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# 6

## The Living Organisms Characteristics and Habitats

Paheli and Boojho went on vacation to many places of interest. One such trip took them to the river Ganga in Rishikesh. They climbed the mountains of the Himalayas, where it was very cold. They saw many kinds of trees on these mountains — oaks, pines and deodars, very different from the ones near their home on the plains! In yet another trip, they travelled to Rajasthan and moved on camels through the hot desert. They collected different kinds of cactus plants from this trip. Finally, they went on a trip to Puri and visited the sea beach, dotted with casuarina trees. While recollecting all the fun that they had on these trips, a thought struck them. All these places were so different from one another, some were cold, some very hot and dry, and some places so humid. And yet all of them had many **organisms** (living creatures) of various kinds.

They tried to think of a place on Earth where there may not be any living creatures. Boojho thought of places near his home. Inside the house, he tried the cupboards. He had thought that there may not be any living organisms here, but he found one tiny spider in the cupboard. Outside the home too, there did not seem to be any place, he could think of, that did not have living creatures

of some kind or the other (Fig. 6.1). Paheli started thinking and reading about far away places. She read that people have even found tiny living organisms in the openings of volcanoes!



**Fig. 6.1** Search for living organisms

### 6.1 ORGANISMS AND THE SURROUNDINGS WHERE THEY LIVE

Another thought that occurred to Paheli and Boojho was about the kinds of living organisms that were present in different locations that they had visited. The deserts had camels, the mountains had goats and yak. Puri had some other creatures — crabs on the beach and such a variety of fish being caught by the fishermen at the sea! And then, there did seem to be some creatures like ants that were present in all these different locations. The kinds of plants found in each of these regions were so different from the plants of the other regions. What about the surroundings

in these different regions? Were they the same?

### Activity 1

Let us start with a forest. Think of all the plants, animals and objects that can be found there. List them in Column 1 of Table 6.1. List things, animals and plants, found in the other regions that are also shown in the table. You can collect the examples scattered through this chapter to fill Table 6.1. Discuss also with your friends, parents and teachers, to find more examples to fill the tables. You can also consult many interesting books in libraries that talk of animals, plants and minerals of different regions.

Try and include many plants, animals and objects, big and small, in each of the columns in this table. What kind of objects will we find that may not be animals or plants? Perhaps parts of plants like dried leaves, or parts of animals, like bones. We may also find different kinds of soils and pebbles. Water in the oceans may have salts dissolved in it as discussed in Chapter 3. There could be many more objects.

As we go through the chapter, keep adding more examples to Table 6.1. We

will discuss the table as we travel through many more interesting places.

### 6.2 HABITAT AND ADAPTATION

What do you find from the plants and animals listed in Activity 1? Did you find a large variety in them? Look at what you have entered in the column for the desert and the column for the sea in Table 6.1. Did you list very different kind of organisms in these two columns?

What are the surroundings like, in these two regions?

In the sea, plants and animals are surrounded by **saline** (salty) water. Most of them use the air dissolved in water.

There is very little water available in the desert. It is very hot in the day time and very cold at night in the desert. The animals and plants of the desert live on the desert soil and breathe air from the surroundings.

The sea and the desert are very different surroundings and we find very different kind of plants and animals in these two regions, isn't it? Let us look at two very different kind of organisms from the desert and the sea – a camel and a fish. The body structure of a camel helps it to survive in desert conditions. Camels have long legs which help to

**Table 6.1 Animals, plants and other objects found in different surroundings**

In the forest	On mountains	In the desert	In the sea	Any other?

keep their bodies away from the heat of the sand (Fig. 6.2). They excrete small amount of urine, their dung is dry and they do not sweat. Since camels lose very little water from their bodies, they can live for many days without water.

Let us look at different kinds of fish. Some of these are shown in Fig. 6.3. There are so many kinds of fish, but, do you see that they all have something common about their shape? All the ones shown here have the streamlined shape that was discussed in Chapter 5. This shape helps them move inside water. Fish have slippery scales on their bodies. These scales protect the fish and also help in easy movement through water. We discussed in Chapter 5, that fish have flat fins and tails that help them to change directions and keep their body balance in water. Gills present in the fish help them to use oxygen dissolved in water.

We see that the features of a fish help it to live inside water and the features of a camel help it to survive in a desert.

We have taken only two examples from a very wide variety of animals and plants that live on the Earth. In all this variety of organisms, we will find that they have certain features that help them live in the surroundings in which they are normally found. The presence of specific features or certain habits, which enable an organism to live naturally in a place is called adaptation. Adaptation of organisms differ depending on their place of dwelling. That is why a fish cannot live out of water and a camel cannot live in sea.

The place where organisms live is called **habitat**. Habitat means a dwelling place (a home). The habitat provides food, water, air, shelter and other needs to organisms. Several kinds of plants and animals live in the same habitat.

The plants and animals that live on land are said to live in **terrestrial habitats**. Some examples of terrestrial habitats are forests, grasslands, deserts, coastal and mountain regions. On the other hand, the habitats of plants and



**Fig. 6.2** Camels in their surroundings



**Fig. 6.3** Different kinds of fish

There are some changes that can happen in an organism over a short period of time to help them adjust to some changes in their surroundings. For instance, if we live in the plains and suddenly go to high mountain regions, we may experience difficulty in breathing and doing physical exercise for some days. We need to breathe faster when we are on high mountains. After some days, our body adjusts to the changed conditions on the high mountain. Such small changes that take place in the body of a single organism over short periods, to overcome small problems due to changes in the surroundings, are called **acclimatisation**. These changes are different from the adaptations that take place over thousands of years.

animals that live in water are called **aquatic habitats**. Lakes, rivers and oceans are some examples of aquatic habitats. There are large variations among terrestrial habitats like forests, grasslands, deserts, coastal and mountain regions located in different parts of the world.

The organisms, both plants and animals, living in a habitat are its **biotic** components. The non-living things such as rocks, soil, air and water in the habitat constitute its **abiotic components**. Are sunlight and heat biotic or abiotic components?

We know that some plants grow from seeds. Let us look at some abiotic factors and their effect on seeds as they grow into young plants.

## Activity 2

Recall Activity 7 in Chapter 4 — we made sprouts from gram and maize seeds. When the seed turned into a sprout, it is said to have **germinated**. This is the beginning of life of a new plant.

Collect some dry *moong* seeds. Keep 20-30 seeds aside and soak the rest in

water for a day. Divide the soaked seeds into four parts. Keep one part completely submerged in water for 3-4 days. Do not disturb the dry seeds and those submerged in water. Keep one part of soaked seeds in a sunny room and another in a completely dark region like a cupboard that does not allow any light to come in. Keep the last part in very cold surroundings, say, in a refrigerator or with ice around them. Rinse them and replace the water every day. What do you notice, after a few days? Do the seeds in all the five conditions germinate uniformly? Do you find slower or no germination in any of these?

Do you realise that abiotic factors like air, water, light and heat are important for the growth of plants. In fact, abiotic factors are important for all living organisms.

We find that organisms exist in very cold as well as very hot climates, isn't it? How do they manage to survive? Adaptation is the method by which organisms get well adjusted to the climate.

Adaptation does not take place in a short time because the abiotic factors of a region also change very slowly. Those organisms which cannot adapt to these changes die, and only the adapted ones survive. Organisms adapt to different abiotic factors in different ways. This results in a wide variety of organisms in different habitats.

Let us look at some habitats, understood the abiotic factors and the adaptations of animals in these habitats.

### 6.3 A JOURNEY THROUGH DIFFERENT HABITATS

#### Some Terrestrial Habitats

##### Deserts

We discussed the abiotic factors of a desert and the adaptations in camels. What about other animals and plants that are found in deserts? Do they have the same kind of adaptations?

There are desert animals like rats and snakes, which do not have long legs that a camel has. To stay away from the intense heat during the day, they stay in burrows deep in the sand (Fig 6.4). These animals come out only during the night, when it is cooler.

Fig. 6.5 shows some typical plants that grow in a desert. How are these adapted to the desert?

#### Activity 3

Bring a potted cactus and a leafy plant to the classroom. Tie polythene bags to some parts of the two plants, as was done for Activity 4 in Chapter 4, where we studied transpiration in plants.



**Fig. 6.4** Desert animals in burrows



**Fig. 6.5** Some typical plants that grow in desert

Leave the potted plants in the sun and observe after a few hours. What do you see? Do you notice any difference in the amount of water collected in the two polythene bags?

Desert plants lose very little water through transpiration. The leaves in desert plants are either absent, very small, or they are in the form of spines. This helps in reducing loss of water from the leaves through transpiration. The leaf-like structure you see in a cactus is, in fact, its stem (Fig. 6.5). Photosynthesis in these plants is usually carried out by the stems. The

stem is also covered with a thick waxy layer, which helps to retain water in the tissues of cacti. Most desert plants have roots that go very deep into the soil for absorbing water.

### **Mountain regions**

These habitats are normally very cold and windy. In some areas, snowfall may take place in winters.

There is a large variety of plants and animals living in the mountain regions. Have you seen the kind of trees shown in Fig. 6.6?



**Fig. 6.6** Trees of a mountain habitat

If you live in a mountain region or have visited one, you may have seen a large number of such trees. But, have you ever noticed such trees naturally growing in other regions?

How are these trees adapted to the conditions prevailing in their habitat? These trees are normally cone shaped and have sloping branches. The leaves of some of these trees are needle-like. This helps the rainwater and snow to slide off easily. There could be trees with shapes very different from these that are

also present on mountains. They may have different kind of adaptations to survive on the mountains.

Animals living in the mountain regions are also adapted to the conditions there (Fig. 6.7). They have thick skin or fur to protect them from cold. For example, yaks have long hair to keep them warm. Snow leopard has thick fur on its body



(a)



(b)



(c)

**Fig. 6.7** (a) Snow leopard, (b) yak and (c) mountain goat are adapted to mountain habitats

including feet and toes. This protects its feet from the cold when it walks on the snow. The mountain goat has strong hooves for running up the rocky slopes of the mountains.

As we go up in the mountainous regions, the surroundings change and we see different kinds of adaptations at different heights.

### Grasslands

A lion lives in a forest or a grassland and is a strong animal that can hunt and kill animals like deer. It is light brown in colour. Look at the picture of a lion and that of a deer (Fig. 6.8). How are the eyes placed in the face for these two animals? Are they in the front or on the side of the face? Lions have long claws in their front legs that can be withdrawn inside the toes. Do the features of a lion help it in any way to



(a)



(b)

**Fig. 6.8 (a) Lion and (b) deer**

survive? Its light brown colour helps it to hide in dry grasslands when it hunts for **prey** (animals to eat). The eyes in front of the face allow it to have a correct idea about the location of its prey.

A deer is another animal that lives in forests and grasslands. It has strong teeth for chewing hard plant stems of the forest. A deer needs to know about the presence of **predators** (animals like lion that make it their prey) in order to run away from them and not become their prey. It has long ears to hear movements of predators. The eyes on the side of its head allow it to look in all directions for danger. The speed of the deer helps them to run away from the predators.

There are many other features of a lion, a deer or other animals and plants that help them to survive in their habitat.

## Some Aquatic Habitats

### Oceans

We already discussed how fish are adapted to live in the sea. Many other sea animals have streamlined bodies to help them move easily in water. There are some sea animals like squids and octopus, which do not have this streamlined shape. They stay deeper in the ocean, near the seabed and catch any prey that moves towards them. However, when they move in water they make their body shapes streamlined. These animals have gills to help them use oxygen dissolved in water.

There are some sea animals like dolphins and whales that do not have

gills. They breathe in air through nostrils or **blowholes** that are located on the upper parts of their heads. This allows them to breathe in air when they swim near the surface of water. They can stay inside the water for a long time without breathing. They come out to the surface from time to time, to breathe in air. Did you ever see this interesting activity of dolphins in television programme or films on ocean life?

### Ponds and lakes

Have you seen plants growing in ponds, lakes, rivers and even some drains? Go on a field trip to a nearby pond, if possible, and try to observe the kinds of plants that are seen there. Observe the leaves, stems and roots of these plants.

Some of these plants have their roots fixed in the soil below the water



**Fig. 6.9** Some aquatic plants float on water. Some have their roots fixed in the soil at the bottom. Some aquatic plants are submerged in water.

(Fig. 6.9). In terrestrial plants, roots normally play a very important role in the absorption of nutrients and water from the soil. However, in aquatic plants, roots are much reduced in size and their main function is to hold the plant in place.

The stems of these plants are long, hollow and light. The stems grow up to the surface of water while the leaves and flowers, float on the surface of water.

Some aquatic plants are submerged in water. All parts of such plants are under water. Some of these plants have narrow and thin ribbon-like leaves. These can bend in the flowing water. In some submerged plants, leaves are often highly divided, through which the water can easily flow without damaging them.

Frogs usually live in ponds. Frogs can stay both inside the water as well as move on land. They have strong back legs that help them in leaping and catching their prey. They have webbed feet which help them swim in water.

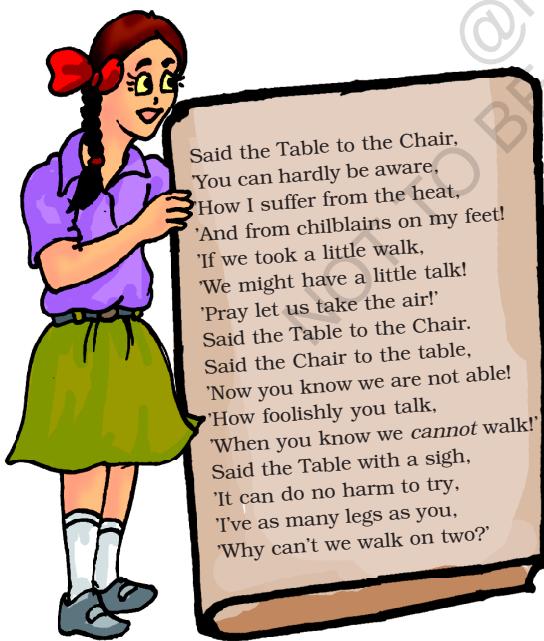
We have discussed only a few common animals and plants compared to the wide variety that live in different habitats. You may have also noticed the very wide variety in plants around you, when you prepared a herbarium as part of the suggested activities in Chapter 4. Imagine the kind of variety that you could see in a herbarium of leaves of plants from all regions of the Earth!

## 6.4 CHARACTERISTICS OF ORGANISMS

We went on a journey through different habitats and discussed many plants and

animals. In Activity 1, we listed objects, plants and animals found in different surroundings. Suppose we stop a while and think which examples in our list are living? Let us think of examples from a forest. Trees, creepers, small and big animals, birds, snakes, insects, rocks, soil, water, air, dry leaves, dead animals, mushrooms and moss may be only some of the objects that are present in the forest. Which of these are living?

Think of objects that you can see around you at this moment and group them as living and non-living. In some cases, it is easy for us to know. For example, we know that objects like chair or table are not alive. Paheli was reading this rhyme from *Complete Nonsense* written by Edward Lear:



Said the Table to the Chair,  
You can hardly be aware,  
How I suffer from the heat,  
'And from chilblains on my feet!  
'If we took a little walk,  
'We might have a little talk!  
'Pray let us take the air!'  
Said the Table to the Chair.  
Said the Chair to the table,  
'Now you know we are not able!  
'How foolishly you talk,  
'When you know we *cannot* walk!'  
Said the Table with a sigh,  
'It can do no harm to try,  
'I've as many legs as you,  
'Why can't we walk on two?'

Paheli and Boojho found the poem very funny, because they knew that a chair or a table is not alive and it cannot talk or walk.

Chair, table, stone or a coin are not alive. Similarly, we do know that we are alive and so are all the people of the world. We also see animals around us that are so full of life — dogs, cats, monkeys, squirrels, insects and many others.

