps us to form an idea about the vegetation and wildlife of a place.

LONGITUDE

We already know that to locate any place on the Earth's surface, we need to refer to the location of the place east or west from a given

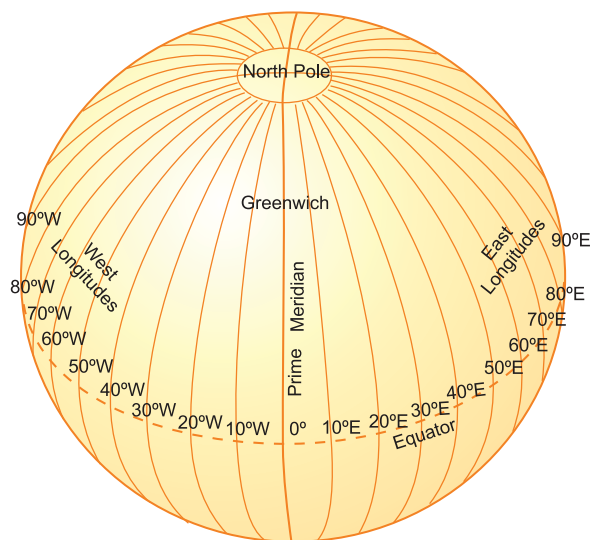


Fig 2.7 : Meridians of Longitude

line of reference, apart from knowing the latitude of the place. For example, Allahabad in India and Hyderabad in Pakistan (before the division of the country in 1947, Hyderabad of India was called Hyderabad **Deccan** while Hyderabad of Pakistan was known as Hyderabad **Sind**) are located along the same latitude $25^{\circ} 25' N$, but we can know about the actual location of the place only when we refer to its longitude along with the latitude. Allahabad is located at $81^{\circ} 85'$, approximately, $82^{\circ} E$ longitude while Hyderabad of Pakistan is located along $68^{\circ} 36' E$ longitude.

On the globe, the lines of longitude extend from pole to pole. It looks like an peeled orange.

The line of reference for locating places east or west is the **Prime Meridian**. For historical reasons, in 1884, the meridian passing the old **Royal Astronomical Observatory in Greenwich, England**, was chosen as the 0° longitude or Prime Meridian. There are 180 meridians to the east and 180 meridians to the west of the Prime Meridian. They are angular distances of a place east or west of the Prime Meridian, measured from the centre of the Earth.

However, if you observe a globe you will see that $180^{\circ} E$ and $180^{\circ} W$ meridian is the same line. The total number of the lines of meridian on the globe are 360.

Characteristics of longitude

All meridians are half circles because they join the North and South Poles. They are of equal length. Look at the globe again, you will see that 180° meridian and 0° meridian (Prime Meridian) meet each other to form a complete circle. They divide the Earth into two equal halves – the Eastern Hemisphere and the Western Hemisphere.

Two opposite meridians meet to form a complete circle. They divide the Earth into two equal halves, so all meridians are termed as 'Great Circles'.

The distance between the lines of longitude decreases from 111 km at the equator towards the poles where the distance is zero as all the meridians meet here. Meridians are not parallel

to each other like latitudes. The meridians are equidistant to each other.

Importance of longitude

Apart from helping in locating places, longitudes play a prime role in measuring time.

Since time immemorial our concept of time is based on the position and apparent movement of Sun across the sky. This is due to rotation of the Earth on its axis from west to east. The Earth completes one circle of rotation through 360° in 24 hours. This means that each of the 360 degrees of longitude faces the sun at midday once in 24 hours. We can also say that the Earth rotates through 15 degrees of longitude in one hour or **1 degree of longitude in 4 minutes**.

24 hours for 360° rotation

$$1 \text{ hour} = \frac{360^\circ}{24 \text{ hours}} = 15^\circ \text{ rotation.}$$

1 hr or 60 min = 15° .

\therefore For 1° rotation, time required

$$\frac{60 \text{ min}}{15} = 4 \text{ minutes}$$

As the Earth rotates from west to east, places to the east of prime meridian (0°) will experience sunrise earlier than places to its west. If we travel eastward from Greenwich (0°) by 15 degrees, our time will be $15^\circ \times 4 \text{ min} = 60 \text{ min}$ or 1 hour ahead of the Greenwich Time (termed as Greenwich Mean Time or G.M.T.). If we go westward it will be one hour behind Greenwich for 15° W.

