5. Temperature

Do it yourself !

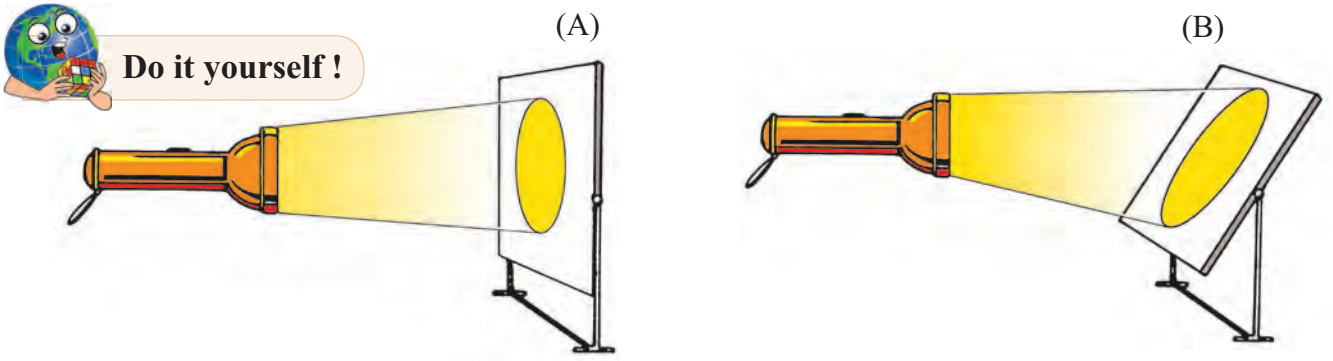

Figure 5.1 : The perpendicular and slanting area occupied by the torchlight rays

- Take a torchlight and keep it stable at one place. Take two large paper sheets large enough to accommodate its entire beam. Paste the papers on two flat boards.
- Hold the board perpendicular to the beam (figure 5.1A).
- Draw the outline of the area lit up by the beam Name the paper 'A'.
- Now use the other paper. Hold it in such a way that it makes an angle of 120° with the beam (figure 5.1B). Draw the outline of the area occupied by the beam. Name the paper 'B'.
- Observe both the papers 'A' and 'B'.

Now tell –

- On which paper does the beam occupy a larger area?
- On which paper is the area smaller?
- Now change the angle between the beam of light and the paper. Observe the changes that occur in the area occupied by the beam of light.
- What is the relation between the angle of the paper and the area occupied by the beam?

Explanation

Sunrays coming towards the earth travel in straight lines. However, as the earth is spherical in shape, these are not perpendicular to all the parts of the earth's surface. In some parts, they are perpendicular whereas in other parts, they are slanting. Let us see what effect it has on the earth.

- The perpendicular rays occupy less area (fig 5.1A). The part where the rays occupy lesser area receives bright sunshine and greater heat. Hence the surface there gets heated more and the air becomes hotter.
- The slant rays occupy a larger area (figure 5.1B). In this area, sunlight appears less bright and there is less heat. Hence the surface there gets less heated and the air too, is less hot.

Do it yourself !

The region marked 'A' in figure 5.2 receives perpendicular rays, while the region marked 'B' receives slant rays and in the region marked 'C' the rays are extremely slanting.

- Using a scale, measure the lengths of the lit up portions on the earth's surface in A, B and C regions.
- Measure the width of the rays shown between the earth and the sun.
- Considering the parallels of latitude marked in the figure, tell the regions where the temperature will be high, moderate and low.
- Discuss this in the class and write the answers in your notebook.