How do we know that something is living? Often, it is not so easy to decide. We are told that plants are living, but they do not move like a dog or a pigeon. On the other hand, a car or a bus can move, still we consider them as non-living. Plants and animals appear to grow in size with time. But then, at times, clouds in the sky also seem to grow in size. Does it mean that clouds are living? No! So, how does one distinguish between living and non-living things? Do living things have some common characteristics that make them very different from the non-living?

You are a wonderful example of a living being. What characteristics do you have which make you different from a non-living thing? List a few of these characteristics in your notebook. Look at your list and mark those characteristics that you have listed, which may also be found in animals or plants.

Some of these characteristics are perhaps common to all living things.

## Do all organisms need food?

Earlier, we learnt that all living things need food and how essential it is to animals and to us. We have also learnt that plants make their own food by the process of photosynthesis. Animals depend on plants or other animals for their food.

Food gives organisms the energy needed for them to grow. Organisms also need energy for other life processes that go on inside them.

## Do all organisms show growth?

Does the *kurta* you had four years back, still fit you? You cannot wear it any more, isn't it? You must have grown taller during these years. You may not realise it, but you are growing all the time and in few more years you will become an adult. (Fig. 6.10).

Young ones of animals also grow into adults. You would surely have



**Fig. 6.10** A baby grows into an adult

noticed pups grow into adults. A chick hatched from an egg, grows into a hen or a cock. (Fig. 6.11).

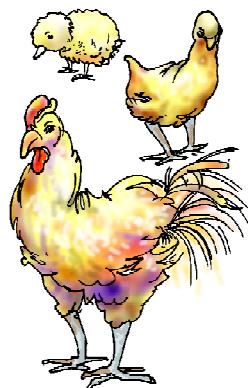
Plants also grow. Look around you and see a few plants of a particular type. Some are very small and young, some are bigger. They may all be in different stages of growth. Look at the plants after a few days and weeks. You may find that some of them have grown in size. Growth seems to be common to all living things.

Do you think, non-living things show growth?

## Do all organisms respire?

Can we live without breathing? When we inhale, the air moves from outside to the inside of our body. When we breathe out, the air moves from inside our body to outside. Breathing is part of a process called **respiration**. In respiration, some of the oxygen of the air we breathe in, is used by the body. We breathe out carbon dioxide produced in this process.

The process of breathing in animals like cows, buffaloes, dogs or cats is similar to humans. Observe any one of these animals while they are taking rest, and notice the movement of their abdomen. This slow movement indicates that they are breathing.



**Fig. 6.11** A chicken grows into an adult

Respiration is necessary for all living organisms. It is through respiration that the body finally obtains energy from the food it takes.

Some animals may have different mechanisms for the exchange of gases, which is a part of the respiration process. For example, earthworms breathe through their skin. Fish, we have learnt, have gills for using oxygen dissolved in water. The gills absorb oxygen from the air dissolved in water.

Do plants also respire? Exchange of gases in plants mainly takes place through leaves. The leaves take in air through tiny pores in them and use the oxygen. They give out carbon dioxide to the air.

We learnt that in sunlight, plants use carbon dioxide to produce food and give out oxygen. The amount of oxygen released in the process of food preparation by plants is much more than the oxygen they use in respiration. Respiration in plants takes place day and night.

### **Do all organisms respond to stimuli?**

How do you respond, if you suddenly step on a sharp object like a thorn, while walking barefoot? How do you feel when you see or think about your favourite food? You suddenly move from a dark place into bright sunlight. What happens? Your eyes shut themselves automatically for a moment till they adjust to the changed bright

surroundings. Your favourite food, bright light and a thorn, in the above situations are some examples of changes in your surroundings. All of us respond immediately to such changes. Changes in our surroundings that makes us respond to them, are called **stimuli**.

Do other animals also respond to stimuli? Observe the behaviour of animals, when food is served to them. Do you find them suddenly becoming active on seeing the food? When you move towards a bird, what does it do? Wild animals run away when bright light is flashed towards them. Similarly, cockroaches begin to move to their hiding places if the light in the kitchen is switched on at night. Can you give some more examples of responses of animals to stimuli?

Do plants also respond to stimuli? Flowers of some plants bloom only at night. In some plants flowers close after sunset. In some plants like Mimosa, commonly known as ‘touch-me-not’, leaves close or fold when someone touches them. These are some examples of responses of plants towards changes in their surroundings.

### **Activity 4**

Place a potted plant in a room a little away from a window through which sunlight enters some time during the day (Fig. 6.12). Continue watering the plant for a few days. Does the plant grow upright, like plants out in the open? Note the direction in which it bends, if



**Fig. 6.12** Plant respond to light

it is not growing upright. Do you think, this may be in response to some stimulus?

All living things respond to changes around them.

### Living organisms and excretion

All organisms need food. Not all the food that is eaten is completely used, only a part of it is utilised by the body. What happens to the rest? This has to be removed from the body as wastes. Our body produces some wastes in other life processes also. The process of getting rid of wastes by organisms is known as **excretion**.

Do plants also excrete? They do, but not as seen in animals. The mechanisms in plants are a little different. Some plants find it possible to store the waste products within their parts in a way that they do not harm the plant as a whole. Some plants remove waste products as secretions.

Excretion is another characteristic common to all organisms.



### Do all organisms reproduce their own kind?

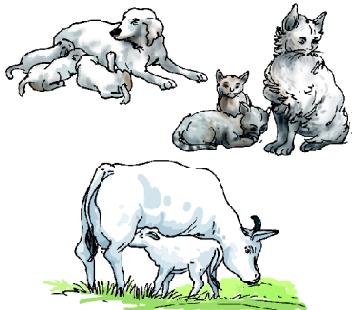
Have you ever seen nests of some birds like pigeons? Many birds lay their eggs in the nest. Some of the eggs hatch and young birds come out of them (Fig. 6.13).



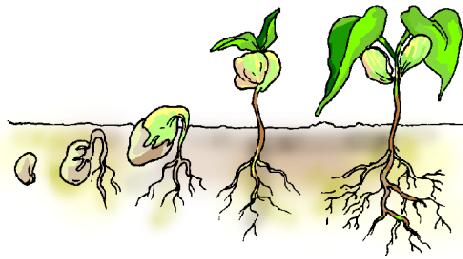
**Fig. 6.13** (a) Birds lay eggs which after hatching produce (b) young ones

Animals **reproduce** their own kind. The mode of reproduction may be different, in different animals. Some animals produce their young ones through eggs. Some animals give birth to the young ones (Fig. 6.14).

Plants also reproduce. Like animals, plants also differ in their mode of reproduction. Many plants reproduce through seeds. Plants produce seeds,



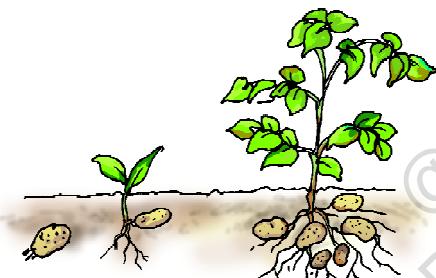
**Fig. 6.14** Some animals which give birth to their young ones



**Fig. 6.15** A seed from a plant germinates into a new plant

which can germinate and grow into new plants (Fig. 6.15).

Some plants also reproduce through parts other than seeds. For example, a part of a potato with a bud, grows into a new plant (Fig. 6.16).



**Fig. 6.16** A new plant grows from a bud of potato

Plants also reproduce through cuttings. Would you like to grow a plant in this way yourself?

### Activity 5

Take a cutting from a rose or a *mehndi* plant. Fix it in the soil and water it regularly. What do you observe, after a few days?

It may not be easy to grow plants from cuttings. Do not be disappointed if your cutting does not grow. Talk to a gardener, if possible, on the care to be given to cuttings to make them grow into plants.

Living things produce more of their own kind through **reproduction**. It takes place in many different ways, for different organisms.

### Do all organisms move?

In Chapter 5, we discussed the various ways in which animals move. They move from one place to another and also show other body movements.

What about plants? Do they also move? Plants are generally anchored in soil so they do not move from one place to another. However, various substances like water, minerals and the food synthesised by them move from one part of the plant to other. Have you noticed any other kind of movement in plants? Opening or closing of flowers? Do you recall how some plants show movement in response to certain stimuli?

We also have some non-living things moving, of course. A bus, car, a small piece of paper, clouds and so on. Is there something different in these movements from the movements of living beings?

There is such a variety of living organisms, but, all of them show some common characteristics, as we have discussed. Yet another common characteristic is that living beings die. Because organisms die, particular types of organisms can survive over thousands of years only if they reproduce their own kind. One single organism may die without ever reproducing, but, the type of organism can exist only if there is reproduction.

We see that, all living things seem to have some common characteristics. They all need food, respire, respond to stimuli, reproduce, show movement, grow and die.

Do we find some non-living things that also show some of these characteristics? Cars, bicycle, clocks and the water in the river move. The moon moves in the sky. A cloud grows in size right in front of our eyes. Can such things be called living? We ask ourselves, do these objects also show **all** the other characteristics of living things?

In general, something that is living may have all the characteristics that we have discussed, while non-living things may not show all these characteristics at the same time.

Is this always true? Do we always find that living things definitely show all the characteristics of the living that we have discussed? Do we always find that non-living things may show only some of these characteristics and never all of them?

To understand this a little better, let us look at a specific example. Consider any seed, say, *moong*. Is it living? It can

stay in a shop for months and not show any growth or some of the other characteristics of life. However, we bring the same seed and plant it in soil, water it and it turns into a whole plant. Did the seed — need food, did it excrete, grow or reproduce when it was in the shop for many months?

We see that there can be cases when we cannot easily say that a thing has all the characteristics that we have discussed, for it to be called living.

### **“What then is life?”**

Push your hand deep inside a sack of wheat. Do you find it is warm inside? There is some heat being produced inside the sack of wheat. The seeds respire and in that process give out some heat.

We see that respiration is a process that takes place in seeds even when some of the other life processes may not be very active.

It may not be very easy to answer our question — “what then is life”? However, looking at all the diversity of living beings around us, we can conclude that **“life is beautiful”!**

## **Key words**

Adaptation	Habitat
Aquatic habitat	Living
Biotic component	Reproduction
Excretion	Respiration
Growth	Stimulus



## Summary

- The surroundings where plants and animals live, is called their habitat.
- Several kinds of plants and animals may share the same habitat.
- The presence of specific features and habits, which enable a plant or an animal to live in a particular habitat, is called adaptation.
- There are many types of habitats, however, these may be broadly grouped as terrestrial (on the land) and aquatic (in water).
- There is a wide variety of organisms present in different habitats.
- Plants, animals and microorganisms together constitute biotic components.
- Rocks, soil, air, water, light and temperature are some of the abiotic components of our surroundings.
- Living things have certain common characteristics — they need food, they respire and, excrete, respond to their environment, reproduce, grow and show movement.

## Exercises

1. What is a habitat?
2. How are cactus adapted to survive in a desert?
3. Fill up the blanks
  - (a) The presence of specific features, which enable a plant or an animal to live in a particular habitat, is called \_\_\_\_\_.
  - (b) The habitats of the plants and animals that live on land are called \_\_\_\_\_ habitat.
  - (c) The habitats of plants and animals that live in water are called \_\_\_\_\_ habitat.
  - (d) Soil, water and air are the \_\_\_\_\_ factors of a habitat.
  - (e) Changes in our surroundings that make us respond to them, are called \_\_\_\_\_.
4. Which of the things in the following list are nonliving?  
Plough, Mushroom, Sewing machine, Radio, Boat, Water hyacinth, Earthworm
5. Give an example of a non-living thing, which shows any two characteristics of living things.
6. Which of the non-living things listed below, were once part of a living thing?  
Butter, Leather, Soil, Wool, Electric bulb, Cooking oil, Salt, Apple, Rubber
7. List the common characteristics of the living things.
8. Explain, why speed is important for survival in the grasslands for animals that live there. (Hint: There are few trees or places for animals to hide in grasslands habitats.)

## SUGGESTED PROJECTS AND ACTIVITIES

1. Many magazines and newspapers talk about possibility of life outside the Earth. Read these articles and have a discussion in the class about what could be defined as life outside Earth.
2. Visit a local zoo and find out what special arrangements are made for the animals that have been brought there from different habitats.
3. Find out where are the habitats of the polar bear and the penguin. For each animal, explain two ways in which it is well adapted to its habitat.
4. Find out which animals live in the foot-hills of the Himalayas. Find out if the types and varieties of animals and plants changes as one goes higher into the mountain regions of the Himalayas.
5. Make a habitat album. Try to obtain pictures of animals and plants that you have listed in Activity 1 and paste these under different habitat sections in the album. Draw the leaf shapes and structures for trees found in these different regions and include these in the album. In addition, draw the patterns of branching found in trees of these different regions and include these also in the album.





0652CH10

# 7

## Motion and Measurement of Distances

There was a general discussion among the children in Paheli and Boojho's class about the places they had visited during the summer vacations. Someone had gone to their native village by a train, then a bus, and finally a bullock cart. One student had travelled by an aeroplane. Another spent many days of his holidays going on fishing trips in his uncle's boat.

The teacher then asked them to read newspaper articles that mentioned about small wheeled vehicles that moved on the soil of Mars and conducted experiments. These vehicles were taken by spacecraft all the way to Mars!

Meanwhile, Paheli had been reading stories about ancient India and wanted to know how people travelled from one place to another in earlier times.

### 7.1 STORY OF TRANSPORT

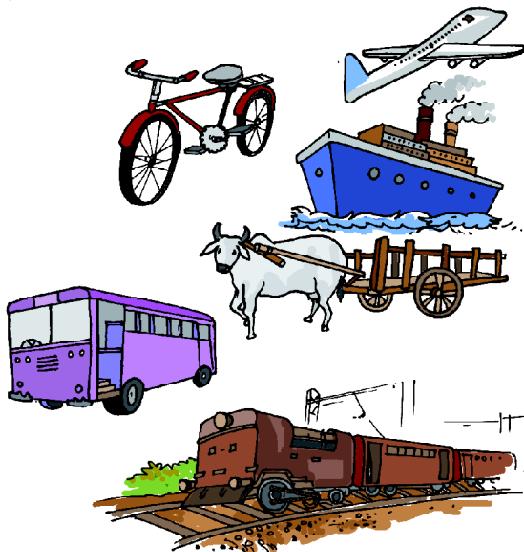
Long ago people did not have any means of transport. They used to move only on foot and carry goods on their back. Later on they began to use animals for transportation.

For transport through water, routes, boats were used from ancient times. To begin with, boats were simple logs of wood in which a hollow cavity could be made. Later, people learnt to put together different pieces of wood and give shapes to the boats. These shapes

imitated the shapes of the animals living in water. Recall our discussions of this streamlined shape of fish in Chapters 5 and 6.

Invention of the wheel made a great change in modes of transport. The design of the wheel was improved over thousands of years. Animals were used to pull carts that moved on wheels.

Until the beginning of the 19th century, people still depended on animals, boats and ships to transport them from place to place. The invention of steam engine led to the development of new means of transport. Railroads were made for steam engine driven carriages and wagons. Later came



**Fig. 7.1** Some means of transportation

automobiles such as motor cars, trucks and buses. Motorised boats and ships were used as means of transport on water. The early years of 1900 saw the development of aeroplanes. These were later improved to carry passengers and goods. Electric trains, monorail, supersonic aeroplanes and spacecraft are some of the contributions of the 20th century.

Fig. 7.1 shows some of the different modes of transport. Place them in the correct order — from the earliest modes of transport to the most recent.

Are there any of the early modes of transport that are not in use today?