Calculating time and longitude

When it is noon 12 o'clock at London, ($0^\circ 1' \text{ W}$ near prime meridian)

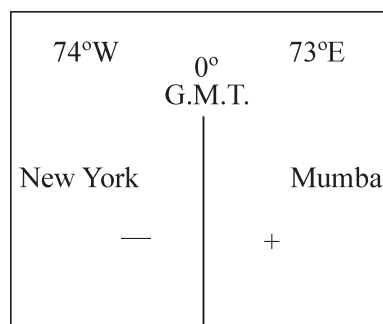
Local time at Mumbai ($72^\circ 54' \text{ E}$ approximately 73°) will be $73 \times 4 = 292 \text{ min}$.

or, $\frac{292}{60} = 4 \text{ hrs } 52 \text{ min}$ ahead of G.M.T i.e., 4.52 p.m.

But local time at New York (74° W) will be $74 \times 4 = 296 \text{ min}$.

or, $\frac{292}{60} = 4 \text{ hrs } 56 \text{ min}$ behind G.M.T.

i.e., $12 \text{ hr} - 4 \text{ hr } 56 \text{ min}$
 $= 7.04 \text{ min a.m.}$



A.M. stands for ante-meridian which means before noon. Ante means before and meridian means sun's position at noon. Thus, the time after midnight and before noon is followed by A.M.

P.M. stands for post meridian i.e., after midday or noon. The time after the noon and before midnight is followed by P.M.

INTERESTING FACT

When watching a cricket match on the T.V., you must have seen that when it is lunch time at Lords (London) at 1 p.m., we are having our evening tea at 6.30 p.m. Our standard time is 5 hrs 30 minutes ahead of G.M.T.

LOCAL TIME AND STANDARD TIME

Why do we need to adopt Standard Time?

Local Time means sun time. The sun can be overhead at any one meridian at a time. Only all places located along that meridian will have 12 noon at that time. Midday occurs at different times at different meridians. So, the local time varies from one meridian to another. Local time is calculated by the shadow cast by the Sun. It is shortest at noon and longest at sunrise and sunset.

As the earth keeps rotating, the places at different longitudes will have different time. As the earth rotates from west to east, people in the east will see the sun first. For instance, Dwarka, ($68^\circ 9' \text{ E}$), Gujarat to the west of India will be 1 hr 44 min behind the time of Dibrugarh Assam, (appr. 95° E) in the east. For each longitude there would be difference of additional 4 minutes.

But that would mean that a traveller going from one end of the country to the other, say from Kolkata to Ahmadabad, would have to keep on adjusting his watch to keep up his appointment.

To avoid this confusion and inconvenience, each country has adopted Standard Time. In India, the longitude $82^{\circ}30'$ passing near Allahabad is more or less the central meridian. So, it has been selected as the standard meridian for our country. The local time along this meridian is taken as the standard time for the country, which is $82\frac{1}{2} \times 4 = 330$ min or 5 hrs 30 min ahead of G.M.T. or Universal Time. So, the Indian Standard Time or I.S.T. is 5 hrs 30 min ahead of G.M.T.

Time Zones

Most countries of the world adopt their standard time from the central meridian of their countries. The whole world is divided into different standard time zones, each of which differ from the next by 15° in longitude or one hour in time.

Countries which have great east-west extent like Australia, Canada, USA and Russia have

more than one Standard Time and different **Time Zones**, e.g., Canada has 6 time zones, the U.S.A. has 4 time zones and Russia has 11 time zones. The whole world has 24 time zones.

THE INTERNATIONAL DATE LINE

We already know that longitude $180^{\circ}E$ and $180^{\circ}W$ are the same line. It is located on the other side of 0° or prime meridian. As we move