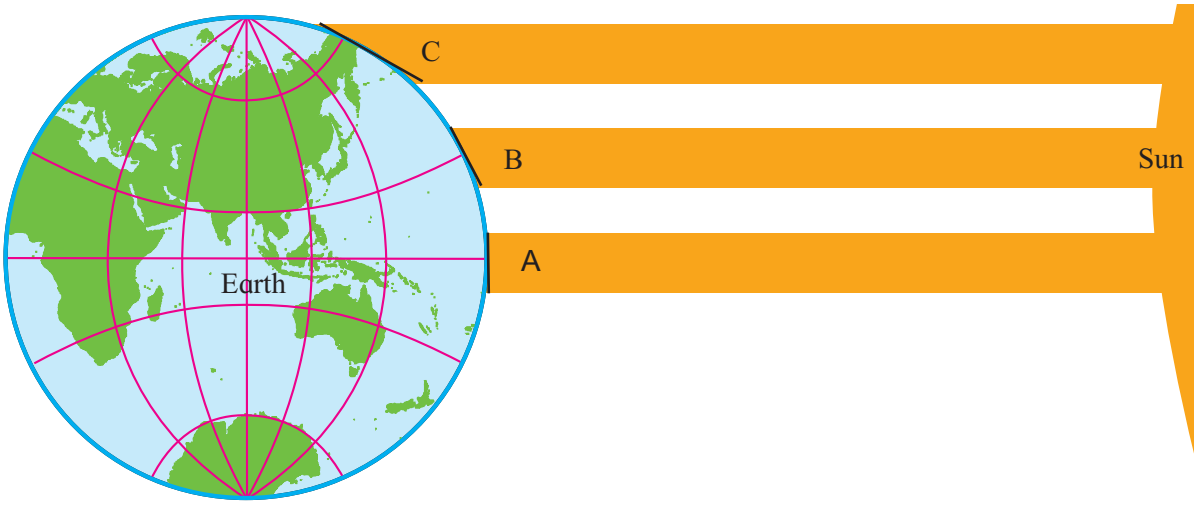

Figure 5.2 : The Earth's Shape and the Distribution of Sunrays

Explanation

Sunrays falling on the earth are straight and parallel to each other. However, we have seen that due to the spherical shape of the earth and the resultant curvature of the surface, they occupy a larger or lesser area. This leads to unequal distribution of the heat received from the sun, resulting in decreasing temperature from the equator to the North and South Poles. Based on the distribution of temperature, the earth can be divided into torrid, temperate and frigid zones or tropical, temperate and polar regions. Try to understand this from figures 2.4 and 5.3.

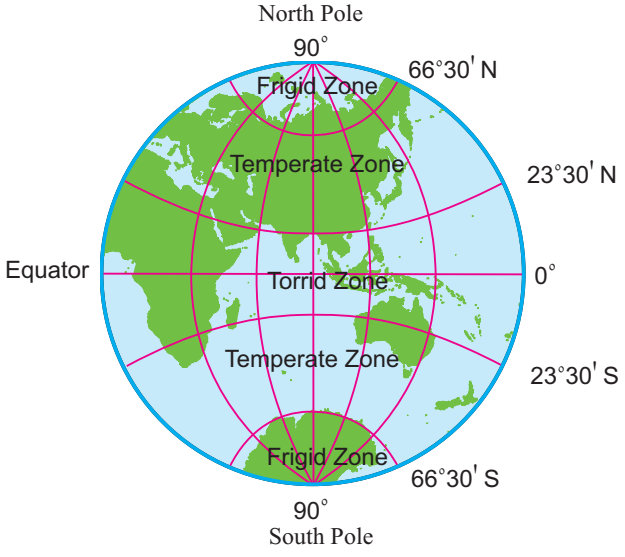

Figure 5.3 : Thermal Zones

Though latitude is the main factor, there are other factors also which influence the distribution of temperature. However, their effects are limited to a particular region. These factors are as follows.

Nearness to the sea, continentality, height above the mean sea-level and physical set-up of a region are factors that lead to diversity in the climate of different regions. Other than these, factors like cloud cover, winds, vegetation cover, urbanization, industrialization, etc. also influence the local climate.

Can you tell?

How will the rays fall between–

0° and 23°30' North and South?

23°30' and 66°30' North and South?

66°30' and 90° North and South?

Use your brain power!

Tell if the following statement is right or wrong. Give reasons.

In order to understand the climate of a region, the latitudinal extent is more useful than the longitudinal extent.

Let us perform an experiment to see that there is a difference in the heating and cooling of land and water.

Do it yourself !

Take two pots of the same size and fill them with water equally. At sunrise, keep one of the pots inside the house and the other one, outside. See that it remains in the sun all the time as shown in figure 5.4 B.