## 7.2 How WIDE IS THIS DESK?

How did people know how far they have travelled?

How will you know whether you can walk all the way to your school or whether you will need to take a bus or a rickshaw to reach your school? When you need to purchase something, is it possible for you to walk to the market? How will you know the answers to these questions?

It is often important to know how far a place is, so that we can have an idea how we are going to reach that place — walk, take a bus or a train, a ship, an aeroplane or even a spacecraft!

Sometimes, there are objects whose length or width we need to know.

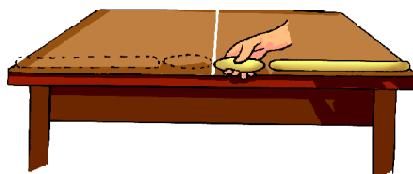
In Paheli and Boojho's classroom, there are large desks which are to be shared by two students. Paheli and Boojho share one desk, but, frequently end up objecting that the other is using a larger share of the desk.

On the teacher's suggestion, they decided to measure the length of the desk, make a mark exactly in the middle of it and draw a line to separate the two halves of the desk.

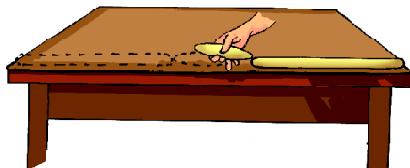
Both Paheli and Boojho are very fond of playing *gilli danda* with their friends. Boojho brought a set of *gilli* and *danda* with him.

Here is how they tried to measure the length of the desk using the *danda* and the *gilli* (Fig. 7.2).

The desk seems to be having a length equal to two *danda* lengths and two lengths of the *gilli*. Drawing a line in the middle of the desk leaves each of them happy with a half of the desk equal to a *danda* and a *gilli* in length. After a few days, the marked line gets wiped out. Boojho now has a new set of *gilli* and *danda* as he lost his old one. Here is how, the length of the desk seems to measure using the *gilli* and *danda* (Fig. 7.3).



**Fig. 7.2** Measuring the length of a desk with *gilli* and *danda*



**Fig. 7.3** Measuring the length of the desk with a different set of *gilli* and *danda*

Hello! Now, when measured with the new set of *gilli* and *danda*, the desk length seems to be about two *danda* lengths, one *gilli* length with a small length still left out. This is less than one *gilli* length. Now what?

What would you suggest Paheli and Boojho do, to measure the length of the whole desk? Can they use a cricket wicket and bails to measure the length or do you think that this might create the similar problem?

One thing they could do is to take a small length of string and mark two points on it. This will be a string length. They can measure the width of the desk in string lengths (Fig. 7.4). How can they use the string to measure distances less than the length of a string? They can fold

the string and mark it into  $\frac{1}{2}$ ,  $\frac{1}{4}$  and  $\frac{1}{8}$  'string lengths'. Now, perhaps Paheli and Boojho can measure the exact length of the desk using the string.

You would say that they should use the scale in their geometry box and solve their problem? Yes, Of course!

Boojho has been reading about the way people used to measure distances



**Fig. 7.4** Measuring the length of the desk with string lengths

before such standard scales were made and he has been trying to follow different methods of measuring distances.

There are so many occasions when we come across a need to measure lengths and distances. The tailor needs to measure the length of the cloth to know if it is enough to stitch a *kurta*. A carpenter needs to measure the height and width of a cupboard to know how much wood he would need to make its door. The farmer needs to know the length and breadth or the area of his land to know how much seed he can sow and how much water would be needed for his crops.

Suppose, you are asked how tall you are? You want to tell the length of a straight line from the top of your head to the heel of your feet.

How long is this room?  
How wide is this desk?  
How far is it from Delhi to Lucknow?  
How far away is the Moon from the Earth?

All these questions have one thing in common. They all concern distance between two places. The two places may be close enough, like the two ends of a table or they may be far apart, like Jammu and Kanyakumari.

Let us do a few measurements to see what exactly we need to do, when we measure distances or lengths.

### 7.3 SOME MEASUREMENTS

#### Activity 1

Work in groups and each of you do this activity one by one. Using your foot as a

unit of length, measure the length and breadth of the classroom. It is possible that while measuring these you may find some part remains to be measured as it is smaller than your foot. Use a string to measure the length of a part of your foot as you did before. Record your observations in Table 7.1.

**Table 7.1 Measuring length and breadth of classroom**

Name of student	Length of the classroom	Width of the classroom

## Activity 2

Work in a group and each of you use your handspan as a unit to measure the width of a table or a desk in the classroom (Fig. 7.5).



**Fig. 7.5** Measuring the width of a table with a handspan

Here too, you may find that you need string lengths equal to your handspan and then fractions of this string length to make the measurement. Record all observations in Table 7.2.

We see that, measurement means the comparison of an unknown quantity

**Table 7.2 Measuring width of a table**

Who measured the width of the table?	Number of handspans

with some known quantity. This known fixed quantity is called a **unit**. The result of a measurement is expressed in two parts. One part is a number. The other part is the unit of the measurement. For example, if in Activity 1, the length of the room is found to be 12 lengths of your foot, then 12 is the number and 'foot length' is the unit selected for the measurement.

Now, study all the measurements recorded in Table 7.1 and 7.2. Are all the measurements for the room using everybody's foot, equal? Are everybody's measurement, by handspan, of the width of the table equal? Perhaps the results could be different as the length of your handspan and that of your friends may not be the same. Similarly, the length of the foot may be slightly different for all the students. Therefore, when you tell your measurement using your handspan or length of foot as a unit to others, they will not be able to understand how big the actual length is, unless they know the length of your handspan or foot.

We see therefore, that some standard units of measurement are needed, that do not change from person to person.

## 7.4 STANDARD UNITS OF MEASUREMENTS

In ancient times, the length of a foot, the width of a finger, and the distance of a step were commonly used as different units of measurements.

The people of the Indus valley civilisation must have used very good measurements of length because we see evidence in excavations of perfectly geometrical constructions.

A cubit as the length from the elbow to the finger tips was used in ancient Egypt and was also accepted as a unit of length in other parts of the world.

People also used the "foot" as a unit of length in different parts of the world. The length of the foot used varied slightly from region to region.

People measured a "yard" of cloth by the distance between the end of the outstretched arm and their chin. The Romans measured with their pace or steps.

In ancient India, small length measurements used were an *angul* (finger) or a *mutthi* (fist). Even today, we can see flower sellers using their forearm as a unit of length for garlands in many towns of India. Many such body parts continue to be in use as unit of length, when convenient.

However, everyone's body parts could be of slightly different sizes. This must

have caused confusion in measurement. In 1790, the French created a standard unit of measurement called the metric system.

For the sake of uniformity, scientists all over the world have accepted a set of standard units of measurement. The system of units now used is known as the International System of Units (SI units). The SI unit of length is a metre. A metre scale is shown in Fig. 7.6. Also shown is the 15 cm scale in your geometry box.

Each metre (m) is divided into 100 equal divisions, called centimetre (cm). Each centimetre has ten equal divisions, called millimetre (mm). Thus,

$$1 \text{ m} = 100 \text{ cm}$$

$$1 \text{ cm} = 10 \text{ mm}$$

For measuring large distances, metre is not a convenient unit. We define a larger unit of length. It is called kilometre (km).

$$1 \text{ km} = 1000 \text{ m}$$

Now, we can repeat all our measurement activities using a standard scale and measure in SI units. Before we do that, we do need to know the correct way of measuring lengths and distances.

## 7.5 CORRECT MEASUREMENT OF LENGTH

In our daily life we use various types of measuring devices. We use a metre scale

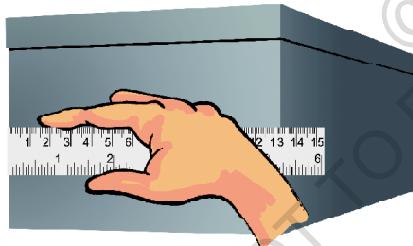


**Fig. 7.6** A metre scale and a 15 cm scale

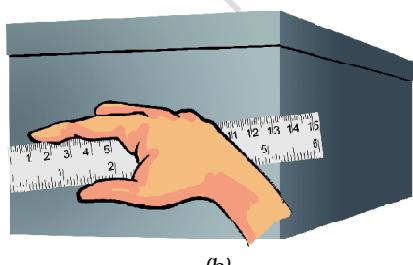
for measuring length. A tailor uses a tape, whereas a cloth merchant uses a metre rod. For measuring the length of an object, you must choose a suitable device. You cannot measure the girth of a tree or the size of your chest using a metre scale, for instance. Measuring tape is more suitable for this. For small measurements, such as the length of your pencil, you can use a 15 cm scale from your geometry box.

In taking measurement of a length, we need to take care of the following:

1. Place the scale in contact with the object along its length as shown in Fig. 7.7.
2. In some scales, the ends may be broken. You may not be able to see the zero mark clearly (Fig. 7.8 (a)]. In such cases, you should avoid taking



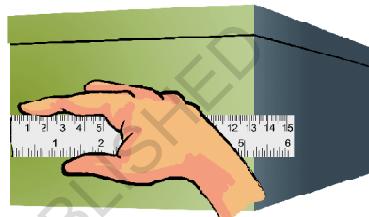
(a)



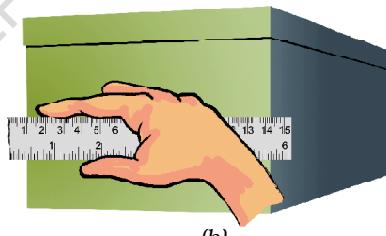
(b)

**Fig. 7.7** Method of placing the scale along the length to be measured (a) correct and (b) incorrect

measurements from the zero mark of the scale. You can use any other full mark of the scale, say, 1.0 cm [Fig. 7.8 (b)]. Then you must subtract the reading of this mark from the reading at the other end. For example, in Fig. 7.8 (b) the reading at one end is 1.0 cm and at the other end it is 14.3 cm. Therefore, the length of the object is  $(14.3 - 1.0)$  cm = 13.3 cm.



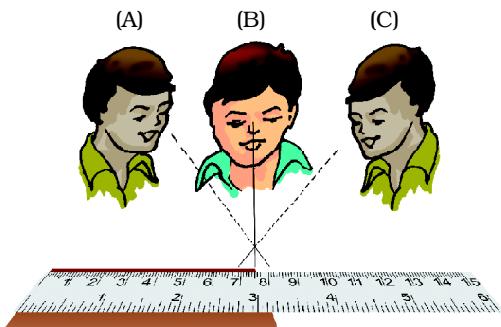
(a)



(b)

**Fig. 7.8** (a) Incorrect and (b) correct method of placing the scale with broken edge

3. Correct position of the eye is also important for taking measurement. Your eye must be exactly in front of the point where the measurement is to be taken as shown in Fig. 7.9. Position 'B' is the correct position of the eye. Note that from position 'B', the reading is 7.5 cm. From positions 'A' and 'C', the readings may be different.



**Fig. 7.9** B is the proper position of the eye for taking reading of the scale

### Activity 3

Measure the height of your classmate using hand span and then by using a metre scale. For this, ask your classmate to stand with his back against a wall. Make a mark on the wall exactly above his head. Now, measure the distance from the floor to this mark on the wall with your hands and then with a metre scale. Let all other students measure this length in a similar way. Record all observations in Table 7.3.

**Table 7.3 Measurement of height**

Who measured the height?	Height in handspans	Height in cm

Study carefully results obtained by different students. The results in column 2 may be different from each other as the length of the handspan may be different for different students. Look

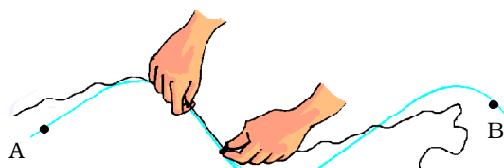
at the results in column 3 where the measurements are done using a standard scale. The results may be close to each other now, but, are they exactly equal? If not, why do you think there is a difference? After all, everybody is using the same scale and not different hand spans. This could be due to small errors in taking observations. In higher classes we will learn about the importance of knowing and handling such errors in measurement.

### 7.6 MEASURING THE LENGTH OF A CURVED LINE

We cannot measure the length of a curved line directly by using a metre scale. We can use a thread to measure the length of a curved line.

### Activity 4

Use a thread to measure the length of the curved line AB (Fig. 7.10). Put a knot on the thread near one of its ends. Place this knot on the point A. Now, place a small portion of the thread along the line, keeping it taut using your fingers and thumb. Hold the thread at this end point with one hand. Using the other hand, stretch a little more portion of the thread along the curved line. Go



**Fig. 7.10** Measuring the length of a curved line with a thread

on repeating this process till the other end B of the curved line is reached. Make a mark on the thread where it touches the end B. Now stretch the thread along a metre scale. Measure the length between the knot in the beginning and the final mark on the thread. This gives the length of the curved line AB.

We see that we need a lot of care to ensure that we are measuring distances and lengths correctly. And, we need some standard units and devices with which we measure these distances and can convey our results to others.

### 7.7 MOVING THINGS AROUND US

#### Activity 5

Think of some objects you have seen recently. List them in Table 7.4. These may include a school bag, a mosquito, a table, people sitting on chairs or people moving about. The list may also have a butterfly, a dog, a cow, your hands, a small baby, a fish in water, a house, a factory, a piece of stone, a horse, a ball, a bat, a moving train, a sewing machine, a wall clock or the hands of a clock. Make your list as large as you can.

Which of these are moving? Which are at rest?

**Table 7.4 Objects at rest and in motion**

Objects at rest	Objects in motion
House	A flying bird
Table	Second's hand of the clock
Clock	

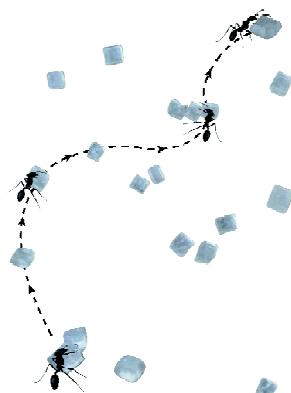
How did you decide whether an object is in motion or at rest?

You might have noticed that the bird is not at the same place after some time, while the table is at the same place. On this basis, you may have decided whether an object is at rest or in motion.

Let us look at the motion of an ant closely.

#### Activity 6

Select a place where you find ants. Spread a large sheet of white paper on the ground and keep a little sugar on it. Ants are likely to be attracted to the sugar and you will find many ants crawling on the sheet of paper soon. For any one ant, try and make a small mark with a pencil near its position when it has just crawled on to the sheet of paper (Fig. 7.11). Keep marking its position after a few seconds as it moves along on the sheet of paper. After some time, shake the paper free of the sugar and the ants. Connect the different points you have marked, with arrows, to show the direction in which the ant was



**Fig. 7.11 Motion of an ant**

moving. Each point you have marked shows where the ant moved to, in intervals of a few seconds.

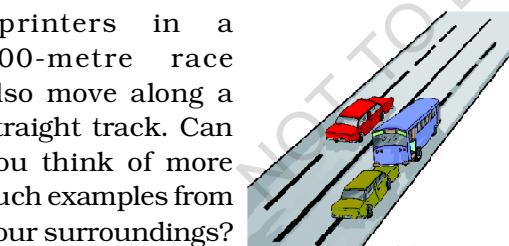
Motion seems to be some kind of a change in the position of an object with time, isn't it?

In Activity 5, where did you place objects like a clock, a sewing machine or an electric fan in your grouping of objects? Are these objects moving from one place to other? No? Do you notice movement in any of their parts? The blades of the fan or the hands of a clock— how are they moving? Is their movement similar to that of an ant or a train? Let us now look at some types of motion to help us understand these differences.

