SCIENCE

(For 6th Class)

Punjab School Education Board

Sahibzada Ajit Singh Nagar

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Foreword

Punjab School Education Board has continuously been engaged in the preparation and review of syllabi and text books. In today's scenario, imparting right education to students is the joint responsibility of teachers as well as parents. With a view to carry out entrusted responsibility, some important changes pertaining to present day educational requirements have been made in the textbooks and syllabus in accordance with NCF 2005.

Science has an important place in school curriculum and a good textbook is the first requisite to achieve desired learning outcomes. Therefore, the content matter of Science for class 6th has been so arranged so as to develop reasoning power of the students and to enhance their understanding of the subject. Graded questions and exercise have been given to suit the mental level of the students. This book is prepared by NCERT, New Delhi for class 6th and is being published by Punjab School Education Board with the permission of NCERT, New Delhi. This step was taken to maintain the uniformity in the Science Subject so that Science student will have no problem while facing the common entrance test at a senior secondary stage.

Every effort has been made to make the book useful for students as well as for the teachers. However, constructive suggestions for its further improvement would be gratefully acknowledged.

Chairperson
Punjab School Education Board

TEXTBOOK DEVELOPMENT COMMITTEE

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1 Food: Where Does It Come From?

What did you eat at home today? Find out what your friend ate today. Did you eat the same kind of food yesterday and today? We all eat different kinds of food at different times, isn't it?

1.1 Food Variety

Activity 1

Ask your friends in the school about the items they would be eating during a day. See if you can also get this information from friends staying in different states of India. List all the items in your notebook as given in Table 1.1, for as many friends as possible.

Table 1.1 What do we eat?

Name of the student/friend	Food items eaten in a day

There seems to be so much variety in the food that we eat. What are these food items made of?

Think about rice cooked at home. We take raw rice and boil it in water. Just two materials or **ingredients** are needed to prepare a dish of boiled rice.

On the other hand, some food items are made with many ingredients. To prepare vegetable curry, we need different kinds of vegetables, salt, spices, oil and so on.

Activity 2

Choose some of the items you listed in Table 1.1 and try to find out what ingredients are used to prepare these, by discussing with your friends and elders at home. List them in Table 1.2. Some examples are given here. Add some more items to this list.

Table 1.2 Food items and their ingredients

Food Item	Ingredients
Roti/chapati	*Atta*, water
Dal	Pulses, water, salt, oil/*ghee*, spices

What do we find? Do we find some ingredients common for different food items? Discuss in class.

So, where do these ingredients come from?

1.2 Food Materials and Sources

It may be easy for us to guess the sources of some of the ingredients that we listed in Table 1.2. Fruits and vegetables, for instance. Where do they come from? Plants, of course! What are the sources of rice or wheat? You may have seen paddy or wheat fields with rows and rows of plants, which give us these grains.

And then, there are food items like milk, eggs, meat, chicken, fish, prawns, beef, pork and such others, which come from animals.

Activity 3

Let us take the food items listed earlier and try to find out where they come from — the ingredients and their sources. Some examples are shown in Table 1.3. Fill in the blanks in Table 1.3 and add more examples to this list.

Table 1.3 Ingredients used to prepare food items and their sources

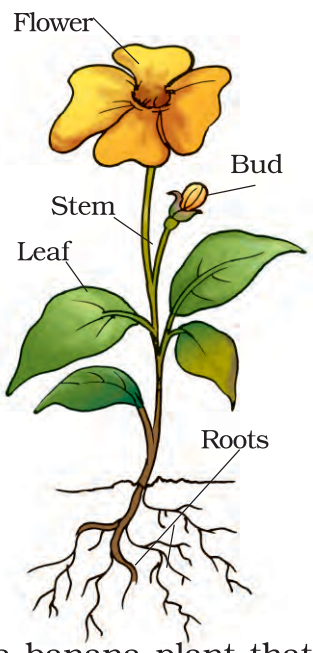
Food Item	Ingredients	Sources
Idli	Rice	Plant
	Urad dal	
	Salt	
	Water	
Chicken curry	Chicken	Animal
	Spices	
	Oil/*ghee*	Plants/ Animals
	Water	
Kheer	Milk	Animal
	Rice	Plant
	Sugar	

What do we conclude from Activity 3? Plants are the sources of food ingredients like grains, cereals, vegetables and fruits. Animals provide us with milk, meat products and eggs. Cows, goats and buffaloes are some common animals which give us milk. Milk and milk products like butter, cream, cheese and curd are used all over the world. Can you name some other animals which give us milk?

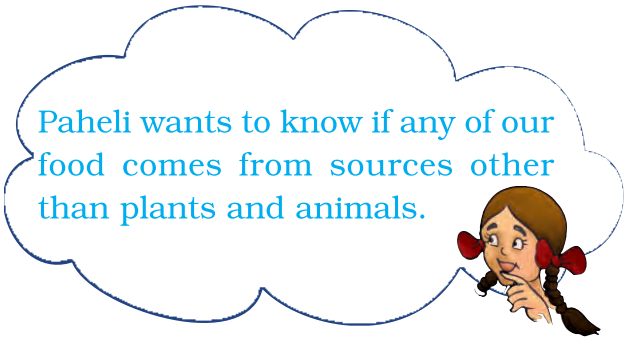
1.3 Plant Parts and Animal Products as Food

Plants are one source of our food. Which parts of a plant?

We eat many leafy vegetables. We eat fruits of some plants. Sometimes roots, sometimes stems and even flowers. Have you ever eaten pumpkin flowers dipped in rice paste and fried? Try it!



Some plants have two or more **edible** (eatable) parts. Seeds of mustard plants give us oil and the leaves are used as a vegetable. Can you think of the different parts of a banana plant that are used as food? Think of more examples where two or more parts of a single plant are used as food.



Activity 4

From all the food items you have listed in Table 1.3, choose those items whose ingredients are obtained from plants. Which part of a plant? Identify these and list the food items and plant parts as shown in Table 1.4.

Table 1.4 Plant parts as food

Food item with plant as the major source	Ingredients/source	Plant part which gives us the ingredient
1. Brinjal curry	Brinjal	Fruit
	Chilli as spice (any other)	Fruit
	Oil from groundnut, mustard, soybean, any other plant	Seed
2.		
3.		

Do not try to test unknown plants around you to see if they are edible! Some plants could be poisonous.

Activity 5

Take some dry seeds of *moong* or *chana*. Put a small quantity of seeds in a container filled with water and leave this aside for a day. Next day, drain the water completely and leave the seeds in the vessel. Wrap them with a piece of wet cloth and set aside. The following day, do you observe any changes in the seed?

A small white structure may have grown out of the seeds. If so, the seeds have **sprouted**. If not, wash the seeds in water, drain the water and leave them aside for another day, covered with a wet cloth. The next day, see if the seeds have sprouted.

After washing these sprouted seeds, you can eat them. They can also be boiled. Add some spices and get a tasty snack to eat.

Do you know where honey comes from, or how it is produced? Have you seen a beehive where so many bees keep buzzing about? Bees collect **nectar** (sweet juices) from flowers, convert it into honey and store it in their hive. Flowers and their nectar may be available only for a part of the year. So, bees store this nectar for their use all through the year. When we find such a beehive, we collect the food stored by the bees as honey.

1.5 What do Animals Eat?

Do you have cattle or a pet that you take care of? A dog, cat, buffalo or a goat? You will then surely be aware of the food, the animal eats. What about other animals? Have you ever observed what a squirrel, pigeon, lizard or a small insect may be eating as their food?

Activity 6

Several animals are listed in Table 1.5. For some of them, the type of food they

eat is also given. Fill in the blanks in the table.

Activity 7

Have a look again at Table 1.5 and group the animals entered here as follows. Place animals which eat only plants or plant products in Group 1. These are called **herbivores**. There are some animals which eat other animals. Place these in Group 2. These animals are called **carnivores**. Do you find some animals which eat both plants and animals? Place them in Group 3. These are called **omnivores**. Prepare a table as in Table 1.6 and enter these separately in the three columns, as shown.

Table 1.5 Animals and their Food

Name of the animal	Food the animal eats
Buffalo	Grass, oilcake, hay, grains
Cat	Small animals, birds, milk
Rat	
Lion	
Tiger	
Spider	
House lizard	
Cow	
Human beings	
Butterfly	
Crow	
Others	

Table 1.6

Herbivores	Carnivores	Omnivores
Cow	Lion	Dog

We know that there are many amongst us, who do not get sufficient food. We need to find ways by which more food can be produced in the country. That will not be enough; we will need to find ways to ensure that this food is made easily available to each one of us.

Key words

Ingredients
Edible
Nectar
Sprouted seeds
Herbivore
Carnivore
Omnivore

Summary

- There is a lot of variation in the food eaten in different regions of India.
- The main sources of our food are plants and animals.
- Animals which eat only plants are called herbivores.
- Animals which eat only animals are called carnivores.
- Animals which eat both plants as well as other animals are called omnivores.

Exercises

1. Do you find that all living beings need the same kind of food?
2. Name five plants and their parts that we eat.
3. Match the items given in Column A with that in Column B

Column A	**Column B**
Milk, curd, *paneer*, *ghee*,	eat other animals
Spinach, cauliflower, carrot	eat plants and plant products
Lions and tigers	are vegetables
Herbivores	are all animal products

4. Fill up the blanks with the words given:

herbivore, plant, milk, sugarcane, carnivore

(a) Tiger is a _____ because it eats only meat.

(b) Deer eats only plant products and so, is called _____.

(c) Parrot eats only _____ products.

(d) The _____ that we drink, which comes from cows, buffaloes and goats is an animal product.

(e) We get sugar from _____.

SUGGESTED PROJECTS AND ACTIVITIES

1. You must have seen a garden lizard around your home. Next time whenever you see it, observe carefully and find out what it takes for food. Is the food different from that of a house lizard?
2. Make a list (with pictures, when possible) of food items generally taken by people of different regions of India. Place these on a large outline map of India to display in your classroom.
3. Find out the names of plants that grow in water and which are eaten as food.
4. In Chapter 10, you will find out ways of measuring length of curved lines. In your mathematics classes you will learn to prepare bar graphs. After you learn these, try the following interesting project. Prepare some sprouts of *moong* as discussed in the chapter. Wash them in water everyday and drain all the water. Let them grow for a week until the whole of the seeds grow into young plants. Measure the lengths of the sprouts everyday using a string. Take care that they do not break. Prepare a bar graph of the number of sprouts having lengths in different ranges.

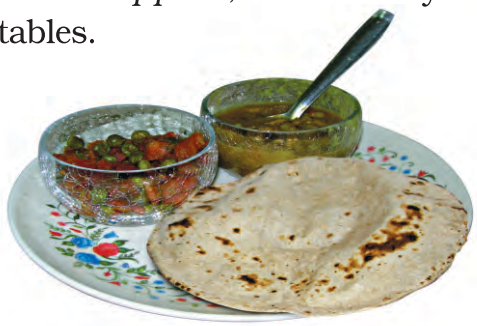
THINGS TO THINK ABOUT

1. Does everyone around you get enough food to eat? If not, why?
2. What are the ways we can think of to avoid wastage of food?

2 Components of Food

In Chapter 1, we made lists of the food items that we eat. We also identified food items eaten in different parts of India and marked these on its map.

A meal could consist of *chapati, dal* and brinjal curry. Another may be rice, *sambar* and a vegetable preparation of lady's finger (*bhindi*). Yet another meal could be *appam*, fish curry and vegetables.



Activity 1

Our meals usually have at least one item made of some kind of grain. Other items could be a *dal* or a dish of meat and vegetables. It may also include items like curd, butter milk and pickles. Some examples of meals from different regions are given in Table 2.1. Select food items you depicted on the map in Chapter 1. Add some more meals to this list and enter these in Table 2.1.

Sometimes, we may not really have all this variety in our meals. If we are travelling, we may eat whatever is available on the way. It may not be possible for some of us, to eat such a variety of items, most of the time.

There must be some reason though, why meals usually consist of such a distribution. Do you think that our body needs different kinds of food for some special purpose?

2.1 What Do Different Food Items Contain?

We know that each dish is usually made up of one or more ingredients, which we get from plants or animals. These

Table 2.1 Some common meals of different regions/states

Region/ State	Item of grain	Item of *dal*/meat	Vegetables	Others
Punjab	*Makki* (corn) *roti*	*Rajma* (Kidney beans)	*Sarson saag* (Mustard leaf curry)	Curd, *ghee*
Andhra Pradesh	Rice	*Tuar dal* and *rasam* (*charu*)	*Kunduru* (*dondakai*)	Buttermilk, *ghee*, pickle (*aavakai*)

ingredients contain some components that are needed by our body. These components are called **nutrients**. The major nutrients in our food are named carbohydrates, proteins, fats, vitamins and minerals. In addition, food contains dietary fibres and water which are also needed by our body.

Do all foods contain all these nutrients? With some simple methods we can test whether cooked food or a raw ingredient contains one or more of these nutrients. The tests for presence of carbohydrates, proteins and fats are simpler to do as compared to the tests for other nutrients. Let us do these tests and record all our observations in Table 2.2.

For carrying out these tests, you will need solutions of iodine, copper sulphate and caustic soda. You will also need a few test tubes and a dropper.

Try these tests on cooked food items as well as raw materials. Table 2.2 shows you a way to record the observations from these tests. Some food items are given in this table. You can conduct the tests either with these or any other available food items. Do these tests carefully and do not try to eat or taste any chemicals.

If the required solutions are not available in readymade form, your teacher can prepare them as follows.

A dilute solution of iodine can be prepared by adding a few drops of tincture iodine to a test tube half filled with water.
Copper sulphate solution can be prepared by dissolving 2 gram (g) of copper sulphate in 100 millilitre (mL) of water.
10 g of caustic soda dissolved in 100 mL of water makes the required solution of caustic soda.

Let us begin by testing different food items to see if they contain **carbohydrates**. There are many types of carbohydrates. The main carbohydrates found in our food are in the form of starch and sugars. We can easily test if a food item contains starch.

Activity 2

Test for Starch

Take a small quantity of a food item or a raw ingredient. Put 2-3 drops of dilute iodine solution on it (Fig. 2.1). Observe if there is any change in the colour of the food item. Did it turn blue-black?

Fig. 2.1 *Testing for starch*

A blue-black colour indicates that it contains starch.

Repeat this test with other food items to find out which of these contain starch. Enter all your observations in Table 2.2.

Test for Protein

Take a small quantity of a food item for testing. If the food you want to test is a solid, you first need to make a paste of it or powder it. Grind or mash a small quantity of the food item. Put some of this in a clean test tube, add 10 drops of water to it and shake the test tube.

Now, using a dropper, add two drops of solution of copper sulphate and ten drops of solution of caustic soda to the test tube (Fig. 2.2). Shake well and let the test tube stand for a few minutes. What do you see? Did the contents of the test tube turn violet? A violet colour indicates presence of **proteins** in the food item.

Now, you can repeat this test on other food items.

Fig. 2.2 *Testing for protein*

Table 2.2 Nutrients present in some food items

Food item	Starch (present)	Protein (present)	Fat (present)
Raw potato	Yes		
Milk		Yes	
Groundnut			Yes
Uncooked powdered rice			
Cooked rice			
Dry coconut			
Uncooked *tuar dal* (powdered)			
Cooked *dal*			
A slice of any vegetable			
A slice of any fruit			
Boiled egg (white portion)			

Test for Fats

Take a small quantity of a food item. Wrap it in a piece of paper and crush it. Take care that the paper does not tear. Now, straighten the paper and observe it carefully. Does it have an oily patch? Hold the paper against light. Are you able to see the light faintly, through this patch?

An oily patch on paper shows that the food item contains **fat**. The food items may sometimes contain a little water. Therefore, after you have rubbed an item on paper, let the paper dry for a while. If there were any water that may have come from food, it would dry up after some time. If no oily patch shows up after this, the food item does not contain any fat.

What do these tests show? Are fats, proteins and starch present in all the food items that you tested? Does a food item contain more than one nutrient? Do you find any food item that does not contain any of these nutrients?

We tested food items for three nutrients — carbohydrates, proteins and fats. There are also other nutrients like **vitamins** and **minerals** that are present in different food items. Why do we need all these nutrients?

2.2 What do Various Nutrients do for our Body?

Carbohydrates mainly provide energy to our body. Fats also give us energy. In fact, fats give much more energy as compared to the same amount of carbohydrates. Foods containing fats and carbohydrates are also called 'energy giving foods' (Fig. 2.3 and Fig. 2.4).

Proteins are needed for the growth and repair of our body. Foods

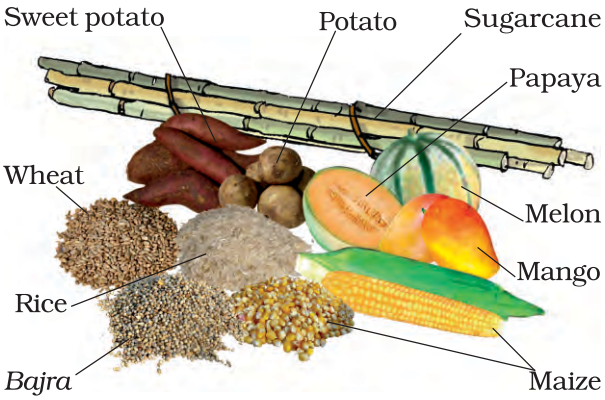
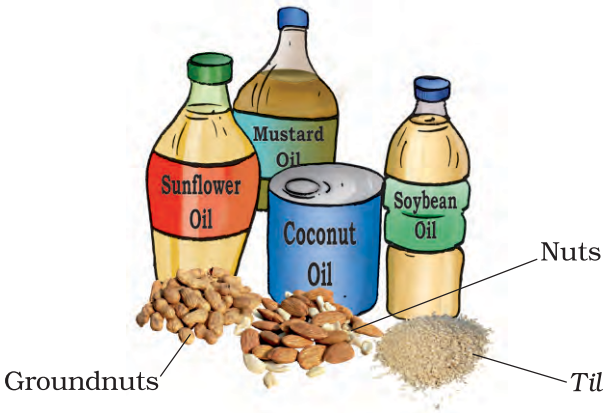


Fig. 2.3 *Some sources of carbohydrates*



(a)

(b)

Fig. 2.4 *Some sources of fats: (a) plant sources and (b) animal sources*

(a)

(b)

Fig. 2.5 *Some sources of proteins: (a) plant sources and (b) animal sources*

containing proteins are often called 'body building foods' (Fig 2.5).