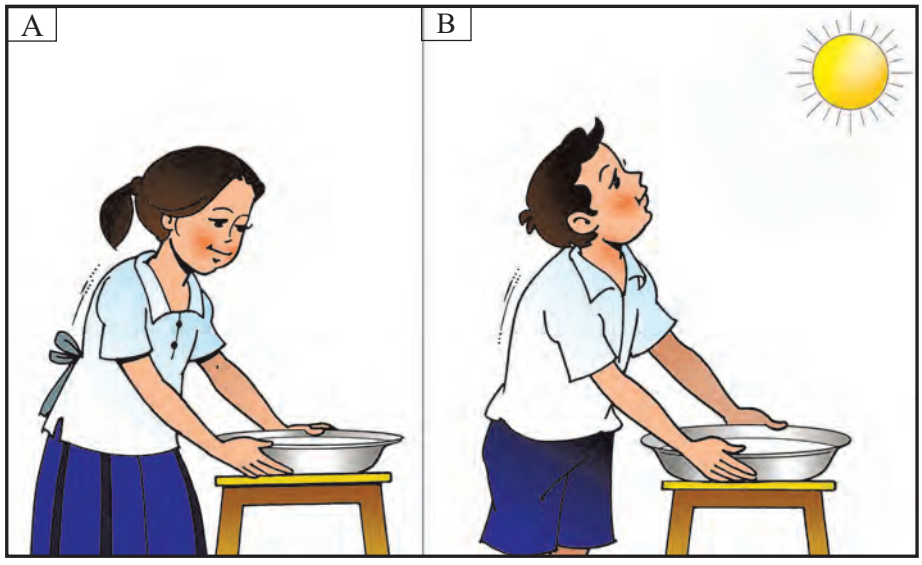

Figure 5.4 : The Heating and Cooling of Water

In the afternoon, walk barefoot on the floor inside the house and feel the temperature of the floor. Feel the temperature of the water in the pot inside.

Perform the same activity outside the house and get the feel of the temperature of land and the water kept in the sun. Write down your observations about the temperatures of land and water.

Do this again, around 7 in the evening. Note your observations again. Now you can remove the pots. Discuss all the observations you have noted in the class.

Always remember.

We normally think that air gets heated due to the sun's rays and because of the hot air, the land and water get heated. But in reality what happens is as follows:

First, land and water get heated due to sunrays. Later, they radiate into the atmosphere, the heat that they have absorbed. As a result, the layer of air close to the surface gets heated. The heat gets transferred vertically to the adjacent upper layers of the air. Hence air closer to the surface is hotter and as one moves higher up from the surface, the temperature of the air decreases. The temperature near the sea-level is higher and it decreases in the mountainous regions.

Explanation

You must have realized that the land cools down earlier than the water. The water kept outside in the sun is still a little warm. Due to this difference in the heating and cooling of land and water, the air over the land gets heated faster and also becomes cooler rapidly. The air over the water gets heated slowly and also looses the heat in a slower manner. In the coastal areas, as compared to continental areas, the temperature of air is lower during the day but warmer at night. Contrary to this, the temperature of air in the continental areas is higher during daytime and lower at night.

In the coastal areas, because of the heating of sea water, water vapour gets mixed in the air. This water vapour holds the heat in the air. As a result, the air in the coastal areas remains moist and warm. Conditions in the continental areas are the opposite. As water vapour is absent, the air remains dry. This leads to sharp differences in the day and night temperatures. The difference in the maximum and minimum temperatures of a day is called diurnal range of temperature.

In short, the difference in the day and night temperatures is less in the coastal areas and more in the continental areas. For example, Mumbai temperatures are even, but at Nagpur they vary

a lot. In the coastal region of Konkan the range of temperature is less but in Vidarbha, the range of temperature is found to be higher. Therefore, coastal areas have an equable climate whereas in continental areas, the climate is extreme. For example, the climate of Mumbai is equable whereas in continental locations like Nagpur it is extreme. The difference in the mean temperatures of summer and winter is called annual range of temperature.

Do you know?

Effect of greenhouse gases: Some gases in the atmosphere like, carbon dioxide and water vapour can hold the heat within themselves for a long period of time. Due to these gases, the temperature of air in the atmosphere increases. The increasing proportion of these gases in the atmosphere leads to climate change. Climate scientists believe that this is the reason for the increasing temperature of the earth. This change in climate is global. This is called global rise in temperature. The gases due to which the temperature increases are called Greenhouse Gases.