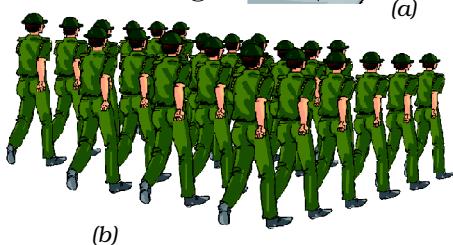
### 7.8 TYPES OF MOTION

You may have observed the motion of a vehicle on a straight road, march-past of soldiers in a parade or the falling of a stone (Fig. 7.12). What kind of motion is this?

Sprinters in a 100-metre race also move along a straight track. Can you think of more such examples from your surroundings?



(a)



(b)

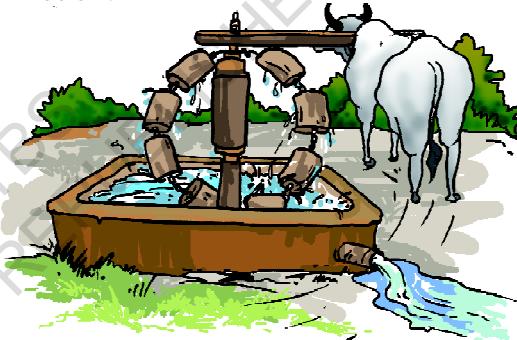
**Fig. 7.12** Some examples of rectilinear motion

In all these examples we see that the objects move along a straight line. This type of motion is called rectilinear motion.

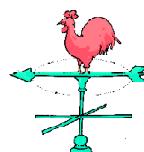
### Activity 7

Take a stone, tie a thread to it and whirl it with your hand. Observe the motion of the stone. We see that the stone moves along a circular path.

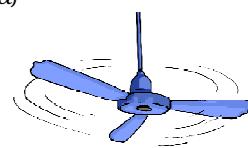
In this motion, the distance of the stone from your hand remains the same. This type of motion is called circular motion.



(a)



(b)

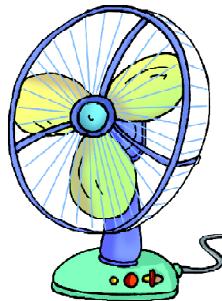


(c)

**Fig. 7.13** Some objects in circular motion

The motion of a point marked on the blade of an electric fan or the hands of a clock are examples of circular motion (Fig. 7.13).

The electric fan or the clock by themselves are not moving from one place to another. But, the blades of the



fan rotate and so do the hands of a clock. If we mark a point anywhere on the blades of a fan or on the hands of a clock, the distance of this point from the centre of the fan or the clock, will remain the same as they rotate.

In some cases, an object repeats its motion after some time. This type of motion is called periodic motion. Take the stone tied with a string that you used in Activity 7. Now, hold the string in your hand and let the stone hang from it. This is a pendulum. Pull the stone to one side with the other hand and let it go. Now the pendulum is in motion. It is an example of periodic motion. A branch of a tree moving to and fro, motion of a child on a swing, strings of a guitar or the membrane of drums (*tabla*) being played, are all examples of periodic motion where an



(a)



(b)



(c)



(d)



(e)

**Fig. 7.14 Examples of periodic motion**

object or a part of it repeats its motion after a fixed interval of time (Fig. 7.14).

Did you observe a sewing machine as a part of Activity 5? You must have observed that it remains at the same location while any point on its wheel moves with a circular motion. It also has a needle that moves up and down continuously, as long as the wheel rotates, isn't it? This needle is undergoing a periodic motion.

Have you observed closely, the motion of a ball along the ground? Here,

**Boojho is not sure why we say that the distance of the stone from your hand is the same when we whirl it around. Can you help him understand this? Remember that the stone is held with a string.**

the ball is rolling on the ground – rotating as well as moving forward along the ground. Thus, the ball undergoes a rectilinear motion as well as rotational motion. Can you think of other examples where objects undergo combinations of different types of motion?

We did many measurement activities and discussed some kinds of motion. We saw that motion is a change in the

position of an object with time. The change in this position can be determined through distance measurements. This allows us to know how fast or slow a motion is. The movement of a snail on the ground, a butterfly flitting from flower to flower, a river flowing, an aeroplane flying, moon going around the Earth and blood flowing inside our bodies show that there is motion everywhere around us!

## Key words

Circular motion

Distance

Measurement

Motion

Periodic motion

Rectilinear motion

SI units

Units of measurement



## Summary

- Different modes of transport are used to go from one place to another.
- In ancient times, people used length of a foot, the width of a finger, the distance of a step as units of measurement. This caused confusion and a need to develop a uniform system of measurement arose.
- Now, we use International System of Units ( SI units). This is accepted all over the world.
- Metre is the unit of length in SI unit.

- Motion in a straight line is called rectilinear motion.
- In circular motion an object moves such that its distance from a fixed point remains the same.
- Motion that repeats itself after some period of time is called periodic motion.

## Exercises

1. Give two examples each, of modes of transport used on land, water and air.
2. Fill in the blanks:
  - (i) One metre is \_\_\_\_\_ cm.
  - (ii) Five kilometre is \_\_\_\_\_ m.
  - (iii) Motion of a child on a swing is \_\_\_\_\_.
  - (iv) Motion of the needle of a sewing machine is \_\_\_\_\_.
  - (v) Motion of wheel of a bicycle is \_\_\_\_\_.
3. Why can a pace or a footstep not be used as a standard unit of length?
4. Arrange the following lengths in their increasing magnitude:  
1 metre, 1 centimetre, 1 kilometre, 1 millimetre.
5. The height of a person is 1.65 m. Express it into cm and mm.
6. The distance between Radha's home and her school is 3250 m. Express this distance into km.
7. While measuring the length of a knitting needle, the reading of the scale at one end is 3.0 cm and at the other end is 33.1 cm. What is the length of the needle?
8. Write the similarities and differences between the motion of a bicycle and a ceiling fan that has been switched on.
9. Why would you not like to use a measuring tape made of an elastic material like rubber to measure distance? What would be some of the problems you would meet in telling someone about a distance you measured with such a tape?
10. Give two examples of periodic motion.

### SUGGESTED PROJECTS AND ACTIVITIES

1. Draw a map of your classroom. Roll a ball on the floor. In your map mark the points where the ball started and where it stopped. Show also the path it moved along. Did the ball move along a straight line?
2. Using string and a scale, let each student measure the length of his/her foot. Prepare a bar graph of the foot length measurements that have been obtained for the whole class.

# 8

# Light, Shadows and Reflections



0652CH11

We see so many objects around us. On the way to school we see things like buses, cars, cycles, trees, animals and sometimes flowers. How do you think, we see objects?

Think of the same places at night time if it were completely dark. What will you see? Suppose you go inside a completely dark room. Are you able to see any objects in the room?

But, when you light a candle or a torch you can see the objects present in the room, isn't it? Without light, things cannot be seen. Light helps us see objects.

The torch bulb is an object that gives out light of its own. The Sun, is another familiar object that gives its own light. During the day, its light allows us to see objects. Objects like the sun that give out or emit light of their own are called **luminous** objects.

What about objects like a chair, a painting or a shoe? We see these when light from a luminous object (like the Sun, a torch or an electric light) falls on these and then travels towards our eye.

## 8.1 TRANSPARENT, OPAQUE AND TRANSLUCENT OBJECTS

Recall our grouping objects as opaque, transparent or translucent, in Chapter 2. If we cannot see through an object at

all, it is an **opaque** object. If you are able to see clearly through an object, it is allowing light to pass through it and is **transparent**. There are some objects through which we can see, but not very clearly. Such objects are known as **translucent**.

### Activity 1

Look around yourself and collect as many objects as you can — an eraser, plastic scale, pen, pencil, notebook, single sheet of paper, tracing paper or a piece of cloth. Try to look at something far away, through each of these objects (Fig. 8.1). Is light from a far away object able to travel to your eye, through any of the objects?

Record your observations in a table as shown in Table 8.1.

We see that a given object or material could be transparent, translucent or



**Fig. 8.1** Observing objects that do or do not allow light to pass through them

**Table 8.1**

Object/material	View through the object possible (fully/ partially/ not at all)	Object is opaque/ transparent/ translucent
Pencil		
Rubber ball		
Sheet of writing paper	Not very sure?	

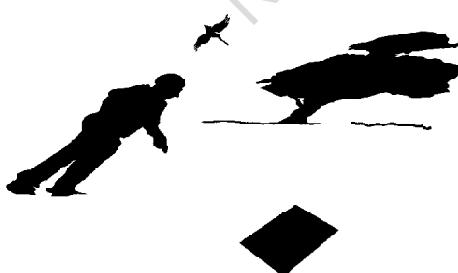
opaque depending on whether it allows light to pass through it completely, partially or not at all.

## 8.2 WHAT EXACTLY ARE SHADOWS?

### Activity 2

Now, one by one hold each of the opaque objects in the sunlight, slightly above the ground. What do you see on the ground? You know that the dark patch formed by each on the ground is due to its shadow. Sometimes you can identify the object by looking at its shadow (Fig. 8.2).

Spread a sheet of paper on the ground. Hold a familiar opaque object at some height, so that its shadow is formed on the sheet of paper on the ground. Ask one of your friends to draw



**Fig. 8.2** Sometimes shadow of an object gives an idea about its shape

the outline of the shadow while you are holding the object. Draw outlines of the shadows of other objects in a similar way.

Now, ask some other friends to identify the objects from these outlines of shadows. How many objects are they able to identify correctly?

Do you observe your shadow in a dark room or at night when there is no light? Do you observe a shadow when there is just a source of light and nothing else, in a room? It seems we need a source of light and an opaque object, to see a shadow. Is there anything else required?

### Activity 3

This is an activity that you will have to do in the dark. In the evening, go out in an open ground with a few friends. Take a torch and a large sheet of cardboard with you. Hold the torch close to the ground and shine it upwards so that its light falls on your friend's face. You now have a source of light that is falling on an opaque object. If there were no trees, building or any other object behind your friend, would you see the shadow of your friend's head? This does not mean

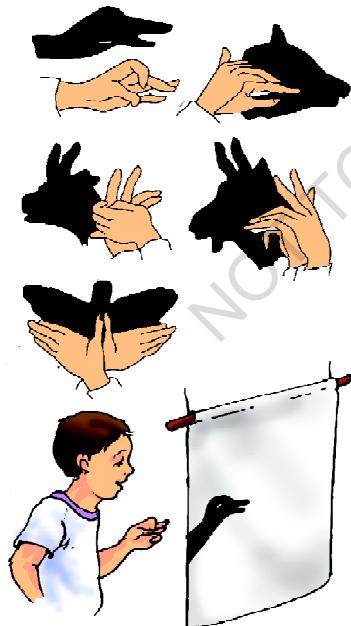


**Fig. 8.3** A shadow is obtained only on a screen

that there is no shadow. After all, the light from the torch is not able to pass through his body to the other side.

Now, ask another friend to hold the cardboard sheet behind your friend. Is the shadow now seen on the cardboard sheet (Fig. 8.3)?

Thus, the shadow can be seen only on a screen. The ground, walls of a room,



**Fig. 8.4** Shadows of animals hidden in your hand

a building, or other such surfaces act as a screen for the shadows you observe in everyday life.

Shadows give us some information about shapes of objects. Sometimes, shadows can also mislead us about the shape of the object. In Fig. 8.4 are a few shadows that we can create with our hands and make-believe that they are shadows of different animals. Have fun!

#### **Activity 4**

Place a chair in the school ground on a sunny day. What do you observe from the shadow of the chair?

Does the shadow give an accurate picture of the shape of the chair? If the chair is turned around a little, how does the shape of the shadow change?

Take a thin notebook and look at its shadow. Then, take a rectangular box and look at its shadow. Do the two shadows seem to have a similar shape?

Take flowers or other objects of different colours and look at their shadows. A red rose and a yellow rose, for instance. Do the shadows look different in colour, when the colours of the objects are different?

Take a long box and look at its shadow on the ground. When you move the box around, you may see that the size of the shadow changes. When is the shadow of the box the shortest, when the long side of the box is pointed towards the Sun or when the short side is pointing towards the Sun?

Let us use this long box, to prepare a simple camera.

### 8.3 A PINHOLE CAMERA

You might think that we need a lot of stuff to make a camera? Not really. If we just wish to make a simple pin hole camera.

#### Activity 5

Take two boxes of cardboard such that one can slide into another with no gap in between them. Cut open one side of each box. On the opposite face of the larger box, make a small hole in the middle [Fig. 8.5 (a)]. In the smaller box, cut out from the middle a square with a side of about 5 to 6 cm. Cover this open square in the box with tracing paper (translucent screen) [Fig. 8.5 (b)]. Slide the smaller box inside the larger one with the hole, in such a way that the side with the tracing paper is inside [Fig. 8.5 (c)]. Your pinhole camera is ready for use.

Holding the pinhole camera look through the open face of the smaller box. You should use a piece of black cloth to cover your head and the pinhole camera. Now, try to look at some distant objects like a tree or a building through the pinhole camera. Make sure that the

objects you wish to look at through your pinhole camera are in bright sun shine. Move the smaller box forward or backward till you get a picture on the tracing paper pasted at the other end.

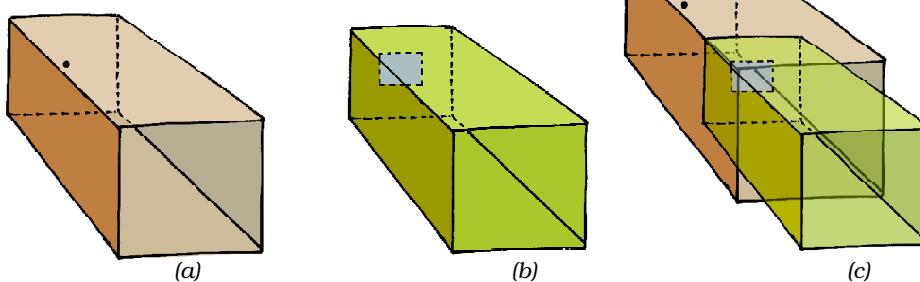
Are these pinhole images different from their shadows?

Look through your pinhole camera at the vehicles and people moving on the road in bright sunlight.

Do the pictures seen in the camera show the colours of the objects on the other side? Are the images erect or upside down? Surprise, surprise!

Let us now image the Sun, with our pinhole camera. We need a slightly different set up for this. We just need a large sheet of cardboard with a small pinhole in the middle. Hold the sheet up in the Sun and let its shadow fall on a clear area. Do you see a small circular image of the Sun in the middle of the shadow of the cardboard sheet?

Look at these pinhole images of the Sun when an eclipse is visible from your location. Adjust your pinhole and screen to get a clear image before the eclipse is to occur. Look at the image as the eclipse begins. You will notice a part



**Fig. 8.5** A sliding pin hole camera

of the image of the Sun gradually becoming darker as the eclipse starts. **Never ever look directly at the Sun.** That could be extremely harmful for the eyes.

There is an interesting pinhole camera in nature. Sometimes, when we pass under a tree covered with large number of leaves, we notice small patches of sunlight under it (Fig. 8.6). These circular images are, in fact, pinhole images of the Sun. The gaps between the leaves, act as the pinholes. These gaps are all kinds of irregular shapes, but, we can see circular images of the Sun. Try to locate images of the



**Fig. 8.6** A natural pinhole camera. Pinhole images of the Sun under a tree!

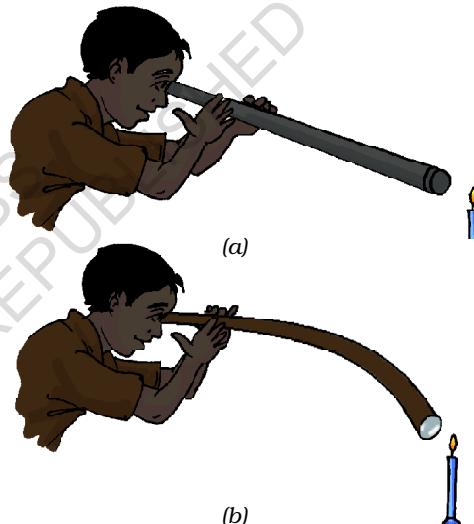
Sun when an eclipse occurs next. That could be so much fun!

