# Our World Then and Now

Book 1

6

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# 1

# Earth and the Solar System

When you look at the sky, what do you see? During the day you see the sun. During the night, you see a vast space with the moon and numerous small points of light. Most of these appear to twinkle and you call them stars. If you look carefully, you will be able to see a few points of light which do not appear to twinkle. These could be planets.

All the objects in the sky are called *heavenly bodies* or *celestial bodies.* The sun, the moon, the stars and the planets, including the earth, are celestial bodies. We cannot see many of the other celestial bodies because they are very, very far from us.

The celestial bodies are spread over a very vast space. This vast space containing all the celestial bodies is called the *universe*. The universe is so huge that it is difficult to imagine its size. Just think of it in this way: the night sky that you see with all its celestial bodies is just a tiny part of the universe. If you were able to see the entire universe, all the celestial bodies that you see now would together look like a tiny spot of light! You would not be able to see the earth or even the sun!

There are different types of celestial bodies in the universe. Here, we will learn about a few of them.

## Stars

We see a large number of celestial bodies shining in the sky. Some of them produce their own light while others, like the moon, reflect the light received from the sun. *Stars are celestial bodies which produce their own heat and light.* Stars are huge bodies made up of very hot gases, and they give out enormous amounts of heat and light.

Our sun is an ordinary, medium-sized star. It looks bigger than the other stars because it is closer to us than any other star. The star nearest to the sun is Proxima Centauri. The distance between the earth and Proxima Centauri is 40,000,000,000,000 km (40 trillion km)!

### Constellation

Of the millions and millions of stars in the sky, some appear to be in groups, forming definite patterns. These groups, which can be recognised by the shapes they form, are called *constellations*.

The Great Bear is one of the constellations visible in the northern sky. The seven brightest

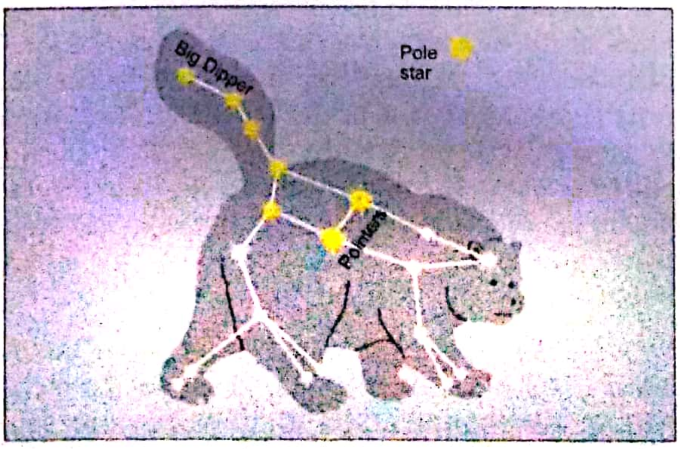



Fig. 1.1 The Great Bear and the pole star

Fig. 1.2 The millions of stars of a galaxy form different shapes. The stars in this galaxy form a spiral.

stars of this constellation look like a long-handled spoon (dipper). These seven stars are called the Big Dipper. The Big Dipper is called *Saptarshi* in India. The two stars called *pointers*, at the head of the Big Dipper, always point towards the pole star. The pole star, which is also known as the North Star or Polaris, is almost directly above the North Pole. This helped navigators determine the north direction before the invention of the magnetic compass.

### Galaxy

We only see a few thousand stars with the unaided eye. Actually there are millions and millions of stars in the universe. We cannot see most of them because they are very far away. Stars are not uniformly distributed in the universe. They occur in groups. *Millions of stars together form a group called galaxy*. There are millions of galaxies in the universe. Scientists give different names to them. Our sun belongs to a galaxy called the *Milky Way Galaxy*.

On a clear night, you might be able to see a faint band of light in the sky. This is called the *Milky Way* or *Akashganga*. The Milky Way is a band of stars in our galaxy. These stars are so far away from us that they cannot be distinguished individually and hence appear as a whitish band. Our galaxy gets its name from the Milky Way.

## The Solar System

The earth and seven other planets move around the sun. Apart from the planets, celestial bodies like dwarf planets, asteroids, comets and meteoroids move around the sun. Some planets and other celestial bodies have moons, or satellites, moving around them. Moons also go around the sun.

*The sun, the eight planets, the moons and the other celestial bodies that move around the sun make up the solar system*. We can think of the solar system as the sun's family.

### The Sun

The sun is at the heart of the solar system. Although it is just a medium-sized star, it is giant in comparison to the other members of the solar system. Its diameter is more than 100 times the earth's diameter, and it weighs 300,000 times more than the earth! The sun is about 150 million kilometres away from the earth. Light from the sun takes about eight minutes to reach us.

The sun is made up of highly compressed hot gases. The sun gives out an enormous amount of heat and light. This makes life possible on earth. Light from the sun gets reflected from the planets and their moons. This makes it possible for us to see them since they do not produce their own light.

### Planets and Their Motions

After the sun, the largest celestial bodies in the solar system are the eight planets. In order of their distances from the sun they are: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.

Planets are spherical in shape. Apart from its moons, there are no independent bodies near a planet that move around the sun.

Mercury, Venus, Earth and Mars are made up of rocks. Jupiter, Saturn, Uranus and Neptune are huge planets made up of gases and liquids. Jupiter, the giant of the solar system, is big enough to contain over 1,300 globes the size of the earth. It is the largest planet, while Mercury is the smallest.

Some planets can be easily identified. Venus is the brightest planet. Mars looks red and is called the Red Planet. If you look at Saturn through a

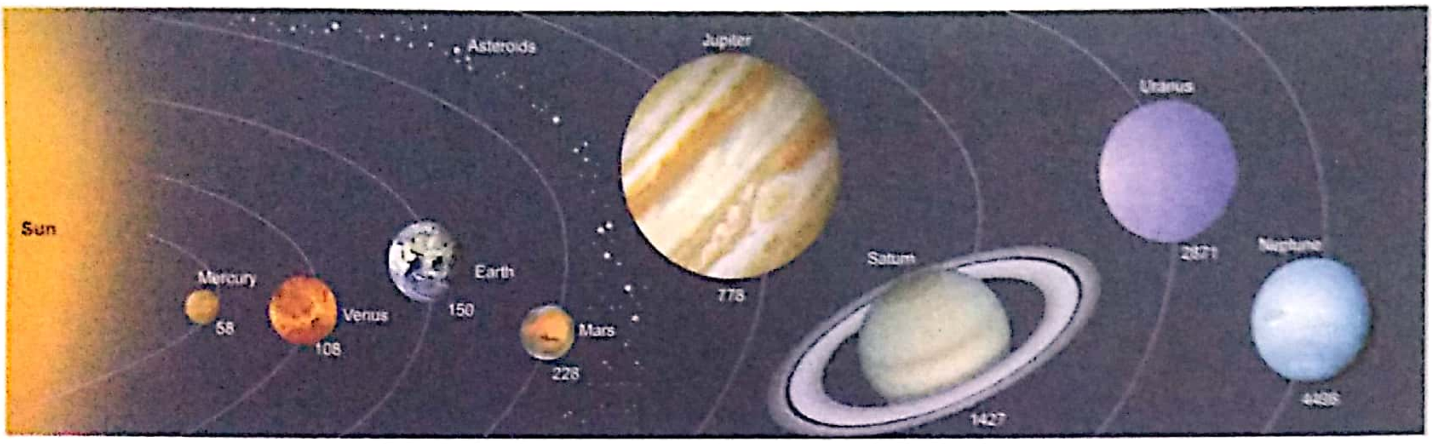



**Fig. 1.3** The solar system. The number below a planet is its mean distance from the sun in million kilometres.

telescope, you will see rings around the planet. The rings are made up of dust particles, rocks and ice. There are rings around Uranus, Jupiter and Neptune too.

The word 'planet' comes from a Greek word which means 'wanderer'. This is a fitting description of the planets because they are constantly in motion. The planets have two types of motion—revolution and rotation.

**Revolution** All planets revolve around the sun in the anticlockwise direction. Each planet revolves in its own slightly elliptical path called *orbit*. (An ellipse looks like an elongated circle.)

Since Mercury is closest to the sun, it has the shortest orbit. Therefore, it takes the least time (88 days) to complete one revolution. The earth takes about 365 days and 6 hours, while Neptune, the farthest planet from the sun, takes nearly 165 years to complete one revolution.

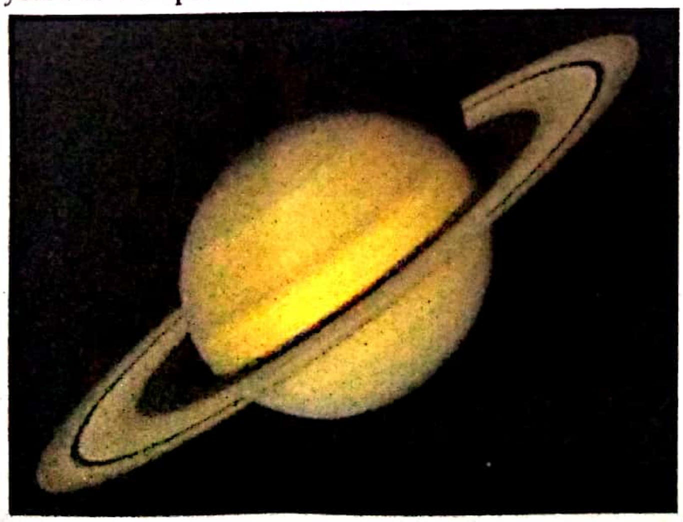


**Fig. 1.4** Saturn's rings are made of ice, rock and dust particles. They were first seen by Galileo through his telescope in 1610.