Vitamins help in protecting our body against diseases. Vitamins also help in keeping our eyes, bones, teeth and gums healthy.

Vitamins are of different kinds known by different names. Some of these are Vitamin A, Vitamin C, Vitamin D, Vitamin E and K. There is also a group of vitamins called Vitamin B-complex. Our body needs all types of vitamins in small quantities. Vitamin A keeps our skin and eyes healthy. Vitamin C helps body to fight against many diseases. Vitamin D helps our body to use calcium for bones and teeth. Foods that are rich in different vitamins are shown in Fig. 2.6 to Fig. 2.9.

Minerals are needed by our body in small amounts. Each one is essential

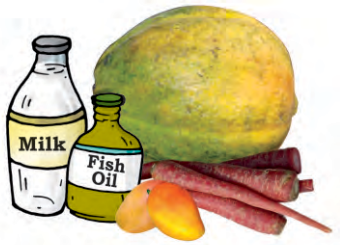


Fig. 2.6 *Some sources of Vitamin A*

Fig. 2.7 *Some sources of Vitamin B*

Fig. 2.8 *Some sources of Vitamin C*

Fig. 2.9 *Some sources of Vitamin D*

for proper growth of body and to maintain good health. Some sources of different minerals are shown in Fig. 2.10.

Most food items, usually, have more than one nutrient. You may have noticed this, while recording your observations in Table 2.2. However, in a given raw material, one particular nutrient may be present in much larger quantity than in others. For example, rice has more carbohydrates than other nutrients. Thus, we say that rice is a "carbohydrate rich" source of food.

Besides these nutrients, our body needs **dietary fibres** and water. Dietary fibres are also known as roughage. Roughage is mainly provided by plant products in our foods. Whole grains and pulses, potatoes, fresh fruits and vegetables are main sources of roughage. Roughage does not provide any nutrient to our body, but is an essential component of our food and adds to its bulk. This helps our body get rid of undigested food.

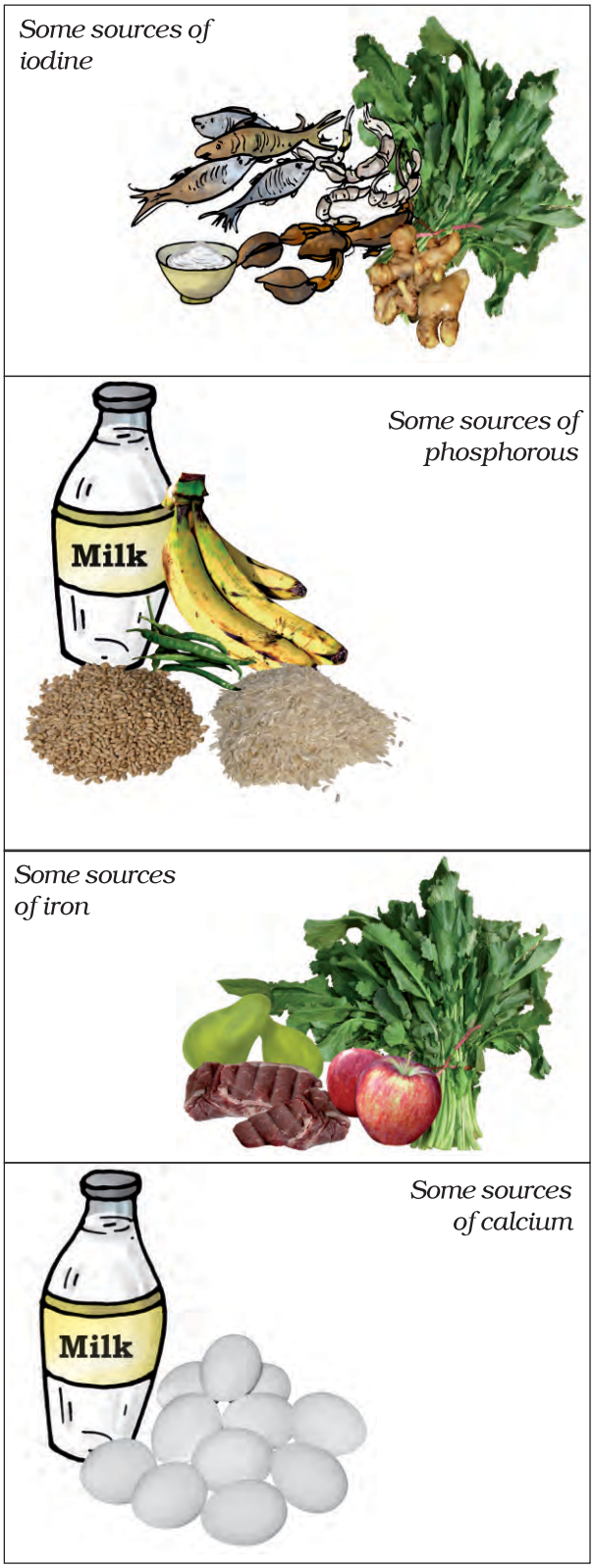


Fig. 2.10 *Sources of some minerals*

Water helps our body to absorb nutrients from food. It also helps in throwing out some wastes from body as urine and sweat. Normally, we get most of the water that our body needs from the liquids we drink — such as water, milk and tea. In addition, we add water to most cooked foods. Let's see if there is any other source which provides water to our body.

Activity 3

Take a tomato or a fruit like lemon. Cut it into small pieces. Do your hands get wet while doing so?

Carefully observe whenever vegetables and fruits are being cut, peeled, grated or mashed at your home. Do you find any fresh vegetables or fruits that do not contain some amount of water?

We see that many food materials themselves contain water. To some extent, our body needs are met by this water. Apart from this, we also add water while cooking many food items.

2.3 Balanced Diet

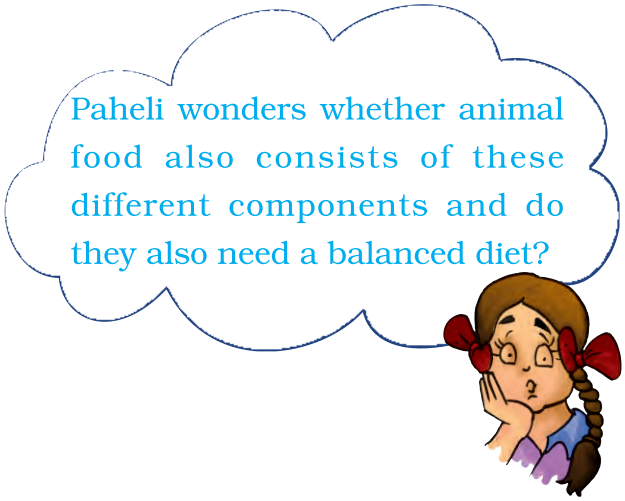
The food we normally eat in a day is our diet. For growth and maintenance of good health, our diet should have all the nutrients that our body needs, in right quantities. Not too much of one and not too little of the other. The diet should also contain a good amount of roughage and water. Such a diet is called a **balanced diet**.

Do you think that people of all ages need the same type of diet? Do you also think that, what we need for a balanced diet would depend on the amount of physical work that we do?

Prepare a chart of whatever you eat over a period of a week. Check whether all the nutrients mentioned are present in one or the other food items being eaten within a day or so.

Pulses, groundnut, soyabean, sprouted seeds (*moong* and Bengal gram), fermented foods (South Indian foods such as *idlis)*, a combination of flours (*missi roti*, *thepla* made from cereals and pulses), banana, spinach, *sattu*, jaggery, available vegetables and other such foods provide many nutrients. Therefore, one can eat a balanced diet without expensive food materials.

Eating the right kind of food is not enough. It should also be cooked



properly so that its nutrients are not lost. Are you aware that some nutrients get lost in the process of cooking and preparations?

If the vegetables and fruits are washed after cutting or peeling them, it

may result in the loss of some vitamins. The skins of many vegetables and fruits contain vitamins and minerals. Similarly, repeated washing of rice and pulses may remove some vitamins and minerals present in them.

We all know that cooking improves the taste of food and makes it easier to digest. At the same time, cooking also results in the loss of certain nutrients. Many useful proteins and considerable amounts of minerals are lost if excess water is used during cooking and is then thrown away.

Vitamin C gets easily destroyed by heat during cooking. Would it not be sensible to include some fruits and raw vegetables in our diet?

Boojho thought that fats would be the best foods to eat, all the time. A *katori* of fat will give much more energy than a *katori* of carbohydrate rich food, isn't it? So, he ate nothing but food rich in fats — fried food like *samosa* and *poori*, *malai, rabdi* and *peda*.

Do you think he was right? No, of course not! It can be very harmful for us to eat too much of fat rich foods and we may end up suffering from a condition called **obesity**.

2.4 Deficiency Diseases

A person may be getting enough food to eat, but sometimes the food may not contain a particular nutrient. If this continues over a long period of time, the person may suffer from its **deficiency**. Deficiency of one or more nutrients can cause diseases or disorders in our body. Diseases that occur due to lack of nutrients over a long period are called **deficiency diseases**.

If a person does not get enough proteins in his/her food for a long time, he/she is likely to have stunted growth, swelling of face, discolouration of hair, skin diseases and diarrhoea.

If the diet is deficient in both carbohydrates and proteins for a long period of time, the growth may stop completely. Such a person becomes very lean and thin and so weak that he/she may not even be able to move.

Deficiency of different vitamins and minerals may also result in certain diseases or disorders. Some of these are mentioned in Table 2.3.

All deficiency diseases can be prevented by taking a balanced diet.

In this chapter, we asked ourselves the reason why widely varying food from different regions had a common

Table 2.3 – Some diseases/disorders caused by deficiency of vitamins and minerals

Vitamin/ Mineral	Deficiency disease/disorder	Symptoms
Vitamin A	Loss of vision	Poor vision, loss of vision in darkness (night), sometimes complete loss of vision
Vitamin B1	Beriberi	Weak muscles and very little energy to work
Vitamin C	Scurvy	Bleeding gums, wounds take longer time to heal
Vitamin D	Rickets	Bones become soft and bent
Calcium	Bone and tooth decay	Weak bones, tooth decay
Iodine	Goiter	Glands in the neck appear swollen, mental disability in children
Iron	Anaemia	Weakness

distribution. This distribution, we find, ensures that our meals have a balance of the different nutrients needed by the body.

Key words

Balanced diet
Beriberi
Carbohydrates
Energy
Fats
Minerals
Nutrients
Proteins
Roughage
Scurvy
Starch
Vitamins

Summary

- The major nutrients in our food are carbohydrates, proteins, fats, vitamins and minerals. In addition, food also contains dietary fibres and water.
- Carbohydrates and fats mainly provide energy to our body.
- Proteins and minerals are needed for the growth and the maintenance of our body.
- Vitamins help in protecting our body against diseases.
- Balanced diet provides all the nutrients that our body needs, in right quantities, along with adequate amount of roughage and water.
- Deficiency of one or more nutrients in our food for a long time may cause certain diseases or disorders.

Exercises

1. Name the major nutrients in our food.
2. Name the following:
   (a) The nutrients which mainly give energy to our body.
   (b) The nutrients that are needed for the growth and maintenance of our body.
   (c) A vitamin required for maintaining good eyesight.
   (d) A mineral that is required for keeping our bones healthy.
3. Name two foods each rich in:
   (a) Fats
   (b) Starch
   (c) Dietary fibre
   (d) Protein
4. Tick (√) the statements that are correct.
   (a) By eating rice alone, we can fulfill nutritional requirement of our body. ( )
   (b) Deficiency diseases can be prevented by eating a balanced diet. ( )
   (c) Balanced diet for the body should contain a variety of food items. ( )
   (d) Meat alone is sufficient to provide all nutrients to the body. ( )
5. Fill in the blanks.
   (a) _____ is caused by deficiency of Vitamin D.
   (b) Deficiency of _____ causes a disease known as beri-beri.
   (c) Deficiency of Vitamin C causes a disease known as _____.
   (d) Night blindness is caused due to deficiency of _____ in our food.

SUGGESTED PROJECTS AND ACTIVITIES

1. Prepare a diet chart to provide balance diet to a twelve year old child. The diet chart should include food items which are not expensive and are commonly available in your area.
2. We have learnt that excess intake of fats is harmful for the body. What about other nutrients? Would it be harmful for the body to take too much of proteins or vitamins in the diet? Read about diet related problems to find answers to these questions and have a class discussion on this topic.
3. Test the food usually eaten by cattle or a pet to find out which nutrients are present in animal food. Compare results obtained from the whole class to conclude about balanced diet requirements for different animals.

3 Fibre to Fabric

Paheli and Boojho won the first prize in a Science Quiz competition held at their school. They were very excited and decided to use the prize money to buy clothes for their parents. When they saw a large variety of cloth material, they got confused (Fig. 3.1). The shopkeeper explained that some clothes or fabrics were cotton and some were synthetic. He also had woollen mufflers and shawls. There were many silk sarees as well. Paheli and Boojho felt very excited. They touched and felt these different fabrics. Finally, they bought a woollen muffler and a cotton saree.

After their visit to the cloth shop, Paheli and Boojho began to notice various fabrics in their surroundings. They found that bed sheets, blankets, curtains, tablecloths, towels and dusters were made from different kinds of fabrics. Even their school bags and the gunny bags were made from some kind of fabric. They tried to identify these fabrics as cotton, wool, silk or synthetic. Can you also identify some fabrics?

Fig. 3.1 *A cloth shop*

3.1 Variety in Fabrics

Activity 1

Visit a nearby tailoring shop. Collect cuttings of fabrics leftover after stitching. Feel and touch each piece of fabric. Now, try to label some of the fabrics as cotton, silk, wool or synthetic after asking for help from the tailor.

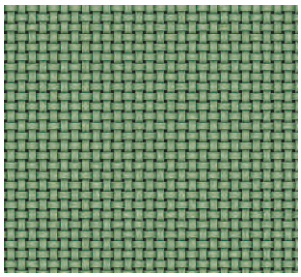


Fig.3.2 *Enlarged view of a piece of fabric*

Do you wonder what these different fabrics are made of? When you look at any fabric, it seems a continuous piece. Now, look at it closely. What do you notice (Fig. 3.2)?

Activity 2

Select a piece of cotton fabric you labelled in Activity 1. Now, try to find a loose thread or **yarn** at one of the edges and pull it out (Fig. 3.3). If no loose

Fig. 3.3 *Pulling a thread from a fabric*

yarns are visible, you can gently pull one out with a pin or a needle.

We find that a fabric is made up of yarns arranged together. What are these yarns made of?

3.2 Fibre

Activity 3

Take out a yarn from a piece of cotton fabric. Place this piece of yarn on the table. Now, press one end of the yarn with your thumb. Scratch the other end of the yarn along its length with your nail as shown in Fig. 3.4. Do you find that at this end, the yarn splits up into thin strands (Fig. 3.5)?

Fig.3.4 *Splitting the yarn into thin strands*

Fig. 3.5 *Yarn split up into thin strands*

You might have observed something similar when you try to thread a needle. Many a time, the end of the thread is separated into a few thin strands. This makes it difficult to pass the thread through the eye of the needle. The thin strands of thread that we see, are made up of still thinner strands called **fibres**.

Fabrics are made up of yarns and yarns are further made up of fibres. Where do these fibres come from?

The fibres of some fabrics such as cotton, jute, silk and wool are obtained from plants and animals. These are called **natural fibres.** Cotton and jute are examples of fibres obtained from plants. Wool and silk fibres are obtained from animals. Wool is obtained from the fleece of sheep or goat. It is also obtained from the hair of rabbits, yak and camels. Silk fibre is drawn from the cocoon of silkworm.

For thousands of years natural fibres were the only ones available for making fabrics. In the last hundred years or so, fibres are also made from chemical

substances, which are not obtained from plant or animal sources. These are called **synthetic fibres**. Some examples of synthetic fibres are polyester, nylon and acrylic.

3.3 Some Plant Fibres

Cotton

Have you ever made wicks for oil lamps? What do you use for making these wicks? This cotton wool is also used for filling mattresses, quilts or pillows.

Take some cotton wool, pull it apart and look at its edges. What do you observe? The small, thin strands that you see are made up of cotton fibres.

Where does this cotton wool come from? It is grown in the fields. Cotton plants are usually grown at places having black soil and warm climate. Can you name some states of our country where cotton is grown? The fruits of the cotton plant (**cotton bolls**) are about the size of a lemon. After maturing, the bolls burst open and the seeds covered with cotton fibres can be seen. Have you ever seen a cotton field that is ready for picking? It looks like a field covered with snow (Fig.3.6).

Fig.3.6 *Field of cotton plants*

From these bolls, cotton is usually picked by hand. Fibres are then separated from the seeds by combing. This process is called **ginning** of cotton. Ginning was traditionally done by hand (Fig.3.7). These days, machines are also used for ginning.

Fig. 3.7 *Ginning of cotton*

Jute

Jute fibre is obtained from the stem of the jute plant (Fig 3.8). It is cultivated during the rainy season. In India, jute is mainly grown in West Bengal, Bihar and Assam. The jute plant is normally harvested when it is at flowering stage. The stems of the harvested plants are immersed in water for a few days. The stems rot and fibres are separated by hand.

Fig. 3.8 *A jute plant*

Fig. 3.9 *Making yarn from cotton*

To make fabrics, all these fibres are first converted into **yarns**. How is it done?

3.4 Spinning Cotton Yarn

You can try making cotton yarn yourself.

Activity 4

Hold some cotton wool in one hand. Pinch some cotton between the thumb and forefinger of the other hand. Now, gently start pulling out the cotton, while continuously twisting the fibres (Fig. 3.9). Are you able to make a yarn?

The process of making yarn from fibres is called **spinning**. In this process, fibres from a mass of cotton wool are drawn out and twisted. This brings the fibres together to form a yarn.

A simple device used for spinning is a hand spindle, also called *takli* (Fig. 3.10). Another hand operated device used for spinning is *charkha* (Fig. 3.11). Use of *charkha* was popularised by Mahatma Gandhi as part of the Independence movement. He encouraged people to wear clothes made of homespun yarn and shun imported cloth made in the mills of Britain.

