keep their bodies away from the heat of the sand (Fig. 9.2). 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. 9.3. 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 8. 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 8, 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 a plant or an animal to live in its surroundings, is called **adaptation**. Different animals are adapted to their surroundings in different ways.

The surroundings where organisms live is called a **habitat.** The organisms depend for their food, water, air, shelter and other needs on their habitat. Habitat means a dwelling place (a home). Several kinds of plants and animals may share 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. 9.2 *Camels in their surroundings*

Fig. 9.3 *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**. Ponds, swamps, lakes, rivers and oceans are some examples of aquatic habitats. There are large variations in forests, grasslands, deserts, coastal and mountain regions located in different parts of the world. This is true for all aquatic habitats as well.

The living things such as plants and animals, in a habitat, are its **biotic** components. Various non-living things such as rocks, soil, air and water in the habitat constitute its **abiotic components**. Sunlight and heat also form abiotic components of the habitat.

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 5 in Chapter 1 — we made sprouts from *moong* and *chana* seeds. When the seed turned into a sprout, it **germinated**. This was the beginning of a new plant, from the seed.

Collect some dry *moong* seeds. Keep a small heap of 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. Set these three parts to germinate by rinsing them and draining the water every day. What do you notice, after a few days? Do the seeds in all the five parts germinate equally? Do you find slower or no germination in any of these?

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

We find that organisms exist in very cold as well as very hot climates and surroundings, isn't it? How do they manage to survive? That is where, adaptation comes in.

Adaptation does not take place in a short time. Over thousands of years, the abiotic factors of a region change. Those animals which cannot adapt to these changes die out, and only the adapted ones survive. Animals adapt to different abiotic factors in different ways. The result is variety of organisms present in different habitats.

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

Fig. 9.4 *Desert animals in burrows*

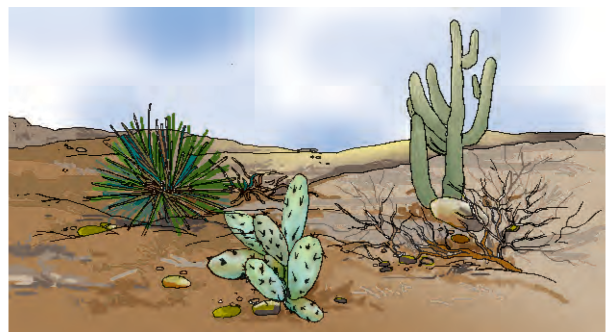


Fig. 9.5 *Some typical plants that grow in desert*

9.3 A Journey Through Different Habitats

Some Terrestrial Habitats

Deserts

We discussed the abiotic factors of a desert and the adaptations in camels to these. 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 the long legs that the camel has. To stay away from the intense heat during the day, they stay in burrows deep in the sand (Fig 9.4). These animals come out only during the night, when it is cooler.

Fig. 9.5 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 7, where we studied transpiration in plants. 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 on 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 present in the shape 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. 9.5). 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. 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. 9.6?

Fig. 9.6 *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. 9.7). 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)

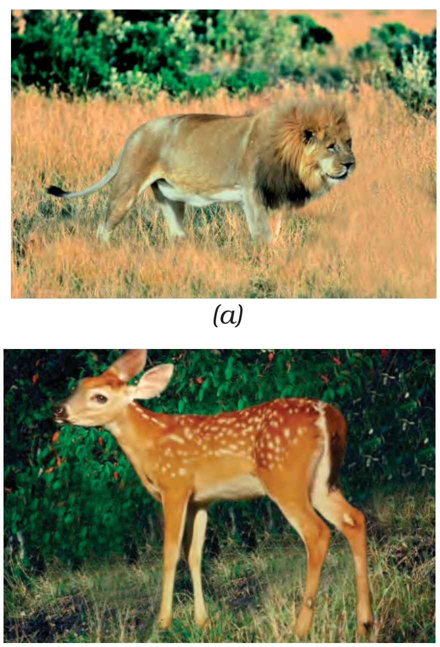
(c)

Fig. 9.7 *(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. 9.8). 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 survive? It's 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)

(b)

Fig. 9.8 *(a) Lion and (b) deer*

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 draw the kinds of plants that are seen there. How are the leaves, stems and roots of these plants placed?

Some of these plants have their roots fixed in the soil below the water (Fig. 9.9). 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.

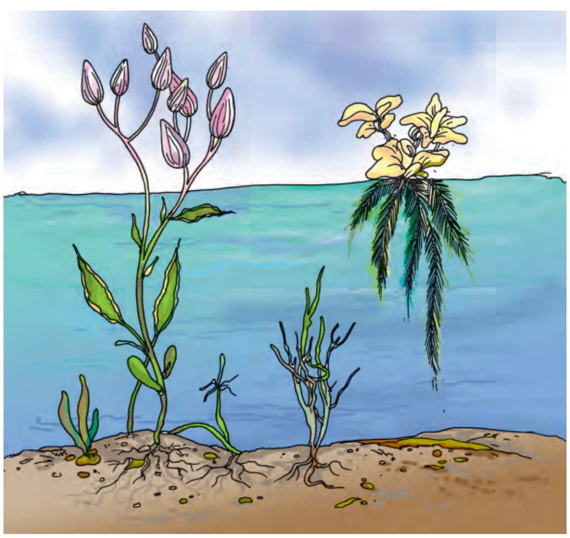


Fig. 9.9 *Some aquatic plants float on water. Some have their roots fixed in the soil at the bottom. Some aquatic plants are completely submerged in water.*

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 the water.

Some aquatic plants are totally submerged in water. All parts of such plants grow 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 have ponds as their habitat. Frogs can stay both inside the pond 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 the 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 7. Imagine the kind of variety that you could see in a herbarium of leaves of plants from all regions of the Earth!

9.4 Characteristics of the Living Beings

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, objects like chair or a table in our homes we know that they are not alive. Paheli was reading this rhyme from *Complete Nonsense* written by Edward Lear:

Paheli and Boojho found the poem so very funny, because they knew that a chair or a table is not alive and it cannot talk, walk or suffer from the usual problems that all of us face.

A chair, table, stone or a coin. We know that they 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 things, but they do not appear to 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 living things need food?

In Chapters 1 and 2, 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 through the process of photosynthesis. Animals depend on plants and other animals for their food.

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

Do all living things 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 9.10).

Young ones of animals also grow into adults. You would surely have noticed pups of a dog grow into adults. A chicken hatched from an egg, grows into a hen or a cock. (Fig 9.11).

Fig. 9.10 *A baby grows into an adult*

Fig. 9.11 *A chicken grows into an adult*

Plants also grow. Look around you and see a few plants of a particular type. Some are very small and young, some are grown. 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 cannot show growth?

Do all living things respire?

Can we live without breathing? When we inhale, the air moves from outside to the inside of the 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 living body. We breathe out the 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.

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 their 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 of air to produce their own food and give out oxygen. Plants produce their food only during the daytime whereas respiration in them takes place day and night. The amount of oxygen released in the process of food preparation by plants is much more than the oxygen they use in respiration.

Do all living things 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 the 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. 9.12). 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. 9.12 *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 living things take food. Not all the food that is eaten is really used, only a part of it is utilised by the body. What happens to the rest? This has to be removed by the body as wastes. Our body also produces some wastes in other life processes. The process of getting rid of these wastes by the living organisms is known as **excretion**.

Do plants also excrete? Yes, they do. However, the mechanisms in plants are a little different. Some harmful or poisonous materials do get produced in plants as wastes. 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 characteristics common to all living things.

Do all living things 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 may hatch and young birds come out of these (Fig. 9.13).

(a) *(b)*

Fig. 9.13 *(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. 9.14).

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

Fig. 9.14 *Some animals which give birth to their young ones*

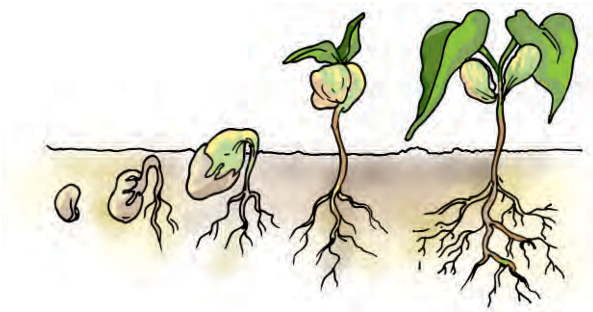


Fig. 9.15 *A seed from a plant germinates into a new plant*

which can germinate and grow into new plants (Fig.9.15).

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 9.16).

Fig. 9.16 *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 *menhdi* 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 living things move?

In Chapter 8, 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

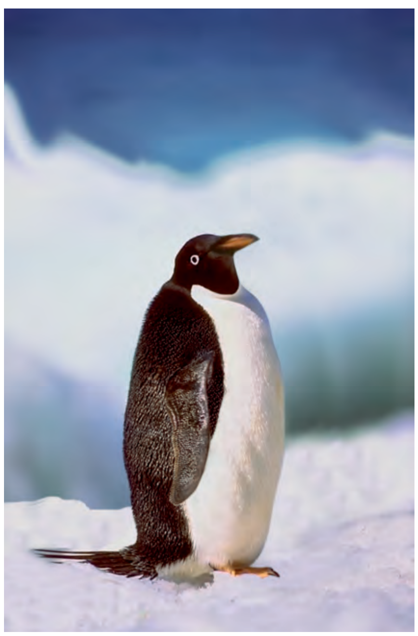
- The surroundings where plants and animals live, is called their habitat.
- Several kinds of plants and animals may share the same habitat.
- The presence of specific features and habits, which enable a plant or an animal to live in a particular habitat, is called adaptation.
- There are many types 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.



10 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.

10.1 Story of Transport

Long ago people did not have any means of transport. They used to move only on foot and carry goods either on their back or using animals.

For transport along 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 8 and 9.

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 vehicles that moved on wheels.

Until the beginning of the 19th century, people still depended on animal power to transport them from place to place. The invention of steam engine introduced a new source of power. Railroads were made for steam engine driven carriages and wagons.

Fig 10.1 *Means of transportation*

Later came automobiles. 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 20th century contributions.

Fig. 10.1 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?

10.2 How Far have you Travelled? 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 fighting 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 of them 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. 10.2).

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. 10.3).

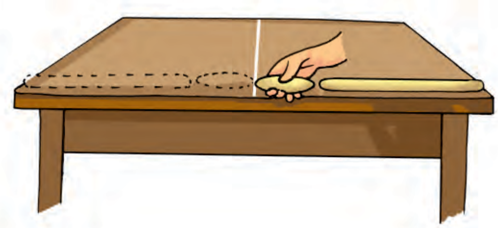


Fig. 10.2 *Measuring the length of a desk with gilli and danda*

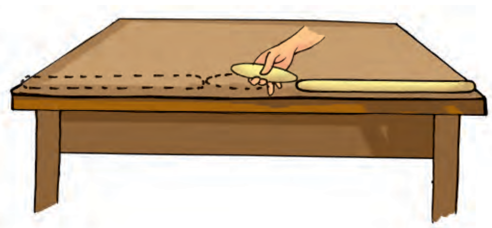


Fig. 10.3 *Measuring the length of the desk with a different set of gilli and danda*

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. 10.4). 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. 10.4 *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 broom?

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.

10.3 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 10.1.

Table 10.1 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. 10.5).

Fig. 10.5 *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 10.2.

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

Table 10.2 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 10.1 and 10.2. 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.

10.4 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.10.6. 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 m = 100 cm

1 cm = 10 mm

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

1 km = 1000 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.