**Rotation** Apart from revolving around the sun, each planet spins, or rotates, about its *axis*. The earth's axis is the imaginary line joining the North Pole and the South Pole through the centre of the earth. From above the North Pole, the earth appears to rotate in the anticlockwise direction. This means that a place on the west side of the earth appears to go towards the east. On a road trip, if you go from *west to east*, distant objects like mountains seem to move from *east to west*. Similarly, since the earth rotates from west to east, the sun appears to move from east to west.

A day on a planet is the time taken by it to complete one rotation. The earth completes a rotation in about 23 hours and 56 minutes. Jupiter rotates the fastest. It takes 9 hours and 55 minutes to complete a rotation. Thus it has the shortest day. Venus takes the longest time—a day on Venus is as long as 243 days on earth!

## Earth—A Unique Planet

The earth is the fifth largest planet. It is a sphere which is slightly flattened at the poles. From a spacecraft, the land on earth looks a mixture of green and brown. The oceans, which cover more

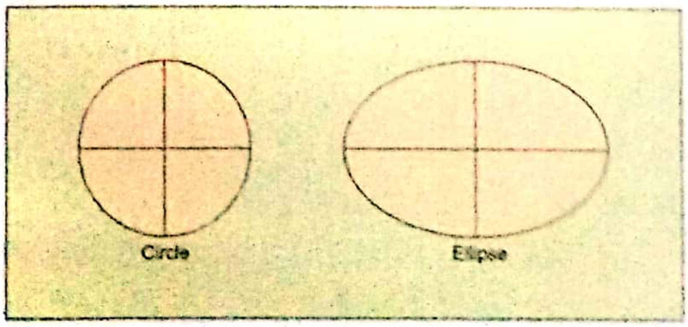



**Fig. 1.5** A circle and an ellipse

Table 1.1 Planet facts

| Planet | Diameter (km) | Time taken for one revolution | Time taken for one rotation | Moons* | Rings |
|---|---|---|---|---|---|
| Mercury | 4,879 | 87.97 days | 58.646 days | 0 | No |
| Venus | 12,100 | 224.7 days | 243 days | 0 | No |
| Earth | 12,756 | 365.24 days | 23 h 56 min | 1 | No |
| Mars | 6,794 | 1.88 years | 24 h 37 min | 2 | No |
| Jupiter | 142,984 | 11.86 years | 9 h 55 min | 62 | Yes |
| Saturn | 120,536 | 29.4 years | 10 h 39 min | 60 | Yes |
| Uranus | 51,118 | 84.02 years | 17 h 14 min | 27 | Yes |
| Neptune | 49,528 | 164.79 years | 16 h 7 min | 13 | Yes |

*Moons discovered till July 2007

area than the land, look blue. The earth is, therefore, called the Blue Planet.

The earth is a unique planet of the solar system. It is the only planet on which life exists. This is because the conditions required to support life are found only on earth. Now let us see what these conditions are.

**Moderate temperature** The amount of heat a planet receives from the sun depends on its distance from the sun. Neptune is the farthest planet and, therefore, the coldest. The average temperature on Neptune is about –225°C. On Mercury and Venus, which are closest to the sun, the temperatures go above 400°C! The earth is the third planet from the sun. It has an average temperature of 22°C. This temperature is suitable for plants and animals.

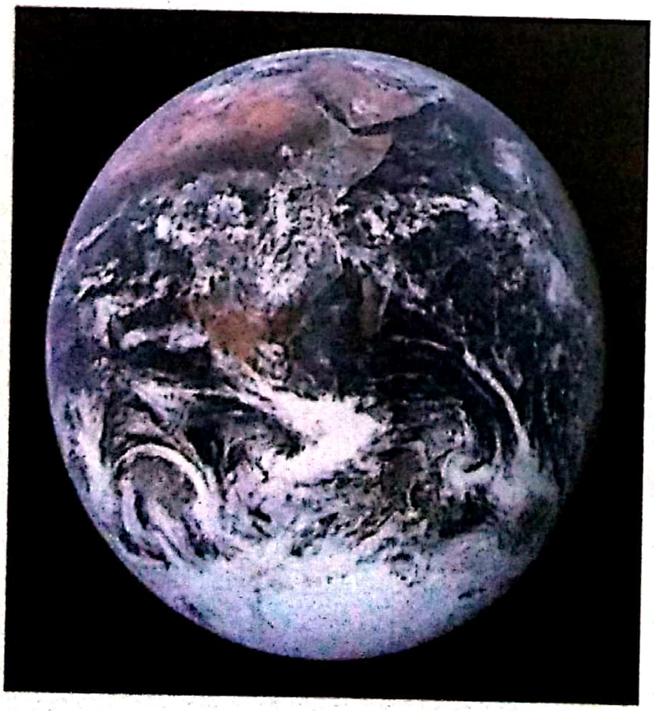


Fig. 1.6 Earth as seen from space

**Water in liquid form** You know that plants and animals need water. The earth is the only planet on which liquid water is found. On some other planets water is found only in frozen form.

**Favourable atmosphere** The earth is surrounded by a layer of gases. This layer of gases is called its *atmosphere*. Animals need oxygen to breathe. This gas is found in the earth's atmosphere. Plants need carbon dioxide to make food. This gas is also present in our atmosphere. Apart from these, the earth's atmosphere has a gas called ozone. This protects plants and animals from certain harmful rays of the sun.

The combination of the factors mentioned above makes life possible on earth.

## Satellites

*Satellites, or moons, of planets are small celestial bodies which revolve around planets.* As the planets revolve around the sun, the satellites move with them. As a result, the satellites also revolve around the sun. Like planets, satellites shine by reflecting light from the sun.

All planets except Mercury and Venus have satellites. The moon is the earth's satellite. Jupiter has the most number of satellites—62. The satellites are smaller than the planets around which they revolve. Jupiter's satellite Ganymede is the largest satellite in the solar system. It is even larger than Mercury.

### The Moon

The moon is the largest and the brightest thing in the night sky. The moon looks so large because it is

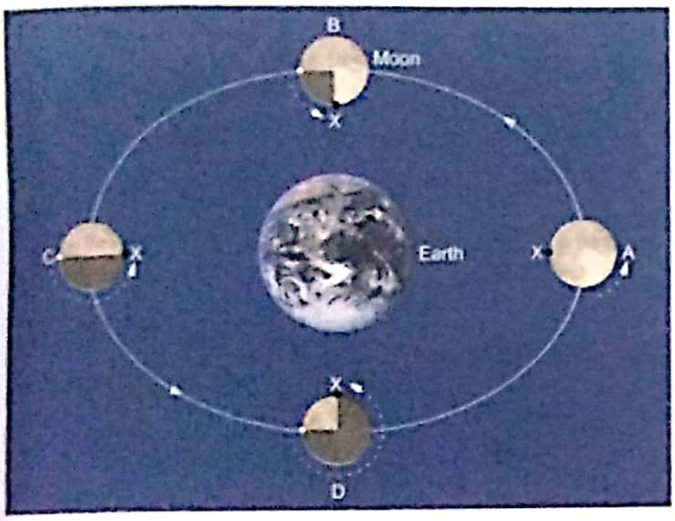



**Fig. 1.7** Only one face of the moon is visible from the earth. The shaded regions show the quarters of rotation.

closer to us than any other celestial body. The moon shines because it reflects sunlight.

The moon revolves around the earth once in 27 days and 8 hours. During this period, it also rotates, or spins, about its axis once. This means that its periods of rotation and revolution are the same. Because of this we always see the same side of the moon. Figure 1.7 will help you understand this better. Let X be a point on the moon facing the earth. Starting from A, the moon completes a quarter of its revolution and reaches B. Since it is rotating at the same rate at which it is revolving, it has also completed a quarter rotation. It is clear from the diagram that the point X on the moon still faces the earth. As you can see, this is true at all the points in the moon's orbit.

The sun always lights up one side of the moon. But as the moon moves around the earth, we only see parts of this side. These are called *phases of the moon*. The moon appears as a full disc when we see the whole of the lit up side. This is called *full moon*, or *purnima*. When the part facing us does not receive sunlight, we cannot see the moon. This is known as the *new moon*, or *amavasya*. After this, the moon appears as a crescent. The crescent grows larger as days pass, till the full moon appears. After the new moon, it takes about fifteen days for the full moon to appear. Many traditional calendars are based on the movement of the moon.

There is no life on the moon. It does not have water or an atmosphere. During the day the temperature on the moon is about 100°C. It falls to –150°C at night. The moon has many mountains and plains. It also has circular depressions called craters on its surface. The moon's surface is covered with a mixture of rocks and dust.

Man has always been fascinated by the moon. During the 1960s, many spacecraft were sent to the moon. On 21 July 1969, man's dream of going to the moon came true. On that day Neil Armstrong became the first man to walk on the moon.

### Artificial Satellites

An object designed to revolve around the earth or any other heavenly body is called an *artificial satellite*. Satellites are carried into space by rockets. They have many uses. Some relay TV and telephone signals. Others take pictures of clouds, vast areas of land, etc. These pictures have many uses. For example, pictures of cloud formations help in weather forecasting. India's INSAT satellites are used to take such pictures. They are also used for communication and TV broadcasting.