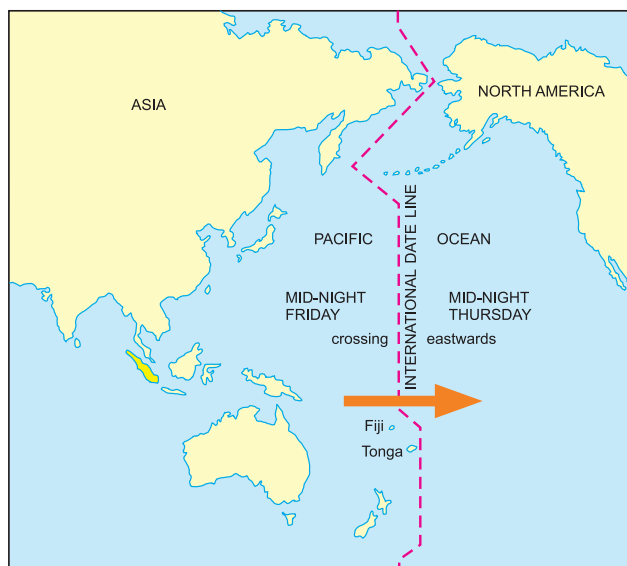


Fig 2.8 : International Date Line

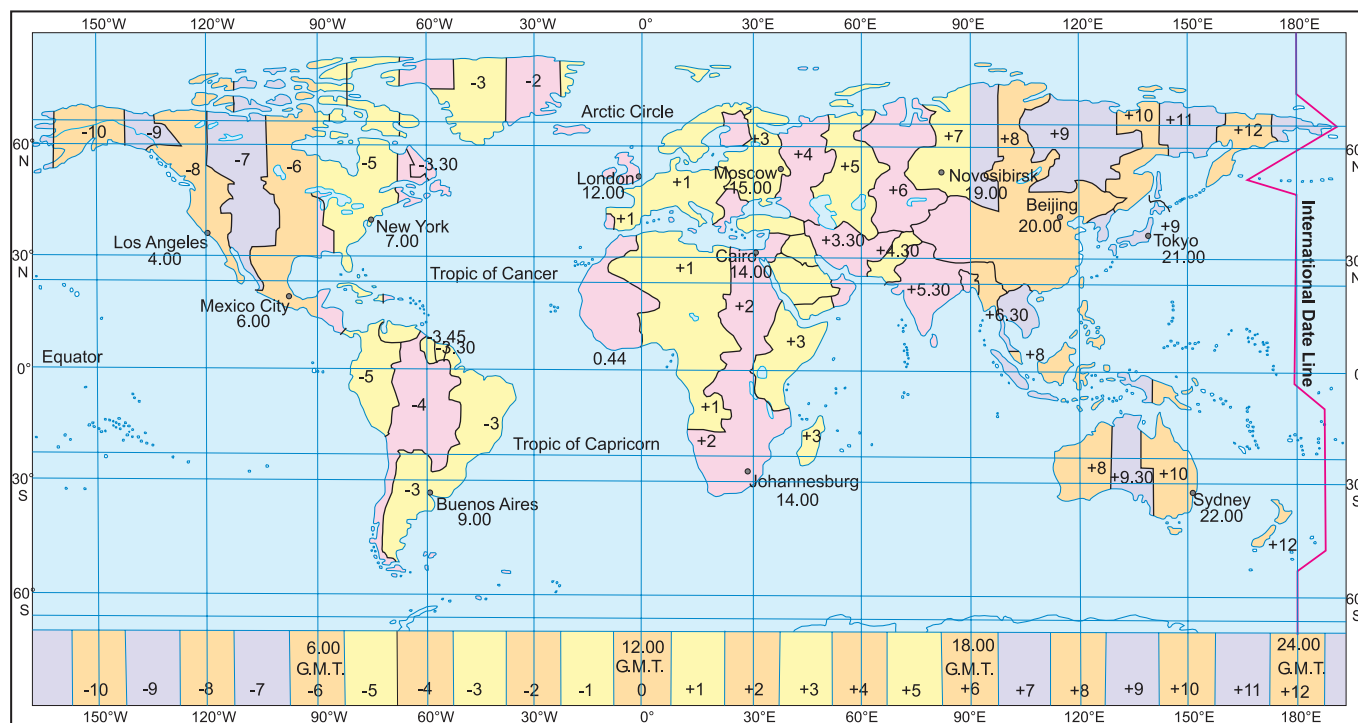


Fig 2.9 : World Time Zones

eastward of prime meridian we gain time until at 180°E we are 12 hours ahead of G.M.T. When we move westward to 180°W we will be 12 hours behind G.M.T. Thus, there is a difference of 24 hours or a day when we cross east or west of this line. This line is known as the International Date Line. It is line on which a day is either

added to the calendar or subtracted. It means that travelling towards the east one will lose a day and travelling towards the west one will gain a day. The line is, however, not straight, it is curved to avoid landmass and passes through Ocean. This is to avoid falling in any Standard Time Zone of any country.

Points to Remember

- The equator is an imaginary line that passes from east to west through the centre of the Earth. The set of lines running east to west, parallel to the equator, are called lines of latitude.
- There are 180 meridians to the east and 180 meridians to the west of the Prime Meridian. They are angular distances of a place east or west of the Prime Meridian, measured from the centre of the Earth.
- Local Time means sun time. The sun can be overhead at any one meridian at a time.
- Most countries of the world adopt their standard time from the central meridian of their countries.