10.5 Correct Measurement of Length

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

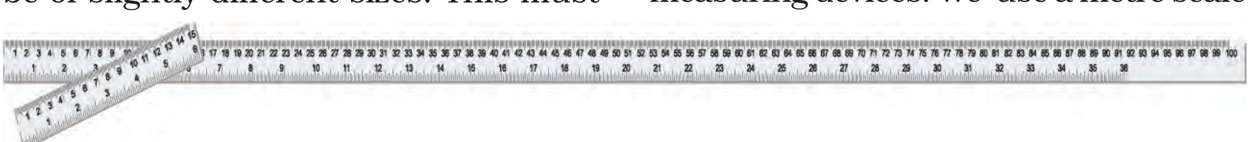
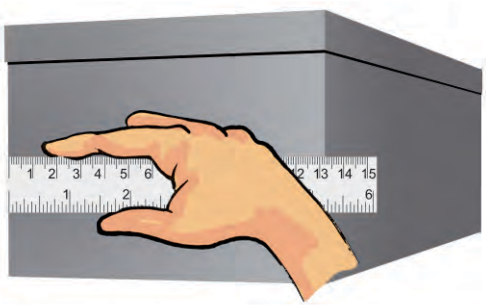


Fig.10.6 *A metre scale and a 15 cm scale*

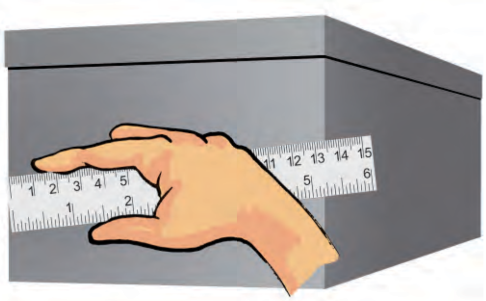
for measuring length. A tailor uses a tape, whereas a cloth merchant uses a metre rod. For measuring the length of an object, you must choose a suitable device. You cannot measure the girth of a tree or the size of your chest using a metre scale, for instance. Measuring tape is more suitable for this. 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.10.7.
2. In some scales, the ends may be broken. You may not be able to see the zero mark clearly [Fig.10.8 (a)]. In such cases, you should avoid taking measurements from the zero mark of the scale. You can use any other full mark of the scale, say, 1.0 cm [Fig.10.8 (b)]. Then you must subtract the reading of this mark from the reading at the other end. For example, in Fig.10.8 (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.

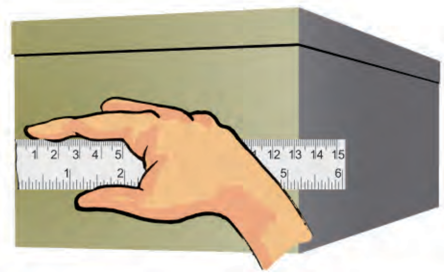


(a)

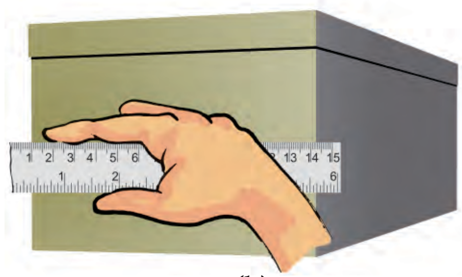


(b)

Fig. 10.7 *Method of placing the scale along the length to be measured (a) correct and (b) incorrect*



(a)



(b)

Fig. 10.8 *(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.10.9. 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.

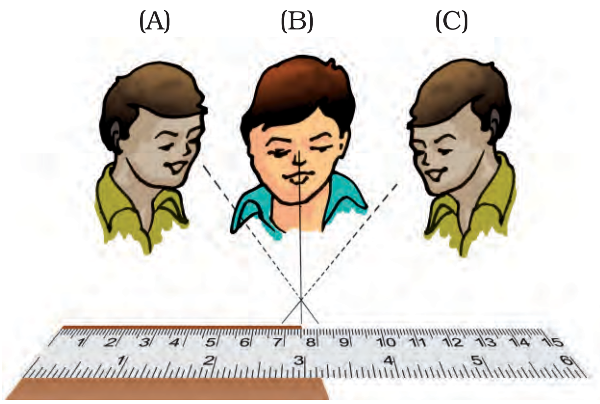


Fig. 10.9 *B is the proper position of the eye for taking reading of the scale*

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 handspan and then with a metre scale. Let all other students measure this length in a similar way. Record all observations in Table 10.3.

Table 10.3 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.

10.6 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.10.10). 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.10.10 *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.

10.7 Moving Things Around us

Activity 5

Think of some objects you have seen recently. List them in Table 10.4. A school bag, a mosquito, a table, people sitting on desks, people moving about? May be a butterfly, dog, cow, your hand, a small baby, a fish in water, a house, a factory, a 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?

Table10. 4 Objects in rest and 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

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. 10.11). 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. 10.11 *Motion of an ant*

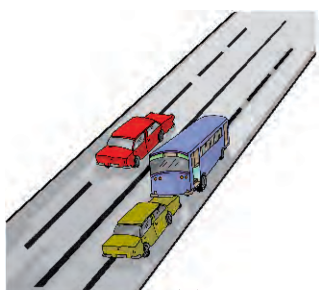
moving. Each point you have marked shows where the ant moved to, in intervals of a few seconds.

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 a train? Let us now look at some types of motion to help us understand these differences.

10.8 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. 10.12). 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)

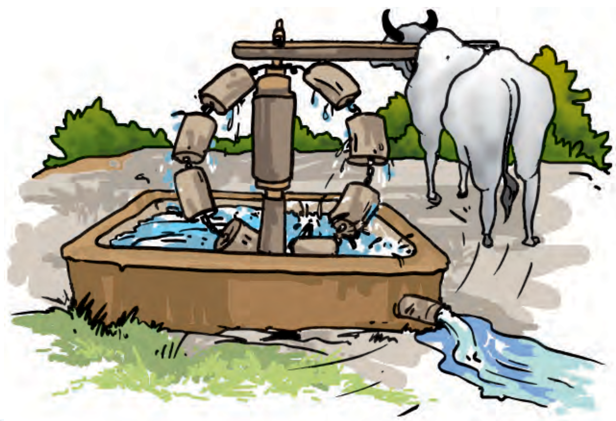
Fig.10.12 *Some examples of rectilinear motion*

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

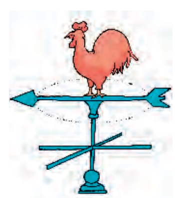
Activity 7

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 (Fig. 10.13).



(a)



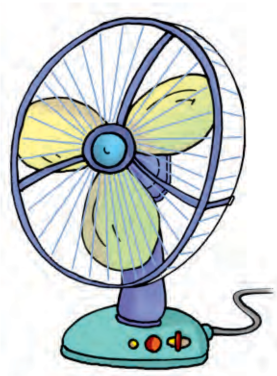
(b)

(c)

Fig. 10.13 *Some objects in circular motion*

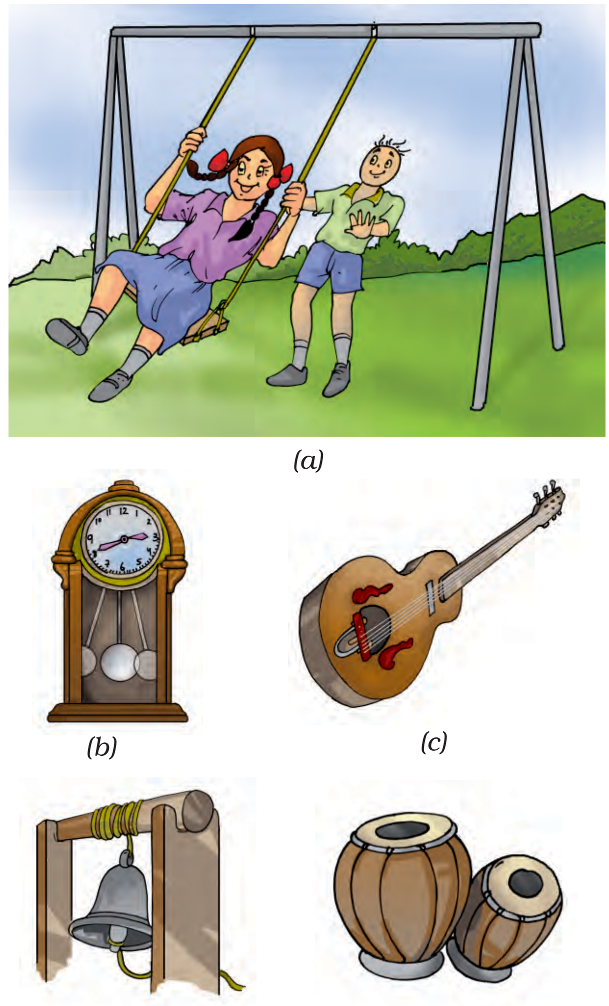
The motion of a point marked on the blade of an electric fan or the hands of a clock are examples of circular motion.

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 6. Now, hold the string in your hand and let the stone hang from it. Pull the stone to one side with the other hand and let it go. This is a pendulum. Something to have a lot of fun with and something that will help us understand about periodic motion. Motion of a pendulum, a branch of a tree moving to and fro, motion of a child on a swing, strings of a guitar or the surface of drums (*tabla*) being played, are all examples of periodic motion where an object or a part of it repeats its motion after a fixed interval of time (Fig. 10.14).



(a) (b) (c) (d) (e)

Fig. 10.14 *Examples of periodic motion*

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.

Did you observe a sewing machine as a part of Activity 5? You must have observed that it remains at the same location while 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 on the ground? Here, the ball is rolling on the ground – rotating as well as moving forward on 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 along on clear rounded pebbles, an aeroplane flying high up in the air — making jet trails, moon going around the Earth, blood flowing inside our bodies, 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 Unit (SI unit). 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 could you not use an elastic measuring tape to measure distance? What would be some of the problems you would meet in telling someone about a distance you measured with an elastic 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.

11 Light, Shadows and Reflections

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

11.1 Transparent, Opaque and Translucent objects

Recall our grouping objects as opaque, transparent or translucent, in Chapter 4. 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 you 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. 11.1). 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 11.1.

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

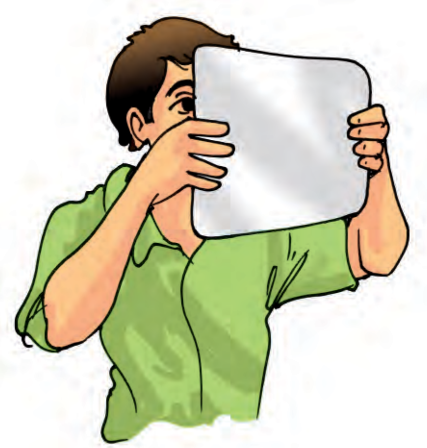


Fig. 11.1 *Observing objects that do or do not allow light to pass through them*

Table 11.1

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.

11.2 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. 11.2).

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

Fig. 11.2 *Sometimes shadow of an object gives an idea about its shape*

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. 11.3 *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. 11.3)?

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

Fig 11.4 *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. 11.4 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.

11.3 A Pinhole Camera

Surely we need a lot of complicated stuff to make a camera? Not really. If we just wish to make a simple pin hole camera.

Activity 5

Take two boxes so 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. 11.5 (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. 11.5 (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. 11.5 (c)]. Your pin hole camera is ready for use.

Holding the pin hole 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.

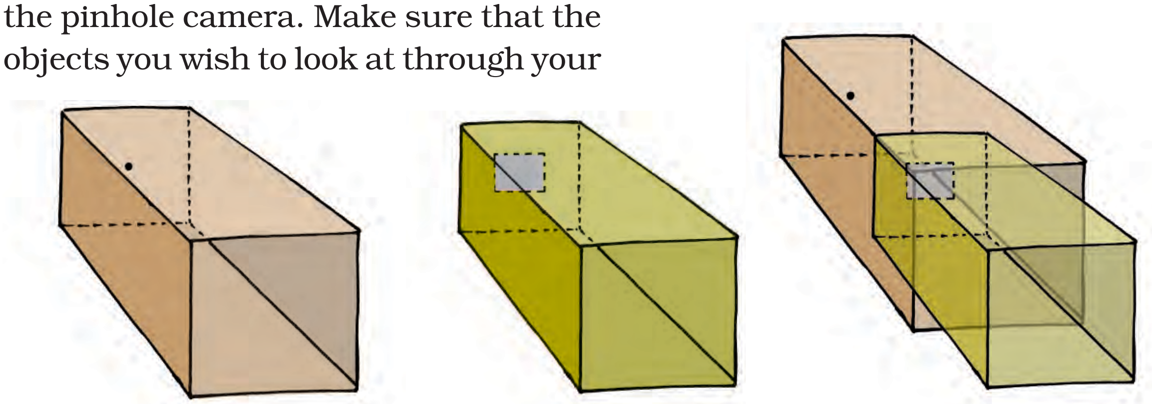
Are these pin hole images different from their shadows?

Look through your pin hole camera at the vehicles and people moving on the road in bright sun light.