**Fig. 1.8** Phases of the moon as seen from the earth

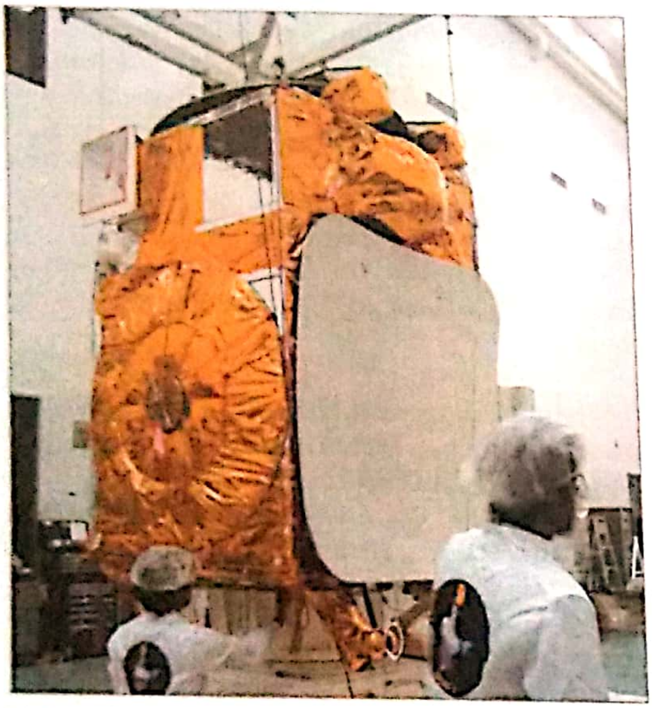


**Fig. 1.9** The artificial satellite INSAT 1B being prepared for launch

**Fig. 1.11** Halley's comet is named after the English astronomer Edmond Halley. It completes a revolution around the sun in 76 years.

## *Other Celestial Bodies*

**Dwarf planets** A *dwarf planet* is a spherical celestial body that orbits the sun. It is much smaller than a planet. Unlike a planet, a dwarf planet has other sun-orbiting bodies (other than moons) near it. For example, these bodies could be very large rocks. This is how dwarf planets differ from planets. Pluto, which was considered a planet from 1930 to 2006, is now considered a dwarf planet. Ceres and Eris are two other dwarf planets.

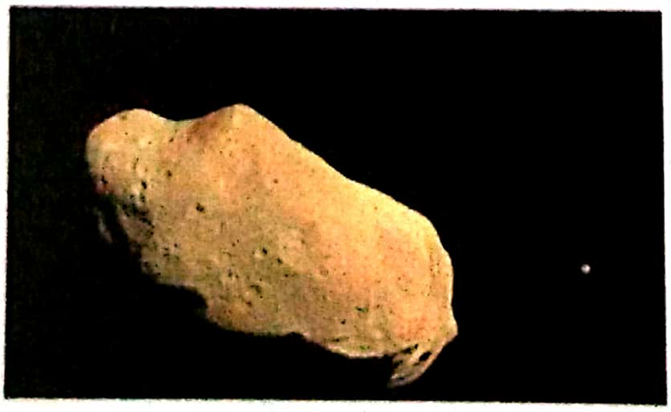


**Fig. 1.10** Asteroids can have moons too. Shown here are the asteroid Ida and its moon, Dactyl—the small object on the right.

**Asteroids** Thousands of small celestial bodies revolve around the sun between the orbits of Mars and Jupiter. These are called *asteroids* or *minor planets*. Many astronomers believe that asteroids are fragments of a planet which exploded a long time ago.

**Meteoroids** Small pieces of rock and dust revolve around the sun. They are called *meteoroids*. When meteoroids enter the earth's atmosphere, they start burning. These burning pieces cause a flash of light as they fall, and we call them *shooting stars* or *meteors*. Most meteors burn up completely while falling.

A meteor that survives its fall and hits the ground is called a *meteorite*. A large meteorite creates a crater where it falls. About 50,000 years ago a meteorite created a huge crater called the Meteor Crater in Arizona, USA.

**Comets** Comets are among the most beautiful sights in the solar system. They revolve around the sun in long, elliptical orbits. When comets come near the sun, they start to glow. Comets take years to complete their orbits. Therefore, we see them only after many years.

Our universe is a wonderful place. We know very little about its distant members. Each year scientists discover new facts about the universe, which help us understand it better.

E. *Think and answer.*

1. Why does the sun appear to move from east to west on the earth?
2. Why is Neptune the coldest planet?
3. Why do we always see the same side of the moon?
4. State the similarities and differences between a planet and a dwarf planet.

F. *Fill in the blanks.*

1. The Great Bear is a .......
2. Our sun belongs to the ...... Galaxy.
3. The only star in the solar system is the .......
4. ...... is the largest planet.
5. Blue Planet is to Earth what Red Planet is to .......
6. ...... of planets are celestial bodies which revolve around the planets.

G. *State whether the following statements are true or false.*

1. The pole star is also called the North Star.
2. Planets shine by their own light.
3. Saturn is the only planet that has rings around it.
4. On Venus, a day is longer than a year.
5. After a new moon, it takes about fifteen days for the full moon to appear.
6. Rockets are carried into space by artificial satellites.
7. Most of the asteroids are located between Saturn and Uranus.
8. Asteroids may have moons.

H. *Choose the correct option.*

1. The sun and other stars are huge bodies made up of
   (a) liquids (b) rocks (c) hot gases (d) ice
2. Light from the sun reaches the earth in about
   (a) 8 seconds (b) 8 minutes (c) 8 hours (d) 8 days
3. The sun makes life possible by providing us with
   (a) oxygen (b) heat and light (c) water (d) carbon dioxide
4. The path of a planet around the sun is called its
   (a) revolution (b) rotation (c) orbit (d) spin
5. Water in liquid form is found only on
   (a) Mars (b) the moon (c) the earth (d) Pluto
6. The celestial body nearest to the earth is
   (a) the moon (b) the sun (c) Proxima Centauri (d) Venus
7. A piece of rock which burns as it falls through the earth's atmosphere is called a
   (a) meteor (b) meteorite (c) meteoroid (d) asteroid
8. Which one of these shows a galaxy?

(a)

(b)

(c)

(d)


I. *Tick (✓) the correct boxes.*

| Planet | Made up of rocks | Made up of gases and liquids | Longest orbit | Shortest orbit | Longest day | Shortest day | Has no satellite | Has rings |
|---|---|---|---|---|---|---|---|---|
| Mercury | | | | | | | | |
| Venus | | | | | | | | |
| Earth | | | | | | | | |
| Mars | | | | | | | | |
| Jupiter | | | | | | | | |
| Saturn | | | | | | | | |
| Uranus | | | | | | | | |
| Neptune | | | | | | | | |

## Things to Do

**Assignment**

- Find out the name of the first rocket which took man to the moon. Who were the astronauts on this mission?

**Presentation**

- Collect information on Chandrayaan 1 and its findings. Make a presentation on how these findings might affect our lives in future.

**Group activity**

- Observe the night sky. If possible, get a pair of binoculars. Try to identify Venus. It is usually the brightest starlike object and it does not twinkle. Also look carefully at the moon. Can you see the craters?

**Group discussion**

- Hold a group discussion on Mars One, its mission and the possible outcomes of the mission.

❑

# 2

# Maps

You must have seen a globe in your principal's office or on the table of your geography teacher. You may also have seen maps of various countries. In this chapter you will learn how important globes and maps are.

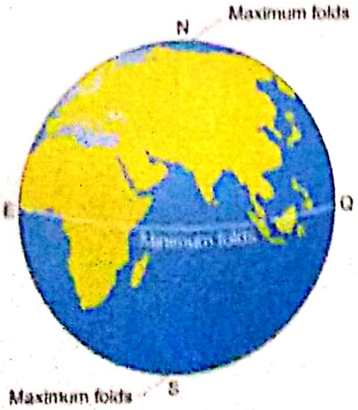
## Globes

We use a globe to represent the spherical earth. In other words, *the globe is a model of the earth on a small scale*. The shapes of the continents and oceans are quite precise on a globe. Their sizes are shown on a reduced scale. But the details like small towns and villages of a country cannot be shown on a globe. Larger globes show some more details, but it is difficult to handle them. These days, there are pocket globes, which can be inflated when required.

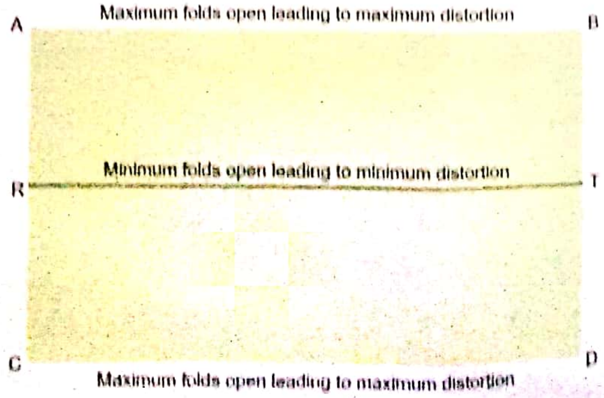
## Maps

The earth's surface, either whole or part of it, can be represented on paper. Such a representation is called a map. To make a detailed map, we can use a large sheet of paper. This large map can then be folded or rolled. Also, details of various continents, countries, etc., can be put together to make a book of maps, or an atlas. The maps in an atlas will usually contain more information than a large globe. Thus, *maps can have more information and are easier to handle than globes.*

Since on maps the curved surface of the earth is represented on a flat surface, a problem arises. A round shape cannot be flattened completely. So, when we try to show parts of the world on a flat surface, the shapes and sizes of the continents and oceans get distorted. The maximum distortion is seen in the regions around the poles.




(a)




(b)

**Fig. 2.1** The distortion in maps

You can understand this better with the help of a simple experiment. Take a piece of paper and wrap it over a globe or a ball. You will see that it is impossible to cover the globe with the piece of paper without making folds, or creases, in the paper. You will also notice the maximum number of folds at the poles, N and S, in Figure 2.1 (a) and the minimum around the middle.

When the paper is unwrapped, the points N and S open out to become the straight lines AB and CD, as shown in Figure 2.1 (b). The part with the least number of creases opens out into the straight line RT. The lines AB, CD and RT are all equal in length. Now, do you see how the poles, which are just points on the globe, are stretched in a map and become equal to the middle portion of the globe? Thus, shapes near the poles of the earth have maximum distortion when represented on a map.

These days maps with the minimum amount of distortion at the poles are being made. Maps are of various kinds. Some of these are described below.

**Physical maps** These are maps which show the natural features on the earth's surface, like mountains, plateaus, plains, rivers, and so on.

**Political maps** These maps show boundaries of countries and of the states within the countries. They also show the locations of cities and towns.