Boojho has this thought. We saw upside down images of people on the road, with our pinhole camera. What about the images of the Sun? Did we notice them to be upside down or anything like that?

Paheli has another thought. Surely, all these results that we are seeing, formation of shadows and pinhole images are possible only if light moves in a straight path?

### Activity 6

Let us use a piece of a pipe or a long rubber tube. Light a candle and fix it on a table at one end of the room. Now standing at the other end of the room look at the candle through the pipe



**Fig. 8.7** Looking through a pipe pointed (a) towards and (b) a little away from a candle

[Fig. 8.7 (a)]. Is the candle visible? Bend the pipe a little while you are looking at the candle [Fig. 8.7 (b)]. Is the candle visible now? Turn the pipe a little to your right or left. Can you see the candle now?

What do you conclude from this?

This suggests that light travels along a straight line, isn't it? That is why, when opaque objects obstruct it, a shadow forms.

## 8.4 MIRRORS AND REFLECTIONS

We all use mirrors at home. You look into the mirror and see your own face inside the mirror. What you see is a **reflection** of your face in the mirror. We also see reflections of other objects that are in front of the mirror. Sometimes, we see reflections of trees, buildings and other objects in the water of a pond or a lake.

### Activity 7

This activity should be done at night or in a dark room. Ask one of your friends to hold a mirror in his/her hand at one corner of the room. Stand at another corner with a torch in your hand. Cover the glass of torch with your fingers and switch it on. Adjust your fingers with a small gap between them so that you can get a beam of light. Direct the beam of the torch light onto the mirror that your friend is holding. Do you see a patch of light on the other side (Fig. 8.8)? Now,



**Fig. 8.8** A mirror reflects a beam of light

adjust the direction of the torch so that the patch of light falls on another friend standing in the room.

This activity suggests that a mirror changes the direction of light that falls on it.

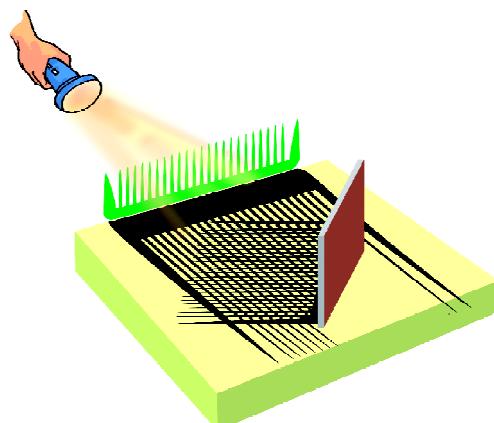
Here is an activity that shows light travelling along straight lines and getting reflected from a mirror.

### Activity 8

Fix a comb on one side of a large thermo Col sheet and fix a mirror on the other side as shown in Fig. 8.9. Spread a dark coloured sheet of paper between the mirror and the comb. Keep this in sunlight or send a beam of light from a torch through the comb.

What do you observe? Do you get a pattern similar to that shown in Fig. 8.9?

This activity gives us an idea of the manner in which light travels and gets reflected from a mirror.



**Fig. 8.9** Light travelling in a straight line and getting reflected from a mirror

## Key words

Luminous

Mirror

Opaque

Pinhole camera

Reflection

Shadow

Translucent

Transparent



## Summary ➔

- Opaque objects do not allow light to pass through them.
- Transparent objects allow light to pass through them and we can see through these objects clearly.
- Translucent objects allow light to pass through them partially.
- Shadows are formed when an opaque object comes in the path of light.
- Pinhole camera can be made with simple materials and can be used to image the Sun and brightly lit objects.
- Light travels in straight line.
- Mirror reflection gives us clear images.

## Exercises ➔

1. Rearrange the boxes given below to make a sentence that helps us understand opaque objects.

OWS	AKE	OPAQ	UEO	BJEC	TSM
SHAD					


2. Classify the objects or materials given below as opaque, transparent or translucent and luminous or non-luminous:

Air, water, a piece of rock, a sheet of aluminium, a mirror, a wooden board, a sheet of polythene, a CD, smoke, a sheet of plane glass, fog, a piece of red hot iron, an umbrella, a lighted fluorescent tube, a wall, a sheet of carbon paper, the flame of a gas burner, a sheet of cardboard, a lighted torch, a sheet of cellophane, a wire mesh, kerosene stove, sun, firefly, moon.

3. Can you think of creating a shape that would give a circular shadow if held in one way and a rectangular shadow if held in another way?
4. In a completely dark room, if you hold up a mirror in front of you, will you see a reflection of yourself in the mirror?

### SUGGESTED ACTIVITIES

1. Make a row of your friends — A, B, C and D, standing in a line. Let one friend stand in front facing them and holding out a mirror towards them (Fig. 8.10).

Now, each person can tell who they are able to see in the Mirror. A, B, C, or D.

If, A is able to see B in the mirror then, can B also see A in the mirror? Similarly, for any two pairs amongst A, B, C, or D?

If A is not able to see B in the mirror, then, is B able to see A in the mirror?

Similarly, for any two pairs amongst A, B, C, or D?



**Fig. 8.10**

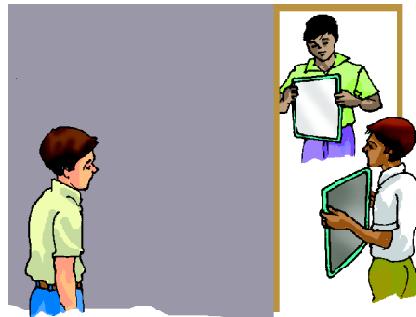
This activity tells us something about the way light travels and gets reflected from mirrors. You will learn more about this in higher classes.

2. **Daayan-Baayan**—Take a comb in your right hand and bring it up to your hair and look at yourself in the mirror. There is your familiar face, grinning at you 😊

Wait, try and find out which is the hand holding the comb, in your mirror reflection. Is it the right hand or the left? You were holding it in your right hand, isn't it?

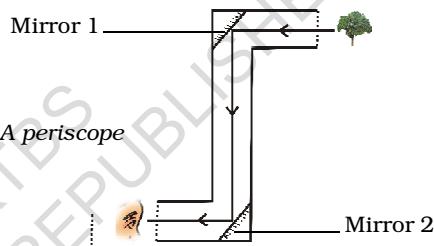
While a pinhole camera seems to be giving us upside down images, a mirror seems to be turning right hand into left hand and the left into right hand. We will learn more about this in the higher classes.

3. **Magic Device**—In the chapter on symmetry in your Mathematics textbook, you might have made an interesting device Kaleidoscope, that uses reflections. Now, let us make another device, a periscope, that uses reflections to see around corners! Ask one of your friends to stand in the corridor just outside the entrance to the classroom with a mirror in hand. Ask another friend also holding a mirror, to stand in the middle of classroom in front of the entrance. Now ask your friends to adjust their mirrors in such a way that the image of object on the other side of the corridor becomes visible to you while you are standing inside the class (Fig. 8.11).



**Fig. 8.11** Seeing around corners!

You can make a simple periscope by placing two mirrors in a 'Z' shaped box as shown in Fig. 8.12.



**Fig. 8.12** A periscope

### THINGS TO THINK ABOUT

1. Opaque objects cast shadows, isn't it? Now, if we hold a transparent object in the Sun, do we see anything on the ground that gives us a hint that we are holding something in our hand?
2. We saw that changing colour of opaque objects does not change the colour of their shadows. What happens if we place an opaque object in coloured light? You can cover the face of a torch with a coloured transparent paper to do this. (Did you ever notice the colours of evening shadows just as the Sun is setting?)

### THINGS TO READ

Rudyard Kipling's "Just So Stories" and in particular, the story of "How the Leopard got its spots" where he mentions stripy, speckly, patchy-blatchy shadows. Here are a few lines from this story, that has a lot of shadows.

...after ever so many days, they saw a great, high, tall forest full of tree trunks all 'sclosively speckled and sprotted and spottled, dotted and splashed and slashed and hatched and cross-hatched with shadows. (Say that quickly aloud, and you will see how very shadowy the forest must have been.)

'What is this,' said the Leopard, 'that is so 'sclosively dark, and yet so full of little pieces of light?'



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# 9

## Electricity and Circuits

We use electricity for many purposes to make our tasks easier. For example, we use electricity to operate pumps that lift water from wells or from ground level to the roof top tank. What are other purposes for which you use electricity? List some of them in your notebook.

Does your list include the use of electricity for lighting? Electricity makes it possible to light our homes, roads, offices, markets and factories even after sunset. This helps us to continue working at night. A power station provides us with electricity. However, the supply of electricity may fail or it may not be available at some places. In such situations, a torch is sometimes used for providing light. A torch has a bulb that lights up when it is switched on. Where does the torch get electricity from?

### 9.1. ELECTRIC CELL

Electricity to the bulb in a torch is provided by the electric cell. Electric cells

are also used in alarm clocks, wristwatches, transistor radios, cameras and many other devices. Have you ever carefully looked at an electric cell? You might have noticed that it has a small metal cap on one side and a metal disc on the other side (Fig. 9.1). Did you notice a positive (+) sign and a negative (-) sign marked on the electric cell? The



**Fig.9.1** An Electric Cell

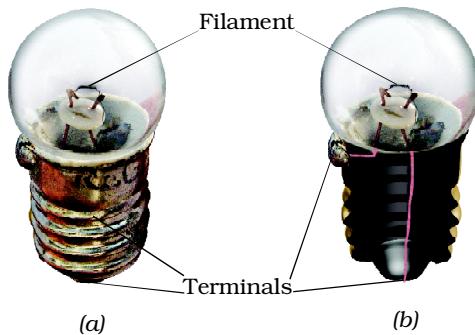
metal cap is the positive terminal of the electric cell. The metal disc is the negative terminal. All electric cells have two terminals; a positive terminal and a negative terminal.

An electric cell produces electricity from the chemicals stored inside it. When the chemicals in the electric cell are used up, the electric cell stops

#### Caution



You might have seen the danger sign shown here displayed on poles, electric substations and many other places. It is to warn people that electricity can be dangerous if not handled properly. Carelessness in handling electricity and electric devices can cause severe injuries and sometimes even death. Hence, you should never attempt to experiment with the electric wires and sockets. Also remember that the electricity generated by portable generators is equally dangerous. Use only electric cells for all activities related to electricity.



**Fig.9.2** (a) Torch bulb and (b) its inside view

producing electricity. The electric cell then has to be replaced with a new one.

A torch bulb has an outer case of glass that is fixed on a metallic base [Fig. 9.2 (a)]. What is inside the glass case of the bulb?

### Activity 1

Take a torch and look inside its bulb. You can also take out the bulb with the help of your teacher. What do you notice? Do you find a thin wire fixed in the middle of the glass bulb [Fig. 9.2 (b)]? Now switch the torch on and observe which part of the bulb is glowing.

The thin wire that gives off light is called the **filament** of the bulb. The filament is fixed to two thicker wires, which also provide support to it, as shown in Fig. 9.2 (b). One of these thick wires is connected to the metal case at the base of the bulb [Fig. 9.2 (b)]. The other thick wire is connected to the metal tip at the centre of the base. The base of the bulb and the metal tip of the base are the two terminals of the bulb. These two terminals are fixed in such a

**Caution:** Never join the two terminals of the electric cell without connecting them through a switch and a device like a bulb. If you do so, the chemicals in the electric cell get used up very fast and the cell stops working.

way that they do not touch each other. The electric bulbs used at home also have a similar design.

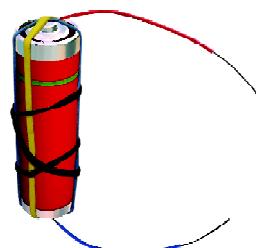
Thus, both the electric cell and the bulb have two terminals each. Why do they have these two terminals?

### 9.2 A BULB CONNECTED TO AN ELECTRIC CELL

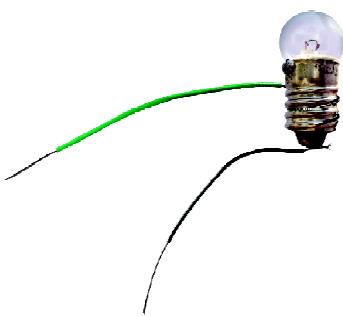
Let us try to make an electric bulb light up using an electric cell. How do we do that?

### Activity 2

Take four lengths of electric wire with differently coloured plastic coverings. Remove a little of the plastic covering from each length of wire at the ends. This would expose the metal wires at the ends of each length. Fix the exposed parts of two wires to the cell and the other two of the bulb as shown in Fig. 9.3 and Fig. 9.4.



**Fig.9.3** Electric cell with two wires attached to it



**Fig.9.4** Bulb connected to two wires

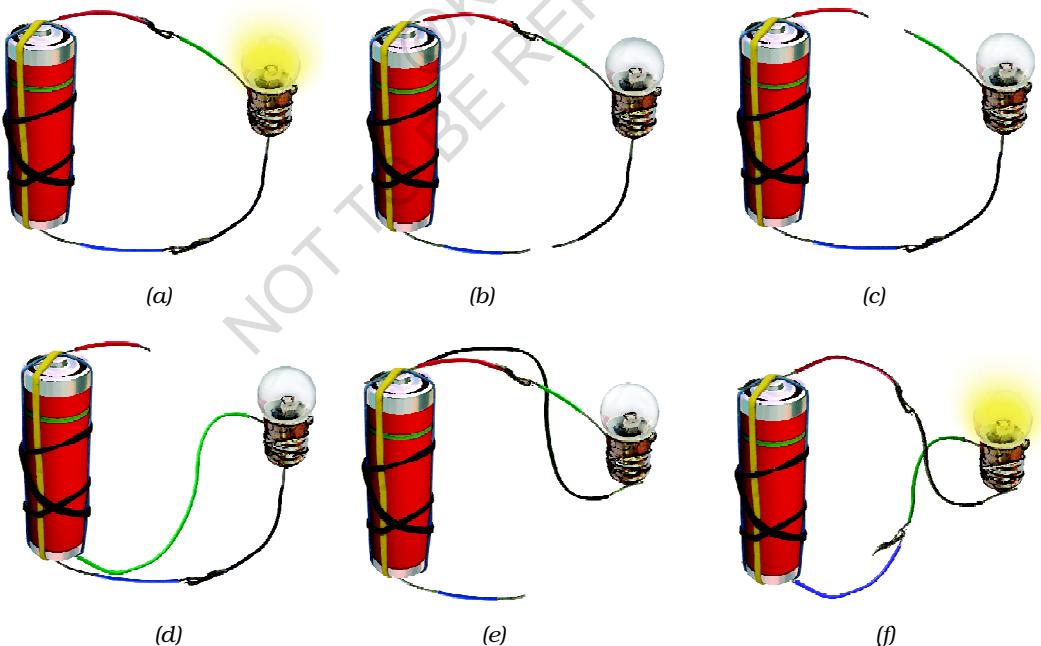
You can stick the wires to the bulb with the tape used by electricians. Use rubber bands or tape to fix the wires to the cell.

Now, connect the wires fixed to the bulb with those attached to the cell in six different ways as have been shown in Fig. 9.5 (a) to (f). For each arrangement, find out whether the bulb glows or not.

Write 'Yes' or 'No' for each arrangement in your notebook.

Now, carefully look at the arrangements in which the bulb glows. Compare these with those in which the bulb does not glow. Can you find the reason for the difference?