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 pin hole camera. We need a slightly different set up for this. We just need a large sheet of cardboard with a small pin hole 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 pin hole images of the Sun when an eclipse is visible from your location. Adjust your pin hole and screen to get a clear image before the eclipse is to occur. Look at the image as



(a) (b) (c)

Fig. 11.5 *A sliding pin hole camera* the eclipse begins. You will notice a part of the Sun's image 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 pin hole camera in nature. Sometimes, when we pass under a tree covered with large number of leaves, we notice small patches of sun light under it (Fig. 11.6). These circular images are, in fact, pin hole images of the Sun. The gaps between the leaves, act as the pin holes. These gaps are all kinds of irregular shapes, but, we can see circular images of the Sun. Try to locate images of the Sun when an eclipse occurs next. That could be so much fun!

Fig. 11.6 *A natural pinhole camera. Pinhole images of the Sun under a tree!*

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. 11.7 (a)]. Is the candle visible? Bend the pipe a little while you are looking at the candle [Fig. 11.7 (b)]. Is the candle visible now? Turn the pipe a little to your right or left. Can you see the candle now?

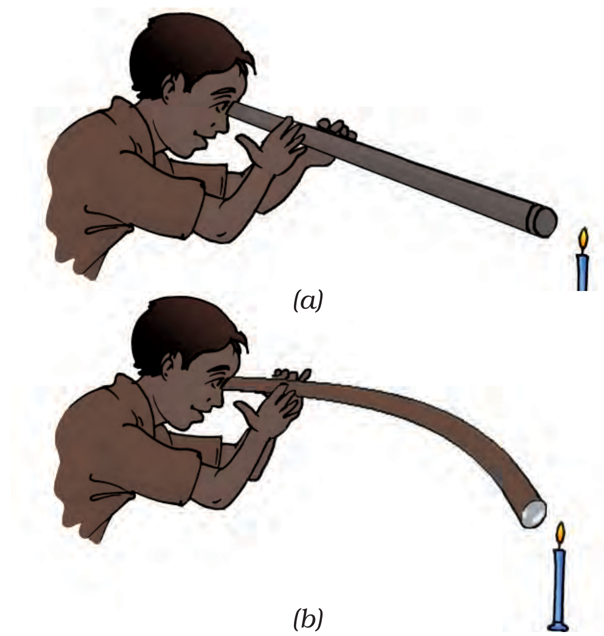


Fig. 11.7 *Looking through a pipe pointed (a) towards and (b) a little away from a candle*

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.

11.4 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. 11.8)? Now, adjust the direction of the torch so that the patch of light falls on another friend standing in the room.

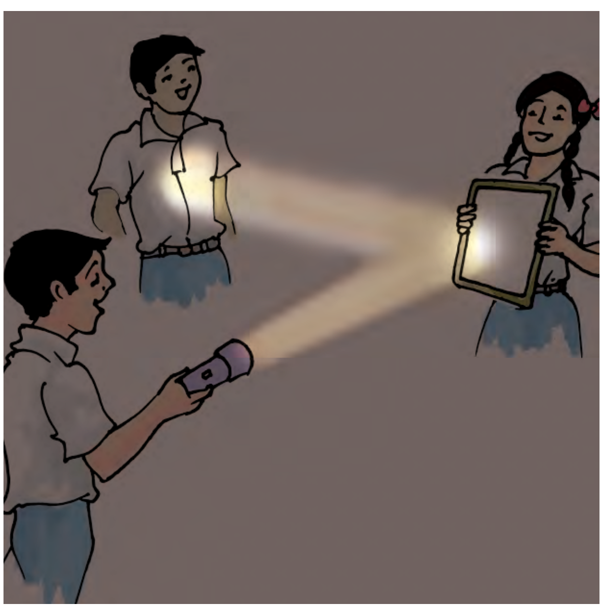


Fig. 11.8 *A mirror reflects a beam of light*

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. 11.9. 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. 11.9?

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

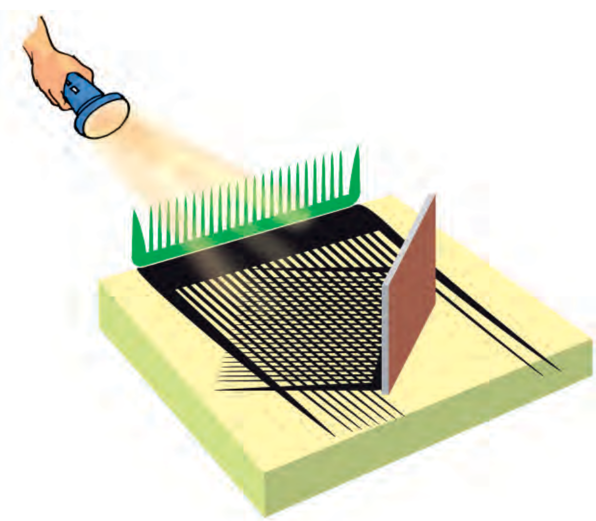


Fig. 11.9 *Light travelling in a straight line and getting reflected from a mirror*

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.
- Mirror reflection gives us clear images.
- Images are very different from shadows.
- Light travels in straight line.

Exercises

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

O W S	A K E	O P A Q	U E O	B J E C	T S M
S H A D					

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. 11.10).

   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?

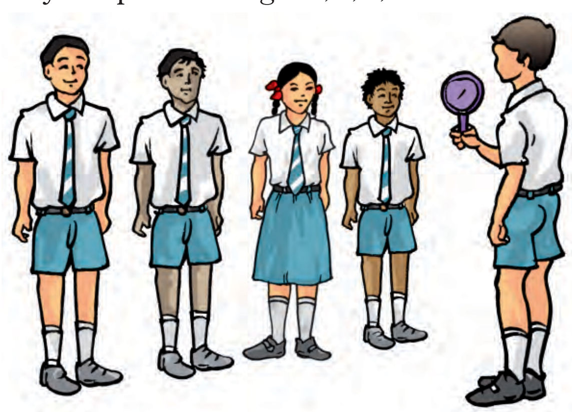


Fig. 11.10

   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 pin hole 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 freinds to stand in the corridor just out side 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 ajust 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. 11.11).

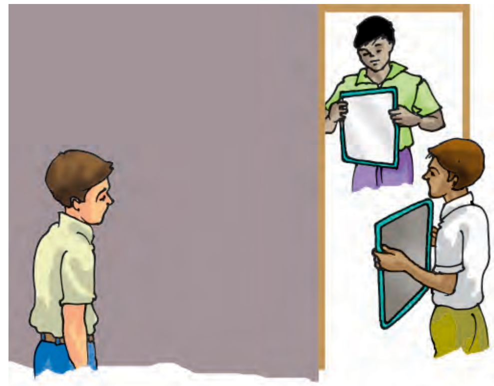


Fig. 11.11 *Seeing around corners!*

You can make a simple periscope by placing two mirrors in a 'Z' shaped box as shown in Fig. 11.12.

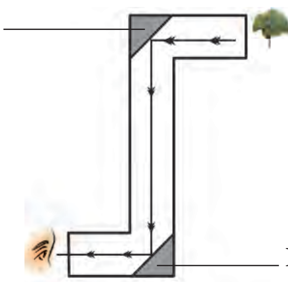


Fig. 11.12 *A periscope*

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 noticed 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 'sclusively speckled and sprottled 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 'sclusively dark, and yet so full of little pieces of light?'

12 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?

12.1. 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. 12.1). Did you notice a positive (+) sign and a negative (–) sign marked on the electric cell? The

Fig.12.1 *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.

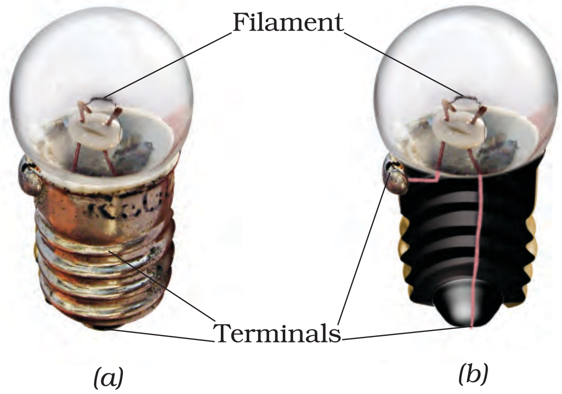


Fig.12.2 *(a) Torch bulb and (b) its inside view*

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. 12. 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. 12.2 (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. 12.2 (b). One of these thick wires is connected to the metal case at the base of the bulb [Fig. 12.2 (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 way that they do not touch each other. The electric bulbs used at home also have a similar design.

> **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.

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

12.2. 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. 12.3 and Fig. 12.4.

Fig.12.3 *Electric cell with two wires attached to it*

Fig.12.4 *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 has been shown in Fig. 12.5 (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 arrangment in Fig. 12.5 (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. 12.5. Did the bulb glow for the arrangements in which you could not move the pencil from one terminal to the other?

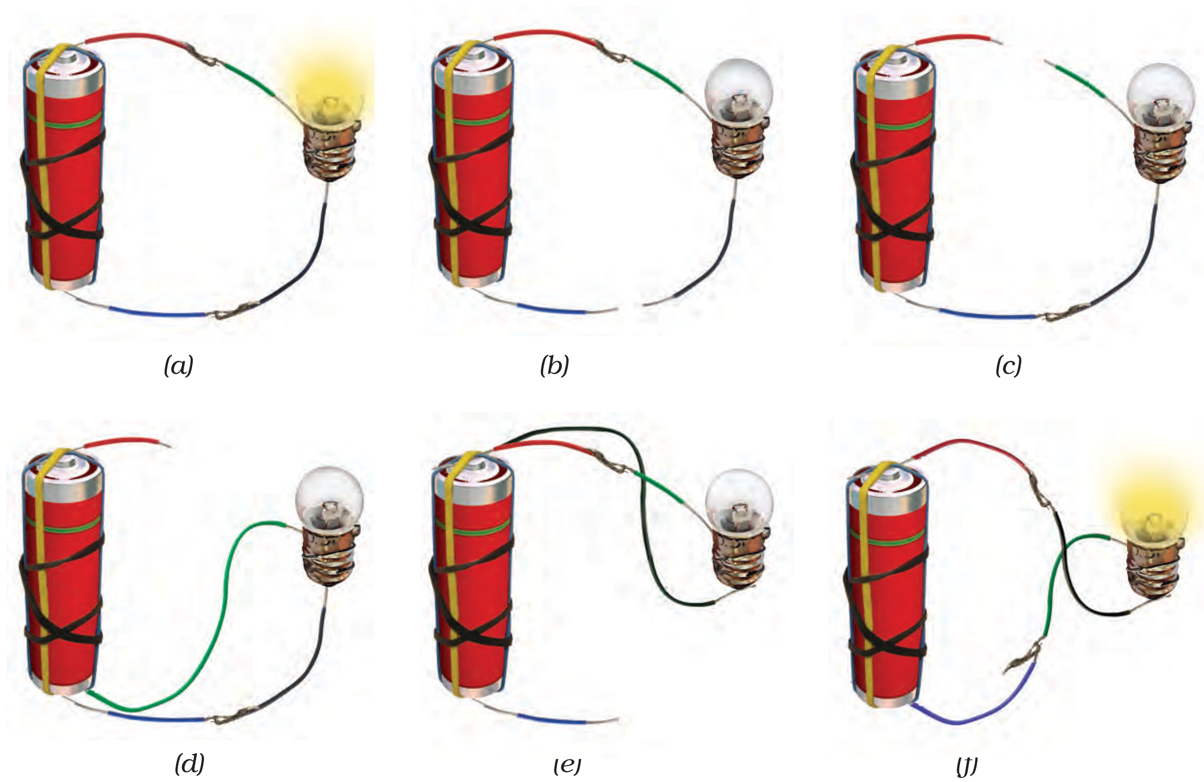


Fig.12.5 *Different arrangements of electric cell and bulb*

12.3 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. 12. 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.12.6. When the

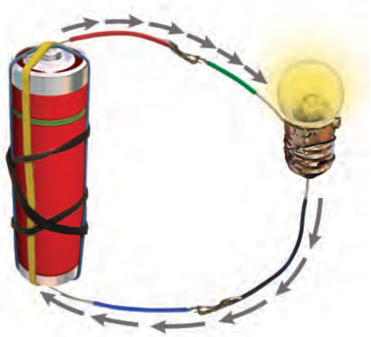


Fig.12.6 *Direction of current in an electric circuit*

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. 12.5 (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. 12.7. 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. 12.7 *A home made torch*

Paheli has another arrangement of the cell and the bulb. Will the torch bulb glow in the following arrangement?