Fig. 3.10 *A Takli*

Fig. 3.11 *Charkha*

Spinning of yarn on a large scale is done with the help of spinning machines. After spinning, yarns are used for making fabrics.

3.5 Yarn to Fabric

There are many ways by which fabrics are made from yarns. The two main processes are weaving and knitting.

Weaving

In Activity 2, you might have noticed that a fabric is made up of two sets of yarns arranged together. The process of arranging two sets of yarns together to make a fabric is called **weaving**. Let us try to weave some paper strips.

Activity 5

Take two sheets of paper of different colours. Cut square pieces of length and width equal to 30 cm from each sheet. Now, fold both the sheets into half. On one sheet draw lines as shown in the

Fig. 3.12 *Weaving with paper strips*

Fig 3.12 (a) and on the other as shown in Fig.3.12 (b). Cut both the sheets along the dotted lines and then unfold. Weave the strips one by one through the cuts in the sheet of paper as shown in Fig.3.12 (c). Fig. 3.12 (d) shows the pattern after weaving all the strips.

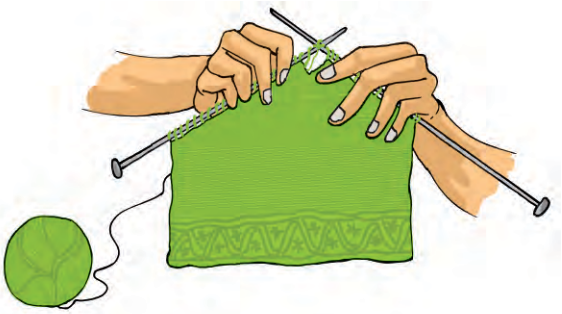


Fig 3.14 *Knitting*

Fig. 3.13 *Handloom*

In a similar manner, two sets of yarn are woven to make a fabric. The yarns are much thinner than our paper strips, of course! Weaving of fabric is done on **looms** (Fig. 3.13). The looms are either hand operated or power operated.

Knitting

Have you noticed how sweaters are knitted? In **knitting**, a single yarn is used to make a piece of fabric (Fig. 3.14). Have you ever pulled the yarn from a torn pair of socks? What happens? A single yarn gets pulled out continuously as the fabric gets unravelled. Socks and many other clothing items are made of knitted fabrics. Knitting is done by hand and also on machines.

Paheli wants to know if you have seen any fabrics that are made of the fibres on the outer covering of coconut. What are these fibres normally used for?

Weaving and knitting are used for making different kinds of fabric. These fabrics are used for a variety of clothing items.

3.6 History of Clothing Material

Have you ever wondered what materials people used in ancient times for clothes? It appears that in those times people used the bark and big leaves of trees or animal skins and furs to cover themselves.

After people began to settle in agricultural communities, they learnt to weave twigs and grass into mats and baskets. Vines, animal fleece or hair were twisted together into long strands. These were woven into fabrics. The early Indians wore fabrics made out of cotton that grew in the regions near the river Ganga. Flax is also a plant that gives natural fibres. In ancient Egypt, cotton as well as flax were cultivated near the river Nile and were used for making fabrics.

In those days, stitching was not known. People simply draped the fabrics around different parts of their body. Many different ways of draping fabrics were used. With the invention of the sewing needle, people started stitching fabrics to make clothes. Stitched clothes have gone through many variations since this invention. But, is it not amazing that even today *saree*, *dhoti*, *lungi* or turban is used as an un-stitched piece of fabric?

Just as there is a large variety in the food eaten all over our country, a large variety exists also in fabrics and clothing items.

Key words

Cotton wool
Fabric
Fibre
Knitting
Spinning
Weaving
Yarn

Summary

- There is a variety of clothing material or fabric, such as, cotton, silk, wool and polyester.

- Fabrics are made from yarns, which in turn are made from fibres.
- Fibres are either natural or synthetic. Cotton, wool, silk and jute are some natural fibres, while nylon and polyester are some examples of synthetic fibres.
- Fibres like cotton and jute are obtained from plants.
- The process of making yarn from fibres is called spinning.
- Fabric from yarns is made by weaving and knitting.

Exercises

1. Classify the following fibres as natural or synthetic:

   nylon, wool, cotton, silk, polyester, jute

2. State whether the following statements are true or false:

   a) Yarn is made from fibres.

   b) Spinning is a process of making fibres.

   c) Jute is the outer covering of coconut.

   d) The process of removing seed from cotton is called ginning.

   e) Weaving of yarn makes a piece of fabric.

   f) Silk fibre is obtained from the stem of a plant.

   g) Polyester is a natural fibre.

3. Fill in the blanks:

   a) Plant fibres are obtained from_____ and _____ .

   b) Animals fibres are _____ and _____ .

4. From which parts of the plant cotton and jute are obtained?
5. Name two items that are made from coconut fibre.
6. Explain the process of making yarn from fibre.

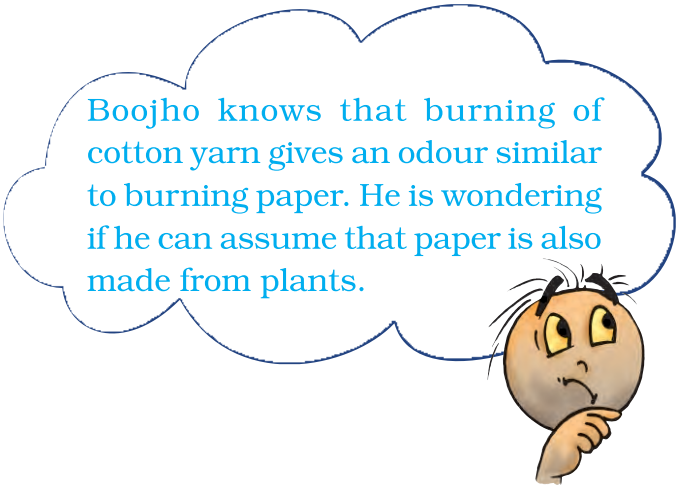
SUGGESTED PROJECTS AND ACTIVITIES

1. Visit a nearby handloom or powerloom unit and observe the weaving or knitting of fabric.
2. Find out if any crop is grown in your region for obtaining fibre. If yes, what is it used for?
3. India has been a major producer of cotton and its fabric. India exports cotton fabrics and items to many other countries. Find out, how it helps us?

4. Do you know that famous Sufi Saint and poet Kabir, was a weaver? Find out about his life and teachings.

5. You can do an activity to identify the yarns of a fabric under the supervision of your teacher or parents. Pull out six to eight yarns from the fabric. Hold one end of the yarn with a tong and bring the other end over the flame of a candle. Observe carefully. Do the yarns shrink away from the flame? Do the yarns melt or burn? What type of odour is given off? Note down your observations.

   If these are cotton yarns, they burn but do not shrink or melt. The burning yarn gives an odour similar to burning paper. The silk yarn shrinks away from the flame and burns but does not melt. It has the odour of charred meat. The wool yarn also shrinks and burns but does not melt. It has a strong odour of burning hair. The synthetic yarns shrink and burn. They also melt and give out an odour similar to burning plastics.



4 Sorting Materials into Groups

4.1 Objects Around us

We saw that our food and clothes have so much variety in them. Not just food and clothes, there is such a vast variety of objects everywhere. We see around us, a chair, a bullock cart, a cycle, cooking utensils, books, clothes, toys, water, stones and many other objects. All these objects have different shapes, colours and uses (Fig. 4.1).

Look around and identify objects that are round in shape. Our list may include a rubber ball, a football and a glass marble. If we include objects that are nearly round, our list could also include objects like apples, oranges, and an earthen pitcher (*gharha*). Suppose we were looking for objects that are edible. We might include all the items that we have listed in Tables 1.1, 1.2 and 1.3 in Chapter 1. We might also find that some of those round shaped objects we just listed out, are also in this group.

Fig. 4.1 *Objects around us*

Let us say, we wish to make a group of objects that are made of plastics. Buckets, lunch boxes, toys, water containers, pipes and many such objects, may find a place in this group. There are so many ways to group objects! In the above examples we have grouped objects on the basis of their shape or the materials they are made from.

All objects around us are made of one or more materials. These materials may be glass, metal, plastics, wood, cotton, paper, mud or soil. Can you think of more examples of materials?

Activity 1

Let us collect as many objects as possible, from around us. Each of us could get some everyday objects from home and we could also collect some objects from the classroom or from outside the school. What will we have in our collection? Chalk, pencil, notebook, rubber, duster, a hammer, nail, soap, spoke of a wheel, bat,

matchbox, salt, potato! We can also list objects that we can think of, but, cannot bring to the classroom. For example, wall, trees, doors, tractor, road.

Separate all objects from this collection that are made from paper or wood. This way we have divided all objects into two groups. One group has the objects that are made from paper or wood while the other group has the objects that are not made of these materials. Similarly, we could separate the things that are used for preparing food.

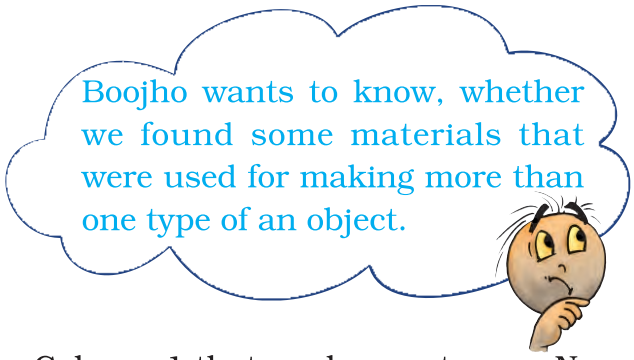
Let us be a little more systematic. List all objects collected, in Table 4.1. Try to identify the materials that each one is made of. It would be fun to make this a large table – collecting information about as many objects as possible. It may seem difficult to find out the materials out of which some of these objects are made. In such cases, discuss with your friends, teacher and parents to identify the materials.

Table 4.1 Objects and the materials they are made of

Objects	Materials they are made of
Plate (*thali*)	Steel, glass, plastics (any other)
Pen	Plastics, metal

Activity 2

Table 4.2 lists some common materials. You can also add more materials in



Column 1 that are known to you. Now, try and think of everyday objects you know, that are made mainly of these materials, and list them in Column 2.

Table 4.2 Different types of objects that are made from the same material

Material	Objects made of these materials
Wood	Chair, table, plough, bullock cart and its wheels, ...
Paper	Books, notebooks, newspaper, toys, calendars,...
Leather	
Plastics	
Cotton	

What do we find from these tables? First, we grouped objects in many different ways. We then found that objects around us are made of different materials. At times, an object is made of a single material. An object could also be made of many materials. And then again, one material could be used for making many different objects. What decides which material should be used

for making any given object? It seems that we need to know more about different materials.

4.2 Properties of Materials

Have you ever wondered why a tumbler is not made with a piece of cloth? Recall our experiments with pieces of cloth in Chapter 3 and also keep in mind that we generally use a tumbler to keep a liquid. Therefore, would it not be silly, if we were to make a tumbler out of cloth (Fig 4.2)! What we need for a tumbler is glass, plastics, metal or other such material that will hold water. Similarly, it would not be wise to use paper-like materials for cooking vessels.

Fig. 4.2 *Using a cloth tumbler*

We see then, that we choose a material to make an object depending on its properties, and the purpose for which the object is to be used.

So, what are all the properties of materials that would be important for their usage? Some properties are discussed here.

Appearance

Materials usually look different from each other. Wood looks very different from iron. Iron appears different from copper or aluminium. At the same time, there may be some similarities between iron, copper and aluminium that are not there in wood.

Activity 3

Collect small pieces of different materials – paper, cardboard, wood, copper wire, aluminium sheet, chalk. Do any of these appear shiny? Separate the shiny materials into a group.

Now, observe as the teacher cuts each material into two pieces and look at the freshly cut surface (Fig. 4.3). What do you notice? Does the freshly cut surface of some of these materials appear shiny? Include these objects also in the group of shiny materials.

Do you notice such a shine or lustre in the other materials, cut them anyway as you can? Repeat this in the class with as many materials as possible and make a list of those with and without lustre. Instead of cutting, you can rub the surface of material with sand paper to see if it has lustre.

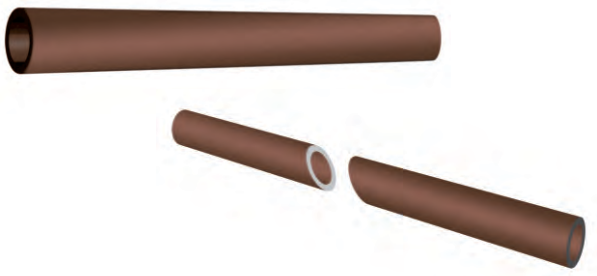


Fig. 4.3 *Cutting pieces of materials to see if they have lustre*

Materials that have such lustre are usually metals. Iron, copper, aluminium and gold are examples of metals. Some metals often lose their shine and appear dull, because of the action of air and moisture on them. We therefore, notice the lustre, only on their freshly cut surface. When you visit an ironsmith or a workshop, look out for freshly cut surfaces of metal rods to see if they have lustre.

Hardness

When you press different materials with your hands, some of them may be hard to compress while others can be easily compressed. Take a metal key and try to scratch with it, the surface of a piece of wood, aluminium, a piece of stone, a nail, candle, chalk, any other material or object. You can easily scratch some materials, while some cannot be scratched so easily. Materials which can be compressed or scratched easily are called **soft** while some other materials which are difficult to compress are called **hard**. For example, cotton or sponge is soft while iron is hard.

In appearance, materials can have different properties, like lustre, hardness, be rough or smooth. Can you think of other properties that describe the appearance of a material?

Soluble or Insoluble?

Activity 4

Collect samples of some solid substances such as sugar, salt, chalk powder, sand and sawdust. Take five glasses or beakers. Fill each one of them about two-thirds with water. Add a small amount (spoonful) of sugar to the first glass, salt to the second and similarly, add small amounts of the other substances into the other glasses. Stir the contents of each of them with a spoon. Wait for a few minutes. Observe what happens to the substances added to water (Fig. 4.4). Note your observations as shown in Table 4.3.

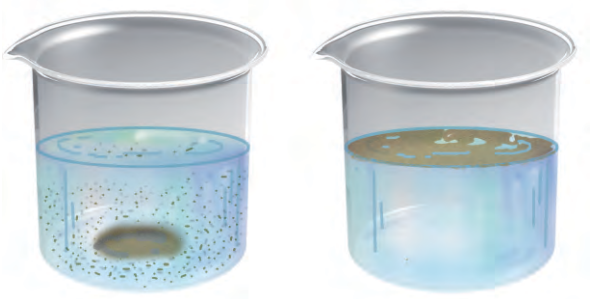


Fig. 4.4 *What disappears, what doesn't?*

Table 4.3 Mixing different solid materials in water

Substance	Disappears in water/ does not disappear
Salt	Disappears completely in water
Sugar	
Sand	
Chalk powder	
Sawdust	

You will notice that some substances have completely disappeared or dissolved in water. We say that these substances are **soluble** in water. Other substances do not mix with water and do not disappear even after we stir for a

long time. These substances are **insoluble** in water.

Water plays an important role in the functioning of our body because it can dissolve a large number of substances. Do liquids also dissolve in water?

Activity 5

Collect samples of vinegar, lemon juice, mustard oil or coconut oil, kerosene or any other liquid. Take a glass tumbler. Fill it up to half with water. Add a few spoonfuls of one liquid to this and stir it well. Let it stand for five minutes. Observe whether the liquid mixes with water (Fig. 4.5). Repeat the same with other liquids, as many different liquids as are available to you. Write your observations in Table 4.4.

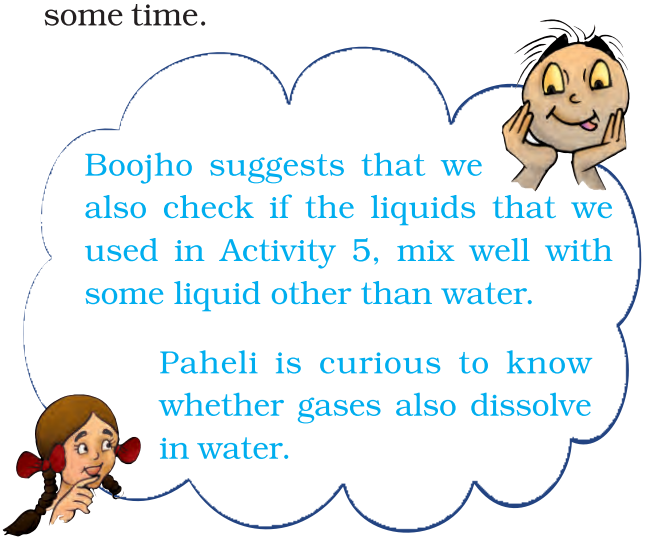
Table 4.4 Solubility of some common liquids in water

Liquid	Mixes well/ Does not mix
Vinegar	Mixes well
Lemon juice	
Mustard oil	
Coconut oil	
Kerosene	

(a) (b)

Fig. 4.5 *(a) Some liquids mix well with water while (b) some others do not*

We notice that some liquids get completely mixed with water. Some others do not mix with water and form a separate layer when kept aside for some time.



Some gases are soluble in water whereas others are not. Water, usually, has small quantities of some gases dissolved in it. For example, oxygen gas dissolved in water is very important for the survival of animals and plants that live in water.

Objects may float or sink in water

While doing Activity 4, you might have noticed that the insoluble solids separated out from water. You may have also noticed this with some liquids in Activity 5. Some of these materials that did not mix with water, floated to the surface of water. Others may have sunk to the bottom of the tumbler, right? We notice many examples of objects that float in water or sink (Fig. 4.6). Dried leaves fallen on the surface of a pond, a stone that you throw into this pond, few

Figure 4.6 *Some objects float in water while others sink in it*

drops of honey that you let fall into a glass of water. What happens to all of these?

Boojho would like you to give him five examples each, of objects that float and those that sink in water. What about testing these same materials to see if they float or sink in other liquids like oil?

Transparency

You might have played the game of hide and seek. Think of some places where you would like to hide so that you are not seen by others. Why did you choose those places? Would you have tried to hide behind a glass window? Obviously not, as your friends can see through that and spot you. Can you see through all the materials? Those substances or materials, through which things can be seen, are called transparent (Fig. 4.7). Glass, water, air and some plastics are examples of transparent materials. Shopkeepers usually prefer to keep biscuits, sweets and other eatables in transparent containers of glass or plastic, so that buyers can easily see these items (Fig. 4.8).