**Thematic maps** Maps can also show types of soils, forest areas, the distribution of minerals and industries, and so on in an area. Such maps, which are based on a theme or a topic, are called *thematic maps*.

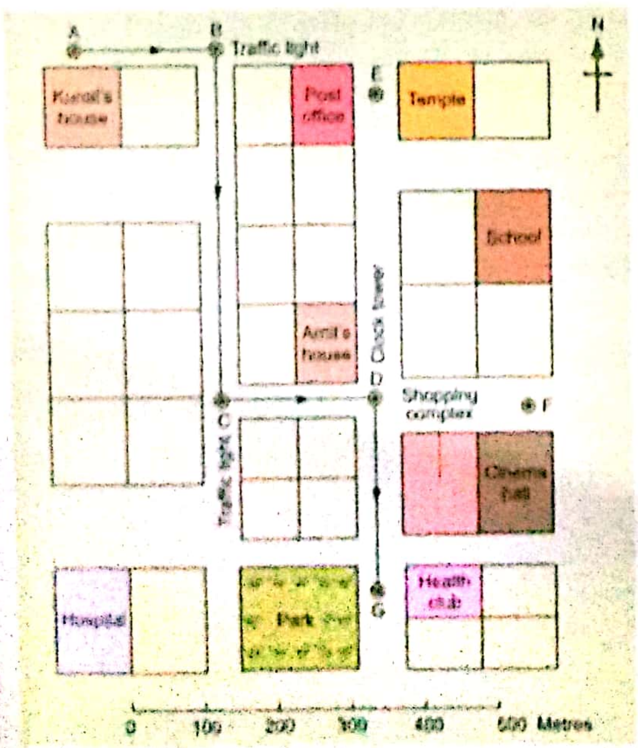



Fig. 2.2 A map showing a part of a town

### History of Map-making

The science of map-making is called *cartography*. Ancient map-makers assumed many shapes of the earth. For example, the Babylonians thought that the earth is flat and disc-shaped, and they drew the map of the world based on this. It was Ptolemy, a geographer living in Egypt, who first represented the earth as a sphere. He is considered the father of cartography. He was also the first to mark the north line on a map.

In ancient times, different materials were used to make maps. The Babylonians used clay tablets, the Egyptians used metal plates and the Eskimos used animal skin to make maps. These maps were not very accurate. But as new lands were discovered, and as people started travelling to distant lands, the quality of maps improved.

Modern maps are either printed on a material such as paper or plastic, or they are stored in computers. Modern maps are more accurate than the old ones. Images from satellites and aeroplanes are used to make detailed maps with the help of computers.

## Important Features of Maps

Every map is provided with some aids or tools to help you read it. There is a scale, a vertical line marked 'N' at the top and some required symbols. These are essential features of a map. You will now learn how they help you to read maps.

### Scale

If you look through your atlas, you will see maps of countries, continents and even of the whole world. Thus, very large areas are shown on a small sheet of paper. Do you know how this is done? It is done by making a small distance on paper represent a large distance on the ground. It is decided that a particular length on paper will show a particular distance on the ground. For example, let us consider two places which are 100 km apart. If we say that 1 cm on the map stands for 50 km on the ground, these two places would be 2 cm apart on the map. This relation of 1 cm on the map representing 50 km on the ground is the *scale of the map*. Different maps use different scales.

The scale of a map is generally shown by a graduated straight line of a particular length. The scale is generally drawn at the top or the bottom of a map. Sometimes the scale is not drawn. It is given in words, for example, 1 cm to 100 km. This means that 1 cm on the map represents 100 km on the ground.

Observe the scale drawn in Figure 2.2, which shows a part of a town. On this scale, 1 cm on the map represents 100 metres on the ground.

**Finding distances** You can use the scale of a map to find the distance between any two points on it. Say, you want to find the actual ground distance between the clock tower (D) and temple (E). First measure the distance between D and E using your ruler. We find that DE measures 4 cm. Since 1 cm on the map represents 100 m on the ground, the actual distance between D and E is 4 × 100 m = 400 metres.

In the map shown in Figure 2.2, how will you find the ground distance between Kunal's house (A) and the health club (G)? First of all, you have to break up the distance between A and G, choosing points that are joined by roads. These points are the traffic lights (B) and (C) and the clock tower (D). Measure the distances AB, BC, CD and DG with a ruler. Add them to get the total distance. Let us say the total distance is 11.2 cm. Since 1 cm on the map represents 100 metres on the ground, the ground distance is 11.2 × 100 m = 1120 metres.

**Scale and size of map** The size of a map depends on the scale you choose. You will understand this better by studying Figure 2.3. Suppose 1 cm on the map shows 1 km on the ground. Then two places A and B which are 6 km apart on the ground will be shown 6 cm apart on the map, as on the upper line in Figure 2.3.

Now, if we want to reduce the size of the map, we choose another scale, and say that 1 cm on the map covers 2 km on the ground. Now, only 3 cm on the map will show 6 km on the ground. Hence the distance between A and B on the map will now become 3 cm. This is shown by the second line in Figure 2.3. We say that the first scale is larger than the second.

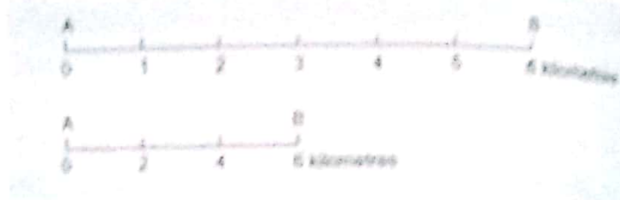



Fig. 2.3 Different scales

## Directions

If you look at any map, you will notice a vertical line at the upper right or left corner, as in Figure 2.2. The uppermost point of this line has an arrow marked with the letter 'N'. This line is called the *north line* and it shows the north direction. Once you know the north direction, you can easily find the other directions, namely, east (E), west (W) and south (S). These four directions are called the *cardinal points* of the compass.

Other than the four major directions, there are four intermediate directions. These are north-east (NE), south-east (SE), south-west (SW) and north-west (NW). These directions help in locating a place with greater accuracy.

Some maps may not show the north line. In such maps, the upper part is always taken as the north. The lower part is thus the south, and the left and right sides represent the directions west and east respectively.

**Finding the direction of a place** Two places A and B are shown in Figure 2.5. You have to find the direction of B with respect to A. Draw vertical and horizontal lines intersecting at point A. Indicate the directions as shown in the figure. Join A and B by a straight line. Now it is easy to see that B is to the south-west of A. Can you find the direction of Kunal's house from Amit's house on the map shown in Figure 2.2?

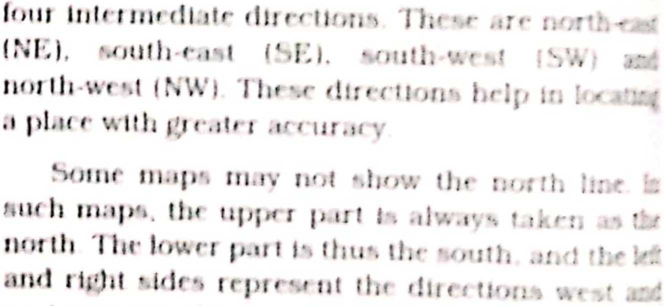



Fig. 2.4 The four cardinal points of the compass and the four intermediate directions

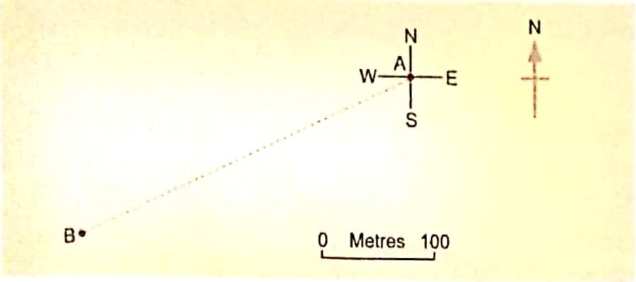



Fig. 2.5 Direction of a place with respect to another

**Finding the location of a place** Suppose your friend says that his house is 1 km from your school. With just this information, you cannot locate his house on your town's map. This is because there would be so many places which are 1 km from the school. Now, if he tells you that his house is 1 km to the south of the school, it would be easy to locate his house. That is because on the map, there would be only one place which is 1 km to the south of the school. Similarly, if your friend had just told you that his house is to the south of the school, you would not have located his house. Thus, to locate a place P with respect to a place Q, we need to know both the direction of P with respect to Q, and its distance from Q.

## Conventional Symbols

You have learnt that maps show various features. It is impossible to show the actual shapes and sizes of trees, buildings, villages, etc., in a map because of limited space. So, they are shown with the help of various symbols. These symbols not only make it easier to draw maps, but also to read them. If different people use different symbols to draw maps, it would be difficult to understand each other's maps. People all over the world use the same set of symbols, and there is an international agreement on these symbols. These are called *conventional symbols*.

Some common conventional symbols have been shown in Figure 2.6. These will help you understand the details shown in maps. The map in Figure 2.7 shows a small town and its surrounding areas. Now you can apply various tools like the scale, the north line and the conventional symbols to study this map. You can find the total length and breadth of the area shown in the map. What are the features that can be seen in the map?

## *Sketch*

You know that a map shows the features of an area according to a scale. But sometimes we need a rough drawing of an area to tell us where a particular place is located with respect to certain other places. Suppose, Amit wants to go to Sujit's house, but does not know the way. Sujit may make a rough drawing to show Amit how to reach his house. Such a drawing would not be drawn to any scale. Nor would it have all the features of the area drawn in detail. This kind of a rough drawing of an area is called a *sketch*.