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?

12.4 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 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. 12.8. 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.

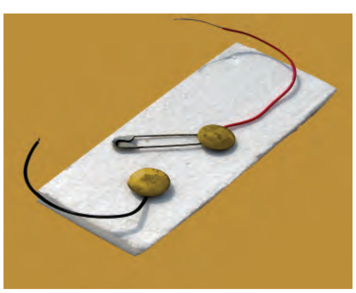


Fig. 12.8 *A simple switch*

Fig 12.9 *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.12.9. 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. 12.10). Since the material of the safety pin allows the current to pass

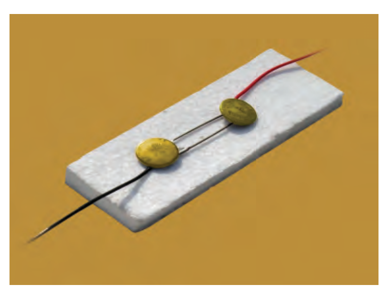


Fig. 12.10 *A switch in 'on' position*

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 this position, the switch is said to be 'off' as in Fig. 12.9.

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.

Boojho has drawn the inside of the torch as in Fig. 12.11. 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?

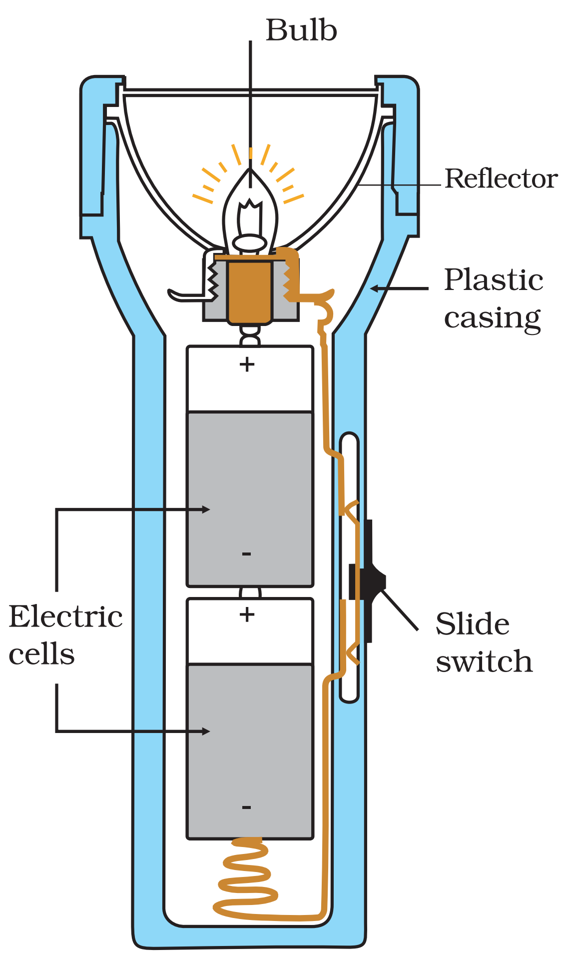


Fig. 12.11 *Inside view of a torch*

12.5 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. 12.12 (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.

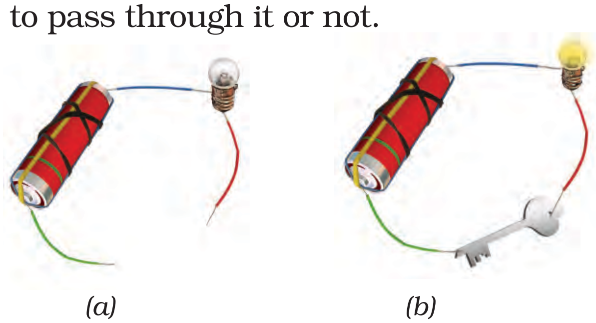


Fig. 12.12 *(a) A conduction tester (b) Testing whether the bulb glows when the tester is in contact with a key*

Collect samples of different types of materials such as coins, cork, rubber, glass, keys, pins, plastic scale, wooden block, pencil lead, 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. 12.12 (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.12.1, and record your observations.

Table 12.1 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 12.1, 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 4. 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.12.9). 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	Insulator
Electric cell	Switch
Electric circuit	Terminal

Exercises

1. Fill in the blanks :

   (a) A device that is used to break an electric circuit is called ______________.

   (b) An electric cell has ______________ terminals.

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

   (a) Electric current can flow through metals.

   (b) Instead of metal wires, a jute string can be used to make a circuit.

   (c) Electric current can pass through a sheet of thermo Col.

3. Explain why the bulb would not glow in the arrangement shown in Fig. 12.13.

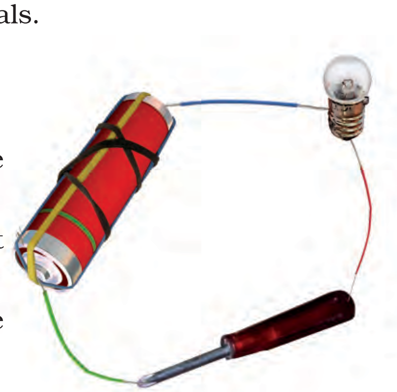


Fig. 12.13

4. Complete the drawing shown in Fig 12.14 to indicate where the free ends of the two wires should be joined to make the bulb glow.
5. What is the purpose of using an electric switch? Name some electrical gadgets that have switches built into them.
6. Would the bulb glow after completing the circuit shown in Fig. 12.14 if instead of safety pin we use an eraser?

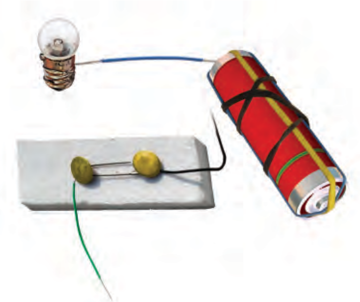


Fig. 12.14

7. Would the bulb glow in the circuit shown in Fig. 12.15?

Fig. 12.15

8. 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.
9. Why should an electrician use rubber gloves while repairing an electric switch at your home? Explain.
10. 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

1. 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.
2. 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.
3. 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.

13 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. 13.1)!

Fig. 13.1 *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. 13.2). If you have any one of these items, try to locate the magnets hidden in these.

Fig. 13.2 *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.13.3 *A natural magnet on a hillside!*

mountainside (Fig. 13.3). 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

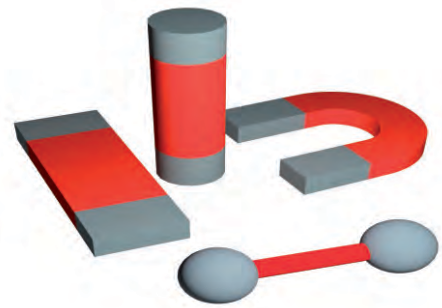


Fig. 13.4 *Magnets of different shapes*

magnets are prepared in different shapes. For example, bar magnet, horse-shoe magnet, cylindrical or a ball-ended magnet. Fig.13.4 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. 13.5. 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.

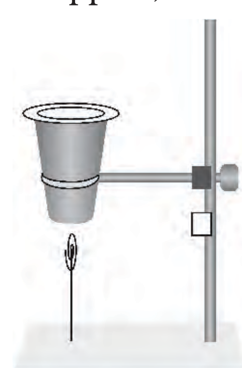


Fig. 13.5 *Effect of magnet - a paper clip hanging in air!*

13.1 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 13.1. and record your observations.

Look at the last column of Table 13.1 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 13.1? Is soil a magnetic or a non-magnetic material?

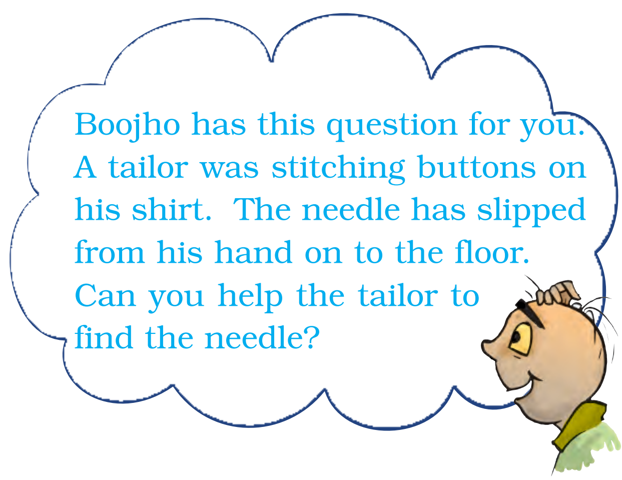


Table 13.1 Finding the objects attracted by magnet

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. 13.6?

Make a table of what you find.

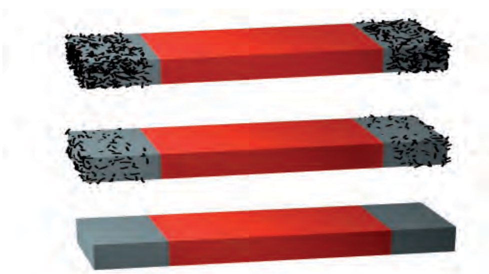


Fig. 13.6 *Magnet with (a) many iron filings (b) few iron filings and (c) no iron filings sticking to it.*

Table 13.2 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.

13.2 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. 13.7)? Remove the iron filings sticking to the magnet and repeat the 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.

Fig. 13.7 *Iron filings sticking to a bar magnet*

Draw a diagram to show the way iron filings stick to the magnet. Is your drawing similar to that shown in Fig. 13.6 (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. 13.4?

13.3 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. 13.8). 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.

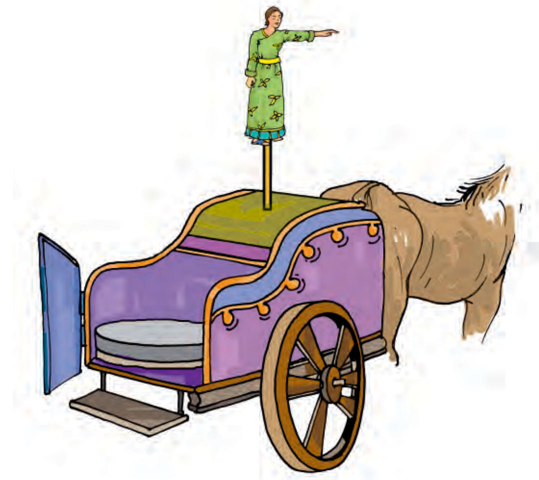


Fig. 13.8 *The chariot with direction finding statue*

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. 13.9). 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. 13.9 *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 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.

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

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. 13.10). The compass also has a dial

Fig. 13.10 *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.

13.4 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. 13.11). 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 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.

Fig.13.11 *Making your own 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. 13.12). 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. 13.12 *A compass in a cup*

13.5 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. 13.13 *Do opposite poles attract each other?*

Fig. 13.14 *Repulsion between similar poles?*

(Fig. 13.13). 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. 13.13). 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 13.3. 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 13.14). 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 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.

Table 13.3

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	

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

A Few Cautions

Magnets loose their properties if they are heated, hammered or dropped from some height (Fig. 13.15). Also, magnets become weak if they are not stored properly. To keep them safe, bar

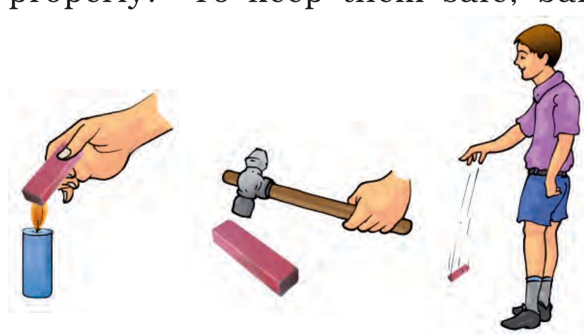


Fig. 13.15 *Magnets lose their property on heating, hammering and droping*

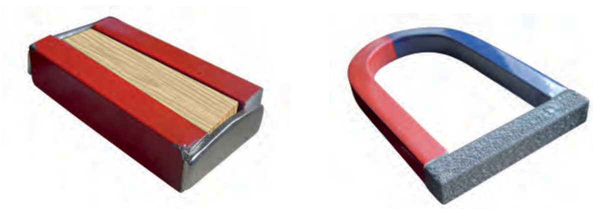


Fig. 13.16 *Store your magnets safely*

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. 13.16).