Fig. 4.7 *Looking through opaque, transparent or translucent material*

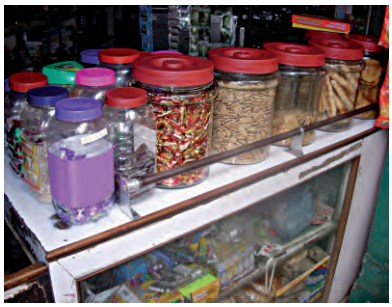


Fig. 4.8 *Transparent bottles in a shop*

On the other hand, there are some materials through which you are not able to see. These materials are called opaque. You cannot tell what is kept in a closed wooden box, a cardboard carton or a metal container. Wood, cardboard and metals, are examples of opaque materials.

Do we find that we can group all materials and objects, without any confusion, as either opaque or transparent?

Activity 6

Take a sheet of paper and look through it towards a lighted bulb. Make a note of your observation. Now, put 2-3 drops

of some oil and spread it on the sheet of paper. Look again towards the lighted bulb through that portion of the paper on which the oil has been spread. Do you find that the bulb is more clearly visible than before? But, can you see clearly through the oiled paper? Is everything on the other side of it visible? Perhaps not. The materials through which objects can be seen, but not clearly, are known as **translucent**. Remember the oily patch on paper when we tested food items for presence of fats? That was translucent too! Can you think of some more examples of translucent materials?

We can therefore group materials as opaque, transparent and translucent.

Fig. 4.9 *Does torch light pass through your palm?*

Paheli suggests covering the glass of a torch with your palm at a dark place. Switch on the torch and observe the other side of the palm. She wants to know whether palm of your hand is opaque, transparent or translucent?

We learnt that materials differ in their appearance and the way they mix in water or other liquids. They may float or sink in water or may be transparent, opaque or translucent. Materials can be grouped on the basis of similarities or differences in their properties.

Why do we need to group materials? In everyday life, we often group materials for our convenience. At home, we usually store things in such a manner that similar objects are placed together. Such an arrangement helps us to locate them easily. Similarly, a grocer usually keeps all type of biscuits at one corner of his shop, all soaps at another while grains and pulses are stored at some other place.

There is another reason why we find such grouping useful. Dividing materials in groups makes it convenient to study their properties and also observe any patterns in these properties. We will study more about this in higher classes.

Key words

Hard	Opaque
Insoluble	Rough
Lustre	Soluble
Material	Translucent
Metals	Transparent

Summary

- Objects around us are made up of a large variety of materials.
- A given material could be used to make a large number of objects. It is also possible that an object could be made of a single material or of many different types of materials.
- Different types of materials have different properties.
- Some materials are shiny in appearance while others are not. Some are rough, some smooth. Similarly, some materials are hard, whereas some others are soft.
- Some materials are soluble in water whereas some others are insoluble.
- Some materials such as glass, are transparent and some others such as wood and metals are opaque. Some materials are translucent.
- Materials are grouped together on the basis of similarities and differences in their properties.
- Things are grouped together for convenience and to study their properties.

Exercises

1. Name five objects which can be made from wood.
2. Select those objects from the following which shine:
   Glass bowl, plastic toy, steel spoon, cotton shirt
3. Match the objects given below with the materials from which they could be made. Remember, an object could be made from more than one material and a given material could be used for making many objects.

Objects	Materials
Book	Glass
Tumbler	Wood
Chair	Paper
Toy	Leather
Shoes	Plastics

4. State whether the statements given below are True or False.
   (i) Stone is transparent, while glass is opaque.
   (ii) A notebook has lustre while eraser does not.
   (iii) Chalk dissolves in water.
   (iv) A piece of wood floats on water.

(v) Sugar does not dissolve in water.

(vi) Oil mixes with water.

(vii) Sand settles down in water.

(viii) Vinegar dissolves in water.

5. Given below are the names of some objects and materials:

   Water, basket ball, orange, sugar, globe, apple and earthen pitcher

   Group them as:

   (a) Round shaped and other shapes

   (b) Eatables and non eatables

6. List all items known to you that float on water. Check and see if they will float on an oil or kerosene.

7. Find the odd one out from the following:

   a) Chair, Bed, Table, Baby, Cupboard

   b) Rose, Jasmine, Boat, Marigold, Lotus

   c) Aluminium, Iron, Copper, Silver, Sand

   d) Sugar, Salt, Sand, Copper sulphate

SUGGESTED ACTIVITY

1. You may have played a memory game with your friends. Several objects are placed on a table, you are asked to observe them for a few minutes, go into another room and write down the names of all objects that you can remember. Play this game, with a difference! Ask all the participants in the game to remember objects with some particular property while playing this memory game — remember and write down the names of objects that were made of wood or objects that are edible and so on. Have fun!

2. From a large collection of materials, make groups of objects having different properties like transparency, solubility in water and other properties. In later chapters you will also learn about properties of materials related to electricity and magnetism. After making different groups from the collected materials, try and find out if there are any patterns in these groups. For instance, do all materials which have lustre conduct electricity?

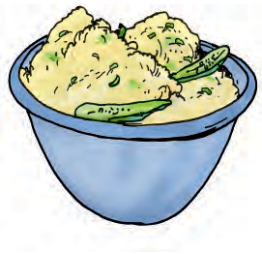
5 Separation of Substances

There are many instances when we notice a substance being separated from a mixture of materials.

Tea leaves are separated from the liquid with a strainer, while preparing tea (Fig. 5.1).

Fig. 5.1 *Separating tea leaves with a strainer*

Grain is separated from stalks, while harvesting. Milk or curd is churned to separate the butter (Fig. 5.2). As we learned in Chapter 3, we gin cotton to separate its seeds from the fibre.



Perhaps you might have eaten salted *daliya* or *poha*. If you found that it had chillies in it, you may have carefully taken them out before eating.

Suppose you are given a basket containing mangoes and guavas and asked to separate them. What would you do? Pick out one kind and place them in a separate container, right?

Seems easy, but what if the materials we want to separate are much smaller

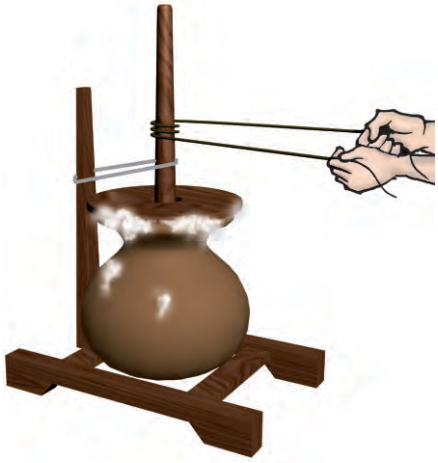


Fig. 5.2 *Butter is taken out by churning milk or curds*

than mango or guava? Imagine you are given a glass of sand with salt mixed in it. Impossible, even to think of separating salt from this mixture by picking out grains of sand by hand!

But, why would we need to separate substances like this at all, is what Paheli wants to know.

Activity 1

In Column 1 of Table 5.1, are given a few processes of separation. The purpose of separation and the way separated components are used is mentioned in Column 2 and 3 respectively. However, the information given in Columns 2 and 3 is jumbled up. Can you match each

Table 5.1 Why do we separate substances?

Separation process	Purpose for which we do the separation	What do we do with the separated components?
1) Separate stones from rice	a) To separate two different, but useful components.	i) We throw away the soild component.
2) Churning milk to obtain butter	b) To remove non-useful components.	ii) We throw away the impurities.
3) Separate tea leaves	c) To remove impurities or harmful components.	iii) We use both the components.

process with its purpose and the way separated components are used?

We see that, before we use a substance, we need to separate harmful or non-useful substances that may be mixed with it. Sometimes, we separate even useful components if we need to use them separately.

The substances to be separated may be particles of different sizes or materials. These may be solids, liquids or even gases. So, how do we separate substances mixed together if they have so many different properties?

5.1 Methods of Separation

We will discuss some simple methods of separating substances that are mixed together. You may come across some of these methods being used in day to day activities.

Hand Picking

Activity 2

Bring a packet of grain purchased from a shop to the classroom. Now, spread the grain on a sheet of paper. Do you find only one kind of grain on the sheet of paper? Are there pieces of stone, husks, broken grain and particles of any other grain in it? Now, remove with your hand the pieces of stone, husks and other grains from it.

This method of **handpicking** can be used for separating slightly larger sized impurities like the pieces of dirt, stone, and husk from wheat, rice or pulses (Fig. 5.3). The quantity of such impurities is usually not very large. In such situations, we find that handpicking is a convenient method of separating substances.

Fig. 5.3 *Handpicking stones from grain*

Threshing

You must have seen bundles of wheat or paddy stalks lying in fields after

harvesting the crop. Stalks are dried in the sun before the grain is separated from them. Each stalk has many grain seeds attached to it. Imagine the number of grain seeds in hundreds of bundles of stalk lying in the field! How does the farmer separate grain seeds from those bundles of stalks?

One may pluck mangoes or guavas from the trees. But, grain seeds are much smaller than mangoes or guavas. So, plucking them from their stalks would be impossible. How does one separate grain seeds from their stalks?

The process that is used to separate grain from stalks etc. is **threshing**. In this process, the stalks are beaten to free the grain seeds (Fig. 5.4). Sometimes,

Fig. 5.4 *Threshing*

threshing is done with the help of bullocks. Machines are also used to thresh large quantities of grain.

Winnowing

Activity 3

Make a mixture of dry sand with sawdust or powdered dry leaves. Keep this mixture on a plate or a newspaper. Look at this mixture carefully. Can the two different components be made out easily? Are the sizes of particles of the two components similar? Would it be possible to separate the components by handpicking?

Now, take your mixture to an open ground and stand on a raised platform. Put the mixture in a plate or sheet of paper. Hold the plate or the sheet of paper containing the mixture, at your shoulder height. Tilt it slightly, so that the mixture slides out slowly.

What happens? Do both the components — sand and sawdust (or powdered leaves) fall at the same place? Is there a component that blows away? Did the wind manage to separate the two components?

This method of separating components of a mixture is called **winnowing**. Winnowing is used to separate heavier and lighter components of a mixture by wind or by blowing air.

Fig. 5.5 *Winnowing*

This method is commonly used by farmers to separate lighter husk particles from heavier seeds of grain (Fig. 5.5).

The husk particles are carried away by the wind. The seeds of grain get separated and form a heap near the platform for winnowing. The separated husk is used for many purposes such as fodder for cattles.

Sieving

Sometimes, we may wish to prepare a dish with flour. We need to remove impurities and bran that may be present in it. What do we do? We use a sieve and pour the flour into it (Fig. 5.6).

Sieving allows the fine flour particles to pass through the holes of the sieve while the bigger impurities remain on the sieve.

In a flour mill, impurities like husk and stones are removed from wheat before grinding it. Usually, a bagful of wheat is poured on a slanting sieve. The sieving removes pieces of stones, stalk and husk that may still remain with wheat after threshing and winnowing.

Fig. 5.6 *Sieving*

You may have also noticed similar sieves being used at construction sites

Fig. 5.7 *Pebbles and stones are removed from sand by sieving*

to separate pebbles and stones from sand (Fig. 5.7).

Activity 4

Bring a sieve and a small quantity of flour from home, to the class. Sieve the flour to separate any impurities in it. Now, make a fine powder of chalk pieces and mix it with the flour. Can we separate the flour and the powdered chalk by sieving?

Sieving is used when components of a mixture have different sizes.

Sedimentation, Decantation and Filtration

Sometimes, it may not be possible to separate components of a mixture by winnowing and handpicking. For example, there may be lighter impurities like dust or soil particles in rice or pulses. How are such impurities separated from rice or pulses before cooking?

Rice or pulses are usually washed before cooking. When you add water to these, the impurities like dust and soil

particles get separated. These impurities go into water, which becomes a little muddy. Now, what will sink to the bottom of the vessel — rice or dust? Why? Have you seen that the vessel is tilted to pour out the dirty water?

When the heavier component in a mixture settles after water is added to it, the process is called **sedimentation**. When the water (along with the dust) is removed, the process is called **decantation** (Fig. 5.8). Let us find a few other mixtures that can be separated through sedimentation and decantation.

The same principle is used for separating a mixture of two liquids that do not mix with each other. For example, oil and water from their mixture can be separated by this process. If a mixture of such liquids is allowed to stand for some time, they form two separate layers. The component that forms the top layer can then be separated by decantation.

Let us again consider a mixure of a solid and liquid. After preparing tea, what do you do to remove the tea leaves? Try decantation. It helps a little. But, do you still get a few leaves in your tea? Now, pour the tea through a strainer.

Fig. 5.8 *Separating two components of a mixture by sedimentation and decantation*

Did all the tea leaves remain in the strainer? This process is called **filtration** (Fig. 5.1). Which method of separating tea leaves from prepared tea is better, decantation or filtration?

Let us now consider the example of water that we use. Do all of us, at all times, get safe water to drink? Sometimes, water supplied through taps may be muddy. The water collected from ponds or rivers may also be muddy, especially after rains. Let us see if we can use some method of separation to remove insoluble impurities like soil from the water.

Activity 5

Collect some muddy water from a pond or a river. If it is not available, mix some soil to water in a glass. Let it stand for half an hour. Observe the water carefully and note your observations.

Does some soil settle at the bottom of water? Why? What will you call this process?

Now, slightly tilt the glass without disturbing the water. Let the water from the top flow into another glass (Fig. 5.8). What will you call this process?

Is the water in the second glass still muddy or brown in colour? Now filter it. Did the tea strainer work? Let us try filtering the water through a piece of cloth. In a piece of cloth, small holes or pores remain in between the woven threads. These pores in a cloth can be used as a filter.

If the water is still muddy, impurities can be separated by a filter that has even

smaller pores. A filter paper is one such filter that has very fine pores in it. Fig. 5.9 shows the steps involved in using a filter paper. A filter paper folded in the form of a cone is fixed onto a funnel (Fig. 5.10). The mixture is then poured on the filter paper. Solid particles in the mixture do not pass through it and remain on the filter.

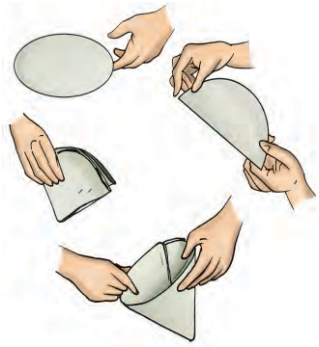


Fig. 5.9 *Folding a filter paper to make a cone*

Fig. 5.10 *Filtration using a filter paper*

Fruit and vegetable juices are usually filtered before drinking to separate the seeds and solid particles of pulp. The method of filtration is also used in the process of preparing cottage cheese (*paneer*) in our homes. You might have seen that for making *paneer*, a few drops of lemon juice are added to milk as it boils. This gives a mixture of particles of solid *paneer* and a liquid. The *paneer* is then separated by filtering the mixture through a fine cloth or a strainer.

Evaporation

Activity 6

Heat a beaker containing some water. Allow the water to boil. If you continue heating, would the water turn into steam and disappear completely? Now, add two spoons of salt to water in another beaker and stir it well. Do you see any change in the colour of water? Can you see any salt in the beaker, after stirring? Heat the beaker containing the salt water (Fig. 5.11). Let the water boil away. What is left in the beaker?

Fig. 5.11 *Heating a beaker containing salt water*

In this activity, we used the process of evaporation, to separate a mixture of water and salt.

The process of conversion of water into its vapour is called **evaporation**. The process of evaporation takes place continuously wherever water is present.

Where do you think, salt comes from? Sea water contains many salts mixed in it. One of these salts is the common salt. When sea water is allowed to stand in shallow pits, water gets heated by sunlight and slowly turns into water vapour, through evaporation. In a few days, the water evaporates completely leaving behind the solid salts (Fig. 5.12). Common salt is then obtained from this mixture of salts by further purification.

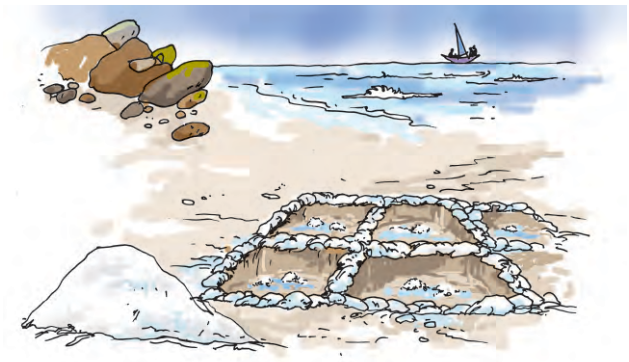


Fig. 5.12 *Obtaining salt from sea water*

Use of more than one method of separation

We have studied some methods for separation of substances from their mixtures. Often, one method is not sufficient to separate the different substances present in a mixture. In such a situation, we need to use more than one of these methods.

Activity 7

Take a mixture of sand and salt. How will we separate these? We already saw that handpicking would not be a practical method for separating these.

Keep this mixture in a beaker and add some water to it. Leave the beaker aside for some time. Do you see the sand settling down at the bottom? The sand can be separated by decantation or filtration. What does the decanted liquid contain? Do you think this water contains the salt which was there in the mixture at the beginning?

Now, we need to separate salt and water from the decanted liquid. Transfer this liquid to a kettle and close its lid. Heat the kettle for some time. Do you notice steam coming out from the spout of the kettle?

Take a metal plate with some ice on it. Hold the plate just above the spout of the kettle as shown in Fig. 5.13. What do you observe? Let all the water in the kettle boil off.

When the steam comes in contact with the metal plate cooled with ice, it condenses and forms liquid water. The water drops that you observed falling from the plate, were due to condensation of steam. The process of conversion of water vapour into its liquid form is called **condensation**.

Did you ever see water drops condensed under a plate that has been used to cover a vessel containing milk that has just been boiled?

After all the water has evaporated, what is left behind in the kettle?

We have thus, separated salt, sand and water using processes of decantation, filtration, evaporation and condensation.

Paheli faced a problem while recovering salt mixed with sand. She has mixed a packet of salt in a small

Fig. 5.13 *Evaporation and condensation*

amount of sand. She then tried the method suggested in Activity 7, to recover the salt. She found, however, that she could recover only a small part of the salt that she had taken. What could have gone wrong?