Keep the tip of your pencil on the wire near one terminal of the electric cell for the arrangement in Fig. 9.5 (a). Move the pencil along the wire all the way to the bulb. Now, from the other terminal of the bulb, move along the other wire connected to the cell. Repeat this exercise for all the other arrangements in Fig. 9.5. Did the bulb glow for the arrangements in which you could not move the pencil from one terminal to the other?

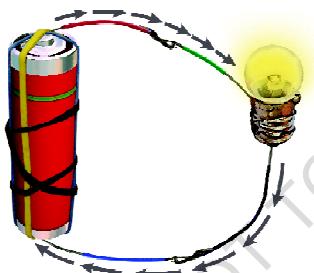


**Fig.9.5** Different arrangements of electric cell and bulb

### 9.3 AN ELECTRIC CIRCUIT

In Activity 2 you connected one terminal of the electric cell to the other terminal through wires passing to and from the electric bulb. Note that in the arrangements shown in Fig. 9. 5 (a) and (f), the two terminals of the electric cell were connected to two terminals of the bulb. Such an arrangement is an example of an electric circuit. The electric circuit provides a complete path for electricity to pass (current to flow) between the two terminals of the electric cell. The bulb glows only when **current** flows through the circuit.

In an electric circuit, the direction of current is taken to be from the positive to the negative terminal of the electric cell as shown in Fig. 9.6. When the



**Fig.9.6** Direction of current in an electric circuit

terminals of the bulb are connected with that of the electric cell by wires, the current passes through the filament of the bulb. This makes the bulb glow.

Sometimes an electric bulb does not glow even if it is connected to the cell. This may happen if the bulb has **fused**. Look at a fused bulb carefully. Is the filament inside it intact?

An electric bulb may fuse due to many reasons. One reason for a bulb to fuse is a break in its filament. A break in the filament of an electric bulb means a break in the path of the current between the terminals of the electric cell. Therefore, a fused bulb does not light up as no current passes through its filament.

Can you now explain why the bulb did not glow when you tried to do so with the arrangements shown in Fig. 9.5 (b), (c), (d) and (e)?

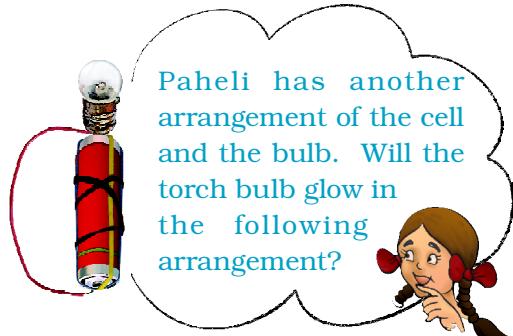
Now we know how to make a bulb light up using an electric cell. Would you like to make a torch for yourself?

### Activity 3

Take a torch bulb and a piece of wire. Remove the plastic covering at the two ends of the wire as you did before. Wrap one end of a wire around the base of an electric bulb as shown in Fig. 9.7. Fix the other end of the wire to the negative terminal of an electric cell with a rubber band. Now, bring the tip of the base of the bulb, that is, its other terminal in contact with the positive terminal of the



**Fig. 9.7** A home-made torch



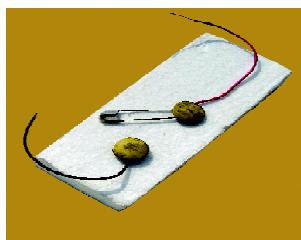
cell. Does the bulb glow? Now move the bulb away from the terminal of the electric cell. Does the bulb remain lighted? Is this not similar to what you do when you switch your torch on or off?

#### 9.4 ELECTRIC SWITCH

We had an arrangement for switching on or off our home made torch by moving the base of the bulb away from the tip of the cell. This was a simple switch, but, not very easy to use. We can make another simple and easier switch to use in our circuit.

#### Activity 4

You can make a switch using two drawing pins, a safety pin (or a paper clip), two wires and a small sheet of thermo Col or a wooden board. Insert



**Fig. 9.8** A simple switch

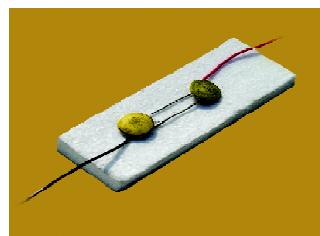
a drawing pin into the ring at one end of the safety pin and fix it on the thermo Col sheet as shown in Fig. 9.8. Make sure that the safety pin can be rotated freely. Now, fix the other drawing pin on the thermo Col sheet in a way that the free end of the safety pin can touch it. The safety pin fixed in this way would be your switch in this activity.



**Fig. 9.9** An electric circuit with a switch

Now, make a circuit by connecting an electric cell and a bulb with this switch as shown in Fig. 9.9. Rotate the safety pin so that its free end touches the other drawing pin. What do you observe? Now, move the safety pin away. Does the bulb continue to glow?

The safety pin covered the gap between the drawing pins when you made it touch two of them. In this position the switch is said to be 'on' (Fig. 9.10). Since the material of the safety pin allows the current to pass



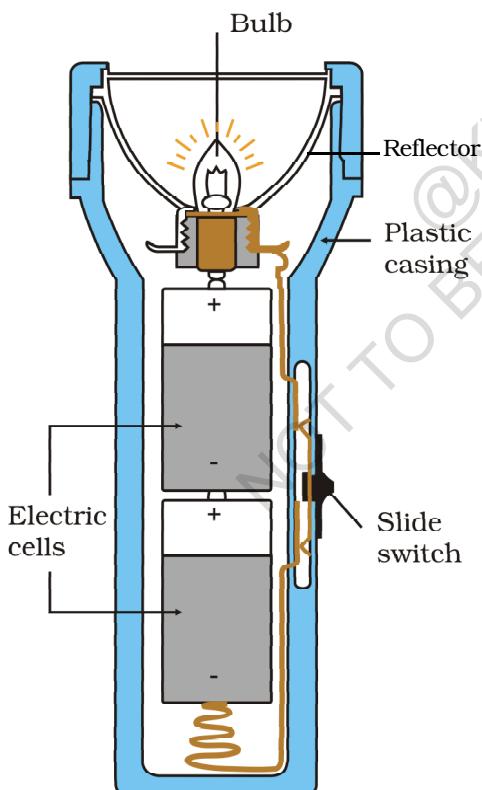
**Fig. 9.10** A switch in 'on' position

through it, the circuit was complete. Hence, the bulb glows.

On the other hand, the bulb did not glow when the safety pin was not in touch with the other drawing pin. The circuit was not complete as there was a gap between the two drawing pins. In



**Boojho has drawn the inside of the torch as in Fig. 9.11. When we close the switch, the circuit is completed and the bulb glows. Can you draw a red line on the figure indicating the complete circuit?**



**Fig. 9.11** Inside view of a torch

this position, the switch is said to be 'off' as in Fig. 9.9.

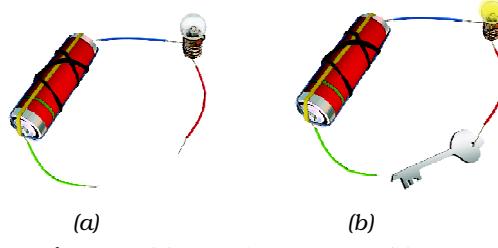
A switch is a simple device that either breaks the circuit or completes it. The switches used in lighting of electric bulbs and other devices in homes work on the same principle although their designs are more complex.

## 9.5 ELECTRIC CONDUCTORS AND INSULATORS

In all our activities we have used metal wires to make a circuit. Suppose we use a cotton thread instead of a metal wire to make a circuit. Do you think that the bulb will light up in such a circuit? What materials can be used in electric circuits so that the current can pass through them? Let us find out.

### Activity 5

Disconnect the switch from the electric circuit you used for Activity 4. This would leave you with two free ends of wires as shown in Fig. 9.12 (a). Bring the free ends of the two wires close, to let them touch each other. Does the bulb light up? You can now use this arrangement to test whether any given material allows current to pass through it or not.



**Fig. 9.12** (a) A conduction tester (b) Testing whether the bulb glows when the tester is in contact with a key

Collect samples of different types of materials such as coins, cork, rubber, glass, keys, pins, plastic scale, wooden block, aluminium foil, candle, sewing needle, thermo Col, paper and pencil lead. One by one bring the free ends of the wires of your tester in contact with two ends of the samples you have collected [Fig. 9.12 (b)]. Make sure that the two wires do not touch each other while you are doing so. Does the bulb glow in each case?

Make a table in your notebook similar to Table 9.1, and record your observations.

**Table 9.1 Conductors and insulators**

Object used in place of the switch	Material it is made of	Bulb glows? (Yes/No)
Key	Metal	Yes
Eraser	Rubber	No
Scale	Plastic	
Matchstick	Wood	
Glass bangle	Glass	
Iron nail	Metal	

What do you find? The bulb does not glow when the free ends of the wires are in contact with some of the materials you have tested. This means that these materials do not allow the electric current to pass through them. On the other hand, some materials allow electric current to pass through them, which is indicated by the glowing bulb. Materials which allow electric current to pass through them are **conductors** of electricity.

**Insulators** do not allow electric current to pass through them. With the help of Table 9.1, name the materials that are conductors of electricity and also those which are insulators.

Conductors \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Insulator \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

What do you conclude? Which materials are conductors and which are insulators? Recall the objects that we grouped as those having lustre, in Chapter 2. Are they the conductors? It now seems easy to understand why copper, aluminum and other metals are used for making wires.

Let us recall Activity 4 in which we made an electric circuit with a switch (Fig. 9.9). When the switch was in the open position, were the two drawing pins not connected with each other through the thermo Col sheet? But, thermo Col, you may have found is an insulator. What about the air between the gap? Since the bulb does not glow when there is only air in the gap between the drawing pins in your switch, it means that air is also an insulator.

Conductors and insulators are equally important for us. Switches, electrical plugs and sockets are made of conductors. On the other hand, rubber and plastics are used for covering electrical wires, plug tops, switches and other parts of electrical appliances, which people might touch.

**Caution:** Your body is a conductor of electricity. Therefore, be careful when you handle an electrical appliance.

## Summary

- Electric cell is a source of electricity.
- An electric cell has two terminals; one is called positive (+ ve) while the other is negative (- ve).
- An electric bulb has a filament that is connected to its terminals.
- An electric bulb glows when electric current passes through it.
- In a closed electric circuit, the electric current passes from one terminal of the electric cell to the other terminal.
- Switch is a simple device that is used to either break the electric circuit or to complete it.
- Materials that allow electric current to pass through them are called conductors.
- Materials that do not allow electric current to pass through them are called insulators.

## Key words

Bulb	Filament
Conductors	Insulators
Electric cell	Switch
Electric circuit	Terminal



## Exercises

1. Fill in the blanks :

- A device that is used to break an electric circuit is called \_\_\_\_\_.
- An electric cell has \_\_\_\_\_ terminals.

2. Mark 'True' or 'False' for following statements:

- Electric current can flow through metals.
- Instead of metal wires, a jute string can be used to make a circuit.
- Electric current can pass through a sheet of thermo Col.

3. Explain why the bulb would not glow in the arrangement shown in Fig. 9.13.

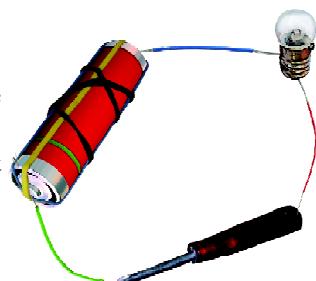
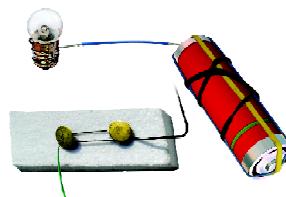
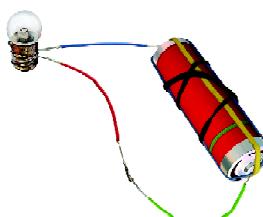


Fig. 9.13

- Complete the drawing shown in Fig. 9.14 to indicate where the free ends of the two wires should be joined to make the bulb glow.
- What is the purpose of using an electric switch? Name some electrical gadgets that have switches built into them.
- Would the bulb glow after completing the circuit shown in Fig. 9.14 if instead of safety pin we use an eraser?
- Would the bulb glow in the circuit shown in Fig. 9.15?



**Fig. 9.14**



**Fig. 9.15**

- Using the "conduction tester" on an object it was found that the bulb begins to glow. Is that object a conductor or an insulator? Explain.
- Why should an electrician use rubber gloves while repairing an electric switch at your home? Explain.
- The handles of the tools like screwdrivers and pliers used by electricians for repair work usually have plastic or rubber covers on them. Can you explain why?

### SOME SUGGESTED ACTIVITIES

- Imagine there were no electric supply for a month. How would that affect your day to day activities and others in your family? Present your imagination in the form of a story or a play. If possible stage the play written by you or your friends in school.
- For your friends, you may set up a game "How steady is your hand?". You will need a cell, an electric bulb, a metal key, two iron nails (about 5 cm in length), about one and a half metre long thick metal wire (with its plastic insulation scraped off) and few pieces of connecting wires. Fix two nails nearly one metre apart on a wooden board so that these can be used as a hook. Fix the wire between the nails after inserting it through the loop of the key. Connect one end of this wire to a bulb and a cell. Connect the other terminal of the cell to the key with a wire. Ask your friend to move the loop along the straight wire without touching it. Glowing of the bulb would indicate that the loop of the key has touched the wire.
- Read and find out about Alessandro Volta who invented the electric cell. You may also find out about Thomas Alva Edison who invented the electric bulb.



# 10

## Fun with Magnets

Paheli and Boojho went to a place where a lot of waste material was piled into huge heaps. Something exciting was happening! A crane was moving towards the heap of junk. The long hand of the crane lowered a block over a heap. It then began to move. Guess, what? Many pieces of iron junk were sticking to the block, as it moved away (Fig. 10.1)!



**Fig. 10.1** Picking up pieces of iron from waste

They had just read a very interesting book on magnets and knew immediately that there must be a magnet attached to the end of the crane that was picking up iron from the junk yard.

You might have seen magnets and have even enjoyed playing with them. Have you seen stickers that remain attached to iron surfaces like almirahs or the doors of refrigerators? In some pin holders, the pins seem to be

sticking to the holder. In some pencil boxes, the lid fits tightly when we close it even without a locking arrangement. Such stickers, pin holders and pencil boxes have magnets fitted inside (Fig. 10.2). If you have any one of these items, try to locate the magnets hidden in these.



**Fig. 10.2** Some common items that have magnets inside them

### How Magnets Were Discovered

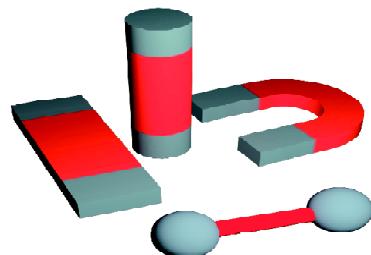
It is said that, there was a shepherd named Magnes, who lived in ancient Greece. He used to take his herd of sheep and goats to the nearby mountains for grazing. He would take a stick with him to control his herd. The stick had a small piece of iron attached at one end. One day he was surprised to find that he had to pull hard to free his stick from a rock on the



**Fig. 10.3** A natural magnet on a hillside!

mountainside (Fig. 10.3). It seemed as if the stick was being attracted by the rock. The rock was a natural magnet and it attracted the iron tip of the shepherd's stick. It is said that this is how natural magnets were discovered. Such rocks were given the name magnetite, perhaps after the name of that shepherd. Magnetite contains iron. Some people believe that magnetite was first discovered at a place called Magnesia. The substances having the property of attracting iron are now known as magnets. This is how the story goes.