## *Plan*

A map shows the locations of various places or features of an area. A detailed map of a part of a town may show schools, parks, roads, etc. But even the most detailed maps cannot show the internal details of buildings. Sometimes we need to know

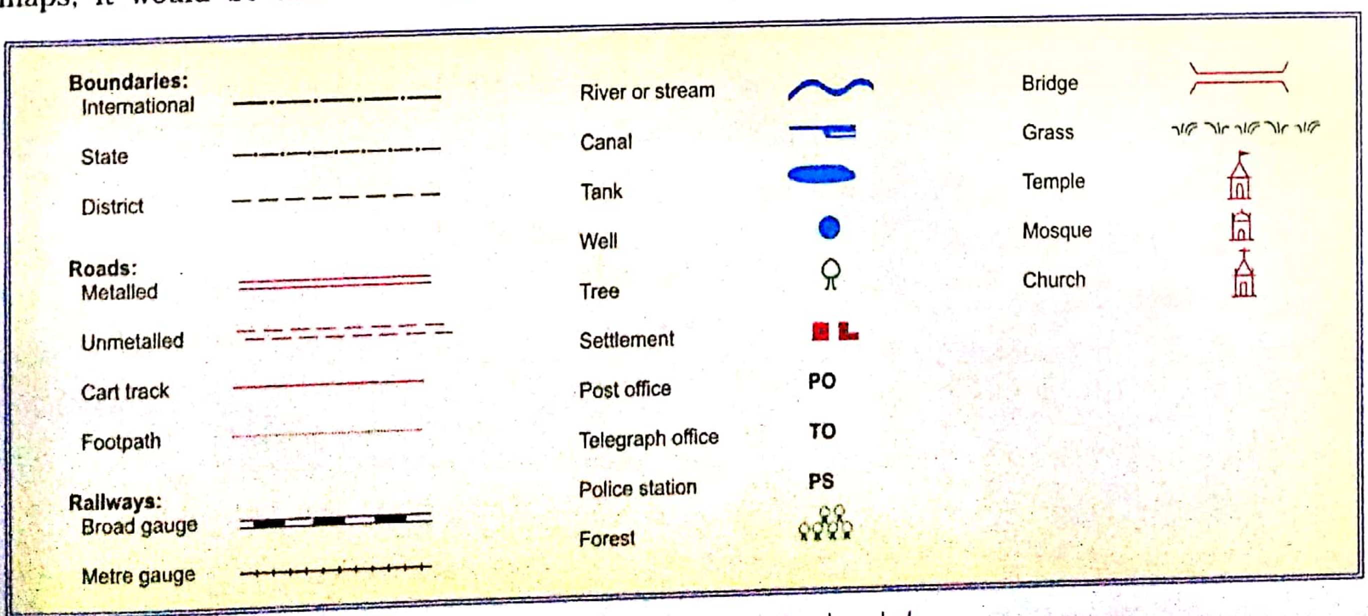



Fig. 2.6 Some common conventional symbols


Fig. 2.7 The map of a town and its surrounding areas

the details of a particular building or of a room in a building. At such times, we refer to detailed drawings known as plans.

*A plan is a detailed drawing of a small area drawn on a very large scale*. It shows the details of a small area, for example, a room or a house. Before a house is built, a plan showing the rooms, windows, doors, etc., is drawn. Figure 2.9 shows the plan of a cinema hall. Notice the difference in the scales in Figures 2.2 and 2.9. In the first, 1 cm on the map represents 100 metres. In the second, 1 cm on the plan represents 5 metres. So, the scale of the plan is larger than the map's.

**Maps, sketches and plans** Maps, plans and sketches are alike in one respect. They are drawn to show various objects and features on the ground on a sheet of paper. But each is drawn in a different manner to suit a specific purpose.

Maps cover large areas. Thus, the scale used for drawing a map is small. Also, since they cover large areas, maps cannot show many details. Plans, on the other hand, cover very small areas. The scale used to draw a plan is very large compared to the scale of a map. Plans show the details of a small area. Thus, the basic difference between a map and a plan is that a map covers *a large area on a small*

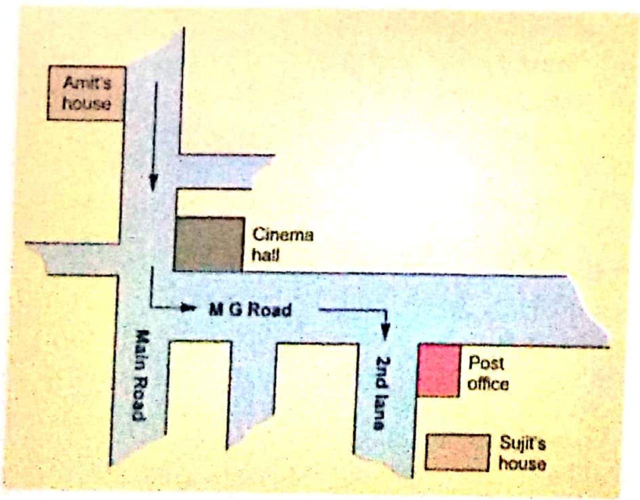



Fig. 2.8 A sketch

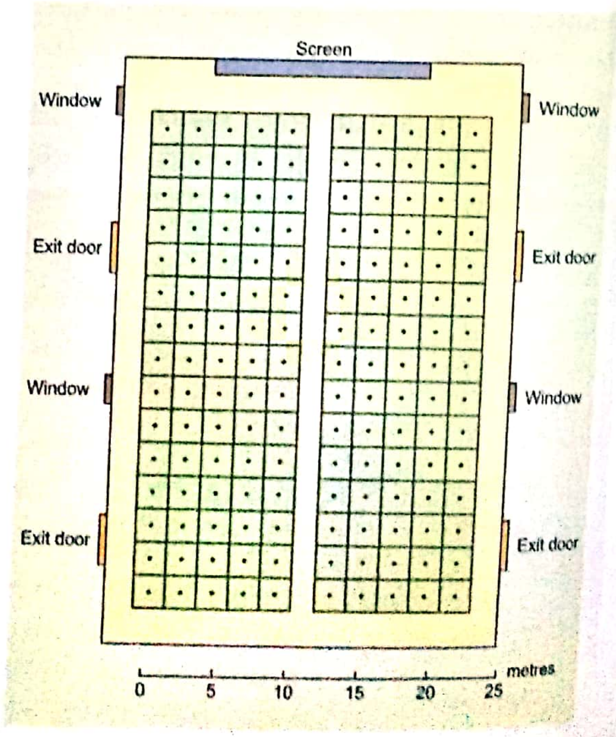



Fig. 2.9 A plan of a cinema hall

*scale*, and a plan shows the details of *a very small area on a large scale*.

The most important way in which a sketch differs from both maps and plans is that it is not drawn to scale. It is usually drawn to show the position of a place or object with respect to some other places or objects. So, a sketch usually does not show all the details of the area, but only those ones which are necessary. A sketch may cover a very small area or quite a large one. Sketches can be drawn more easily than plans and maps.

## Things to Remember

| | |
|---|---|
| *globe* | a model of the earth showing important features like continents, oceans, countries, etc. |
| *map* | a representation of the curved surface of the whole earth or part of it on a flat sheet of paper according to a chosen scale |
| *scale* | the relation between the distance on the map and the corresponding distance on the ground |
| *cardinal points* | the north, south, east and west points indicating the four directions of a compass |
| *north line* | the vertical line with an arrow at the top, marked with the letter 'N', indicating the north direction |
| *conventional symbols* | the symbols used to represent various features on maps |
| *sketch* | a rough drawing showing only some features of an area, drawn without using any scale |
| *plan* | a drawing of a very small area showing details, drawn using a very large scale |

## Exercises

A. *Answer the following questions orally.*

1. What is a globe?
2. What do we call a book of maps?
3. What do we call the science of map-making?
4. Who first represented the earth as a sphere?
5. Name the cardinal points of the compass.
6. Name three kinds of tools that help us read a map.

B. *Answer the following questions in not more than 20 words.*

1. What is a map?
2. What is the north line?
3. What information do you need to locate a place with respect to another?

C. *Answer the following questions in not more than 40 words.*

1. What are political and physical maps?
2. What is a map's scale? Give one example.
3. What are conventional symbols? Why are they needed?

D. *Answer the following questions in not more than 80 words.*

1. How are maps more useful than globes? What is the main disadvantage in using maps?
2. What is a plan? How is it useful?

3. Show the differences between maps, plans and sketches using the table format shown below.

| | Map | Plan | Sketch |
|---|---|---|---|
| 1. Area covered | | | |
| 2. Scale | | | |
| 3. Details shown | | | |

E. *Think and answer.*

1. A map's scale is given thus: 1 cm to 200 km. How far apart will two places be on the map, if the ground distance between them is 1,200 km?
2. Why is there an international agreement on conventional symbols?

F. *Fill in the blanks.*

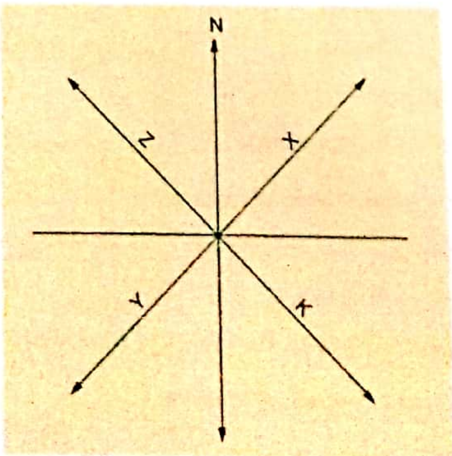
1. In a world map, the maximum distortion is at the ...... .
2. The ...... drew maps on clay tablets.
3. If a map does not have the north line, the ...... part is taken as the north.
4. The direction to the right of the north line is ...... .
5. A ...... shows the details of a small area on a large scale.

G. *State whether the following statements are true or false.*

1. Maps usually have more information than globes do.
2. A map showing the distribution of minerals in a country is a thematic map.
3. A map shows a large area on a large scale.
4. NW indicates the direction between the north and the east.
5. A sketch is a rough drawing.