Can water dissolve any amount of a substance?

In chapter 4, we found that many substances dissolve in water and form a solution. We say that these substances are soluble in water. What will happen if we go on adding more and more of these substances to a fixed quantity of water?

Activity 8

You will need a beaker or a tumbler, a spoon, salt and water. Pour half a cup of water in the beaker. Add one teaspoonful of salt and stir it well, until the salt dissolves completely (Fig 5.14). Again add a teaspoonful of salt and stir well. Go on adding salt, one teaspoonful at a time, and stir.

After adding a few spoons of salt, do you find that some salt remains undissolved and settles at the bottom of the beaker? If yes, this means that no more salt can be dissolved in the amount of water we have taken. The solution is now said to be **saturated**.

Here is a hint as to what might have gone wrong when Paheli tried to recover large quantity of salt mixed with sand. Perhaps the quantity of salt was much more than that required to form a saturated solution. The undissolved salt

Fig 5.14 Dissolving salt in water

would have remained mixed with the sand and could not be recovered. She could solve her problem by using a larger quantity of water.

Suppose, she did not have sufficient quantity of water to dissolve all the salt in the mixture. Is there some way that water could be made to dissolve more salt before the solution gets saturated?

Let us try and help Paheli out.

Activity 9

Take some water in a beaker and mix salt in it until it cannot dissolve any more salt. This will give you a saturated solution of salt in water.

Now, add a small quantity of salt to this saturated solution and heat it. What do you find? What happens to the undissolved salt in the bottom of the beaker? Does it dissolve, now? If yes, can some more salt be dissolved in this solution by heating it?

Let this hot solution cool. Does the salt appear to settle at the bottom of the beaker again?

The activity suggest that larger quantity of salt can be dissolved in water on heating.

Does water dissolve equal amounts of different soluble substances? Let us find out.

Activity 10

Take two glasses and pour half a cup of water in each of them. Add a teaspoon of salt to one glass and stir till the salt dissolves. Go on adding salt, one teaspoon at a time, till the solution saturates. Record the number of spoons of salt that dissolved in the water, in Table 5.2. Now, repeat the same activity with sugar. Repeat this with some other substances that are soluble in water.

What do you notice from Table 5.2? Do you find that water dissolves different substances in different amounts?

Table 5.2

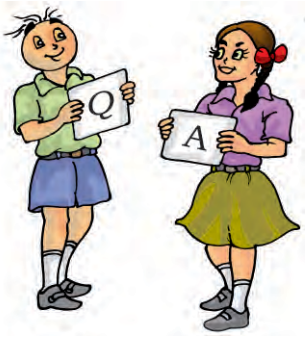
Substance	Number of spoons of substance that dissolved in water
Salt	
Sugar	

We have discussed a few methods of separating substances. Some of the methods of separation presented in this chapter are also used in a science laboratory.

We also learnt that a solution is prepared by dissolving a substance in a liquid. A solution is said to be saturated if it cannot dissolve more of the substance in it.

Key words

Churning
Condensation
Decantation
Evaporation
Filtration
Handpicking
Saturated solution
Sedimentation
Sieving
Solution
Threshing
Winnowing



Summary

- Handpicking, winnowing, sieving, sedimentation, decantation and filtration are some of the methods of separating substances from their mixtures.

- Husk and stones could be separated from grains by handpicking.
- Husk is separated from heavier seeds of grain by winnowing.
- Difference in the size of particles in a mixture is utilised to separate them by the process of sieving and filtration.
- In a mixture of sand and water, the heavier sand particles settle down at the bottom and the water can be separated by decantation.
- Filtration can be used to separate components of a mixture of an insoluble solid and a liquid.
- Evaporation is the process in which a liquid gets converted into its vapour. Evaporation can be used to separate a solid dissolved in a liquid.
- A saturated solution is one in which no more of that substance can be dissolved.
- More of a substance can be dissolved in a solution by heating it.
- Water dissolves different amount of soluble substances in it.

Exercises

1. Why do we need to separate different components of a mixture? Give two examples.
2. What is winnowing? Where is it used?
3. How will you separate husk or dirt particles from a given sample of pulses before cooking.
4. What is sieving? Where is it used?
5. How will you separate sand and water from their mixture?
6. Is it possible to separate sugar mixed with wheat flour? If yes, how will you do it?
7. How would you obtain clear water from a sample of muddy water?
8. Fill up the blanks
   (a) The method of separating seeds of paddy from its stalks is called _____.
   (b) When milk, cooled after boiling, is poured onto a piece of cloth the cream (*malai*) is left behind on it. This process of separating cream from milk is an example of _____.
   (c) Salt is obtained from seawater by the process of _____.
   (d) Impurities settled at the bottom when muddy water was kept overnight in a bucket. The clear water was then poured off from the top. The process of separation used in this example is called _____.
9. True or false?
   (a) A mixture of milk and water can be separated by filtration.
   (b) A mixture of powdered salt and sugar can be separated by the process of winnowing.

(c) Separation of sugar from tea can be done with filtration.

(d) Grain and husk can be separated with the process of decantation.

10. Lemonade is prepared by mixing lemon juice and sugar in water. You wish to add ice to cool it. Should you add ice to the lemonade before or after dissolving sugar? In which case would it be possible to dissolve more sugar?

SUGGESTED PROJECTS AND ACTIVITIES

1. Visit a nearby dairy and report about the processes used to separate cream from milk.
2. You have tried a number of methods to separate impurities like mud from water. Sometimes, the water obtained after employing all these processes could still be a little muddy. Let us see if we can remove even this impurity completely. Take this filtered water in a glass. Tie a thread to a small piece of alum. Suspend the piece of alum in the water and swirl. Did the water become clear? What happened to the mud? This process is called loading. Talk to some elders in your family to find out whether they have seen or used this process.

THINGS TO SEE

"The winnowers", painted by Gustav Courbet in 1853

Reproduced with permission from Museè de Beaus Arts, Nantes, France

6 Changes Around us

What fun if you suddenly get some magical powers to change anything around you! What are the things you would want to change?

We do not have magical powers, of course. But, we can still change a few things around us, perhaps many things. Can you list a few things you can change around you, with no magic involved?

Many changes are taking place around us on their own. In the fields, the crops change from time to time. Sometimes, leaves fall from trees, change colour and dry out. The flowers bloom and then wither away. Are any changes happening in your body? Your nails grow, your hair grows, you grow taller and your weight increases as you grow. Did you realise earlier that so many changes are taking place around you all the time?

Can some of the changes be grouped together?

How can we group various changes? It might help, if we find some similarities between them.

6.1 Can All Changes Always Be Reversed?

Activity 1

Take a balloon and blow it. Take care that it does not burst. The shape and size of the balloon have changed (Fig. 6.1). Now, let the air escape the balloon.

Fig 6.1 *A balloon changes its size and shape on blowing air into it*

Activity 2

Take a piece of paper and fold it as shown in Fig.6.2. You have changed the sheet of paper into a toy aeroplane. You may have lots of fun in flying this plane. Once you are tired of it, unfold the paper again.

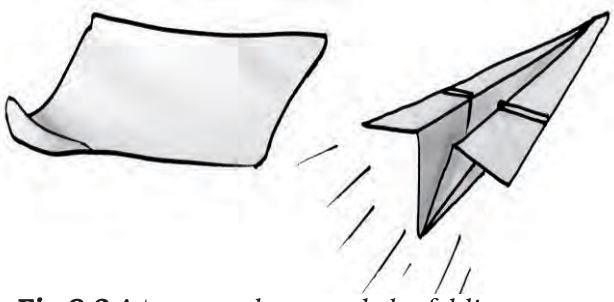


Fig 6.2 *A toy aeroplane made by folding paper*

Activity 3

Take some dough and make a ball. Try to roll out a *roti* (Fig. 6.3). May be you are not happy with its shape and wish to change it back into a ball of dough again.

Fig 6.3 *A ball of dough and a rolled out roti*

Now, think about the three changes you observed in Activity 1, 2 and 3. What do they have in common?

Was it possible to get the balloon back to its original shape and size?

Was the size of the paper same as before and after making an aeroplane?

Was it possible to get back the ball of dough again?

What do you conclude? In each of the three activities, is it possible to get back to the material with which we started our activity? If the answer is yes, it means that the changes occurring in these activities can be reversed. Now, let us repeat the same activities with a difference.

Activity 4

Take the same balloon, which you used in Activity 1. Blow it to its full size and tie its mouth with a string tightly. Prick it with the pointed tip of your pencil. Oops! It burst.

Activity 5

Take the same piece of paper, which you used in Activity 2. Draw an aeroplane on it and cut along its outline (Fig.6.4).

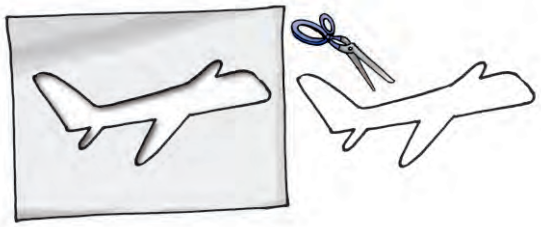


Fig. 6.4 *An aeroplane cut out of paper*

Activity 6

Roll out a *roti* from the ball of dough again and bake it on a *tawa* (Fig.6.5).

Fig 6.5 *A roti*

Suppose, you are asked the same three questions which you answered after Activity 3. What would your answers be, now?

We see that, the changes which have occurred in the Activity 4, 5 and 6 can not be reversed.

You use a pencil and an eraser. With repeated use, their shape and size changes. Can we reverse this change?

You must have seen a potter working on his wheel. He shapes a lump of clay into a pot. Can this change be reversed? He then bakes the pot in an oven. Now, can this change be reversed?

Some common changes are given in Table 6.1. Which of these changes, do you think can be reversed?

We find that one way we can group changes is to see if they can be reversed.

Table 6.1 Some common changes

Change	Can be Reversed
Raw egg to boiled egg	Yes/No
Batter to idli	
Wet clothes to dry clothes	
Woollen yarn to knitted sweater	
Grain to its flour	
Cold milk to hot milk	
Straight string to a coiled string	
Bud to flower	
Milk to *paneer*	
Cow dung to biogas	
Stretched rubber band to its normal size	
Ice cream to molten ice cream	

6.2 Could There be Other Ways to Bring a Change?

We all have seen the tools which are used to dig the soil (Fig. 6.6). Have you ever seen how the iron blade in these tools is fixed to the wooden handle?

The iron blade of these tools has a ring in which the wooden handle is fixed. Normally, the ring is slightly smaller in size than the wooden handle. To fix the handle, the ring is heated and it becomes slightly larger in size **(expands)**. Now, the handle easily fits into the ring. When the ring cools down it contracts and fits tightly on to the handle.

Fig. 6.6 *Tools are often heated before fixing wooden handles*

Such a change is also used for fixing the metal rim on a wooden wheel of a cart as shown in Fig.6.7. Again the metal rim is made slightly smaller than the wooden wheel. On heating, the rim expands and fits onto the wheel. Cold water is then poured over the rim, which contracts and fits tightly onto the wheel.

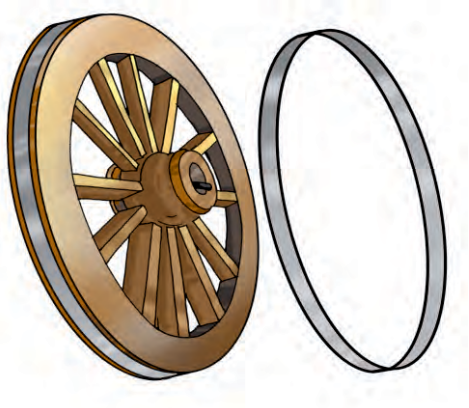
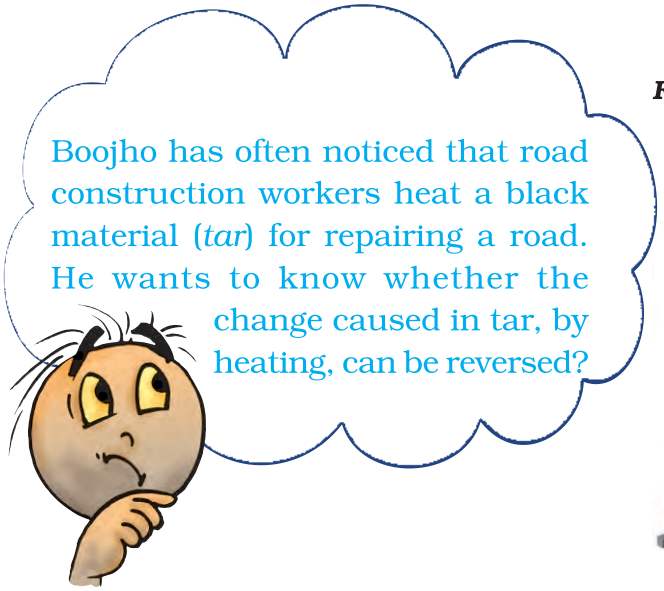


Fig. 6.7 *Cart wheel with metal rim fixed to it*

When we heat water in a pan, it begins to boil after some time. If we continue to heat further, the quantity of water in the pan begins to decrease.

The water changes into its vapour. In Activity 7, Chapter 5 you have observed that water vapour gets changed into liquid water when it is cooled. We all have noticed melting of ice. Ice melts when it is heated. What does it change into? Is it possible to change this water back into ice?

Let us observe some more changes.



Paheli wants to know if you have ever seen a blacksmith making some tools. How does a blacksmith change a piece of iron into different tools? A piece of iron is heated till it becomes red-hot. It then becomes soft and is beaten into a desired shape. What change has taken place in iron, on being heated?

Activity 7

Take a small candle and measure its length with a scale. Now, fix it at a suitable place and light it. Let it burn for some time. Now blow out the candle and measure its length again (Fig.6.8).

Can the change in the length of the candle be reversed? If we were to take some wax in a pan and heat it, can this change be reversed (Fig. 6.9)?

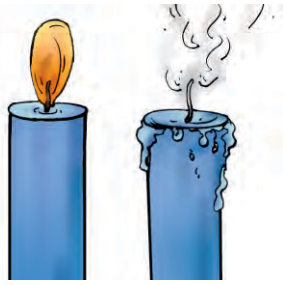


Fig.6.8 *Burning of a candle*

Fig.6.9 *Heating wax*

Repeat Activity 7 with an incense stick. Wait till it burns away completely. What are the changes that occur in the incense stick? The stick burns to produce some new material. These are ash and some gases. We cannot see these gases but can sense them due to their pleasant smell. Can this change be reversed? And what about the change, which occurred in the matchstick you used for lighting the candle or incense stick?

So far we have discussed the changes occurring in a given object or its material. What about the changes that occur when two substances are mixed together?

In Chapter 4, we dissolved salt in water. Do you think a change occured in salt or in water? Is it possible to reverse this change? Wait, in Chapter 5, we learnt how to separate salt from its solution in water. So, can we say that the change due to dissolving salt in water be reversed?

Paheli asks if you have ever seen curd being set. A small quantity of curd is added to warm milk. The milk is stirred and is set aside for a few hours at a warm place. In a few hours, the milk changes into curd. Can this change be reversed?

We find that a few ways to bring about a change in a substance could be, by heating it or by mixing it with some other substance. We also find that some changes can be reversed, while some others cannot be reversed. There must be many other ways of changing things around us. It is possible that some of them could be reversed. Thus, changes around us could be grouped as those that can be reversed or cannot be reversed. In higher classes, you will learn more about the ways in which changes can be made and the way these can be grouped.

Key words

Changes
Contraction
Evaporation
Expansion
Melting

Summary

- Some changes can be reversed and some cannot be reversed.
- A change may occur by heating a substance or by mixing it with some other.

Exercises

1. To walk through a waterlogged area, you usually shorten the length of your dress by folding it. Can this change be reversed?
2. You accidentally dropped your favourite toy and broke it. This is a change you did not want. Can this change be reversed?
3. Some changes are listed in the following table. For each change, write in the blank column, whether the change can be reversed or not.

S. No.	Change	Can be reversed (Yes/ No)
1.	The sawing of a piece of wood	
2.	The melting of ice candy	
3.	Dissolving sugar in water	
4.	The cooking of food	
5.	The ripening of a mango	
6.	Souring of milk	

4. A drawing sheet changes when you draw a picture on it. Can you reverse this change?
5. Give examples to explain the difference between changes that can or cannot be reversed.
6. A thick coating of a paste of Plaster of Paris (POP) is applied over the bandage on a fractured bone. It becomes hard on drying to keep the fractured bone immobilised. Can the change in POP be reversed?
7. A bag of cement lying in the open gets wet due to rain during the night. The next day the sun shines brightly. Do you think the changes, which have occurred in the cement, could be reversed?

SUGGESTED PROJECTS AND ACTIVITIES

1. Take a lemon, a paintbrush and a piece of paper. Cut the lemon and squeeze out its juice in a cup. Dip the brush in the lemon juice and write a message on the paper. Let the paper dry and you find that the letters of your message become invisible. Now, press the paper with hot iron or warm it by holding it above the flame of a candle (Take care that it does not catch fire). As the paper gets warm, invisible letters change into dark brown colour. Identify the changes that can be reversed.
2. Observe preparation of dishes at your home. Identify two changes that can be reversed.
3. Maintain a record for one year of the seasonal changes in vegetables, clothing, nature and events around you. Identify the changes that can or cannot be reversed.

7 Getting to Know Plants

Go outside and observe all the plants around you. Do you see that some plants are small, some very big, while some are just patches of green on the soil? Some have green leaves, while some others have reddish ones. Some have huge red flowers, some have tiny blue ones, while some have none. We do see a variety of plants existing all around us — near our homes, in the school ground, on the way to the school, in the parks and gardens, isn't it?

Let us get to know the different parts of any plant. This will help us understand the differences between plants of different kinds. Can you label the stem, branches, roots, leaves, and flowers of the plant shown in Fig.7.1? Colour the parts of the plant.

Fig. 7.1 *Parts of a plant*

Fig. 7.2 *A Nature walk!*

Let us now go on a Nature walk, make friends with many different kinds of plants and examine them closely (Fig. 7.2).

7.1 Herbs, Shrubs and Trees

Activity 1

Look closely at the stem and branches of:

1. Plants much smaller than you.
2. Plants that are about your size, and
3. Plants which are much taller than you.

Feel their stem and try to bend them gently to see if they are tender or hard.