Can you tell?

- Find the range of temperature at Mumbai, Nagpur and Srinagar. Draw bar graphs for the same.

What will you do?

You stay at Mhaswad in Maan taluka in Satara district. Your Grandma stays at Vengurla in Sindhudurg district. During Diwali, you often visit Vengurla. You like the sea coast there. The warm air of that region attracts you because you are freed from the dry air and scratching cold of your place. This time Grandma is suffering from asthma. Doctors have advised her to stay at a place which has a drier climate. What should you do?

Do it yourself !

A pot with water is placed on a burner. Drop 4-5 small plastic buttons in it and observe their movement in water (figure 5.5).

Figure 5.5 : Convection and Vertical Flow of Heat

Explanation

Water expands on heating. The hot water from the base moves upwards. With it, the buttons, too, are pushed to the surface. The relatively cooler water in the upper portions moves downwards, taking the buttons with it. This happens repeatedly. In other words, on heating, an upward current sets in the water. In nature, the conditions are slightly different.

Due to temperature differences, both upward and horizontal currents develop in the ocean. Besides temperature differences, factors like winds and differences in the density of water also give rise to horizontal currents. These ocean currents flow from the equator to the polar region and from the polar region to the equator. See figure 5.6.

When an ocean current flows from the frigid to the torrid zone, it reduces the temperature of the coasts in the torrid zone. When a current flows from the torrid to the frigid zone, it increases the temperatures of the coasts in the frigid zone.

Make friends with maps!