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	Repulstion

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. Affect 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 class room 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. 13.17). 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. 13.17 *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?

14 Water

Suppose for some reason your family gets only one bucket of water everyday for a week. Imagine what would happen? Would you be able to cook, clean utensils, wash clothes or bathe? What are the other activities you would not be able to do? What would happen if we do not have easy access to water for a long period of time?

Apart from drinking, there are so many activities for which we use water (Fig. 14.1). Do you have an idea about the quantity of water we use in a single day?

Fig. 14.1 *Uses of water*

14.1 How Much Water do we Use?

Activity 1

List all the activities for which you use water in a day. Some activities are listed in Table 14.1. Make a similar table in your notebook. Throughout the day, measure the amount of water used for each activity by you and other family members. You may use a mug, a glass, a bucket or any other container to measure the amount of water used.

Table 14.1 Estimation of the amount of water used by a family in a day

Activity	Amount of water used
Drinking	
Brushing	
Bathing	
Washing utensils	
Washing clothes	
Toilets	
Cleaning floor	
Any other	
Total water used in a day by a family	

You now have a rough idea as to how much water your family uses in a day. Using this information, calculate the amount of water needed by your family in a year. Now, divide this amount by the number of members of your family. This will give an idea of the amount of water needed by one member of your family in a year. Find the number of people that live in your village or town.

You may now get an idea of the amount of water needed by your village or town in a year.

Boojho wonders whether people living in different regions of our country get the same amount of water. Are there regions where people do not get adequate amount of water? How do they manage?

You have listed a number of activities for which you use water. Do you think, our water requirement is limited to activities like these? We use wheat, rice, pulses, vegetables and many other food items everyday. We know that some of the fibres that we use for making fabric come from plants. Is water not needed to grow these? Can you think of some more uses of water? Water is used in industries for producing almost all the things that we use. So, we need water not only for our daily activities but also for producing many things.

Paheli wants to tell you that about two glasses of water are required to produce each page of a book.

14.2 Where do we get Water From?

Where do you get the water that you use? Some of you may say, "We draw water from a river, spring, pond, well or a hand pump". Some others might say, "We get water from taps". Have you ever wondered where water in the taps comes from? Water that we get from taps is also drawn from a lake or a river or a well (Fig. 14.2). It is then supplied through a network of pipes.

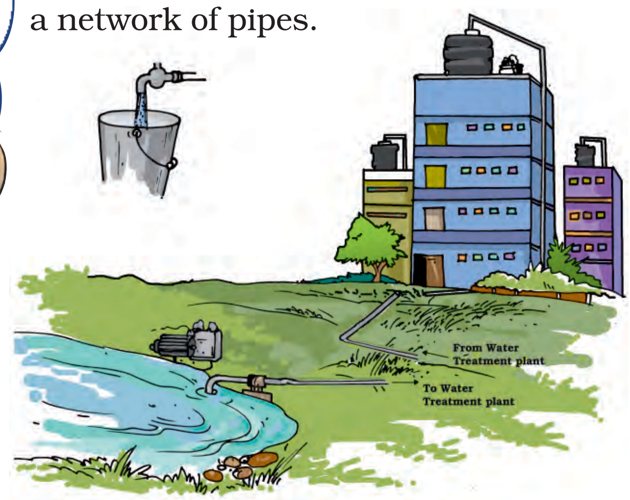


Fig. 14.2 *Water in taps comes from rivers, lakes or wells*

Each of us may be getting water into our homes in different ways. But, finally, all of us get water from the same sources such as ponds, lakes, rivers and wells.

We have discussed some of the sources of water. Where does the water come from, to fill these ponds, lakes, rivers and wells?

Boojho wants you to imagine a day in your life when water supply through taps is not available. So, you have to fetch it yourself from a far away place. Would you use the same amount of water as on any other day?

Fig. 14.3 *Oceans cover a major part of the earth*

Do you know that about two thirds of the Earth is covered with water? Most of this water is in oceans and seas (Fig. 14.3).

The water in the oceans and seas has many salts dissolved in it — the water is saline. So, it is not fit for drinking and other domestic, agricultural and industrial needs. You might have heard the famous lines of the poem "*Rime of the Ancient Mariner*" written by S.T. Coleridge in 1798:

"Water water every where
Nor any drop to drink"

Here the poet has described the plight of sailors on a ship lost in the ocean.

Yet, oceans play an important role in supplying the water that we use. Do you find this surprising? After all, the water that we use is not salty. Many of us live in places far away from the oceans. Does the water supply in these places also depend on the oceans? How does the ocean water reach ponds, lakes, rivers and wells, which supply us water? How come the water from these sources is not saline anymore?

That is where the water cycle comes in!

14.3 Water Cycle

Disappearing Trick of Water

How many times have you noticed that water spilled on a floor dries up after some time? The water seems to disappear. Similarly, water disappears from wet clothes as they dry up (Fig. 14.4). Water from wet roads, rooftops and a few other places also disappears after the rains. Where does this water go?

Fig. 14.4 *Clothes drying on a clothes-line*

Do you remember Activity 6 in Chapter 5 in which water with salt dissolved in it was heated? What did we find? The water evaporated and the salt was left behind. This activity gives us an idea that, on heating, water changes into its vapour. We also realise from this activity, that water vapour does not carry away the salt with it. Water vapours so formed become a part of the air and cannot usually be seen. We also found that heating is essential to convert water into its vapour. However, we have seen that water changes into its vapour also from the fields, roads, rooftops and other land areas. We also discussed in Chapter 5 that to obtain salt, water from the sea is left in shallow pits to let the water evaporate. From where does this water get the heat it needs to evaporate? Let us find out.

Activity 2

Take two similar plates. Place one of the plates in sunlight and keep the other under shade. Now, pour equal amount of water in each of the plates (Fig. 14.5). You can use a cap of a bottle to measure water. Make sure that water does not spill over. Observe the two plates after every 15 minutes. Does the water seem to disappear? From which plate does it disappear first? What is the source of heat for this evaporation?

During the daytime, sunlight falls on the water in oceans, rivers, lakes and ponds. The fields and other land areas also receive sunlight. As a result, water from all these places continuously changes into vapour. However, the salts dissolved in the water are left behind.

In Activity 2, did you find that water also disappeared from the plate kept in the shade, though it could have taken more time? Does the heat from the sunlight reach here? Yes, during the daytime all the air surrounding us gets heated. This warm air provides heat for evaporation of water in the shade. Thus, evaporation takes place from all open surfaces of water. As a result, water vapour gets continuously added to air. However, evaporation of water is a slow process. That is why we rarely notice its loss from a bucket full of water. In sunlight, evaporation takes place faster. On heating water on a burner, its evaporation takes place even faster. Is there any other process through which water vapour gets transferred into air?

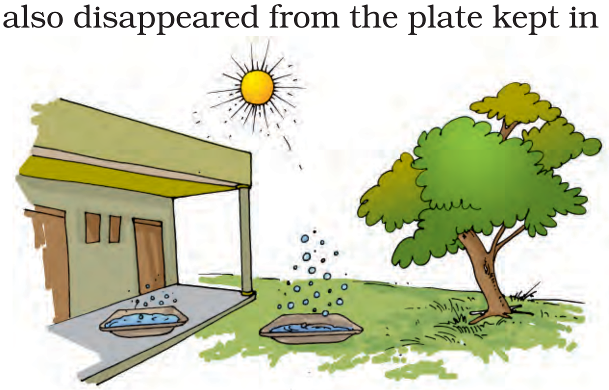


Fig.14.5 *Evaporation of water in sunlight and in shade*

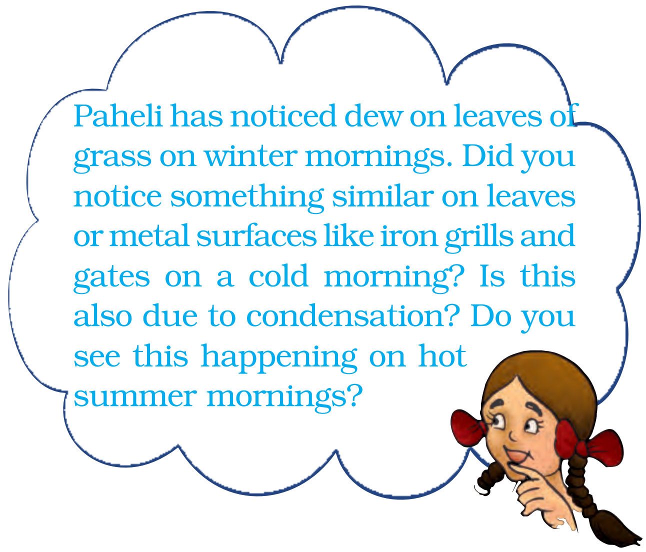
Loss of Water by Plants

You have learnt in Chapter 7 that plants need water to grow. Plants use a part of this water to prepare their food and

Boojho has been reading about transpiration. He asked himself - how much water is lost through transpiration by wheat plants that give us one kilogram of wheat? He found out that this is nearly 500 litres, that is, roughly 25 large sized buckets full of water. Can you now imagine the amount of water lost by plants of all the forests, crops and grasslands together?

retain some of it in their different parts. Remaining part of this water is released by the plants into air, as water vapour through the process of transpiration. Do you remember observing transpiration of water by plants in Activity 4 in Chapter 7?

Water vapour enters the air through the processes of evaporation and transpiration. Is it lost for ever? No, we get it back again, as we will see.



How are clouds formed?

Activity 3

Take a glass half filled with water. Wipe the glass from the outside with a clean piece of cloth. Add some ice into the water. Wait for one or two minutes. Observe the changes that take place on the outer surface of the glass (Fig.14.6).

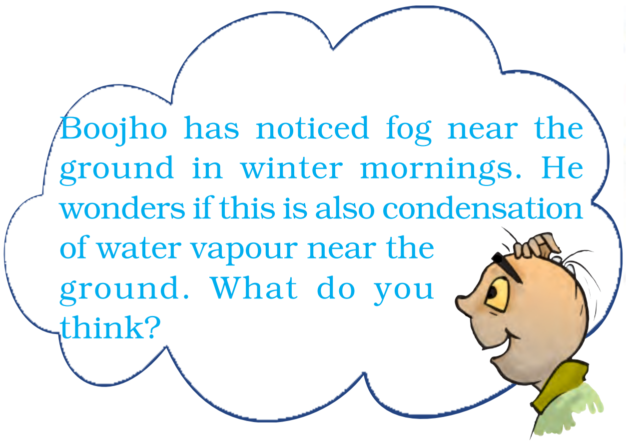
From where do water drops appear on the outer side of the glass? The cold surface of the glass containing iced water, cools the air around it, and the water vapour of the air condenses on the surface of the glass. We noticed this process of condensation in Activity 7 in Chapter 5.

Fig. 14.6 *Drops of water appear on outer surface of the glass containing water with ice*

The process of condensation plays an important role in bringing water back to the surface of earth. How does it happen? As we go higher from the surface of the earth, it gets cooler. When the air moves up, it gets cooler and cooler. At sufficient heights, the air becomes so cool that the water vapour present in it condenses to form tiny drops of water called droplets. It is these tiny droplets that remain floating in air and appear to us as clouds (Fig. 14.7).

It so happens that many droplets of water come together to form larger sized

Fig. 14.7 *Clouds*



drops of water. Some drops of water become so heavy that they begin to fall. These falling water-drops are, what we call rain. In special conditions, it may also fall as hail or snow.

Thus, water in the form of vapour goes into air by evaporation and transpiration, forms clouds, and then comes back to the ground as rain, hail or snow.

14.4 Back to the Oceans

What happens to the water that rain and snow bring to different regions of earth? Almost all land surfaces are above the level of oceans. Most of the water that falls on the land as rain and snow sooner or later goes back to the oceans. This happens in many ways.

Snow in the mountains melts into water. This water flows down the mountains in the form of streams and rivers (Fig. 14.8). Some of the water that falls on land as rain, also flows in the form of rivers and streams. Most of the rivers cover long distances on land and ultimately fall into a sea or an ocean. However, water of some rivers flows into lakes.