Glossary

GLOBE	: A true three-dimensional model of the Earth.
GEOID	: True shape of the Earth or Earth-shaped.
AXIS	: An imaginary line passing from pole to pole, along which the Earth rotates.
LATITUDE	: Angular distance of a place north or south of the equator.
LONGITUDE	: Angular distance of a place east or west of prime meridian or 0° longitude.
POLES	: The two ends of the axis or the imaginary line on which the Earth rotates.
EQUATOR	: The 0° latitude or the parallel which is a Great Circle dividing the Earth in Northern and Southern Hemispheres.
PRIME MERIDIAN	: The 0° longitude passing through Royal Astronomical Observatory in Greenwich, England, also called Greenwich Meridian.
EARTH'S GRID	: Network of latitudes and longitudes on the globe which helps us to locate places.
LOCAL TIME	: Time according to longitude of any place.
STANDARD TIME	: More or less the central meridian passing through a country is selected as standard meridian and the time along it is the standard time of that country.

TIME TO LEARN

A. Multiple Choice Questions (MCQs)

1. A needle fixed through the globe in a tilted manner is called its
 (a) Poles (b) Axis (c) Prime Meridian (d) Equator
2. The Tropic of Cancer is situated at an angular distance of
 (a) 23½°E (b) 66½°N (c) 23½°N (d) 23½°S
3. The Standard Meridian for India is
 (a) 23½°N (b) Prime Meridian (c) 82°30'E (d) 82°30'W

4. The area which receives maximum heat is called
 (a) Torrid zone (b) Frigid zone (c) Temperate zone (d) North Pole
5. The time shown by a watch gives the
 (a) Standard time (b) Local time
 (c) Prime Meridian time (d) American time

B. Fill in the blanks

flattened	bulges	meridians of longitudes	parallels of latitudes
5 hours 30 minutes ahead of G.M.T.		Prime Meridian	Southern
	111 km	equidistant	

1. The Earth _____ at the equator but at the poles it is slightly _____.
2. The Earth's Grid is a network of _____ and _____.
3. The distance between two latitudes is _____ and they are _____ to each other.
4. The Tropic of Capricorn is situated in the _____ Hemisphere.
5. The line of reference for locating places east or west is the _____.
6. The Standard Time for India is _____.

C. Very short answer type questions

1. What is a globe?
2. What is the latitudinal value of the Tropic of Cancer?
3. In which Hemisphere is the Tropic of Capricorn situated?
4. What do you understand by International Date Line?
5. Name the standard meridian for our country.
6. What is the time difference between IST and GMT?

D. Short answer type questions

1. What is the importance of Tropic of Capricorn?
2. Name the hottest and coldest heat zones.
3. How can we locate places on the Earth's surface?
4. What is the importance of Tropic of Cancer.
5. If the time at a place A (10°N, 05°E) is 10 a.m., what will be the time at place B (30°N, 75°E)? Show your calculations.

E. Long answer type questions

1. Explain the Heat Zones of the Earth with the help of a diagram.
2. Differentiate between latitude and longitude.
3. Describe the importance of latitudes and longitudes.
4. Explain various characteristics of latitudes and longitudes.
5. Differentiate between local time and standard time, giving suitable examples.

[HOTS]

F. Activity

- Draw a circle. Let the prime Meridian divide it into two equal halves. Colour and label the Eastern Hemisphere and the Western Hemisphere. Similarly draw another circle and let the equator divide it into two halves. Colour the Northern and Southern Hemispheres.
- Prepare a model of the globe showing various heat zones of the earth. Colour them in different shades.
Hint: Use thermocol sheet, coloured paper, etc.
- Draw a diagram of the globe showing the earth's axis, the equator, Tropics of Cancer and Capricorn, Arctic circle and Antarctic circle.

G. Word Jumble

(Rearrange the following words from the hint provided)

- (i) EGBOL (Three dimensional model of Earth)
- (ii) QTERUAO (0° latitude)
- (iii) DFIGRI (Coldest zone on Earth)
- (iv) OIEGD (True shape of the Earth)
- (v) UTITDEAL (Also known as parallels)

H. Missing Letters

Find the missing letters in the following words with the help of given hint.

- (i) M _ R I _ _ _ N S (All imaginary half circles on Earth from North to South)
- (ii) _ I R _ _ _ F _ R _ N C _ (Decreases from Equator to Poles)
- (iii) S _ _ T _ M _ (Local times of a place)
- (iv) T _ R _ _ D (Hottest heat zone on earth)
- (v) _ E M _ _ R _ _ _ (Zone of moderate climate)

LIFE SKILLS

Read the book 'Around the World in Eighty Days' written by Jules Verne. Try to find out whether Phileas Fogg could actually circumnavigate the world on time and win the bet or he lost it after crossing the International Date Line.