In any case, people now have discovered that certain rocks have the property of attracting pieces of iron. They also found that small pieces of these rocks have some special properties. They named these naturally occurring materials magnets. Later on the process of making magnets from pieces of iron was discovered. These are known as artificial magnets. Nowadays artificial

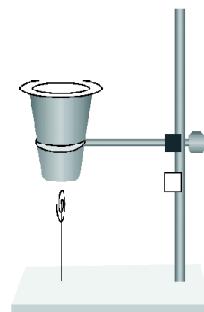


**Fig. 10.4** Magnets of different shapes

magnets are prepared in different shapes. For example, bar magnet, horseshoe magnet, cylindrical or a ball-ended magnet. Fig. 10.4 shows a few such magnets.

### Activity 1

Take a plastic or a paper cup. Fix it on a stand with the help of a clamp as shown in Fig. 10.5. Place a magnet inside the cup and cover it with a paper so that the magnet is not visible. Attach a thread to a clip made of iron. Fix the other end of the thread at the base of the stand. (Mind you, the trick involved here, is to keep the length of the thread sufficiently short.) Bring the clip near the base of the cup. The clip is raised in air without support, like a kite.



**Fig. 10.5** Effect of magnet - a paper clip hanging in air!

## 10.1 MAGNETIC AND NON-MAGNETIC MATERIALS

### Activity 2

Let us walk in the footsteps of Magnes. Only, this time, we will change the positions of the magnet and the iron. There will be a magnet at the end of our shepherd's stick. We can attach a small magnet to a hockey stick, walking stick or a cricket wicket with a tape or some glue. Let us now go out on a "Magnes walk" through the school playground. What does our "Magnes stick" pick up from the school ground? What about objects in the classroom?

Collect various objects of day-to-day use from your surroundings. Test these with the "Magnes stick". You can also take a magnet, touch these objects with it and observe which objects stick to the magnet. Prepare a table in your notebook as shown in Table 10.1. and record your observations.

Look at the last column of Table 10.1 and note the objects that are attracted by a magnet. Now, make a list of

materials from which these objects are made. Is there any material common in all the objects that were attracted by the magnet?

We understand that magnet attracts certain materials whereas some do not get attracted towards magnet. The materials which get attracted towards a magnet are **magnetic** – for example, iron, nickel or cobalt. The materials which are not attracted towards a magnet are **non-magnetic**. What materials did you find to be non-magnetic from Table 10.1? Is soil a magnetic or a non-magnetic material?

Boojho has this question for you.  
A tailor was stitching buttons on his shirt. The needle has slipped from his hand on to the floor.  
Can you help the tailor to find the needle?



Table 10.1 Finding the objects attracted by magnet

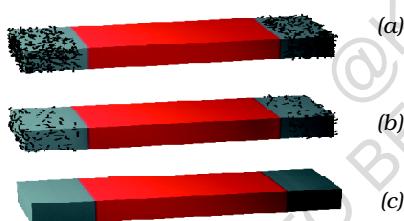
Name of the object	Material which the object is made of (Cloth/plastic/ aluminium/ wood/glass/ iron/ any other)	Attracted by Magnes stick/ magnet (Yes/No)
Iron ball	Iron	Yes
Scale	Plastic	No
Shoe	Leather	?

### Activity 3

Rub a magnet in the sand or soil. Pull out the magnet. Are there some particles of sand or soil sticking to the magnet? Now, gently shake the magnet to remove the particles of sand or soil. Are some particles still sticking to it? These might be small pieces of iron (iron filings) picked up from the soil.

Through such an activity, we can find out whether the soil or sand from a given place contains particles that have iron. Try this activity near your home, school or the places you visit on your holidays. Does the magnet with iron filings sticking to it, look like any one of those shown in Fig. 10.6?

Make a table of what you find.



**Fig. 10.6** Magnet with (a) many iron filings  
(b) few iron filings and  
(c) no iron filings sticking to it.

**Table 10.2 Magnet rubbed in sand.  
How many iron filings?**

Name of location (Colony and town/ city/ village)	Did you find iron filings sticking to the magnet? (Many/ very few/ none)

If you fill this table and send it to Paheli and Boojho, they can compare the amount of iron filings found in soil from different parts of the country. They can share this information with you.

### 10.2 POLES OF MAGNET

We observed that iron filings (if they are present) stick to a magnet rubbed in the soil. Did you observe anything special about the way they stick to the magnet?

### Activity 4

Spread some iron filings on a sheet of paper. Now, place a bar magnet on this sheet. What do you observe? Do the iron filings stick all over the magnet? Do you observe that more iron filings get attracted to some parts of the magnet than others (Fig. 10.7)? Remove the iron filings sticking to the magnet and repeat the



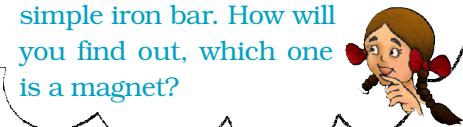
**Fig. 10.7** Iron filings sticking to a bar magnet

activity. Do you observe any change in the pattern with which the iron filings get attracted by different parts of the magnet? You can do this activity using pins or iron nails in place of iron filings and also with magnets of different shapes.

Draw a diagram to show the way iron filings stick to the magnet. Is your drawing similar to that shown in Fig. 10.6 (a)?

We find that the iron filings are attracted more towards the region close

**Paheli has this puzzle for you.**  
You are given two identical bars which look as if they might be made of iron. One of them is a magnet, while the other is a simple iron bar. How will you find out, which one is a magnet?



to two ends of a bar magnet. Poles of a magnet are said to be near these ends. Try and bring a few magnets of different shapes to the classroom. Check for the location of the poles on these magnets using iron filings. Can you now mark the location of poles in the kind of magnets shown in Fig. 10.4?

### 10.3 FINDING DIRECTIONS

Magnets were known to people from ancient times. Many properties of magnets were also known to them. You might have read many interesting stories about the uses of magnets. One such story is about an emperor in China named Hoang Ti. It is said that he had a chariot with a statue of a lady that could rotate in any direction. It had an extended arm as if it was showing the way (Fig. 10.8). The statue had an interesting property. It would rest in such a position that its extended arm always pointed towards South. By looking at the extended arm of the statue, the Emperor was able to locate directions when he went to new places on his chariot.



**Fig. 10.8** The chariot with direction finding statue

Let us make such a direction finder for ourselves.

### Activity 5

Take a bar magnet. Put a mark on one of its ends for identification. Now, tie a thread at the middle of the magnet so that you may suspend it from a wooden stand (Fig. 10.9). Make sure that the magnet can rotate freely. Let it come to rest. Mark two points on the ground to show the position of the ends of the magnet when it comes to rest. Draw a



**Fig. 10.9** A freely suspended bar magnet always comes to rest in the same direction

line joining the two points. This line shows the direction in which the magnet was pointing in its position of rest. Now, rotate the magnet by gently pushing one end in any direction and let it come to rest. Again, mark the position of the two ends in its position of rest. Does the magnet now point in a different direction? Rotate the magnet in other directions and note the final direction in which it comes to rest.

Do you find that the magnet always comes to rest in the same direction? Now can you guess the mystery behind the statue in the Emperor's chariot?

Repeat this activity with an iron bar and a plastic or a wooden scale instead of a magnet. Do not use light objects for this activity and avoid doing it where there are currents of air. Do the other materials also always come to rest in the same direction?

We find that a freely suspended bar magnet always comes to rest in a particular direction, which is the North-South direction. Use the direction of the rising sun in the morning to find out the rough direction towards east, where you are doing this experiment. If you stand facing east, to your left will be North. Using the Sun for finding directions may not be very exact, but, it will help to make out the direction North from the South, on your line. Using this you can figure out which end of the magnet is pointing to the North and which points to the South.

The end of the magnet that points towards North is called its North seeking

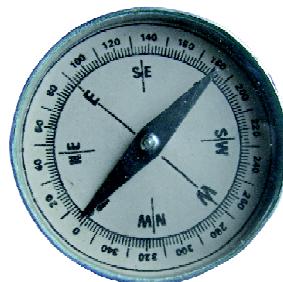
In which direction is the main gate of your school situated from your classroom?



end or the North pole of the magnet. The other end that points towards the South is called South seeking end or the South pole of the magnet. All magnets have two poles whatever their shape may be. Usually, north (N) and south (S) poles are marked on the magnets.

This property of the magnet is very useful for us. For centuries, travellers have been making use of this property of magnets to find directions. It is said that in olden days, travellers used to find directions by suspending natural magnets with a thread, which they always carried with them.

Later on, a device was developed based on this property of magnets. It is known as the compass. A compass is usually a small box with a glass cover on it. A magnetised needle is pivoted inside the box, which can rotate freely (Fig. 10.10). The compass also has a dial



**Fig. 10.10** A compass

with directions marked on it. The compass is kept at the place where we wish to know the directions. Its needle indicates the north-south direction when it comes to rest. The compass is then rotated until the north and south marked on the dial are at the two ends of the needle. To identify the north-pole of the magnetic needle, it is usually painted in a different colour.

#### 10.4 MAKE YOUR OWN MAGNET

There are several methods of making magnets. Let us learn the simplest one. Take a rectangular piece of iron. Place it on the table. Now take a bar magnet and place one of its poles near one edge of the bar of iron. Without lifting the bar magnet, move it along the length of the iron bar till you reach the other end. Now, lift the magnet and bring the pole (the same pole you started with) to the same point of the iron bar from which you began (Fig. 10.11). Move the magnet again along the iron bar in the same direction as you did before. Repeat this process about 30-40 times. Bring a pin or some iron filings near the iron bar to check whether it has become a magnet. If not, continue the process for some



**Fig. 10.11** Making your own magnet

more time. Remember that the pole of the magnet and the direction of its movement should not change. You can also use an iron nail, a needle or a blade and convert them into a magnet.

You now know how to make a magnet. Would you like to make your own compass?

#### Activity 6

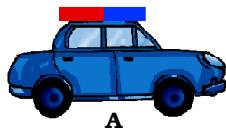
Magnetise an iron needle using a bar magnet. Now, insert the magnetised needle through a small piece of cork or foam. Let the cork float in water in a bowl or a tub. Make sure that the needle does not touch the water (Fig. 10.12). Your compass is now ready to work. Make a note of the direction in which the needle points when the cork is floating. Rotate the cork, with the needle fixed in it, in different directions. Note the direction in which the needle points when the cork begins to float again without rotating. Does the needle always point in the same direction, when the cork stops rotating?



**Fig. 10.12** A compass in a cup

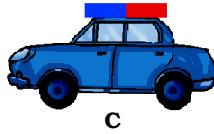
#### 10.5 ATTRACTION AND REPULSION BETWEEN MAGNETS

Let us play another interesting game with magnets. Take two small toy cars and label them A and B. Place a bar magnet on top of each car along its length and fix them with rubber bands



**Fig. 10.13** Do opposite poles attract each other?

(Fig. 10.13). In car A, keep the south pole of the magnet towards its front. Place the magnet in opposite direction in car B. Now, place the two cars close to one another (Fig. 10.13). What do you observe? Do the cars remain at their places? Do the cars run away from each other? Do they move towards each other and collide? Record your observations in a table as shown in Table 10.3. Now, place the toy cars close to each other such that the rear side of car A faces the front side of car B (Fig 10.14). Do they move as before? Note the direction in which the cars move now. Next, place the car A behind car B and note the direction in which they move in each case. Repeat the activity by placing cars



**Fig. 10.14** Repulsion between similar poles?

with their rear sides facing each other. Record your observations in each case.

What do we find from this activity? Do two similar poles attract or repel each other? What about opposite poles — do they attract or repel each other?

This property of the magnets can also be observed by suspending a magnet and bringing one by one the poles of another magnet near it.

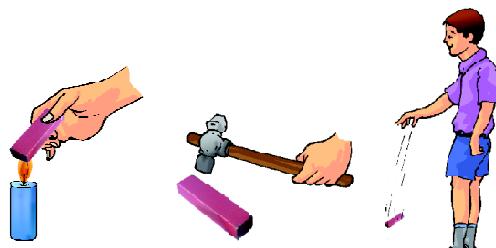
Boojho has this question for you.  
What will happen if a magnet is brought near a compass?



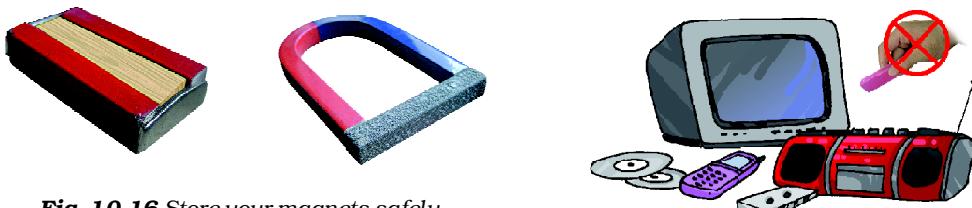
### A Few Cautions

Magnets lose their properties if they are heated, hammered or dropped from some height (Fig. 10.15). Also, magnets become weak if they are not stored properly. To keep them safe, bar

Position of the cars	How do the cars move? Move towards/ away from each other/ not move at all
Front of car A facing the front of car B	
Rear of car A facing the front of car B	
Car A placed behind car B	
Rear of car B facing rear of car A	



**Fig. 10.15** Magnets lose their property on heating, hammering and dropping



**Fig. 10.16** Store your magnets safely

magnets should be kept in pairs with their unlike poles on the same side. They must be separated by a piece of wood while two pieces of soft iron should be placed across their ends (Fig. 10.16).

For horse-shoe magnet, one should keep a piece of iron across the poles.

Keep magnets away from cassettes, mobiles, television, music system, compact disks (CDs) and the computer.

## Key words

Compass

Magnet

Magnetite

North pole

South pole



## Summary

- Magnetite is a natural magnet.
- Magnet attracts materials like iron, nickel, cobalt. These are called magnetic materials.
- Materials that are not attracted towards magnet are called non-magnetic.
- Each magnet has two magnetic poles—North and South.
- A freely suspended magnet always aligns in N-S direction.
- Opposite poles of two magnets attract each other whereas similar poles repel one another.

## Exercises

1. Fill in the blanks in the following:
  - (i) Artificial magnets are made in different shapes such as \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_.
  - (ii) The Materials which are attracted towards a magnet are called \_\_\_\_\_.
  - (iii) Paper is not a \_\_\_\_\_ material.
  - (iv) In olden days, sailors used to find direction by suspending a piece of \_\_\_\_\_.
  - (v) A magnet always has \_\_\_\_\_ poles.
2. State whether the following statements are true or false:
  - (i) A cylindrical magnet has only one pole.
  - (ii) Artificial magnets were discovered in Greece.
  - (iii) Similar poles of a magnet repel each other.
  - (iv) Maximum iron filings stick in the middle of a bar magnet when it is brought near them.
  - (v) Bar magnets always point towards North-South direction.
  - (vi) A compass can be used to find East-West direction at any place.
  - (vii) Rubber is a magnetic material.
3. It was observed that a pencil sharpener gets attracted by both the poles of a magnet although its body is made of plastic. Name a material that might have been used to make some part of it.
4. Column I shows different positions in which one pole of a magnet is placed near that of the other. Column II indicates the resulting action between them for each situation. Fill in the blanks.

Column I	Column II
N - N	_____
N - _____	Attraction
S - N	_____
_____ - S	Repulsion
5. Write any two properties of a magnet.
6. Where are poles of a bar magnet located?
7. A bar magnet has no markings to indicate its poles. How would you find out near which end is its north pole located?
8. You are given an iron strip. How will you make it into a magnet?
9. How is a compass used to find directions?
10. A magnet was brought from different directions towards a toy boat that has

been floating in water in a tub. Effect observed in each case is stated in Column I. Possible reasons for the observed affects are mentioned in Column II. Match the statements given in Column I with those in Column II.