Table 7.1 Categories of plants

Plant name	Column 1 Height	Column 2 Stem				Column 3 Where do the branches appear		Column 4
		Green	Tender	Thick	Hard	At the base of the stem	Higher up on the stem	Category of plant
Tomato	Shorter than me	Yes	Yes					Herb
Mango	Much taller than me			Yes	Yes		Yes	Tree
Lemon	Slightly taller than me				Yes	Yes		Shrub

Take care that the stem does not break. Hug the tall plants to see how thick their stems are!

We also need to notice from where the branches grow in some plants — close to the ground or higher up on the stem.

We will now group all the plants we observed, in Table 7.1. Some examples are shown. You can fill the Columns 1, 2 and 3 for many more plants. Fill Column 4 after you have studied later part of this section.

Based on these characters most plants can be classified into three categories: **herbs, shrubs** and **trees**. An example of each is shown in Fig.7.3.

Suggestion: Work in groups of 4-5 students in doing activities suggested in this Chapter so that a minimum number of plants are uprooted.

Use **weeds** with soft stems for the activities. Do you know what weeds are? In crop fields, lawns, or in pots, often some unwanted plants or weeds start growing. Have you seen farmers removing these weeds from their fields?

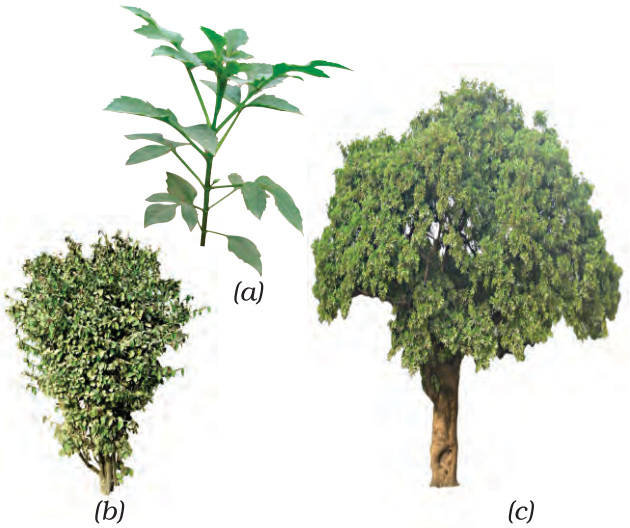


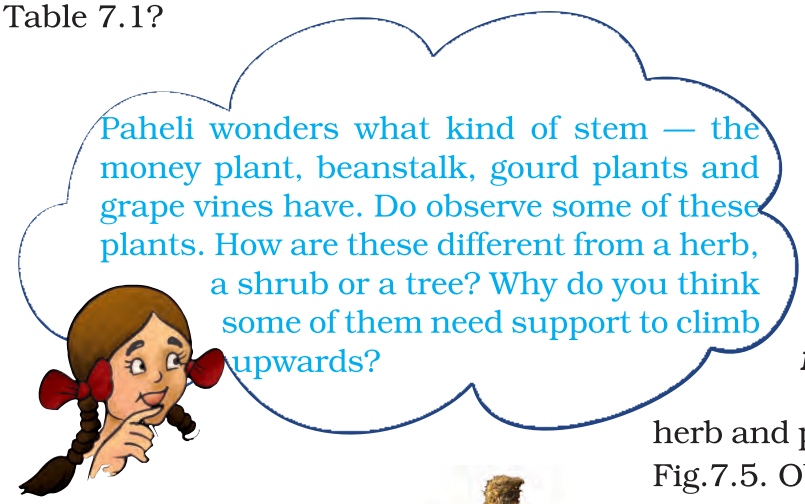
Fig.7.3 *(a) Herb, (b) shrub and (c) tree*

Plants with green and tender stems are called herbs. They are usually short and may not have many branches [Fig.7.3 (a)].

Some plants have the stem branching out near the base. The stem is hard but not very thick. Such plants are called shrubs [Fig .7.3(b)].

Some plants are very tall and have hard and thick brown stem. The stems have branches in the upper part, much above the ground. Such plants are called trees [Fig.7.3(c)].

Based on the above characteristics can you now correctly classify the plants listed by you and complete column 4 in Table 7.1?



Plants with weak stems that cannot stand upright and spread on the ground are called **creepers,** while those that take support on neighbouring structures and climb up are called **climbers** (Fig.7.4). These are different from the herbs, shrubs and trees.

Fig. 7.4 *Climbers*

Perhaps there are some plants in your school or at home that you take care of. Write down the names of any two trees, shrubs, herbs or creepers growing in your house or school.

7.2 Stem

Activity 2

We would require a glass, water, red ink, a herb, and a blade for this activity.

Pour water to fill one-third of the glass. Add a few drops of red ink to the water. Cut the base of the stem of the herb and put it in the glass as shown in Fig.7.5. Observe it the next day.

Fig. 7.5 *What does the stem do?*

Do any of the parts of the herb appear to have red colour? If yes, how do you think the colour reached there?

You can cut the stem across and look for the red colour inside the stem (Fig. 7.6).

From this activity we see that water moves up the stem. In other words, stem **conducts** water. Just like the red ink, minerals dissolved in water also move up in the stem, along with the water.

Fig. 7.6 *(a) Water moves up the stem*
(b) Enlarged view of open end of stem

The water and minerals go to leaves and other plant parts attached to the stem, through narrow tubes inside the stem.

Paheli did this activity with herbs having white flowers. She put one branch with a white flower in the water in glass A and added a few drops of red ink to the water. She did a funny thing with another branch. She split it half way along its length and put the two ends in the water in glasses B and C (Fig. 7.7). She put a few drops of red

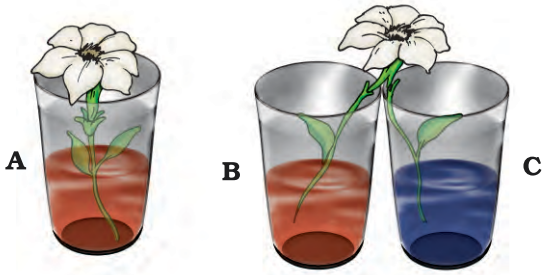


Fig. 7.7 *Paheli's flowers*

ink in glass B and blue ink in glass C. She wants you to guess what would happen to the flower in glass A and the flower put jointly in B and C.

When you had cut across the stem in Activity 2, did you notice a number of spots of red colour arranged in a ring inside the stem? Does this explain the results that Paheli obtained? Try this activity yourself!

7.3 Leaf

Look at leaves of plants around you and draw them in your notebook. Are all the leaves the same in size, shape and colour?

How are they attached to the stem? The part of a leaf by which it is attached to the stem is called **petiole**. The broad, green part of the leaf is called **lamina** (Fig. 7.8). Can you identify these parts of the leaves in plants around you? Do all the leaves have petioles?

Fig. 7.8 *A leaf*

Let us get to know the leaf better by taking its impression! If you thought that leaves cannot sign, here is an activity which will make you think again.

Activity 3

Put a leaf under a white sheet of paper or a sheet in your notebook. Hold it in place as shown in Fig. 7.9. Hold your pencil tip sideways and rub it on the portion of the paper having the leaf below it. Did you get an impression with some lines in it? Are they similar to those on the leaf?

Fig. 7.9 *Taking an impression of a leaf*

These lines on the leaf are called **veins**. Do you see a thick vein in the

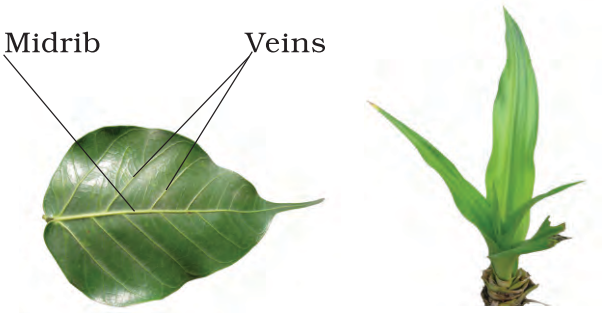


Fig. 7.10 *Leaf venation (a) reticulate and (b) parallel*

Fig. 7.11 *What does the leaf do?*

middle of the leaf? This vein is called the **midrib.** The design made by veins in a leaf is called the **leaf venation**. If this design is net-like on both sides of midrib, the venation is **reticulate** [Fig. 7.10 (a)]**.** In the leaves of grass you might have seen that the veins are parallel to one another. This is **parallel venation** [(Fig. 7.10 (b)]. Observe the venation in as many leaves as you can without removing them from the plant. Draw the pattern and write names of some plants having reticulate and parallel venation.

Shall we now find out some of the functions of a leaf?

Activity 4

We will require a herb, two transparent polythene bags and some string.

Do this activity during day time on a sunny day. Use a healthy, well watered plant that has been growing in the sun, for this activity. Enclose a leafy branch of the plant in a polythene bag and tie up its mouth as shown in Fig. 7.11. Tie up the mouth of another empty polythene bag and keep it also in the sun.

After a few hours, observe the inner surface of the bags. What do you see? Are there any droplets of water in any of the bags? Which bag has the droplets? How do you think they got there? [Don't forget to remove the polythene bag after the activity!]

Water comes out of leaves in the form of vapour by a process called **transpiration**. Plants release a lot of water into the air through this process. We will learn more about this in Chapter 14.

Why did we tie a bag around the leaves? Would we have seen the water from the transpiration of plants otherwise? What makes the water appear on the polythene bag? In Chapter 5, we noticed water changing into different forms in some of our activities. Can you think of these and name the process that makes water drops appear on the polythene bag?

Leaves also have another function. Let us study this.

Activity 5

We would require a leaf, spirit, a beaker, test tube, burner, water, a plate and iodine solution for this activity.

Put a leaf in a test tube and pour spirit to completely cover the leaf. Now,

Fig. 7.12 *What does the leaf contain?*

put the test tube in a beaker half filled with water. Heat the beaker till all the green colour from the leaf comes out into the spirit in the test tube. Take out the leaf carefully and wash it in water. Put it on a plate and pour some iodine solution over it (Fig. 7.12).

> **Note:** Since the activity involves the use of spirit and heating, it is advised that it is demonstrated by the teacher in the class.

What do you observe? Compare your observations with those done in Chapter 2, when you tested food for presence of different nutrients. Does this mean that the leaf has starch in it?

In Chapter 2, we saw that a slice of raw potato also shows the presence of starch. Potatoes get this starch from other parts of the plant and store it. However, leaves prepare their food in the presence of sunlight and a green coloured substance present in them. For this, they use water and carbon dioxide from air. This process is called **photosynthesis**. Oxygen is given out in this process. The food prepared by leaves ultimately gets stored in different parts of plant.

How do we know that the leaf has prepared the starch and not received it from another part of the plant? To test this, the above activity can be repeated with a little difference.

Place a potted plant with green leaves, in a dark room for a day or two. Now, cover a portion of a leaf of the plant completely with black paper and leave the plant in the Sun for a day. Remove the leaf covered in black paper and repeat the test for starch.

What do you see? Which part of the leaf shows the presence of starch? Does this help us understand that leaves produce starch in the presence of sunlight?

We see that the stem supplies leaf with water. The leaf uses the water to make food. The leaves also lose water through transpiration. How do the stem and leaves get the water? That is where the roots come in!

7.4 Root

Look at Fig. 7.13. Who do you think is watering their plant correctly, Paheli or Boojho? Why?

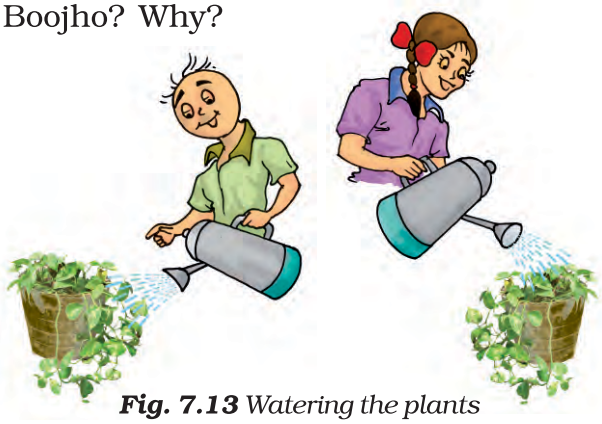


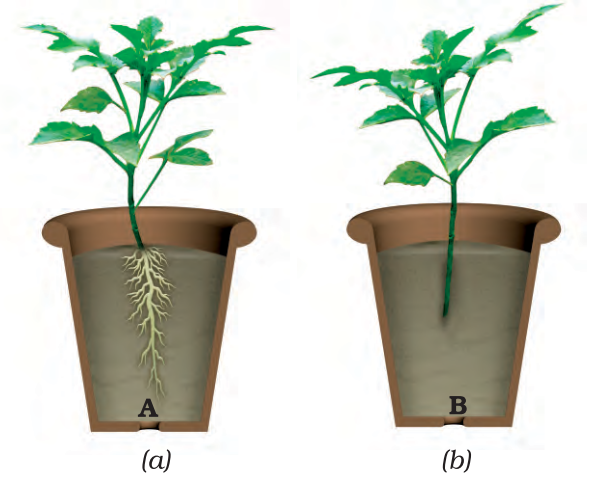
Fig. 7.13 *Watering the plants*

Which part of the plant is in the soil? Let us learn more about this part from the following activities.

Activity 6

You would require two pots, some soil, *khurpi* (for digging), blade or a pair of scissors and water. This activity is to be done in groups of 4-5 students.

Select two weeds of the same kind from an open ground and dig them out. Take care that their roots do not break. Plant one of the weeds in the soil in pot A [Fig. 7.14 (a)]. Cut off the roots from the other weed and plant it in the soil in pot B [Fig. 7.14 (b)]. Water them regularly. Observe the plants after a week. Are both plants healthy?



(a) (b)

Fig. 7.14 *(a) Weed with roots, and (b) without roots*

Both the plants are watered regularly, but, one is without roots, isn't it? Does this activity help you understand an important function of the root?

Let us do an activity to study another function of root.

Activity 7

We would require seeds of gram and maize, cotton wool, *katori* and some water.

Take two *katoris*. Place some wet cotton wool in them. Put 3 or 4 seeds of gram in one and maize in the other. Keep the cotton wet by sprinkling water every day, until the sprouts have grown into young plants. After a week try to separate the young plants from the cotton wool (Fig. 7.15).

Fig. 7.15 *Young plants grown on cotton wool*

Was it easy to separate the cotton wool from the roots? Why?

In Activity 6, we could not easily pull out the plants from the soil, right? We dug them out. The roots help in holding the plant firmly in the soil. They are said to **anchor** the plant to the soil.

You have seen that there are different kinds of stems and leaves. Do the roots also show a variety? Let us find out.

Activity 8

Study Fig. 7.16 (a) and (b) carefully. Now, look at the roots of the gram plants you have pulled out from the cotton wool. Do they look like the roots shown in Fig. 7.16 (a) or those in Fig. 7.16 (b)?

(a) (b)

Fig 7.16 *(a) Roots of*_____

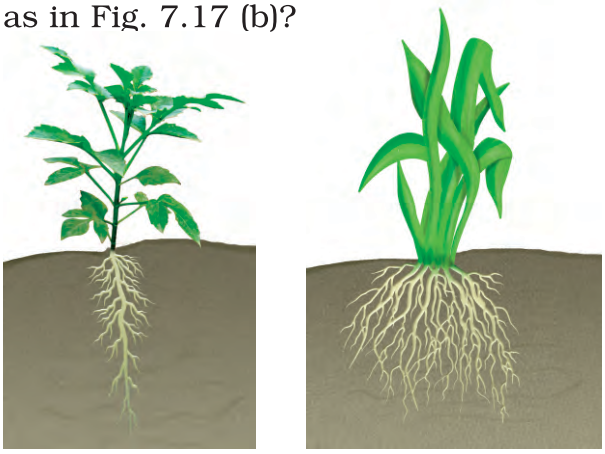
*(b) Roots of*_____

How about the roots of the maize plant? Write 'gram' or 'maize' in the blank spaces in the figure after matching the roots with the figures.

In what way are the roots of gram and maize similar? In what way are they different? There seem to be two different types of roots, isn't it? Are there also other types of roots? Let us find out.

Activity 9

Go to an open ground where many weeds are growing. Dig out a few weeds, wash the soil off the roots and observe them. Do you find that all the weeds that you have dug out have either the kind of roots shown in Fig. 7.17 (a) or as in Fig. 7.17 (b)?



(a) (b)

Fig. 7.17 *(a) Taproot and (b) fibrous roots*

For roots of the kind shown in Fig.7.17 (a), the main root is called **tap root** and the smaller roots are called **lateral roots**. Plants with roots as shown in Fig. 7.17 (b) do not have any main root. All roots seem similar and these are called **fibrous roots**.

Separate the weeds you have collected into two groups. In group (a) put those that have tap roots and in group (b) those that have fibrous roots. Look at the leaves of the plants in Group (a). What kind of venation do they have? What kind of venation do you see for plants of Group (b)?

Do you notice that leaf venation and the type of roots in a plant are related in a very interesting way? In Table 7.2, can you match the type of leaf venation and the type of roots for some plants you have studied in all the activities so far?

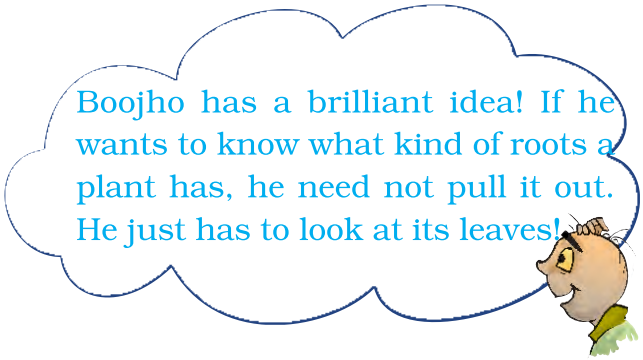


Table 7.2 Types of roots and types of leaf venation

Name of plant	Type of leaf venation	Type of roots

We have learnt that roots absorb water and minerals from the soil and the stem conducts these to leaves and

other parts of the plant. The leaves prepare food. This food travels through the stem and is stored in different parts of a plant. We eat some of these as roots—like carrot, radish, sweet potato, turnip and tapioca. We also eat many other parts of a plant where the food is stored.