H. *Choose the correct option.*

1. Of the following, the map with the smallest scale will be that of
   (a) your city (b) Maharashtra (c) India (d) Asia
2. To build a school, one would need a
   (a) sketch (b) plan (c) map (d) globe
3. In the following diagram which arrow indicates the south-west direction?

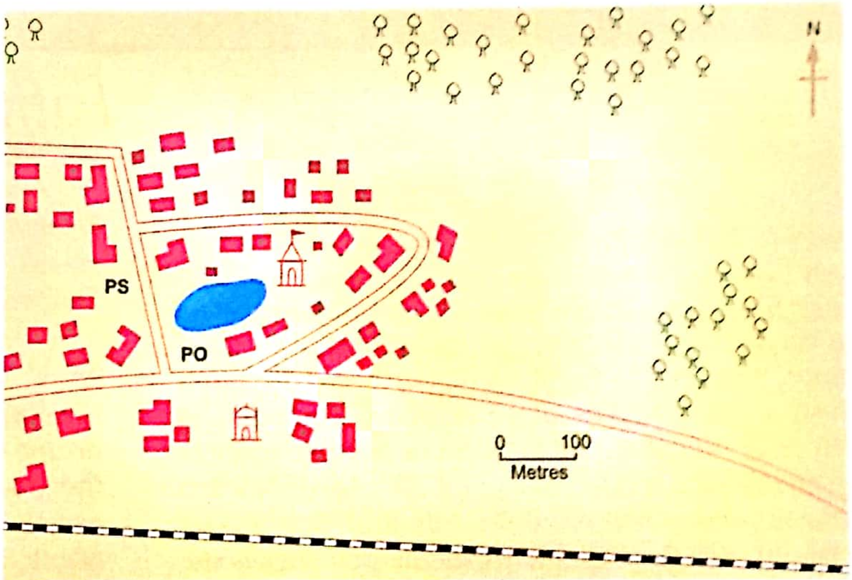



   (a) X (b) Y (c) Z (d) K
4. The symbols used on maps are called conventional symbols because
   (a) they have been used since ancient times
   (b) they are used all over the world under an international agreement
   (c) they are the traditional Indian way of showing various features on maps
   (d) they were used by British map-makers

5. A sketch is drawn using
   (a) a scale (b) the north line
   (c) both a scale and the north line (d) neither a scale nor the north line
6. A map uses a scale in which 1 cm on the map covers 50 metres on the ground. If two places are 4 cm apart on the map, the actual distance between them is
   (a) 50 metres (b) 100 metres (c) 150 metres (d) 200 metres

I. *In the list given below, tick (✓) the features that you can see in the map. You may refer to Figure 2.6 for the conventional symbols that represent the features shown.*

| Feature | |
|---|---|
| Settlement | |
| Post office | |
| Police station | |
| Fire station | |
| Bridge | |
| Metalled road | |
| Unmetalled road | |
| Railway | |
| Tank | |
| Well | |




## Things to Do

### Assignment

- Draw sketches of the routes from your house to the following places:
  (a) the nearest shopping complex (b) the nearest hospital (c) your school

### Project

- On a large outline map of the world, mark any five places that you would love to visit. Below the map, write and paste pictures of what you would like to see in each of these places. For example, you may want to visit Egypt to see the pyramids.

### Group activity

- Draw a plan of your school. Discuss and write down some changes that you would like to make in it. Draw a new plan with the suggested changes made.

### Group discussion

- Hold a group discussion on the importance of maps, plans and sketches in our day-to-day activities.

❑

# 3

# Latitudes and Longitudes

In the previous chapter you learnt that to locate a place, you need to know its distance and direction from another known place or point. The point in reference to which the location of another place is given is called a reference point. The earth has two known points—the North Pole and the South Pole. The pole which points towards the pole star is the North Pole. The other pole is the South Pole.

Using the North Pole and the South Pole as the basic reference points, two sets of *imaginary* circles are drawn around the globe to help us locate places. One set of circles is drawn horizontally between the two poles. These circles are parallel to each other and are called *parallels of latitude* or *parallels*. The other set of circles is drawn through the poles. Half of each circle, running from the North Pole to the South Pole, is called a *meridian of longitude* or a *meridian*. In this chapter you will learn how these circles help to locate any place on the globe.

## Parallels of Latitude

**Equator** *The equator is the imaginary circle drawn around the globe exactly halfway between the two poles*. Each point on the equator lies exactly halfway between the North Pole and the South Pole. Therefore, this imaginary circle cuts the globe into two equal parts called *hemispheres*. *Hemi* means half. The part of the globe which lies to the north of the equator is called the Northern Hemisphere, while the part which lies to the south is called the Southern Hemisphere. India is in the Northern Hemisphere, while Australia is in the Southern Hemisphere.

The equator also cuts each meridian into two equal halves. Since the equator is drawn exactly around the middle of the globe, it is the largest possible circle which can be drawn around the globe.

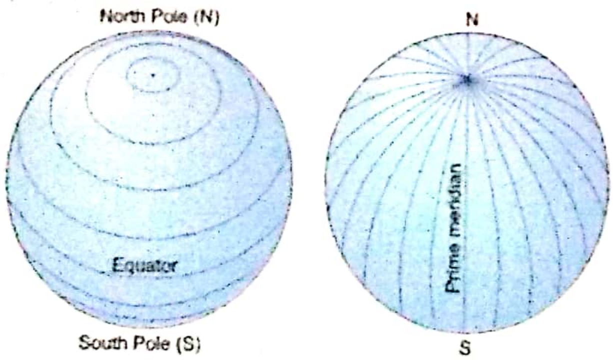


Fig. 3.1 Parallels (a) and meridians (b)

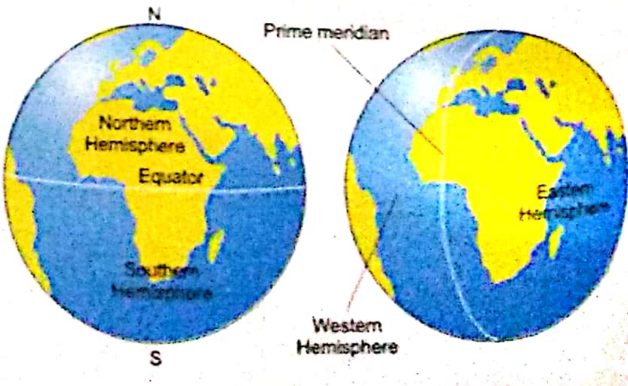


Fig. 3.2 Hemispheres of the globe

## Latitude of a Place

*The latitude of a place is its angular distance north or south of the equator.* It gives the position or location of a place from the equator. Suppose the meridian passing through a place M cuts the equator at R (Figure 3.3). Then the latitude of M is ∠ROM, where O is the centre of the earth.

The latitude of a place is measured in degrees (°). Each degree is divided into 60 equal parts called minutes ('). A minute is further divided into 60 equal parts called seconds ("). The latitude of the place M in Figure 3.3 is ∠ROM, which is 50°, north of the equator.

Places located north of the equator have north latitudes. Similarly, places to the south of the equator have south latitudes. The angular distance of either pole from the equator is one-fourth of a circle (¼ of 360°), or 90°. Thus, *the latitude of the North Pole is 90° north and the latitude of the South Pole is 90° south.*

While writing the latitude of a place, the letter 'N' or 'S' is added to indicate whether the place is to the north or the south of the equator. Thus, the latitude of M (Figure 3.3) is 50°N. Cairo (Africa) and Bourke (Australia) both have a latitude of 30°. But Cairo is to the north of the equator and Bourke is to the south of it. Therefore, the latitude of Cairo is 30°N and that of Bourke is 30°S.

*An imaginary line encircling the earth and joining all places which have the same latitude is called a parallel of latitude* or *a parallel.* All points on a parallel have the same angular distance from the equator. These lines form circles parallel to the equator. The parallels are indicated in the same way as latitudes. For example, the 50°N parallel means the parallel of latitude 50° in the Northern Hemisphere. All points on this parallel have the same latitude of 50°N. *The equator is the 0° parallel.*

**Size of the parallels** The parallels are circles of varying lengths. The length of the parallels decreases gradually from the equator to the poles. The equator is the longest parallel. The 60° parallel is half the length of the equator. The poles are just points.

**Important parallels** You have learnt how the equator acts as a very important reference line. There are other parallels which are important because they help to divide the earth into different zones.

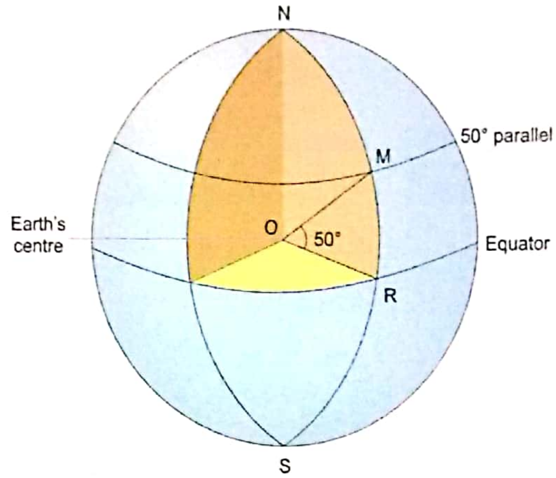



**Fig. 3.3** Angle of latitude

- The *tropic of Cancer* is the parallel 23°30′ (or 23½°) north of the equator. It means that the latitude of all places on this parallel is 23°30′N.
- The *tropic of Capricorn* lies to the south of the equator at an angular distance of 23°30′ from it.
- The *Arctic Circle* is the parallel which lies at an angular distance of 66°30′ north of the equator.
- The *Antarctic Circle* lies to the south of the equator at an angular distance of 66°30′ from it.

### Latitudes and Heat Zones

The parallels that you have just learnt about divide the earth into various heat zones. The different zones have different types of climate and vegetation.