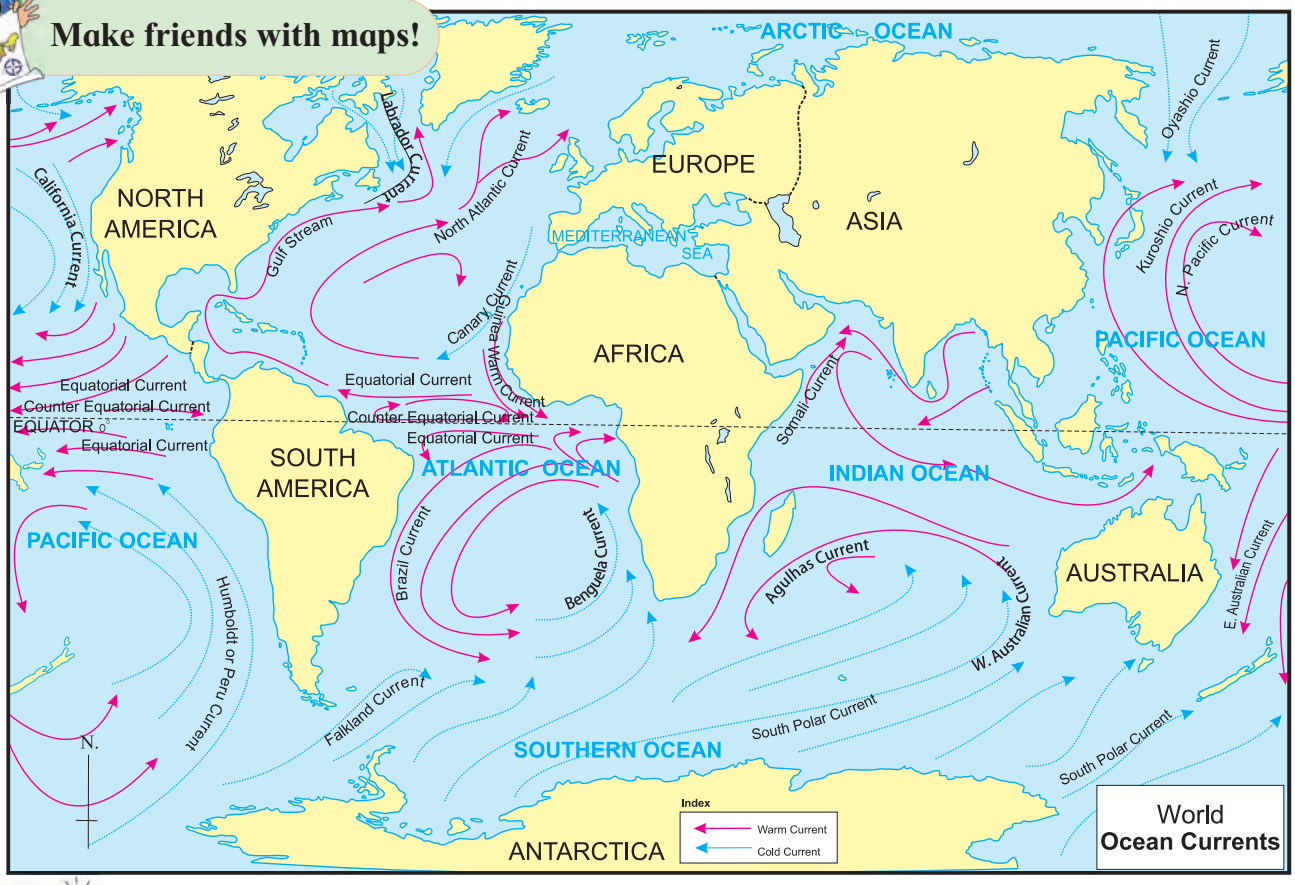

Figure 5.6 : World – Ocean Currents

Use your brain power!

Observe the map. Name the coastal areas that will experience changes in temperature. Give the reason for this.

Do you know?

The regions where warm and cold currents converge are favourable for the growth of planktons. Planktons are the food for fishes. Fish from other areas travel towards these areas in large numbers. They breed in warm waters. Due to high concentration of fish population, fisheries thrive well in these areas. In the map of ocean currents given in 5.6, locate such regions. Find their names from an atlas or the internet. Write these names on the map.

A Type of Plankton

Geography Museum

There are a number of methods of showing distributions on a map. One of these is isolines. Due to this method, the characteristic distribution of a component stands out vividly.

Isolines can be drawn using statistical information about natural factors. These lines are drawn on a map by joining all the points having the same value. The distribution on regional or global levels can be shown using isolines of different factors like height (contours), temperature (isotherms), pressure (isobars), rainfall (isohytes), etc.