Do you agree that stem is like a two way street (Fig. 7.18)? Write down the name of material that goes up the stem and that which comes down.

***Fig. 7.18**. A stem as a two way street!*

In the next section, we will study about the structure of a flower.

7.5 Flower

You are shown three branches of a rose in Fig 7.19 (a), (b) and (c). Which one will help you best to recognize the plant?

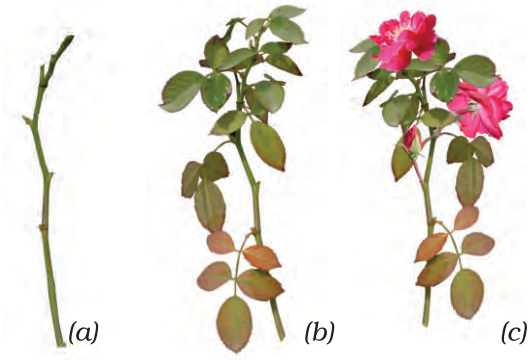


***Fig 7.19** Rose: (a) A leafless branch (b) A branch with leaves (c) A branch with leaves and flowers*

Which colour did you use for the flower in Fig. 7.1? Are all flowers colourful? Have you ever seen flowers on the plants of grass, wheat, maize, mango or guava? If you see any flowers in these plants, are they brightly coloured?

Let us study a few flowers closely.

When choosing flowers to study, avoid using marigold, chrysanthemum or sunflower. You will learn in higher classes that they are not single flowers, but, groups of flowers.

Activity 10

We would require one bud and two fresh flowers each, of any of the following– *datura*, china rose, mustard, brinjal, lady's finger, *gulmohur*. Also a blade, a glass slide or a sheet of paper, a magnifying glass and water.

Observe Fig. 7.20 carefully. Look at the prominent parts of the open flower. These are the **petals** of the flower. Different flowers have petals of different colours.

Where do you think the petals are in a closed bud? Which is the most prominent part in a bud? Did you see that this part is made of small leaf-like structures? They

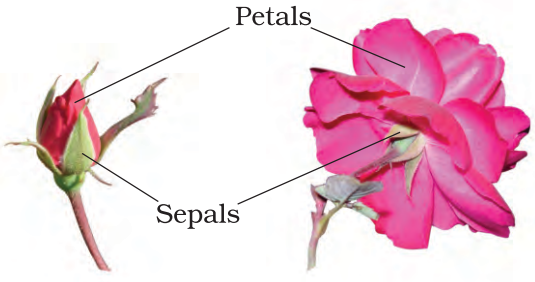


***Fig. 7.20** Bud and flower*

Table 7.3 Observations on flowers

Name of flower	Number and colour of petals	Number and colour of sepals	Are the sepals joined together or separate?	Stamens – are they free or joined to petals	Pistil – Present/ absent
Rose	Many (Colour?)	5 (Colour?)	Separate	Free	Present

are called **sepals**. Take a flower and observe its petals and sepals. Now, answer the following questions:

How many sepals does it have?

Are they joined together?

What are the colours of the petals and the sepals?

How many petals does your flower have?

Are they joined to one another or are they separate?

Do the flowers with joined sepals have petals that are separate or are they joined together?

Make a table based on the observations of the whole class (Table 7.3). Add observations to this table, from a field trip to a locality where there are plants with flowers. Fill the last two columns after you have gone through the entire section.

To see the inner parts of the flower clearly, you have to cut it open, if its petals are joined. For example, in *datura* and other bell shape flowers, the petals have to be cut lengthwise and spread out so that the inner parts can be seen clearly (Fig. 7.21).

Remove the sepals and petals to see the rest of the parts. Study the Fig. 7.22 carefully, compare your flower with the illustration and identify the **stamens** and **pistil** in your flower.

Look at Fig 7.23 carefully. It shows the different kinds of stamens present

Fig. 7.21 *A bell shaped flower*

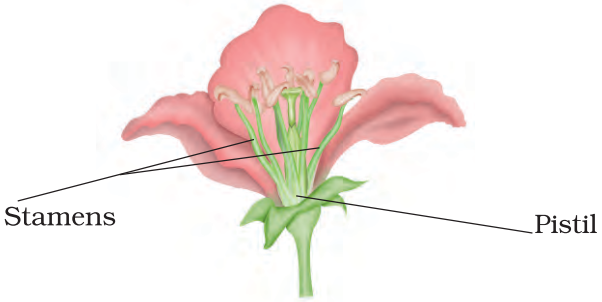


Fig. 7.22 *Parts of a flower*

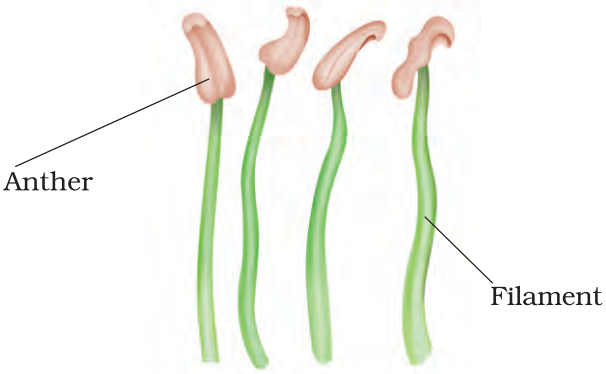


Fig. 7.23 *Parts of a stamen*

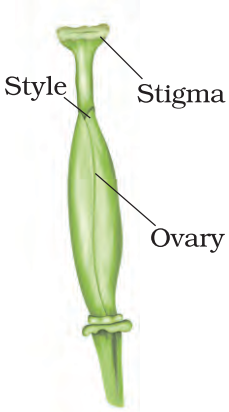


Fig. 7.24 *Parts of a pistil*

in different flowers. Can you recognise both the parts of the stamens in your flower? How many stamens are there in your flower? Draw one stamen and label its parts.

The innermost part of a flower is called the **pistil**. If you cannot see it completely, remove the remaining stamens. Identify the parts of the pistil with the help of Fig. 7.24.

Draw a neat, labelled diagram of the pistil of your flower.

Activity 11

Let us now study the structure of the **ovary** of a flower (Fig. 7.24)**.** It is the lowermost and swollen part of the pistil**.** We will cut this part to study how it looks inside! Look at Fig. 7.25 (a) and (b) carefully to understand how to cut the ovary of a flower.

Take two ovaries from different flowers. Cut them in two different ways as shown in Fig. 7.25. To prevent them from drying, put a drop of water on each of the two pieces of the ovary, you have cut.

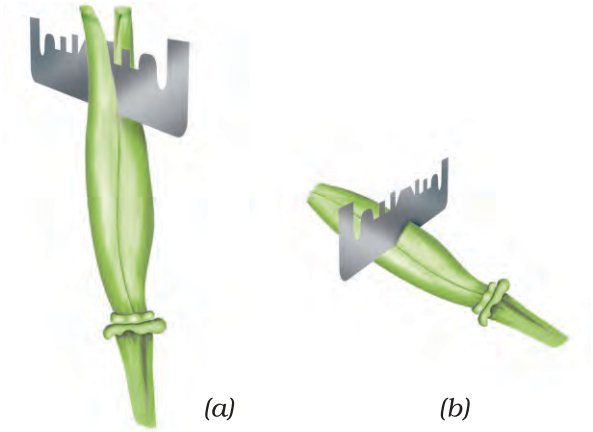


Fig. 7.25 *Cutting an ovary (a) longitudinal cut and (b) transverse cut*

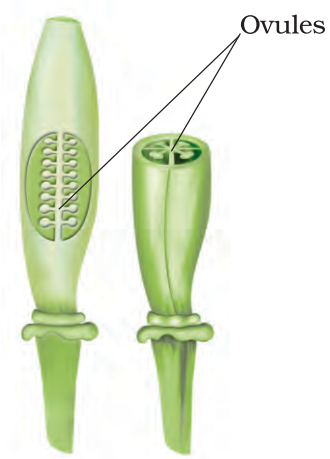


Fig. 7.26 *Inner structure of an ovary (a) longitudinal cut, (b) transverse cut*

Observe the inner parts of the ovary using a lens (Fig. 7.26). Do you see some small bead like structures inside the ovary? They are called **ovules**. Draw and label the inner parts of the ovary in your notebook.

On your field trip, try to find out the names of as many flowers as you can by asking the gardener or any other person. Remember, not to pluck more flowers than you need. Based on what you have filled in Table 7.3, answer the following questions.

Do all flowers have sepals, petals, stamens and pistils? Are there flowers that do not have any of these? Are there flowers which have parts other than these?

Did you find any flowers which have sepals and petals that look similar?

Did you find any flowers in which the number of sepals is different from the number of petals?

Do you now agree that the structure of the flower is not always the same? The number of sepals, petals, stamens and pistils may also be different in different flowers. Sometimes, some of these parts may even be absent!

We have studied some features and functions of leaves, stems and roots. We studied the structure of different flowers. We will learn about the function of flowers in higher classes. We will also learn about fruits in higher classes.

Key words

Climbers
Conduct
Creepers
Fibrous roots
Herbs
Lamina
Lateral roots
Midrib
Ovule
Parallel Venation
Petal
Petiole
Photosynthesis
Pistil
Reticulate venation
Sepal
Shrubs
Stamen
Taproot
Transpiration
Trees
Veins

Summary

- Plants are usually grouped into herbs, shrubs, trees, and climbers based on their height, stems and branches.
- The stem bears leaves, flowers and fruits.
- A leaf usually has a petiole and a lamina.
- The pattern of veins on the leaf is called venation. It can be reticulate or parallel.
- Leaves give out water vapour through the process of transpiration.
- Green leaves make their food by the process of photosynthesis using carbon dioxide and water in the presence of sunlight.

- Roots absorb water and minerals from the soil and anchor the plant firmly in the soil.
- Roots are mainly of two types: tap root and fibrous roots.
- Plants having leaves with reticulate venation have tap roots while plants having leaves with parallel venation have fibrous roots.
- The stem conducts water from roots to the leaves (and other parts) and food from leaves to other parts of the plant.
- The parts of a flower are sepals, petals, stamens and pistil.

Exercises

1. Correct the following statements and rewrite them in your notebook.

   (a) Stem absorbs water and minerals from the soil.

   (b) Leaves hold the plant upright.

   (c) Roots conduct water to the leaves.

   (d) The number of petals and sepals in a flower is always equal.

   (e) If the sepals of a flower are joined together, its petals are also joined together.

   (f) If the petals of a flower are joined together, then the pistil is joined to the petal.

2. Draw (a) a leaf, (b) a taproot and (c) a flower, you have studied for Table 7.3.
3. Can you find a plant in your house or in your neighborhood, which has a long but a weak stem? Write its name. In which category would you classify it?
4. What is the function of a stem in a plant?
5. Which of the following leaves have reticulate venation?

   Wheat, tulsi, maize, grass, coriander (*dhania*), China rose
6. If a plant has fibrous root, what type of venation do its leaves likely to have?
7. If a plant has leaves with reticulate venation, what kind of roots will it have?
8. Is it possible for you to find out whether a plant has taproot or fibrous roots by looking at the impression of its leaf on a sheet of paper?
9. Write the names of the parts of a flower.
10. Which of the following plants have you seen? Of those that you have seen, which one have flowers?

    Grass, maize, wheat, chilli, tomato, *tulsi*, *pipal*, *shisham*, banyan, mango, *jamun*, guava, pomegranate, papaya, banana, lemon, sugarcane, potato, groundnut
11. Name the part of the plant which produces its food. Name this process.
12. In which part of a flower, you are likely to find the ovary?
13. Name two flowers, each with joined and separated sepals.

SUGGESTED PROJECT AND ACTIVITIES

1. **BECOME A LEAF EXPERT**

   Do this activity with a number of leaves over a period of a few weeks. For every leaf that you wish to study, pluck it and wrap it in a wet cloth and take it home. Now, put your leaf in a newspaper and place a heavy book on it. You can also put it under your mattress or a trunk! Take out the leaf after a week. Paste it on a paper and write a poem or story about it. With your leaf collection pasted in a book (a **Herbarium**), you can become quite an expert about leaves!

2. Names of plant parts are hidden in this grid. Search for them by going up, down, or even diagonally forward as well as backward. Have fun!

O	V	U	L	E	L	Y	T	S	T	E	M
V	E	I	N	W	Q	H	E	R	B	P	I
A	N	I	M	A	L	Z	E	X	R	N	D
R	F	I	L	A	M	E	N	T	M	U	R
Y	A	R	A	B	L	C	O	D	B	E	I
L	E	E	U	O	F	O	L	G	H	I	B
A	L	H	I	I	R	J	A	L	K	U	R
T	M	T	N	O	T	P	P	Q	R	R	A
E	E	N	S	T	U	F	E	H	V	W	N
P	Y	A	M	G	I	T	S	Z	Z	N	C
F	L	O	W	E	R	E	H	T	N	A	H
S	T	A	M	E	N	N	S	E	P	A	L

8 Body Movements

Sit absolutely still. Observe the movements taking place in your body. You must be blinking your eyes, time to time. Observe the movements in your body as you breathe. There are so many movements that happen in our bodies.

When you are writing in your notebook which part of the body are you moving? Or, when you turn and look at your friend? Different parts of your body move while you remain at the same place, in these examples. You also move from one place to another — you get up and go to your teacher or to the school compound, or go home after school. You walk, run, skip, jump and move from place to place.

Let us see how animals move from place to place by filling up Table 8.1, after discussing with our friends, teachers and parents.

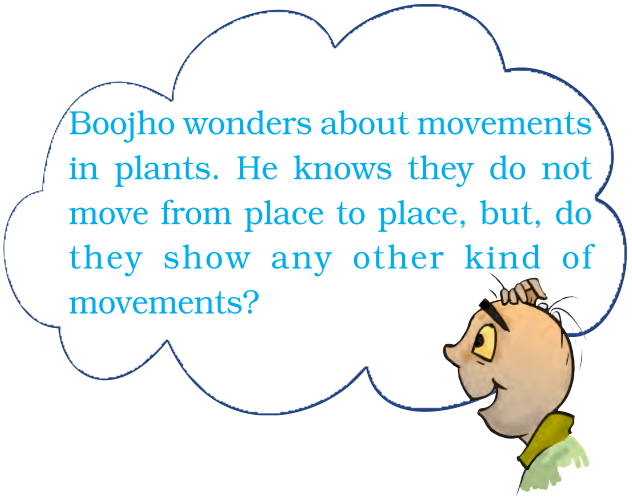


Table 8.1 How do animals move from place to place?

Animal	Body part used for moving from place to place	How does the animal move?
Cow	Legs	Walk
Humans		
Snake	Whole body	Slither
Bird		
Insect		
Fish		

Walk, run, fly, jump, creep, crawl, slither and swim – these are only a few of the ways in which animals move from one place to another. Why are there so many differences in the way that animals move from place to place? Why is it that many animals walk while a snake slithers or crawls and a fish swims?

8.1 Human Body and its Movements

Let us look closely at some of our own movements to begin with, before looking at all these varieties of movements in animals.

Do you enjoy doing physical exercise at school? How do you move your hands and legs while doing different exercises?

Let us try some of the many movements, our body is capable of.

Bowl an imaginary ball at an imaginary wicket. How did you move your arm? Did you rotate it at the shoulder in a circular movement? Did your shoulder also move? Lie down and rotate your leg at the hip. Bend your arm at the elbow and the leg at the knee. Stretch your arm sideways. Bend your arm to touch your shoulder with your fingers. Which part of your arm did you bend? Straighten your arm and try to bend it downwards. Are you able to do it?

Try to move the various parts of your body and record their movements in Table 8.2.

Why is it that we are able to move a few parts of our body easily in various directions and some only in one direction? Why are we unable to move some parts at all?

Activity 1

Place a scale length-wise on your arm so that your elbow is in the centre (Fig. 8.1).

Ask your friend to tie the scale and your arm together. Now, try to bend your elbow. Are you able to do it?

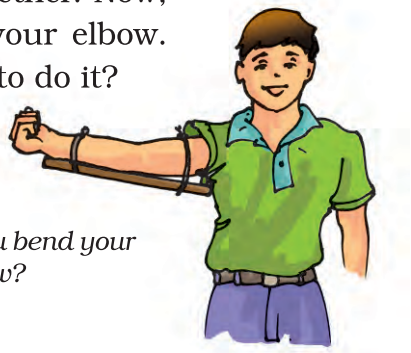


Fig. 8.1 *Can you bend your arm now?*

Table 8.2 Movements in our body

Body Part	Movement				
	Rotates completely	Rotates partly/turns	Bends	Lifts	Does not move at all
Neck		Yes			
Wrist					
Finger					
Knee					
Ankle					
Toe					
Back					
Head					
Elbow					
Arm	Yes				

Did you notice that we are able to bend or rotate our body in places where two parts of our body seem to be joined together — like elbow, shoulder or neck? These places are called **joints**. Can you name more such joints? If our body has no joints, do you think it would be possible for us to move in any way at all?

What exactly is joined together at these joints?

Press your fingers against the top of your head, face, neck, nose, ear, back of the shoulder, hands and legs including the fingers and toes.

Do you get a feel of something hard pressing against your fingers? The hard structures are the bones. Repeat this activity on other parts of your body. So many bones!

Bones cannot be bent. So, how do we bend our elbow? It is not one long bone from the upper arm to our wrist. It is different bones joined together at the elbow. Similarly, there are many bones present in each part of the body. We can bend or move our body only at those points where bones meet.

There are different types of joints in our body to help us carry out different movements and activities. Let us learn about some of them.

Ball and socket joints

Activity 2

Roll a strip of paper into a cylinder. Make a small hole in an old rubber or plastic ball (under supervision) and push the paper cylinder into it as shown in Fig. 8.2. You can also stick the cylinder on the ball. Put the ball in a small bowl. Does the ball rotate freely inside the bowl? Does the paper cylinder also rotate?

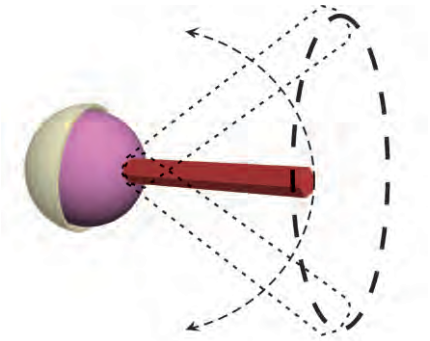


Fig. 8.2 *Making a ball and socket joint*

Now, imagine that the paper cylinder is your arm and the ball is its end. The bowl is like the part of the shoulder to which your arm is joined. The rounded end of one bone fits into the **cavity** (hollow space) of the other bone (Fig.8.3). Such a joint allows movements in all directions. Can you name another such joint you can think of, recollecting the body movements we tried at the beginning of this section?