Fig. 14.8 *Rain water flows down in the form of streams and rivers*

The rainwater also fills up the lakes and ponds. A part of the rainwater gets absorbed by the ground and seems to disappear in the soil. Some of this water is brought back to the air by the process of evaporation and transpiration. The rest seeps into the ground. Most of this water becomes available to us as **ground water**. Open wells are fed by ground water. Ground water is the source for many lakes as well. It is also this ground water which is drawn by a handpump or a tubewell. The more handpumps or tubewells that are used in an area, the deeper we need to dig to find this ground water. The loss in the level of ground water due to over use, is worrisome.

Paheli wants to share a concern with you. In those areas where the land has little or no vegetation, the rainwater flows away quickly. Flowing rainwater also takes the top layer of the soil away with it. There are few areas where most of the land is covered with concrete. This reduces the seepage of rainwater into the ground which ultimately affects the availability of ground water.

We now know that water brought back to the surface of the earth by rain, hail or snow, goes back to oceans. Thus, water from the ocean and surface of the earth goes into air as vapour; returns as rain, hail or snow and finally goes back to the oceans. The circulation of water in this manner is known as the **water cycle** (Fig.14.9). This circulation of water between ocean and land is a continuous process. This maintains the supply of water on land.

14.5 What if it Rains Heavily?

The time, duration and the amount of rainfall varies from place to place. In some parts of the world it rains throughout the year while there are places where it rains only for a few days.

Fig. 14.10 *A scene after heavy rains*

In our country, most of the rainfall occurs during the monsoon season. Rains bring relief especially after hot summer days. The sowing of many crops depends on the arrival of monsoon.

However, excess of rainfall may lead to many problems (Fig. 14.10). Heavy

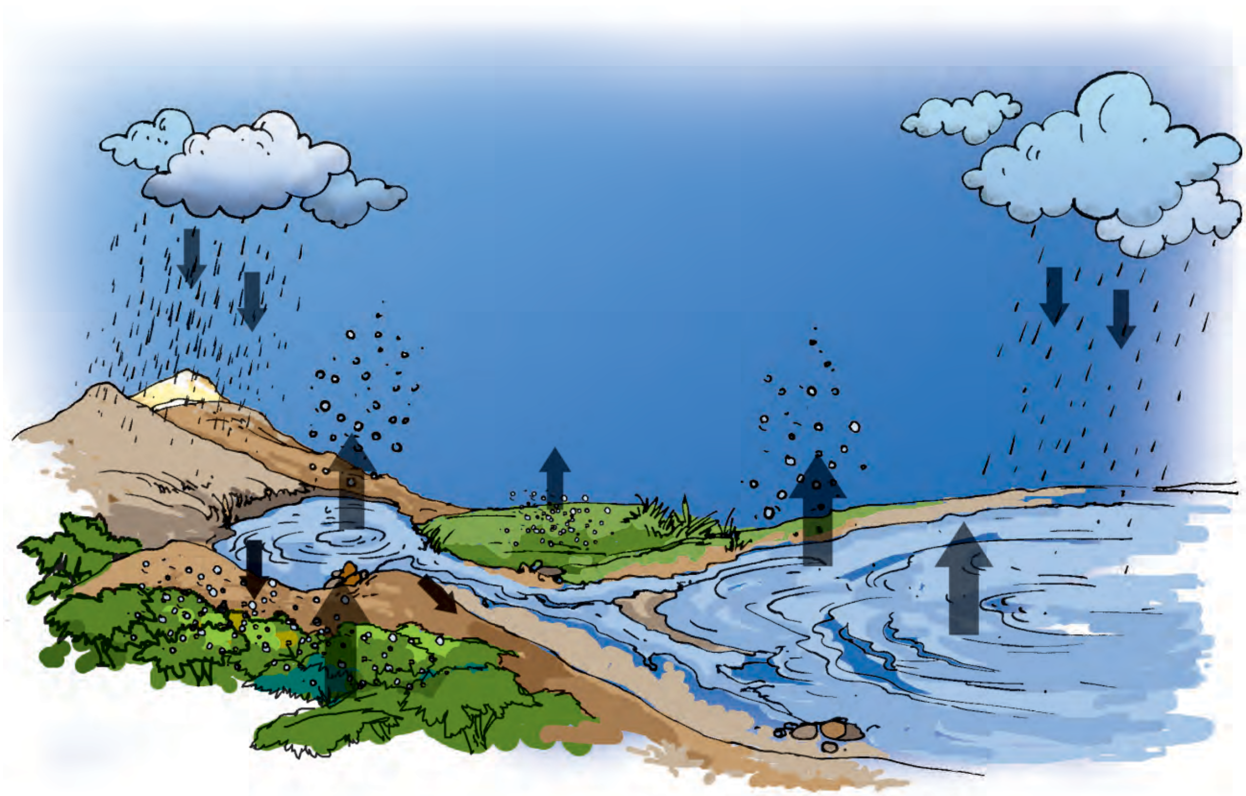


Fig. 14.9 *Water cycle*

Fig. 14.11 *A scene of a flooded area*

rains may lead to rise in the level of water in rivers, lakes and ponds. The water may then spread over large areas causing floods. The crop fields, forests, villages, and cities may get submerged by water (Fig. 14.11). In our country, floods cause extensive damage to crops, domestic animals, property and human life.

During floods, the animals living in the water also get carried away with the waters. They often get trapped on land areas and die when floodwater recedes. Rains also affect the animals living in the soil.

14.6 What Happens if it does not Rain for a Long Period?

Can you imagine what would happen if it does not rain in a region for a year or more? The soil continues to lose water by evaporation and transpiration. Since it is not being brought back by rain, the soil becomes dry. The level of water in ponds and wells of the region goes down and some of them may even dry up. The ground water may also become scarce. This may lead to drought.

In drought conditions, it is difficult to get food and fodder. You might have heard about droughts occurring in some parts of our country or the world. Are you aware of the difficulties faced by the people living in these areas? What happens to the animals and the vegetation in these conditions? Try and find out about this by talking to your parents and neighbours and by reading about it from newspapers and magazines.

14.7 How Can We Conserve Water?

Only a small fraction of water available on the Earth is fit for use of plants, animals and humans. Most of the water is in the oceans and it cannot be used directly. When the level of the ground water decreases drastically, this can not be used any more. The total amount of water on Earth remains the same, but, the water available for use is very limited and is decreasing with over usage.

The demand for water is increasing day-by-day. The number of people using water is increasing with rising population. In many cities, long queues for collection of water are a common site (Fig. 14.12). Also, more and more water is being used for producing food and by the industries. These factors are leading

Fig. 14.12 *A queue for collecting water*

to shortage of water in many parts of the world. Hence, it is very important that water is used carefully. We should take care not to waste water.

14.8 Rainwater Harvesting

One way of increasing the availability of water is to collect rainwater and store it for later use. Collecting rainwater in this way is called **rainwater harvesting**. The basic idea behind rainwater harvesting is "Catch water where it falls".

What happens to the rainwater that falls in places that are mostly covered with concrete roads and buildings? It flows into the drains, isn't it? From there water goes to rivers or lakes, which could be far away. A lot of effort will then be required to get this water back into our homes as the water did not seep into the ground.

Discussed here are two techniques of rainwater harvesting:

1. *Rooftop rainwater harvesting*: In this system the rainwater is collected from the rooftop to a storage tank, through pipes. This water may contain soil from the roof and need filtering before it is used. Instead of collecting rainwater in the tank, the pipes can go directly into a pit in the ground. This then seeps into the soil to recharge or refill the ground water (Fig. 14.13).

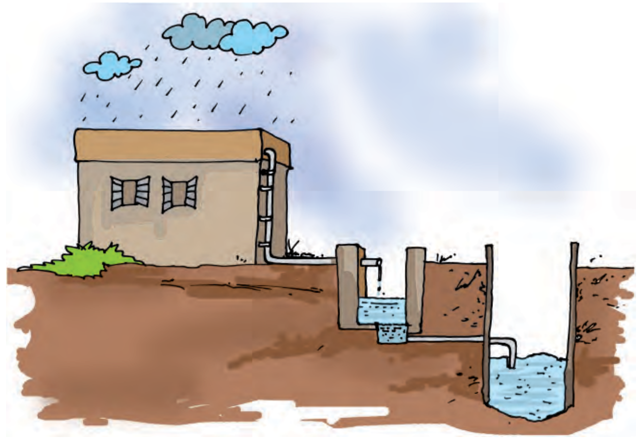
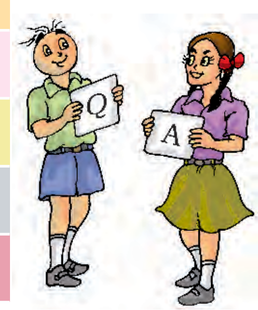


Fig. 14.13 *Rooftop rainwater harvesting*

2. Another option is to allow water to go into the ground directly from the roadside drains that collect rainwater.

Key words

Clouds	Hail
Condensation	Ocean
Drought	Rainwater harvesting
Evaporation	Snow
Flood	Water vapour
Ground water	Water cycle



Summary

- Water is essential for life.
- Water vapour gets added to air by evaporation and transpiration.
- The water vapour in the air condenses to form tiny droplets of water, which appear as clouds. Many tiny water droplets come together and fall down as rain, snow or hail.
- Rain, hail and snow replenish water in rivers, lakes, ponds, wells and soil.
- The circulation of water between ocean and land is known as the water cycle.
- Excessive rains may cause floods while lack of it for long periods may cause droughts.
- The amount of usable water on earth is limited so it needs to be used carefully.

Exercises

1. Fill up the blanks in the following:

   (a) The process of changing of water into its vapour is called ______________.

   (b) The process of changing water vapour into water is called ______________.

   (c) No rainfall for a year or more may lead to ______________ in that region.

   (d) Excessive rains may cause ______________.

2. State for each of the following whether it is due to evaporation or condensation:

   (a) Water drops appear on the outer surface of a glass containing cold water.

   (b) Steam rising from wet clothes while they are ironed.

   (c) Fog appearing on a cold winter morning.

   (d) Blackboard dries up after wiping it.

   (e) Steam rising from a hot girdle when water is sprinkled on it.

3. Which of the following statements are "true" ?

   (a) Water vapour is present in air only during the monsoon. (   )

   (b) Water evaporates into air from oceans, rivers and lakes but not from the soil.(   )

   (c) The process of water changing into its vapour, is called evaporation.(   )

   (d) The evaporation of water takes place only in sunlight.(   )

   (e) Water vapour condenses to form tiny droplets of water in the upper layers of air where it is cooler.(   )

4. Suppose you want to dry your school uniform quickly. Would spreading it near an *anghiti* or heater help? If yes, how?
5. Take out a cooled bottle of water from refrigerator and keep it on a table. After some time you notice a puddle of water around it. Why?
6. To clean their spectacles, people often breathe out on glasses to make them wet. Explain why the glasses become wet.
7. How are clouds formed?
8. When does a drought occur?

SUGGESTED PROJECTS AND ACTIVITIES

1. List three activities in which you can save water. For each activity describe how you would do it.
2. Collect pictures relating to floods or droughts from old magazines or newspapers. Paste them in your notebook and write about the problems that people would have faced.
3. Prepare a poster on ways of saving water and display it on your school notice board.
4. Write a few slogans of your own on the topic 'Save Water'.

15 Air Around us

We have learnt in Chapter 9 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 5 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. 15.1)?

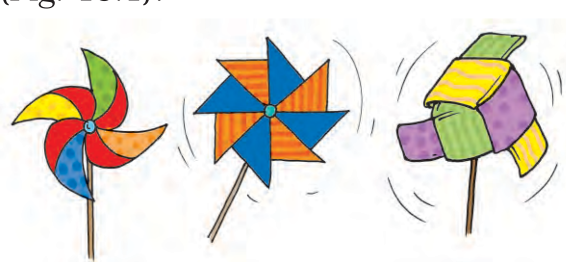


Fig. 15.1 *Different types of firki*

Activity 1

Let us make a *firki* of our own, following the instructions shown in Fig. 15.2.

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

Fig. 15.2 *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. 15.3)? It shows the direction in which the air is moving at that place.

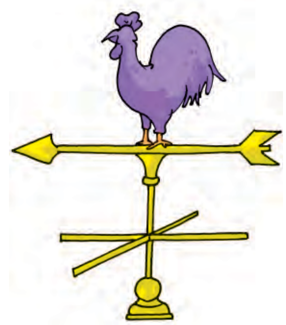


Fig. 15.3 *A weather cock*

15.1 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 glass bottle. Is it really empty or does it have something inside? Turn it, upside down. Is something inside it, now?