Column I	Column II
Boat gets attracted towards the magnet	Boat is fitted with a magnet with north pole towards its head
Boat is not affected by the magnet	Boat is fitted with a magnet with south pole towards its head
Boat moves towards the magnet if north pole of the magnet is brought near its head	Boat has a small magnet fixed along its length
Boat moves away from the magnet when north pole is brought near its head	Boat is made of magnetic material
Boat floats without changing its direction	Boat is made up non-magnetic material

### SOME SUGGESTED ACTIVITIES

1. Using a compass, find the direction in which windows and entrance to your house or classroom open.
2. Try to place two equal sized bar magnets one above the other such that their north poles are on the same side. Note what happens and write your observations in your note book.
3. Few iron nails and screws got mixed with the wooden shavings while a carpenter was working with them. How can you help him in getting the nails and screws back from the scrap without wasting his time in searching with his hands?
4. You can make an intelligent doll, which picks up the things it likes (Fig. 10.17). Take a doll and attach a small magnet in one of its hands. Cover this hand with small gloves so that the magnet is not visible. Now, your intelligent doll is ready. Ask your friends to bring different objects near the doll's hand. Knowing the material of the object you can tell in advance whether the doll would catch it or not.



**Fig. 10.17** An intelligent doll

### THINGS TO READ

'Gulliver's Travels' which has this fantasy of the whole island of Laputa, floating in air. Could magnets be involved?



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# 11

## Air Around us

We have learnt in Chapter 6 that all living things require air. But, have you ever seen air? You might not have seen air, but, surely you must have felt its presence in so many ways. You notice it when the leaves of the trees rustle or the clothes hanging on a clothes-line sway. Pages of an open book begin fluttering when the fan is switched on. The moving air makes it possible for you to fly your kite. Do you remember Activity 3 in Chapter 3 in which you separated the sand and sawdust by winnowing? Winnowing is more effective in moving air. You may have noticed that during storms the wind blows at a very high speed. It may even uproot trees and blow off the rooftops.

Have you ever played with a *firki* (Fig. 11.1)?

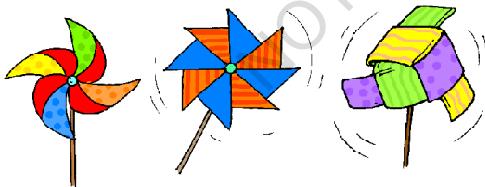


Fig. 11.1 Different types of *firki*

### Activity 1

Let us make a *firki* of our own, following the instructions shown in Fig. 11.2.

Hold the stick of the *firki* and place it in different directions in an open area.



Fig. 11.2 Making a simple *firki*

Move it a little, back and forth. Observe, what happens. Does the *firki* rotate? What makes a *firki* rotate — moving air, isn't it?

Have you seen a weather cock (Fig. 11.3)? It shows the direction in which the air is moving at that place.

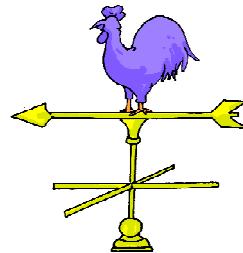


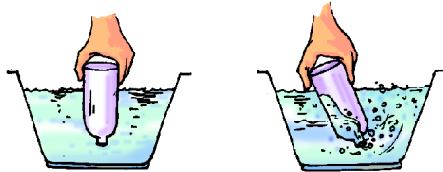
Fig. 11.3 A weather cock

### 11.1 Is AIR PRESENT EVERYWHERE AROUND US?

Close your fist — what do you have in it? Nothing? Try the following activity to find out.

### Activity 2

Take an empty open bottle. Is it really empty or does it have something inside? Turn it, upside down. Is something inside it, now?



**Fig. 11.4** Experiments with an empty bottle

Now, dip the open mouth of the bottle into the bucket filled with water as shown in Fig. 11.4. Observe the bottle. Does water enter the bottle? Now tilt the bottle slightly. Does the water now enter the bottle? Do you see bubbles coming out of the bottle or hear any bubbly sound? Can you now guess what was in the bottle?

Yes! You are right. It is “air”, that was present in the bottle. The bottle was not empty at all. In fact, it was filled completely with air even when you turned it upside down. That is why you notice that water does not enter the bottle when it is pushed in an inverted position, as there was no space for air to escape. When the bottle was tilted, the air was able to come out in the form of bubbles, and water filled up the empty space that the air has occupied.

This activity shows that air occupies space. It fills all the space in the bottle. It is present everywhere around us. Air has no colour and one can see through it. It is transparent.

Our earth is surrounded by a thin layer of air. This layer extends up to many kilometres above the surface of the earth and is called atmosphere. As we move higher in the atmosphere, the air gets rarer.



**Fig. 11.5** Mountaineers carry oxygen cylinders with them

Now can you think, mountaineers carry oxygen cylinders with them, while climbing high mountains (Fig. 11.5)?

## 11.2 WHAT IS AIR MADE UP OF?

Until the eighteenth century, people thought that air was just one substance. Experiments have proved that it is really not so. Air is a mixture of many gases. What kind of a mixture is it? Let us find out about some of the major components of this mixture, one by one.

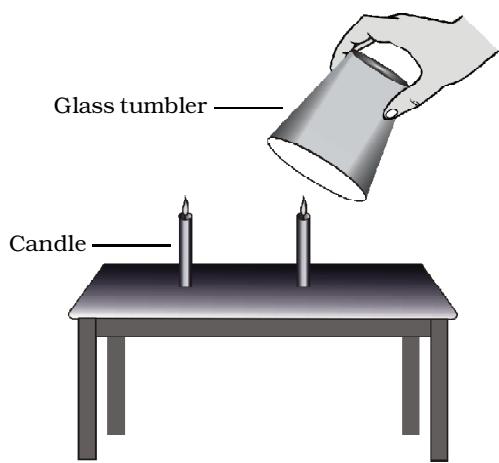
### Water vapour

We have learnt earlier that air contains water vapour. We also saw that, when air comes in contact with a cool surface, it condenses and drops of water appear on the cooled surfaces. The presence of water vapour in air is important for the water cycle in nature.

### Oxygen

### Activity 3

In the presence of your teacher, fix two small candles of the same length on a



**Fig. 11.6** Air has oxygen

table. Light both the candles. Cover one of the candles with an inverted glass tumbler. Observe both the candles carefully.

Do both the candles continue to burn or go off?

You must have observed that the candle covered with glass tumbler got extinguished after some time, whereas the other candle continued burning.

What can be the reason for this? Think about it.

It seems that the candle got extinguished because the component inside of the glass tumbler, which supports burning, is limited. Most of the component is used up by the burning candles. However, the other candle is getting continued supply of air. This component of air, which supports burning, is known as oxygen.

### Nitrogen

In Activity 3 did you observe that air is still present in the glass bottle even after

the candle blew out? This indicates the presence of some component in the air, which does not support burning. The major part of air (which does not support burning candle) is **nitrogen**.

### Carbon dioxide

In a closed room, if there is some material that is burning, you may have felt suffocation. This is due to excess of carbon dioxide that may be accumulating in the room, as the burning continues. Carbon dioxide makes up a small component of the air around us. Plants and animals consume oxygen for respiration and produce carbon dioxide. Plant and animal matter also consumes oxygen on burning and produces mainly carbon dioxide and a few other gases. It is advisable not to burn dry leaves and discarded remains of the crop, which pollute our surroundings.

### Dust and smoke

The burning of fuel also produces smoke. Smoke contains a few gases and fine dust particles and is often harmful. That is why you see long chimneys in factories. This takes the harmful smoke and gases away from our noses, but, brings it closer to the birds flying up in the sky!

Dust particles are always present in air.

### Activity 4

Find a sunny room in your school/home. Close all the doors and windows with curtains pulled down to make the



**Fig. 11.7** Observing presence of dust in air with sunlight

room dark. Now, open the door or a window facing the sun, just a little, in such a way that it allows sunlight to enter the room only through a slit. Look carefully at the incoming beam of sunlight.

Do you see some tiny shining particles moving in the beam of sunlight (Fig. 11.7)? What are these particles?

During winters you might have observed similar beam of sunlight filter through the trees in which dust particles appear to dance merrily around!

This shows that air also contains dust particles. The presence of dust particles in air varies from time to time, and from place to place.

We inhale air when we breathe through our nostrils. Fine hair and mucus are present inside the nose to

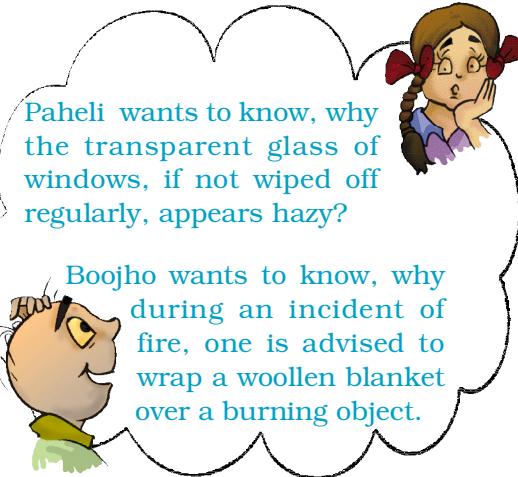
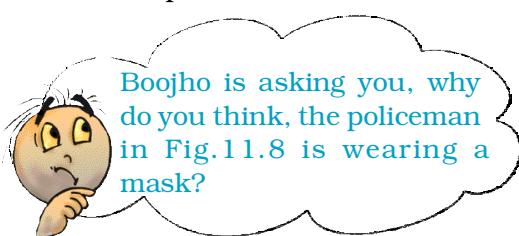


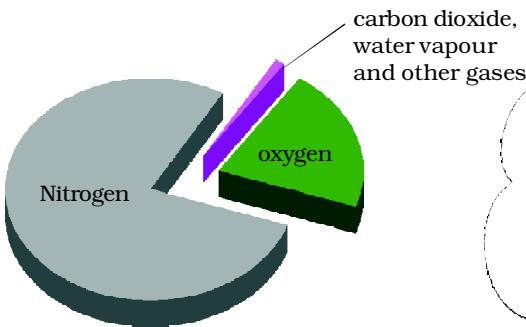
**Fig. 11.8** Policemen regulating traffic at a crowded crossing often wear a mask

prevent dust particles from getting into the respiratory system.

Do you recall being scolded by your parents when you breathe through your mouth? If you do that, harmful dust particles may enter your body.

We may conclude, then, that air contains some gases, water vapour and dust particles. The gases in air are mainly nitrogen, oxygen, small amount of carbon dioxide, and many other gases. However, there may be some





**Fig. 11.9** Composition of air

variations in the composition of air from place to place. We see that air contains mostly nitrogen and oxygen. In fact, these two gases together make up 99% of the air. The remaining 1% is constituted by carbon dioxide and a few other gases and water vapour (Fig. 11.9).

### 11.3 HOW DOES OXYGEN BECOME AVAILABLE TO ANIMALS AND PLANTS LIVING IN WATER AND SOIL?

#### Activity 5

Take some water in a glass or metal container. Heat it slowly on a tripod stand. Well before the water begins to boil, look carefully at the inner surface



**Fig. 11.10** Water contains air

Here is a question from Paheli, "Will the tiny air bubbles seen before the water actually boils, also appear if we do this activity by reheating boiled water kept in an air tight bottle?" If you do not know the answer you may try doing it and see for yourself.



of the container. Do you see tiny bubbles on the inside (Fig. 11.10)?

These bubbles come from the air dissolved in water. When you heat the water, to begin with, the air dissolved in it escapes. As you continue heating, the water itself turns into vapour and finally begins to boil. We learnt in Chapters 5 and 6, that the animals living in water use the dissolved oxygen in water.

The organisms that live in soil also need oxygen to respire, isn't it? How do they get the air they need, for respiration?

#### Activity 6

Take a lump of dry soil in a beaker or a glass. Add water to it and note what happens (Fig. 11.11). Do you see bubbles coming out from soil? These bubbles indicate the presence of air in the soil.

When the water is poured on the lump of soil, it displaces the air which is seen in the form of bubbles. The organisms that live inside the soil and the plant roots respire in this air. A lot



**Fig. 11.11** Soil has air in it

of burrows and holes are formed in deep soil by the animals living in the soil. These burrows also make spaces available for air to move in and out of the soil. However, when it rains heavily, water fills up all the spaces occupied by the air in the soil. In this situation, animals living in the soil have to come out for respiration. Could this be the reason why earthworms come out of the soil, only during heavy rains?

Have you ever wondered why all the oxygen of atmosphere does not get used up though a large number of organisms are consuming it? Who is refilling the oxygen in the atmosphere?

#### 11.4 How is the Oxygen in the Atmosphere Replaced?

In Chapter 4, we read about photosynthesis. In this process, plants make their own food and oxygen is produced along with it. Plants also consume oxygen for respiration, but they produce more of it than they consume. That is why we say plants produce oxygen.

It is obvious that animals cannot live without plants. The balance of oxygen

and carbon dioxide in the atmosphere is maintained through respiration in plants and animals and by the photosynthesis in plants. This shows the interdependence of plants and animals.

We can now appreciate, how important air is for life on earth. Are there any other uses of air? Have you heard about a windmill? Look at Fig. 11.12.



**Fig. 11.12** A windmill

The wind makes the windmill rotate. The windmill is used to draw water from tubewells and to run flour mills. Windmills are also used to generate electricity. Air helps in the movements of sailing yachts, gliders, parachutes and aeroplanes. Birds, bats and insects can fly due to the presence of air. Air also helps in the dispersal of seeds and pollen of flowers of several plants. Air plays an important role in water cycle.

## Key words

Atmosphere

Carbon dioxide

Composition of air

Oxygen

Nitrogen

Smoke

Windmill



## Summary ➤

- Air is found everywhere. We cannot see air, but we can feel it.
- Air in motion is called wind.
- Air occupies space.
- Air is present in water and soil.
- Air is a mixture of nitrogen, oxygen, carbon dioxide, water vapour and a few other gases. Some dust particles may also be present in it.
- Oxygen supports burning and is necessary for living organisms.
- The envelope of air that surrounds the earth is known as atmosphere.
- Atmosphere is essential for life on earth.
- Aquatic animals use dissolved air in water for respiration.
- Plants and animals depend on each other for exchange of oxygen and carbon dioxide from air.

## Exercises

1. What is the composition of air?
2. Which gas in the atmosphere is essential for respiration?
3. How will you prove that air supports burning?
4. How will you show that air is dissolved in water?
5. Why does a lump of cotton wool shrink in water?

6. The layer of air around the earth is known as \_\_\_\_\_.
7. The component of air used by green plants to make their food, is \_\_\_\_\_.
8. List five activities that are possible due to the presence of air.
9. How do plants and animals help each other in the exchange of gases in the atmosphere?

### SUGGESTED PROJECTS AND ACTIVITIES

1. On a clear glass window facing towards an open area, fix a small rectangular strip of paper. Remove the strip after a few days. Do you notice a difference between the rectangular section that was left covered with paper and the rest of the glass window? By repeating this exercise every month, you can have an idea about the amount of dust present in air around you at different times of the year.
2. Observe the leaves of trees, shrubs or bushes planted by the roadside. Note whether their leaves have some dust or soot deposited over them. Take similar observations with the leaves of trees in the school compound or in a garden. Is there any difference in deposition of soot on leaves of trees near the roadside? What could be the possible reasons for this difference? Take a map of your city or town and try to identify regions in the map where you have noticed very thick layer of soot on the plants by the roadside. Compare with results obtained by other classmates and mark these areas on the map. Perhaps the results from all the students could be summarised and reported in newspapers.

## **Notes**

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