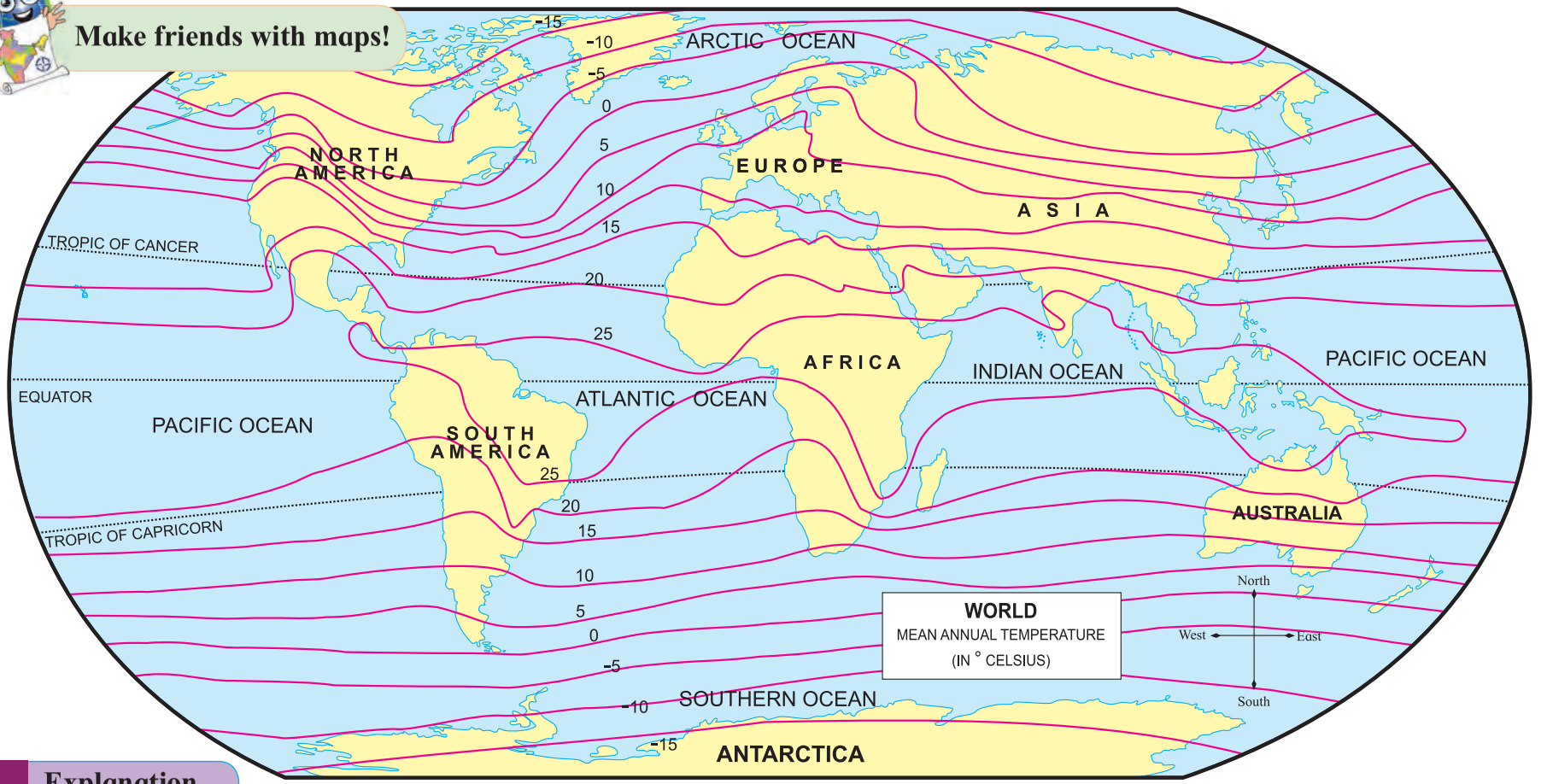

Figure 5.7 : World – Mean Annual Temperature

Explanation

Considering the temperatures of various places on the earth, maps of global distribution are prepared. Figure 5.7 is drawn with the help of isotherms. Isotherms are lines that connect places with the same temperature after avoiding the effect of height. These lines generally appear parallel to the latitudes on a world map.

Observe the isotherm of 25°C in the map. This line occupies areas close to the equator. The shape of this line appears like an ellipse on the map. The north-south spread of this ellipse is greater on the continents as compared to the oceans. The isotherm line occupies some parts of the continents of South America, Africa, Asia and Australia. A very limited portion of the Pacific Ocean is occupied by this isotherm. You will find two isotherms with a label of 0°C. Observe them. The 0°C isotherm from the southern hemisphere is largely straight and is parallel to the line of latitude. Comparatively the line of the same value in the northern hemisphere deviates north and south considerably. In the west, in parts of the Pacific Ocean, it is fairly straight but when it enters the continent of North America it turns somewhat to the north. Then the line proceeds

eastwards. Within a short distance after entering the Atlantic Ocean, it turns towards the north-east. In this part, you will find all the isotherm lines turning towards the north-east. This is because a warm ocean current is located in this area. Further after entering Eurasia while moving eastwards, it turns somewhat to the south-east. Still further in the Pacific Ocean, most of the isotherm lines appear moving eastwards as straight lines.

The isotherms in the southern hemisphere are fairly parallel to the latitudinal lines. From South Pole to the Tropic of Capricorn the distance between these lines is almost equal. As the proportion of land in the southern hemisphere is limited, temperatures in these parts are largely influenced by latitude.

In the northern hemisphere, the distance between these lines varies. In this hemisphere, the proportion of land is comparatively greater. This affects the distribution of temperature. These effects are seen in the form of variations in the distance between the isotherms and curved nature of these lines.

Can you tell?

Answer the following with the help of figure 5.8.

- What is the tube of the thermometer fixed on?
- What substance is used in the thermometer tube?
- What do the figures on the scale indicate?
- In which different units is the temperature measured?
- What season does the temperature in the figure indicate?