**Torrid zone** This zone lies between the tropic of Cancer and the tropic of Capricorn. The word 'torrid' means hot. This zone is the hottest zone of the earth, as it receives relatively direct rays of the sun throughout the year. It is also known as the *tropical zone.* About half of India lies in this zone.

**Temperate zones** Between the tropic of Cancer and the Arctic Circle in the north, and the tropic of Capricorn and the Antarctic Circle in the south, are two zones of moderate temperature called the *temperate zones.* 'Temperate' means moderate. The sun never shines on these areas vertically. In fact, the angle of the sun's rays keeps decreasing as one moves from the tropics to the poles. Since the rays of the sun are always slanted, these areas receive much less heat than the torrid zone.

**Frigid zones** Beyond the Arctic Circle in the north and the Antarctic Circle in the south, the sun never rises much above the horizon. So, these two zones get the least amount of heat. They are the coldest

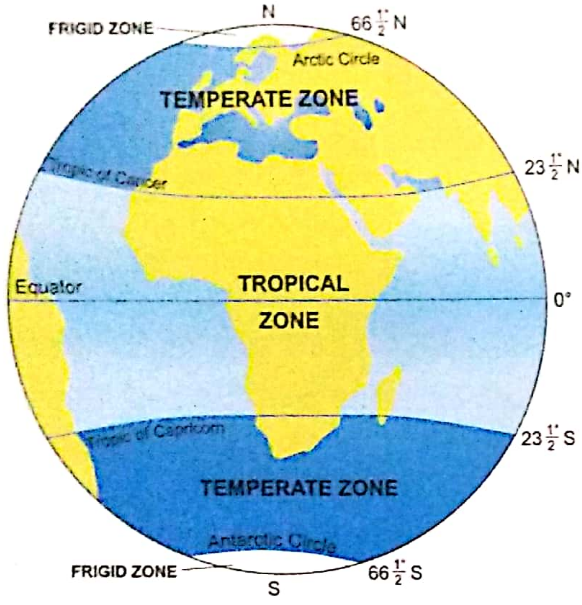



**Fig. 3.4** Heat zones of the earth

regions of the earth. These two zones are called the *frigid zones*.

## Meridians of Longitude

**Prime meridian** You have learnt that the equator is the reference line for locating places in the north and south directions. We need a reference line to locate places in the east and west directions also. This is because all places lying on the same parallel of latitude (say 50°N), will have the same latitude—50°N. Therefore, a place cannot be located uniquely by its latitude alone.

It was easy enough to choose the equator as the reference line for the parallels because it is the longest parallel and it divides the globe into two equal halves. But all meridians run from the North Pole to the South Pole and are equal. So, it was decided by all countries to choose a particular meridian as the reference line. This meridian, passing through the British Royal Observatory at Greenwich, near London, is called the *prime meridian*. It is also known as the *Greenwich meridian*. It serves as the reference line for numbering the other meridians, which are either to the east or to the west of it. The meridians are numbered up to 180° to the east and west of the line of 0° longitude, or the prime meridian. The value of a meridian is followed by the letter 'E' or 'W'. Note that the 180°E and the 180°W meridians are the same. The 180° meridian and the prime meridian together form a circle which cuts the earth into two equal parts called the Eastern and the Western hemispheres. India is in the Eastern Hemisphere, while the USA is in the Western Hemisphere.

### Longitude of a Place

*The longitude of a place is its angular distance east or west of the prime meridian.* It is measured along the parallel which passes through the place. Longitudes are also measured in degrees, minutes and seconds. In Figure 3.5, ∠LMP, ∠AOB and ∠CKD are angles of longitude. The longitude of a place at P, B or D is 40°. The longitude of places on the prime meridian is 0°.

A place has an east or a west longitude depending upon whether it is to the east or west of the prime meridian. For example, the longitude of Dhubri (Assam, India) and that of Memphis (USA) is 90°. But Dhubri is to the east of the prime meridian and Memphis is to the west. So, the longitude of Dhubri is 90°E and that of Memphis 90°W.

All places with the same longitude fall on a line of longitude, or a *meridian of longitude*. Meridian means the highest position of a star or the sun (which reaches its highest position at midday). A line of longitude is called a meridian of longitude because all places located on it have midday at the same time.

You know that the meridians run from the North Pole to the South Pole, which means that they all meet at the poles. So, the meridians come closer gradually from the equator to the poles. Finally, they all meet at the poles (Figure 3.1).

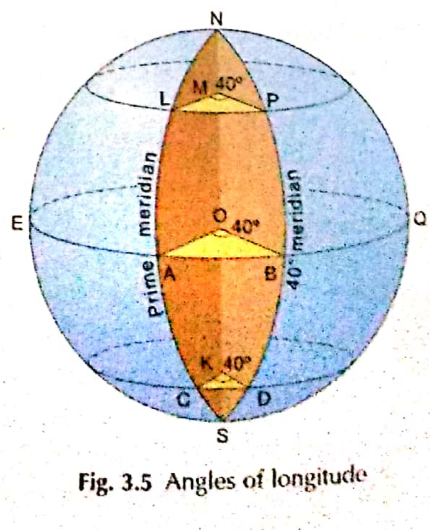



**Fig. 3.5** Angles of longitude

### Finding a Place

The parallels and meridians form a mesh, or a grid. They help us locate a place on a map or globe. Suppose you want to locate Cairo in a map of Africa. The latitude of Cairo is 30°N and its longitude is 31°E. Therefore, the point of intersection of the 30°N parallel and the 31°E meridian on the map will be the position of Cairo.

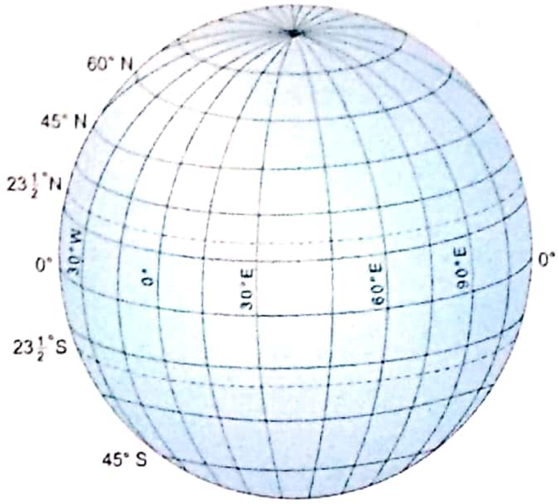



**Fig. 3.6** Parallels and meridians form a grid.

## *Time*

Time can be measured on the basis of the movement of heavenly bodies like the sun, the moon, etc. The sun rises and sets every day. Therefore, it is the best standard for measuring the time at a place.

### Local Time

The local time at a place is fixed on the basis of the apparent movement of the sun. The sun appears to move across the sky from the east to the west. Actually it is the earth which moves from the west to the east. But it seems to us that the sun is moving. This is like the trees which seem to be moving past your window when you look out of a running train. You must have noticed that the trees appear to move in a direction opposite to the train, though they are actually not moving.

When the sun shines exactly overhead, or is at the highest point in the sky, it is midday, or 12 noon, at that place. You can carry out a simple experiment to find this time. Take a wooden peg. Fix it in the ground outside your house. Make sure that it is absolutely erect. You will observe that the shadow of the peg is the longest in the morning and evening. It is the shortest when the sun is directly overhead. This is when it is midday, or the time of the day is 12 noon.

It is possible to note the midday at each place and fix the local time accordingly. Midday occurs at different times at different meridians. So, *the local time varies from one meridian to another.*

**Longitude and time** The earth rotates from the west to the east. That is why any place which is to the east of the place where you live will have its sunrise and midday earlier than your place. Thus the local time of that place will be ahead of your local time. Similarly, any place which is to the west of your town will have its sunrise and midday later than your town. Remember, *when one place is to the east of another, it is ahead of the other in time. A place west of another is behind the other in time.*

It is very easy to calculate the difference between the local times of two places. You know that the earth takes 24 hours to complete one rotation, or to cover 360° of longitudes. Therefore, in 1 hour, it will cover 15° of longitudes. So, 1° of longitude will be covered in 4 minutes. This means, the difference in time between, say, the prime meridian and the 15° meridian will be $15 \times 4$ minutes = 60 minutes, or 1 hour. Thus, when it is 12 noon at the prime meridian, it will be 1 p.m. at a place on the 15°E meridian, and 11 a.m. at a place on the 15°W meridian. In this way, you can find the difference between the local times of two places if you know their longitudes.