Fig. 15.4 *Experiments with an empty bottle*

Now, dip the open mouth of the bottle into the bucket filled with water as shown in Fig. 15.4. 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.

Why do you think, mountaineers carry oxygen cylinders with them, while climbing high mountains (Fig. 15.5)?

Fig. 15.5 *Mountaineers carry oxygen cylinders with them*

15.2 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 size in the middle of two shallow containers. Now, fill the containers with some water. Light the candles and then cover each one of them with an inverted glass (one much

Fig. 15.6 *Air has oxygen*

taller than the other) as shown in Fig. 15.6. Observe carefully what happens to the burning candles and the water level.

Do the candles continue to burn or go off? Does the level of water inside glasses remain the same?

The burning of the candle must be due to presence of some component of air, isn't it? Do you find any difference in your observation with the two glasses of different heights? What can be the reason for this?

Burning can occur only in the presence of **oxygen**. We see that, one component of air is oxygen. Now, the amount of air and hence its oxygen component inside each glass in our experiment, is limited. When most of this oxygen is used up by the burning candle, it can no longer burn and blows out. Also, water rises up in the glass once the candle blows out. However, this rise in water level should not be associated with the amount of oxygen utilised in burning of the candle.

Nitrogen

In Activity 3 did you observe that a major part of 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**. It takes up nearly four-fifth of the space that air fills.

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 on burning, also consumes oxygen and produces mainly carbon dioxide and a few other gases.

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 room dark. Now, open the door or a window facing the sun, just a little, in such a way that it allows sunlight to

Fig. 15.7 *Observing presence of dust in air with sunlight*

Fig.15.8 *Policemen regulating traffic at a crowded crossing often wear a mask*

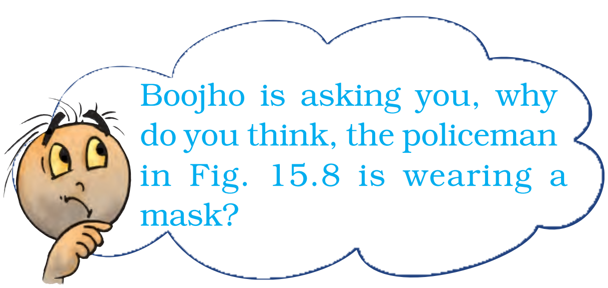
enter the room only through a slit. Look carefully at the incoming beam of sunlight.

Do you see some tiny shining particles moving in the beam of sunlight (Fig. 15.7)? 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!

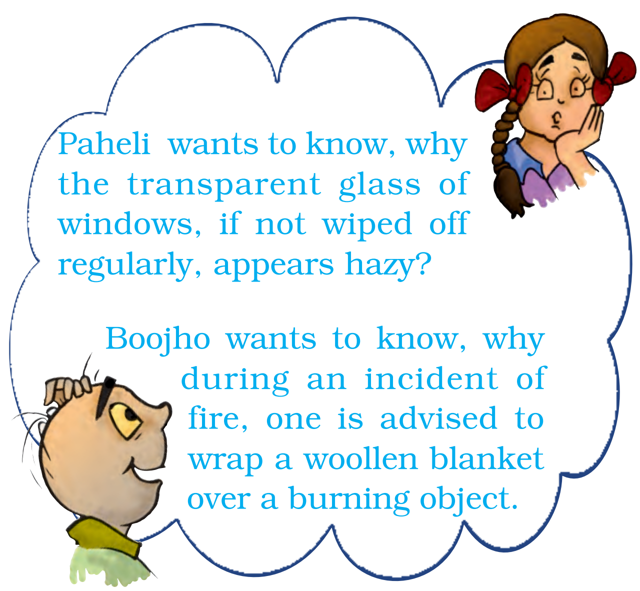
This shows that air also contains dust particles. The presence of dust particles in air varies from time to time, and from place to place.

We inhale air when we breathe through our nostrils. Fine hair and mucus are present inside the nose to 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 variations in the composition of air from place to place. We see that air contains



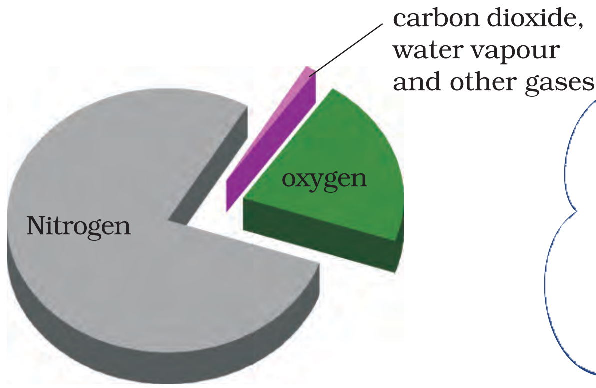


Fig.15.9 *Composition of air*

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.

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, water vapour and dust particles (Fig. 15.9).

15.3 How does Oxygen Become Available to Animals and Plants Living in Water and Soil?

Activity 5

Take some water in a glass vessel or beaker. Heat it slowly on a tripod stand. Well before the water begins to boil, look carefully at the inner surface of the vessel. Do you see tiny bubbles on the inside (Fig. 15.10)?

Fig. 15.10 *Water contains air!*

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 8 and 9, 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. 15.11). 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. 15.11 *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?

15.4 How is the Oxygen in the Atmosphere Replaced?

In Chapter 7, 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. 15.12.

Fig. 15.12 *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.

16 Garbage in, Garbage out

We throw out so much rubbish or garbage everyday from our homes, schools, shops and offices. The grains, pulses, biscuits, milk or oil purchased in shops, are packed in plastic bags or tins. All these wrapping material go out as garbage. We sometimes buy things that are rarely used and often thrown into the garbage.

We generate so much garbage in our day-to-day activities! We often throw groundnut shells on public places, in buses or trains, after eating the nuts. We throw away the ticket when we get off a bus. A child might go on sharpening pencils just for fun. If we make mistakes or spill ink on our notebook, we tear off the sheet and throw it away. And we also throw away many domestic wastes such as broken toys, old clothes, shoes and slippers.

What if the garbage is not removed from our homes and surroundings? How do you think, this will harm us? When *safai karamcharis* take the garbage from the bins, where does the garbage go and what happens to it? Is it possible for all of this garbage to be changed into something that will not harm us? Can we contribute towards this in any way? We will look for answers to these questions, in this chapter.

Children from Paheli and Boojho's school did a project called 'Dealing with Garbage'. We will learn about some of the things they learnt through this project.

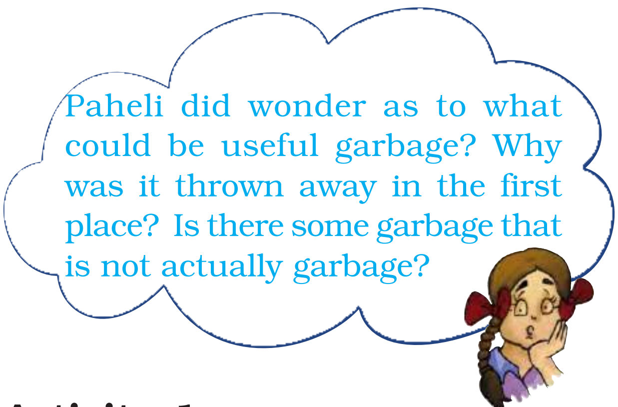
16.1 Dealing with Garbage

Safai karamcharis collect the garbage in trucks and take it to a low lying open area, called a **landfill** (Fig. 16.1).

There the part of the garbage that can be reused is separated out from the one that cannot be used as such. Thus,

Fig. 16.1 *A landfill*

the garbage has both useful and non-useful components. The non-useful component is separated out. It is then spread over the landfill and then covered with a layer of soil. Once the landfill is completely full, it is usually converted into a park or a play ground. For the next 20 years or so, no building is constructed on it. To deal with some of the useful components of garbage, compost making areas are developed near the landfill. What is compost? Let us learn about it, from the following activity.



Activity 1

Collect the garbage from your house before it is thrown into the dustbin. Separate it into two groups, so that they have:

Group 1: Garbage from the kitchen — like fruit and vegetable peels, egg shells, waste food, tea leaves. Include newspapers, dry leaves and paper bags in this group.

Group 2: Pieces of cloth, polythene bags, broken glass, aluminium wrappers, nails, old shoes and broken toys.

Now divide the contents of each group into two separate heaps. Label them as A, B, C and D. Put one heap from Group 1 and one heap from Group 2 into two separate plastic bags. Tie the mouth of these two bags tightly. Put all the four heaps in separate pits and cover them with soil (Fig. 16.2). You can also use four pots to bury these garbage heaps.

***Fig. 16.2** Putting garbage heaps in pits*

Remove the soil after four days and observe the changes in the garbage. A black colour and no foul smell indicates that rotting of garbage is complete. Put the heaps again in the pits and cover with the soil. Observe again after every two days and note your observations as suggested. Did the garbage.

(i) rot completely and not smell?

(ii) rot only partially?

(iii) rot almost completely, but still smells bad?

(iv) not change at all?

Garbage in which heap was seen to rot and which did not?

Enter options (i), (ii), (iii) or (iv) in the columns of Table 16.1 based on your

Table 16.1 What has happened to the garbage heaps?

Garbage heap	After 4 days	After 6 days	After 2 weeks	After 4 weeks
A				
B				
C				
D				

observations. If you make any other observations, do not forget to write all these down in your notebook. Do not remove and burn the garbage that did not rot.

If the garbage was found to rot completely and did not smell, mix it in the soil where you sow your favourite plants. This would provide nutrients to the plants.

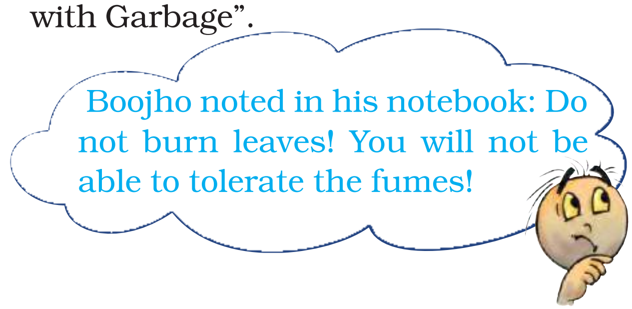
You must have observed from this activity that some things in the garbage rot. They form manure which is used for the plants. The rotting and conversion of some materials into manure is called 'composting'.

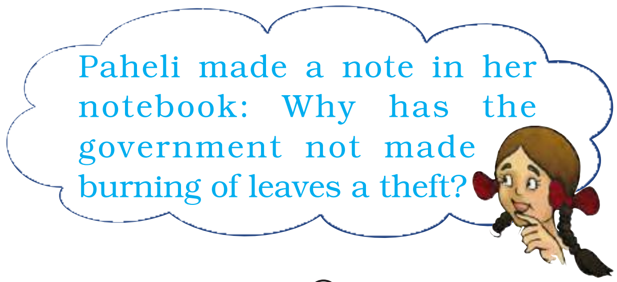
In some cities and towns municipalities provide separate dustbins for collecting two kinds of garbage. Usually one is coloured blue and the other green. The blue bin is for materials that can be used again — such as plastics, metals and glass. Did you notice that these are the materials that do not rot in the garbage heaps? The green bins are for collecting kitchen and other plant or animal wastes. You may have noticed that this type of wastes rot completely when buried in the soil. Do you see why it is necessary for us to separate waste into two groups as we did in Activity 1, before we throw it?

Have you noticed garbage heaps of dried leaves on the roadside? Most of the time these are burnt (Fig. 16.3). Farmers too often burn the husk, dried leaves and part of crop plants in their fields after harvesting. Burning of these, produces smoke and gases that are harmful to our health. We should try to stop such practices. These wastes could be converted into useful compost.

Fig. 16.3 *Burning of leaves produce harmful gases*

Here are some of the observations and thoughts, noted by Paheli and Boojho, from their project "Dealing with Garbage".





Not theft really ☺. She must have meant "illegal". She wanted that the government should make a law against the burning of leaves and other plant wastes anywhere in India.

16.2 Vermicomposting

We can be friends of plants by supplying them with compost. We will also be very good friends to ourselves by making compost.