Thermometer: Different types of thermometers are used for measuring the temperature of air. Mercury or alcohol is used in the thermometers. The freezing point of mercury is -39°C whereas that of alcohol is -130°C. These materials are highly sensitive to temperature variations. Therefore variations in temperature from -30°C to +55°C can easily be observed with the help of these materials. The units of measuring temperature are degrees Celsius or degrees Fahrenheit. As shown in the figure, these are expressed as °C or °F. The difference in daily temperatures (maximum – minimum) can be observed with the help of a thermometer. Air temperature is measured in Celsius.

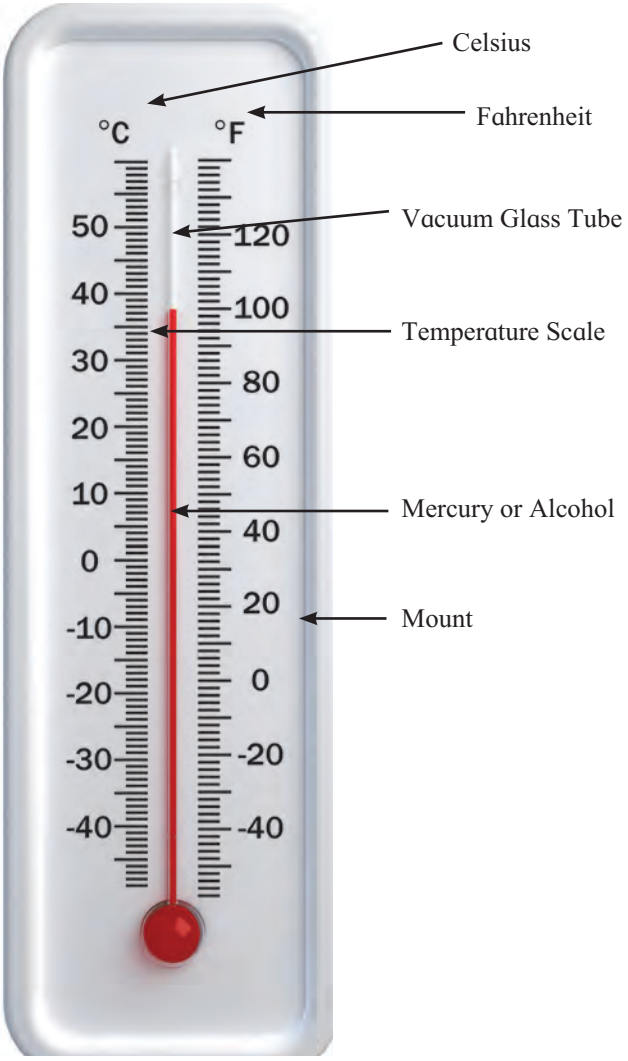

Figure 5.8 : A Simple Thermometer

Use your brain power!

Which season would be the best for visiting the following places, and why? Goa, Chikhaldara, Chennai, Darjiling, Ellora, Agra.

Think a little!

- Will it be alright if water or oil is used in the thermometer?
- Where is the temperature of your district headquarters recorded?

47QUKR

I can do this!

- *Identify the temperature zones.*
- *Tell the factors influencing temperature.*
- *Describe the global distribution of temperature with its characteristics.*
- *Describe the structure of a thermometer.*
- *Handle and use a thermometer.*

Exercises

(A) Where am I?

(1) The isotherm 0°C runs in my surroundings.

(2) The mean annual temperature is 25°C around me.

(3) The mean annual temperature around me is 10°C.

(B) Who am I?

(1) I connect places of equal temperature.

(2) I am useful for measuring the correct temperature.

(3) I get heated due to the land or water near me.

(4) Land and water get heated due to me.

(C) Answer the following.

(1) Explain with a diagram, the effect of the spherical shape of the earth on the temperature at different latitudes.

(2) What is the relation between the latitudinal extent and temperature of a region?

(3) What makes the isotherms run zigzag over continental areas?

Websites for reference

- http://science.nationalgeographic.com
- http://www.ucar.edu
- http://www.bbc.co.uk/schools
- http://www.ecokids.ca

❊ Activity

(1) Use the thermometer in your school and note the daily temperature on a display board.

(2) For two weeks, take down in your notebook, the information regarding weather given in the daily newspapers. Discuss your notes in the classroom.

(See inside the front cover for a specimen.)