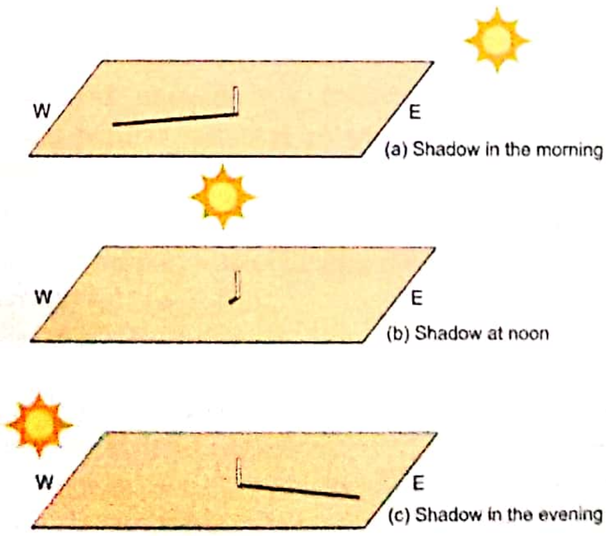



**Fig. 3.7** Determination of noon

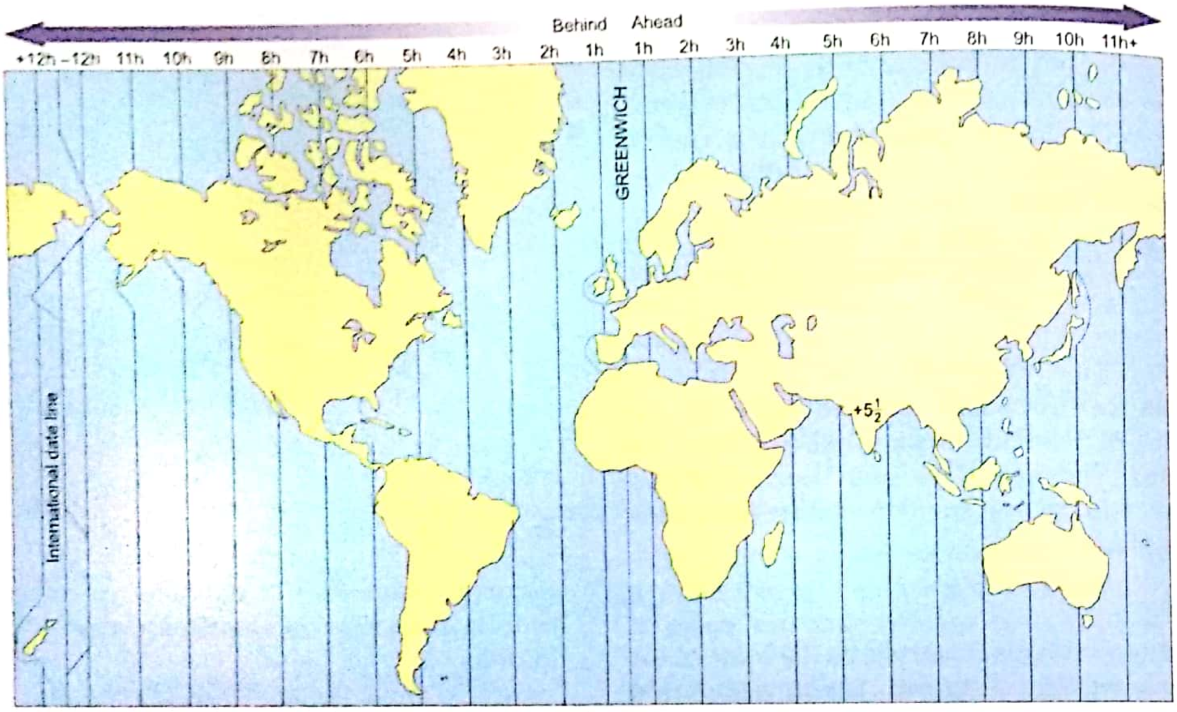



**Fig. 3.8** The time zones

## Standard Time

In countries with a large east-west extent, the variation in local time is very great. Even in our country, the difference in local times of Porbandar (69°29′E) in the west and Dimapur (93°28′E) in the east is about 1½ hours.

Now suppose every place in India followed its own local time. There would be confusion over train timings, flight timings, etc. To solve this problem, the local time of a particular meridian is taken as the *standard time* for an entire region or country. In India, the local time of the 82°30′E meridian has been adopted as the standard time. This is known as the *Indian Standard Time* (*IST*). The 82°30′E meridian was chosen because it passes through more or less the central part of India. It is called the standard meridian of India.

The time at the prime meridian is called the *Greenwich Mean Time (GMT)*. This is the standard time for the UK. Often, the standard times in different countries are expressed as a difference in number of hours from the GMT. The Indian Standard Time is 5½ hours ahead of GMT. This means that when it is 1 p.m. in the UK, it is 6:30 p.m. in India.

Countries which have a very large east-west longitudinal extent often adopt more than one standard time. In mainland USA, for example, there are four standard times, and in Russia there are eleven.

**Time zone** The world is divided into 24 time zones of an hour each. Each zone covers 15° of longitudes. The standard time in a time zone is based on a meridian passing centrally through the zone. Areas in a time zone follow this standard time. When people travel across time zones, they have to adjust their watches.

### *Things to Remember*

| | |
|---|---|
| *latitude* | the angular distance of a place north or south of the equator |
| *longitude* | the angular distance of a place east or west of the prime meridian |
| *parallel* | an imaginary line encircling the earth and joining all places having the same latitude; drawn parallel to the equator |
| *meridian* | an imaginary line, on the earth's surface, passing through the North Pole and the South Pole |

| | |
|---|---|
| *prime meridian* | the 0° meridian passing through the British Royal Observatory at Greenwich near London; also called the Greenwich meridian |
| *equator* | the imaginary line of 0° latitude, encircling the earth and passing halfway between the North Pole and the South Pole |
| *tropic of Cancer* | the 23°30'N parallel |
| *tropic of Capricorn* | the 23°30'S parallel |
| *Arctic Circle* | the 66°30'N parallel |
| *Antarctic Circle* | the 66°30'S parallel |
| *torrid zone* | the hottest zone, lying between the tropic of Cancer and the tropic of Capricorn |
| *temperate zones* | the zones between the tropic of Cancer and the Arctic Circle, and between the tropic of Capricorn and the Antarctic Circle |
| *frigid zones* | the coldest zones, north of the Arctic Circle and south of the Antarctic Circle |
| *local time* | the time at a particular place, fixed by the apparent movement of the sun |
| *standard time* | the local time along a meridian, adopted officially as the time for an entire region or country |

## Exercises

A. *Answer the following questions orally.*

1. What are the two reference points for locating places on the earth?
2. Name the two sets of imaginary circles that help us locate places on the earth.
3. Name a country which is in the Southern Hemisphere.
4. What is the latitude of the North Pole?
5. Between which two parallels does the torrid zone lie?
6. What is Greenwich Mean Time?

B. *Answer the following questions in not more than 20 words.*

1. What is the equator?
2. What is the prime meridian?
3. How are meridians numbered?
4. When would the local time of a place A be ahead of the local time of a place B?
5. What is the importance of the 82½° E meridian in India?

C. *Answer the following questions in not more than 40 words.*

1. What are parallels and meridians?
2. Why is a line of longitude called a meridian?
3. In how many time zones is the world divided? On what is the standard time in a zone based?

D. *Answer the following questions in not more than 80 words.*

1. Define latitude and longitude of a place. Explain with an example how they help to locate a place.
2. Explain tropical and temperate zones. Draw a diagram showing all the heat zones.
3. What is standard time? How is it useful?

E. *Think and answer.*

1. All the lines of longitude meet at the poles but the lines of latitude never meet. Why?
2. Why are the frigid zones the coldest regions of the earth?
3. Why is the shadow of an object shortest at noon?

4. Why does the local time vary from one meridian to another?
5. Explain why a place A, to the east of place B, is ahead in time of the place B.

F. *Fill in the blanks.*

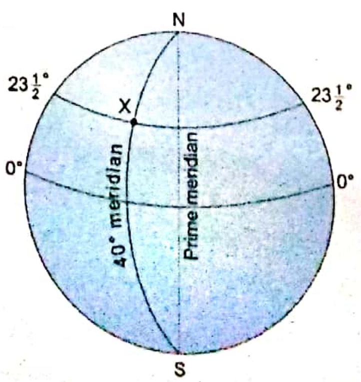
1. The ...... is the longest parallel of latitude.
2. The line of 0° longitude is called the ...... .
3. The ...... lies 23½° south of the equator.
4. The equator is to parallels what the ...... is to meridians.
5. The ...... time of a place depends on the apparent movement of the sun.
6. Countries with large east-west extent often adopt more than one ...... .

G. *State whether the following statements are true or false.*

1. The latitude of the equator is 0°.
2. The equator cuts each meridian into two equal halves.
3. All places on the same parallel have the same latitude.
4. The USA is in the Eastern Hemisphere.
5. All places on the same meridian have the same local time.
6. The IST is 5½ hours behind the GMT.

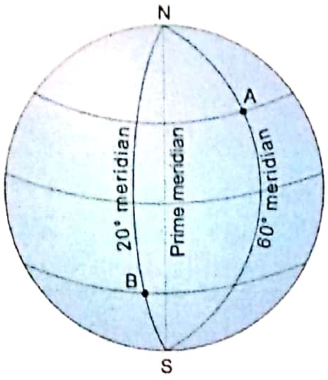
H. *Choose the correct option.*

1. Among the following parallels, which is the longest?
   (a) 10°N (b) 30°N (c) 60°N (d) 80°N
2. On which of the following parallels are the coldest places likely to be found?
   (a) 20°N (b) 50°S (c) 70°N (d) 80°S
3. The prime meridian passes through
   (a) New Delhi, India (b) Greenwich, near London
   (c) New York, USA (d) Cairo, Egypt
4. On which of the following meridians will sunrise take place first?
   (a) 100°E (b) 90°W (c) 0° (d) 10°E
5. When it is 6 a.m. in London, the Indian Standard Time (IST) will be
   (a) 8:30 a.m. (b) 11:30 a.m. (c) 10:30 p.m. (d) 12:30 a.m.
6. The world is divided into time zones, each of
   (a) 1 hour (b) 4 minutes (c) 15 minutes (d) 2 hours
7. The place X in the figure is




   (a) 23½°N (b) 23½°S 40°W (c) 23½°N 40°W (d) 23½°S 40°E

8. In the given figure




(a) the local time of A is ahead of B
(b) the local times of both A and B are the same
(c) the local time of B is ahead of A
(d) none of these is true

## Things to Do

**Mapwork**

- With the help of an atlas find five countries
  (a) through which the equator passes
  (b) which lie in the tropical zone (but not on the equator)
  (c) which lie in a temperate zone

**Assignment**

- Find the approximate longitude and latitude of your town. Find some major cities of the world which lie on or near your town's latitude.

**Project**

- Mark the time zones on an outline map of the world. Also mark the capitals of India and any five other countries. Use the map to find the approximate difference in time between Delhi and each of the other capitals you have marked. Write the figures beside the respective cities. Do not forget to put a '+' or '–' sign before each.

**Debate**

- Hold a debate on the topic 'India should have two time zones'.

**Group activity**

- Construct a sundial in your school playground.

❑