Talking of friends, do you know that earthworms are called farmer's friend? Let us find out how a type of earthworm called redworm is used for composting. This method of preparing compost with the help of redworms is called **vermicomposting**. We can try to make manure by vermicomposting at school.

Activity 2

Let us dig a pit (about 30 cm deep) or keep a wooden box at a place, which is neither too hot nor too cold. What about a place which does not get direct sunlight? Let us now make a comfortable home for our redworms in the pit or the box.

Spread a net or chicken mesh at the bottom of the pit or the box. You can also spread 1 or 2 cm thick layer of sand as an alternative. Now, spread some vegetable wastes including peels of fruits over this layer of sand.

One can also use green leaves, pieces of dried stalks of plants, husk or pieces of newspaper or carboard to spread over the layer of sand. However, shiny or plastic coated paper should not be used for this purpose. Dried animal dung could also be used as a spread over sand or wire mesh.

Sprinkle some water to make this layer wet. Take care not to use excess of water. Do not press the layer of waste. Keep this layer loose so that it has sufficient air and moisture.

Now, your pit is ready to welcome the redworms. Buy some redworms and put them in your pit (Fig. 16.4). Cover them loosely with a gunny bag or an old sheet of cloth or a layer of grass.

Fig. 16.4 *Redworms*

Your redworms need food. You can give them vegetable and fruit wastes, coffee and tea remains and weeds from the fields or garden (Fig. 16.5). It might be a good idea to bury this food about 2-3 cm inside the pit. Do not use wastes

Fig. 16.5 *Food for redworms*

that may contain salt, pickles, oil, vinegar, meat and milk preparations as food for your redworms. If you put these things in the pit, disease-causing small organisms start growing in the pit. Once in a few days, gently mix and move the top layers of your pit.

Redworms do not have teeth. They have a structure called 'gizzard', which helps them in grinding their food. Powdered egg shells or sea shells could be mixed with the wastes. This would help redworms in grinding their food. A redworm can eat food equal to its own weight, in a day.

Redworms do not survive in very hot or very cold surroundings. They also need moisture around them. If you take good care of your worms, in a month's time their number will double.

Observe the contents of the pit carefully after 3-4 weeks. Do you now see loose, soil-like material in the pit? Your vermicompost is ready (Fig. 16.6).

Put some wastes as food in one corner of the pit. Most of the worms will shift towards this part of the pit, vacating the other part. Remove the compost from the vacated part and dry it in the sun for a few hours. Your vermicompost is ready for use!

Fig. 16.6 *Vermicomposting*

The part left in the pit has most of the worms in it. You can use these for preparing more compost or share them with another user.

Use this excellent vermicompost in your pots, gardens or fields. Is this not like getting the 'best out of waste'? Those of you who have agricultural fields can try vermicomposting in large pits. You can save a lot of money that is spent on buying expensive chemical fertilizers and manure from the market.

16.3 Think and Throw

How much of garbage do you think, is thrown out by each house everyday? You can make an estimate by using a bucket as a measure. Use a 5-10 litre bucket to collect the garbage from your home for

Fig. 16.7 *Neighbourhood garbage dump*

a few days. In how many days does the bucket become full? You know the number of members in your family. If you find out the population of your city or town, can you now estimate the number of buckets of garbage that may be generated in a day in your city or town? We are generating mountains of garbage everyday, isn't it (Fig. 16.7)?

Let us read a story about a village where there is less garbage and more wisdom. Nanu studies in Class VI. He is very fond of making paper planes. His mother is very annoyed when he tears off sheets from new notebooks to make aeroplanes, but Nanu does not care.

Once Nanu went to his aunt's village, along with his mother. He was amazed at the variety of things his cousin Shyam had made. Files from old charts, greeting cards decorated with flowers made from pencil shavings, mats from old clothes, baskets from used old polythene bags were some of the items Nanu liked. Shyam had even made a diary from invitation cards!

One morning Nanu went looking for his grandmother (*Nani*). He saw that she was applying a thick paste on a basket. Nanu asked, "*Nani*, What are you doing? What is this paste?"

"This is papier-mâchè, a paste made of clay and paper in which I have also mixed some rice husk", replied *Nani*.

"But, why are you putting it on the basket?", asked Nanu.

"To make it stronger", said *Nani* and added "would you like to learn this from me?" Nanu was not very keen and ran outside to play. He was only interested in tearing up papers to make planes. In fact he also started tearing up papers from Shyam's files!

Shyam collected all the pieces of paper Nanu had used, wondering what to do about him! He just did not listen to anyone!

It was Nanu's birthday in a few days. Shyam planned to invite Nanu's friends. Nanu took out money from his mud pot and went to the market. He bought some paper hats for his friends. He asked the shopkeeper for a polythene bag to keep the hats, who gave him a paper bag instead of polythene. Nanu also bought many other items like biscuits and toffees. He found it difficult to carry all of these things as no shopkeeper was ready to give a polythene bag. Shyam had told him to carry a cloth bag with him and he was sorry he did not listen to him. Somehow, he managed to reach home with all his purchases (Fig. 16.8).

Nanu's friends enjoyed the feast on his birthday and played many games.

Fig. 16.8 *Nanu with bags full of purchases*

All his friends wore the shiny paper hats Nanu had bought!

Shyam had made beautiful papier-mâchè masks for Nanu's friends. He had a special gift for Nanu as well. A photoframe and a greeting card made from the paste of all the pieces of paper Nanu had thrown away! It was a new experience for Nanu. All his friends went home with their masks. Nanu was too excited to finish his meal and look at his gifts.

Nanu returned home, after his holidays were over. How different his town was from Shyam's village! There were no rag pickers in the village as it was neat and clean. But now he stopped making faces when he saw the rag picking children near his house.

You might have seen some children, sorting the garbage near your house or at other places. Observe the children at work and find out how they separate usefull material from the garbage. They are actually helping us.

Talk to one such child and find out:

What do they do with the rubbish they collect? Where do they take it?

Does he/she go to school? What about his/her friends?

If they do not go to school, find out the possible reasons.

Can you help this child to read and write?

Have you ever helped at home to sell old newspapers, glass and metal things, plastic bags and your old notebooks to a garbage dealer? Talk to him and find out what he does with all the garbage.

Would you like to make paper from old and discarded paper like Shyam? Let us learn to do this.

16.4 Recycling of Paper

You will require pieces of old newspapers, magazines, used envelopes, notebooks, or any other paper. Do not use shiny, plastic coated paper. You will also need a frame fitted with a wire mesh or a net. You can also use a large sized sieve in place of a frame.

Tear the paper into small pieces. Put them in a tub or a bucket and pour water in it. Let the pieces of paper remain submerged in water for a day. Make a thick paste of paper by pounding it.

Now, spread the wet paste on the wire mesh fixed to the frame. Pat it gently to make the thickness of layer of the paste as uniform as possible. Wait till water drains off. If required spread an old cloth or a sheet of newspaper on the paste to let it soak up the extra water.

Now, carefully remove the layer of paste from the frame, spread it on a sheet of newspaper in the sun. Keep the corners of the newspaper sheet pressed by putting some weights so that these do not curl up.

You can add food colour, pieces of dry leaves or flower petals or pieces of coloured paper in the paste before spreading it. It would help you to get a recycled paper with beautiful patterns on it.

Can we recycle everything, just as we recycle paper?

16.5 Plastics – Boon or a Curse?

Some kind of plastics can be recycled, but, not all of them. Did you notice that polythene bags and some plastics did not rot in Activity 1? You might now easily understand why polythene bags create a big problem in garbage disposal.

It may be a little difficult to imagine our life without plastics. Shall we list a few things we use that are made of plastics? Toys, shoes, bags, pens, combs, tooth brushes, buckets, bottles, and water pipes — the list is very long. Can you name a few parts of a bus, car, radio, television, refrigerator and a scooter that are made of plastics?

The use of plastics in itself might not create so much of a problem. Problems arise when we use plastics excessively and are ignorant about ways of disposing their waste. This is what is happening all around us! We might even be acting irresponsibly, knowing well about its harmful effects.

We often use plastic bags to store cooked food items. Sometimes these bags may not be suitable for keeping eatables. Consuming food packed in such plastic bags could be harmful to our health. Many a time shopkeepers use plastic bags that have been used earlier for some other purpose. Sometimes bags collected by rag pickers are also used after washing them. Use of such recycled plastic bags to keep food items could be harmfull for our health. For storing eatables we must insist on use of plastic bags that are approved for such a use.

All kind of plastics give out harmful gases, upon heating or burning. These gases may cause many health problems, including cancer, in humans. The government has also laid down guidelines for recycling of plastics.

Paheli would like to suggest that containers used for storing poisonous substances should be recycled separately and that such recycled plastics are not used to make plastic bags.

You must have noticed that people often fill garbage in plastic bags and then throw it away. When stray animals look for food in these bags, they end up swallowing these. Sometimes, they die due to this.

The plastic bags thrown away carelessly on roads and other places get into drains and the sewer system. As a result, drains get choked and the water spills on the roads. During heavy rains, it might even create a flood like situation. There is a lot of harm that too much use of plastics can do!

What can we do to minimise over use of plastics and deal with garbage?

1. We make a minimum use of plastic bags. We re-use the bags whenever it is possible to do so without any adverse affects.
2. We insist shopkeepers use paper bags. We carry a cloth or a jute bag when we go out for shopping.
3. We do not use plastic bags to store eatables.
4. We do not throw plastic bags here and there, after use.
5. We never burn plastic bags and other plastic items.
6. We do not put garbage in plastic bags and throw it away.
7. We use vermicomposting at home and deal with our kitchen waste usefully.
8. We recycle paper.
9. We use both sides of the paper to write. We use a slate for rough work. We use blank sheets of paper left in our notebooks for rough work.
10. We make our family, friends and others to follow proper practices for disposing different kinds of wastes.

The most important point to know and think about is that — more garbage we generate, more difficult it will be to get rid of it.

Key words

Waste
Garbage
Landfill
Compost
Vermicomposting
Recycling

Summary

- Landfill is an area where the garbage collected from a city or town is dumped. The area is later converted into a park.
- Converting plant and animal waste including that from kitchen, into manure, is called composting.

- The method of making compost from kitchen garbage using redworms is called vermicomposting.
- Paper can be recycled to get useful products.
- Plastics cannot be converted into less harmful substances by the process of composting.
- We need to generate less waste and find ways of dealing with the increasing amount of garbage in our surroundings.

Exercises

1. (a) Which kind of garbage is not converted into compost by the redworms?

   (b) Have you seen any other organism besides redworms, in your pit? If yes, try to find out their names. Draw pictures of these.

2. Discuss :

   (a) Is garbage disposal the responsibility only of the government?

   (b) Is it possible to reduce the problems relating to disposal of garbage?

3. (a) What do you do with the left over food at home?

   (b) If you and your friends are given the choice of eating in a plastic plate or a banana leaf platter at a party, which one would you prefer and why?

4. (a) Collect pieces of different kinds of paper. Find out which of these can be recycled.

   (b) With the help of a lens look at the pieces of paper you collected for the above question. Do you see any difference in the material of recycled paper and a new sheet of paper ?

5. (a) Collect different kinds of packaging material. What was the purpose for which each one was used? Discuss in groups.

   (b) Give an example in which packaging could have been reduced?

   (c) Write a story on how packaging increases the amount of garbage.

6. Do you think it is better to use compost instead of chemical fertilisers? Why?

ACTIVITIES FOR DEALING WITH GARBAGE

1. Collect old and discarded objects and material like glass bottles, plastic bottles, coconut husk, wool, bed sheets, greeting cards and any other thing. Can you make something useful out of these, instead of throwing them? Try.
2. Prepare a detailed project report on compost making activity you did in school.

A MATTER OF CONCERN!

In autumn lots of leaves are burnt in cities like Delhi. Some of the gases produced by burning leaves are similar to the gases released by the vehicles moving on the roads.

Instead of burning, if we make compost from these leaves, we can reduce the use of chemical fertilizers.

The green areas which should have fresh air, actually become full of harmful gases due to burning of leaves.

If you find any one is burning the leaves bring it to notice of municipal authorities or write to newspapers about it.

Generate social pressure against burning of leaves. Ensure that fallen leaves are not burnt but used for making compost.

Write to the 'Tree Authority' of your city or state to declare burning of leaves as an offence.