Fig. 8.3 *A ball and socket joint*

Pivotal Joint

The joint where our neck joins the head is a pivotal joint. It allows us to bend

our head forward and backward and turn the head to our right or left. Try these movements. How are these movements different from those of our arm that can rotate a complete circle in its ball and socket joint? In a pivotal joint a cylindrical bone rotates in a ring.

Hinge joints

Open and close a door a few times. Observe the **hinges** of the door carefully. They allow the door to move back and forth.

Activity 3

Let us look at the kind of movement allowed by a hinge. Make a cylinder with cardboard or thick chart paper, as shown in Fig. 8.4. Attach a small pencil to the cylinder by piercing the cylinder at the centre, as shown. Make a hollow half cylinder from cardboard such that the rolled up cylinder can fit inside it easily. The hollow half cylinder with the rolled up cylinder sitting inside it, allows movement like a hinge. Try to move the rolled up cylinder. How does it move? How is this movement different from what we saw with our constructed ball

Fig. 8.4 *Directions of movement allowed by a hinge like joint*

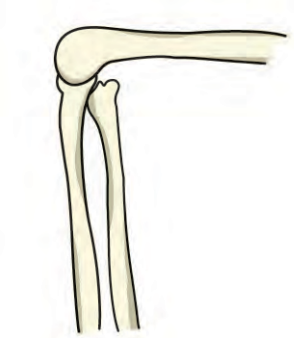


Fig. 8.5 *Hinge joints of the knee*

and socket joint? We saw this kind of movement at the elbow in Activity 1. What we have constructed in Fig. 8.4 is different from a hinge, of course. But, it illustrates the direction in which a hinge allows movement. The elbow has a hinge joint that allows only a back and forth movement (Fig. 8.5). Can you think of more examples of such joints?

Fixed joints

Some joints between bones in our head are different from those we have discussed so far. The bones cannot move at these joints. Such joints are called **fixed** joints. When you open your mouth wide, you can move your lower jaw away from your head, isn't it? Try to move your upper jaw, now. Are you able to move it? There is a joint between the upper jaw and the rest of the head which is a fixed joint.

We discussed only some of the joints that connect parts of our body.

What gives the different parts of the body their different shapes?

If you wanted to make a doll, what will you make first? Perhaps a framework to give the doll shape before making its outer structure, isn't it? All

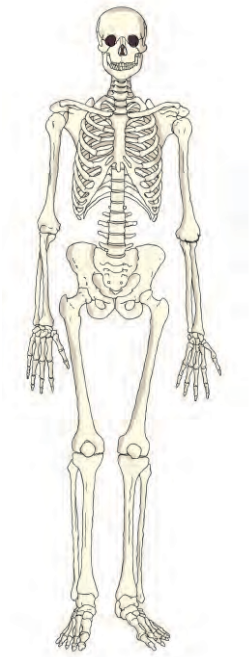


Fig. 8.6 *The Human skeleton*

the bones in our body also form a framework to give a shape to our body. This framework is called the **skeleton** (Fig. 8.6.)

How do we know that this is the shape of a human skeleton? How do we know the shapes of the different bones in our body? We can have some idea about the shape and number of bones in some parts of our body by feeling them. One way we could know this shape better would be to look at X-ray images of the human body.

Did you or anyone in your family ever have an X-ray of any part of your body taken? Sometimes when we are hurt, or have an accident, doctors use these X-ray images to find out about any possible injuries that might have happened to the bones. The X-rays show the shapes of the bones in our bodies.

Feel the bones in your forearm, upper arm, lower leg and upper leg. Try to find the number of bones in each part. Similarly, feel the bones of your ankle and knee joints and compare these with the X-ray images (Fig. 8.7).

Fig 8.7 *X-ray images of ankle and knee joints*

Bend your fingers. Are you able to bend them at every joint? How many bones does your middle finger have? Feel the back of your palm. It seems to have many bones, isn't it (Fig. 8.8)? Is your wrist flexible? It is made up of several small bones. What will happen if it has only one bone?

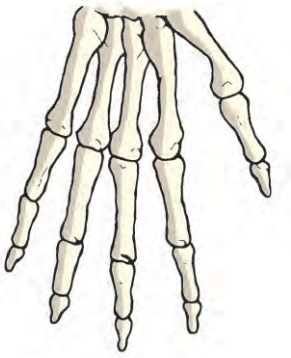


Fig. 8.8 *Bones of the hand*

Activity 4

Take a deep breathe and hold it for a little while. Feel your chest bones and the back bone by gently pressing the middle

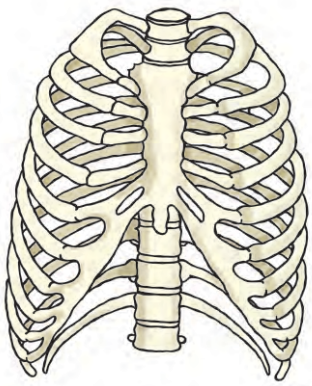


Fig. 8.9 *The rib cage*

of the chest and back at the same time. Count as many ribs (bones of the chest) as possible. Observe Fig. 8.9 carefully and compare with what you feel of the chest bones. We see that the ribs are curiously bent. They join the chest bone and the backbone together to form a box. This is called the **rib cage**. Some important internal parts of our body lie protected inside this cage.

Ask some friends to touch their toes without bending their knees. Starting from the neck, move your fingers downwards on the back of your friend. What you feel is the **backbone**. It is made up of many small bones (Fig. 8.10). The rib cage is joined to these bones.

Fig. 8.10 *The backbone*

If backbone was made up of only one long bone, will your friend be able to bend?

Make your friend stand with a hand pressed to the wall and try to push it. Do you notice two bones standing where the shoulders are? They are called **shoulder bones** (Fig 8.11).

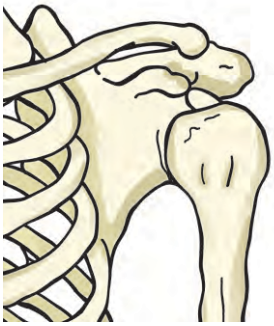


Fig. 8.11 *Shoulder bones*

Observe Fig. 8.12 carefully. This structure is made of **pelvic bones**. They enclose the portion of your body below the stomach. This is the part you sit on.

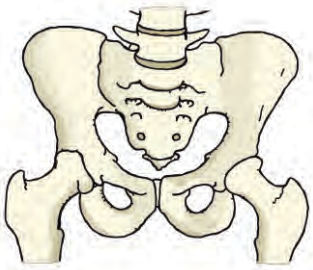


Fig. 8.12 *Pelvic bones*

The skull is made up of many bones joined together (Fig. 8.13). It encloses and protects a very important part of the body, the brain.

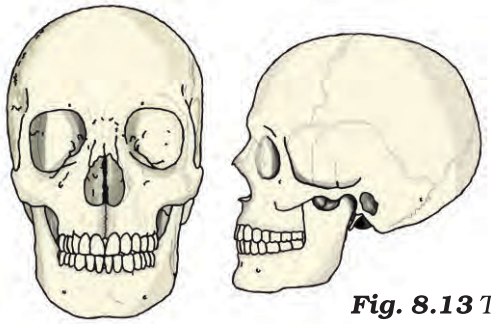


Fig. 8.13 *The skull*

We discussed many bones and the joints of our skeleton. There are some additional parts of the skeleton that are not as hard as the bones and which can be bent. These are called **cartilage**.

Feel your ear. Do you find any hard bony parts that can be bent (Fig. 8.14)? There do not seem to be any bones here, isn't it? Do you notice anything different between the ear lobe

Fig. 8.14 *Upper part of ear has cartilage*

Fig. 8.15 *The ear lobe*

and the portions above it (Fig. 8.15), as you press them between your fingers? You do feel something in the upper parts of the ear that is not as soft as the ear lobe but, not as hard as a bone, isn't it? This is cartilage**.** Cartilage is also found in the joints of the body.

We have seen that our skeleton is made up of many bones, joints and cartilage. You could feel, bend and move many of them. Draw a neat figure of the skeleton in your notebook.

We have learnt about the bones in our body and about joints that help us move in different ways. What makes the bones move the way they do? Let us find out.

Make a fist with one hand, bend your arm at the elbow and touch your shoulder with the thumb (Fig. 8.16). Do you see any change in your upper arm?

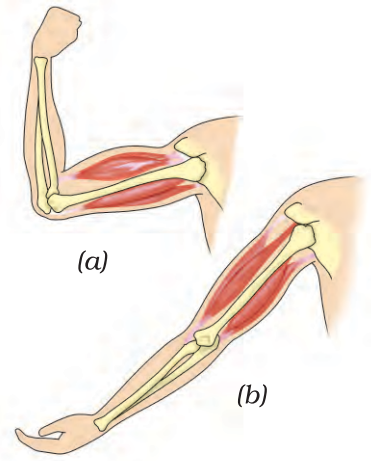


Fig. 8.16 *Two muscles work together to move a bone*

Touch it with the other hand. Do you feel a swollen region inside your upper arm? This is a **muscle**. The muscle bulged due to **contraction** (it became smaller in length). Now bring your arm back to its normal position. What happened to the muscle? Is it still contracted? You can observe similar contraction of muscles in your leg when you walk or run.

When contracted, the muscle becomes shorter, stiffer and thicker. It pulls the bone.

Muscles work in pairs. When one of them contracts, the bone is pulled in that direction. The other muscle of the pair relaxes. To move the bone in the opposite direction, the relaxed musle contracts to pull the bone towards its original position, while the first relaxes. A muscle can only pull. It cannot push. Thus, two muscles have to work together to move a bone. (Fig. 8.16)

Are muscles and bones always required for movement? How do other animals move? Do all animals have

bones? What about an earthworm or a snail? Let us study the manner of movement, that is, the gait of some animals.

8.2 "Gait of Animals"

Earthworm

Activity 5

Observe an earthworm moving on soil in a garden. Gently lift it and place it on a piece of blotting or filter paper. Observe its movement (Fig. 8.17). Then place it on a smooth glass plate or any slippery surface. Observe its movement now. Is it different from that on paper? In which of the above two surfaces do you find that the earthworm is able to move easily?

The body of an earthworm is made up of many rings joined end to end. An

Fig. 8.17 *Movement of earthworm*

earthworm does not have bones. It has muscles which help to extend and shorten the body. During movement, the earthworm first extends the front part of the body, keeping the rear portion fixed to the ground. Then it fixes the front end and releases the rear end. It then shortens the body and pulls the rear end forward. This makes it move forward by a small distance. Repeating such muscle expansions and contractions, the earthworm can move through soil. Its body secretes a slimy substance to help the movement.

How does it fix parts of its body to the ground? Under its body, it has a large number of tiny bristles (hair like structures) projecting out. The bristles are connected with muscles. The bristles help to get a good grip on the ground.

The earthworm, actually, eats its way through the soil! Its body then throws away the undigested part of the material that it eats. This activity of an earthworm makes the soil more useful for plants.

Snail

Activity 6

Collect a snail from a garden. Have you seen the rounded structure it carries on its back (Fig. 8.18)?

Fig. 8.18 *A snail*

This is called the shell and it is the outer skeleton of the snail, but is not made of bones. The shell is a single unit and does not help in moving from place to place. It has to be dragged along.

Place the snail on a glass plate and watch it. When it starts moving, carefully lift the glass plate along with the snail over your head. Observe its movements from beneath.

A thick structure and the head of the snail may come out of an opening in

the shell. The thick structure is its foot, made of strong muscles. Now, carefully tilt the glass plate. The wavy motion of the foot can be seen. Is the movement of a snail slow or fast as compared to an earthworm?

Cockroach

Activity 7

Observe a cockroach (Fig. 8.19).

Cockroaches walk and climb as well as fly in the air. They have three pairs of legs. These help in walking. The body is covered with a hard outer skeleton. This outer skeleton is made of different

Fig. 8.19 *A cockroach*

units joined together and that permits movement.

There are two pairs of wings attached to the breast. The cockroaches have distinct muscles — those near the legs move the legs for walking. The breast muscles move the wings when the cockroach flies.

Birds

Birds fly in the air and walk on the ground. Some birds like ducks and swans also swim in water. The birds can fly because their bodies are well suited for flying. Their bones are hollow and light. The bones of the hind limbs are typical for walking and perching. The

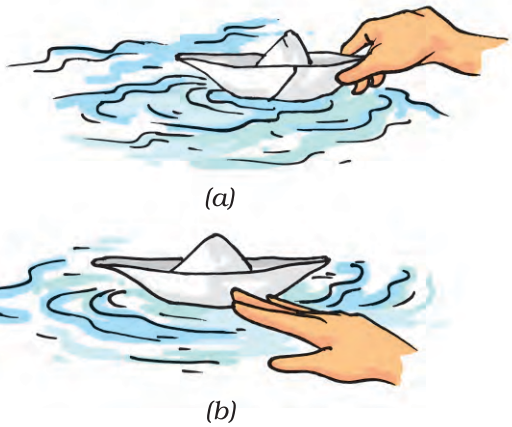
Fig. 8.20 *Skeleton of a bird*

bony parts of the forelimbs are modified as wings. The shoulder bones are strong. The breastbones are modified to hold muscles of flight which are used to move the wings up and down (Fig. 8.20).

Fish

Activity 8

Make a paper boat. Put it in water and push it with one narrow end pointing forward [Fig. 8.21 (a)]. Did it go into the water easily? Now hold the boat sideways and push it into the water from the broad side [Fig. 8.21 (b)]. Are you able to make the boat move in water when you push it from this side?



(a)

(b)

Fig. 8.21 *Playing with boats*

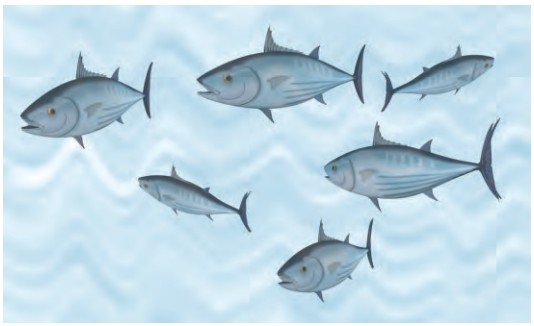


Fig. 8.22 *Fish*

Have you noticed that the shape of a boat is somewhat like a fish (Fig 8.22)? The head and tail of the fish are smaller than the middle portion of the body – the body tapers at both ends. This body shape is called **streamlined**.

The shape is such that water can flow around it easily and allow the fish to move in water. The skeleton of the fish is covered with strong muscles. During swimming, muscles make the front part of the body curve to one side and the tail part swings towards the opposite side. The fish forms a curve as shown in Fig. 8.23. Then, quickly, the body and tail curve to the other side. This makes a jerk and pushes the body forward. A series of such jerks make the fish swim ahead. This is helped by the fins of the tail.

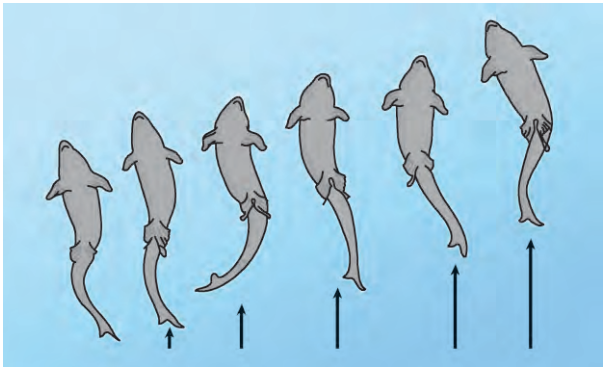


Fig. 8.23 *Movement in Fish*

Fish also have other fins on their body which mainly help to keep the balance of the body and to keep direction, while swimming. Did you ever notice that under water divers wear fin like flippers on their feet, to help them move easily in water?

How do snakes move?

Have you seen a snake slither? Does it move straight(Fig. 8.24)?

Snakes have a long backbone. They have many thin muscles. They are connected to each other even though they are far from one another. Muscles also interconnect the backbone, ribs and skin.

The snake's body curves into many loops. Each loop of the snake gives it a forward push by pressing against the ground. Since its long body makes many loops and each loop gives it this push, the snake moves forward very fast and not in a straightline.

We have learned about the use of bones and muscles for the movements of different animals. Paheli and Boojho have many questions in their sacks about the different movements in animals. So must you be having many unanswered questions buzzing in your

Fig. 8.24 *Movement in a snake*

minds? The ancient Greek philosopher Aristotle, in his book *Gait of Animals*, asked himself these questions. Why do different animals have the body parts that they do have and how do these body parts help animals to move the way they do? What are the similarities and differences in these body parts between different animals? How many body parts are needed by different animals for moving from place to place? Why two legs for humans and four for cows and buffaloes? Many animals seem to be having an even number of legs, why? Why is the bending of our legs different from that of our arms?

So many questions and perhaps we have looked for some answers through our activities in this chapter and we need to look for many more answers.

Key words

Backbone	Muscle
Ball and socket joint	Outer skeleton
Bristles	Pelvic bones
Cartilage	Pivotal joint
Cavity	Rib cage
Fixed joint	Shoulder bones
Gait of animals	Skeleton
Hinge joint	Streamlined

Summary

- Bones and cartilage form the skeleton of the human body. It gives the frame and shape to the body and helps in movement. It protects the inner organs.
- The human skeleton comprises the skull, the back bone, ribs and the breast bone, shoulder and hipbones, and the bones of hands and legs.
- The bones are moved by alternate contractions and relaxations of two sets of muscles.
- The bone joints are of various kinds depending on the nature of joints and direction of movement they allow.
- Strong muscles and light bones work together to help the birds fly. They fly by flapping their wings.
- Fish swim by forming loops alternately on two sides of the body.
- Snakes slither on the ground by looping sideways. A large number of bones and associated muscles push the body forward.
- The body and legs of cockroaches have hard coverings forming an outer skeleton. The muscles of the breast connected with three pairs of legs and two pairs of wings help the cockroach to walk and fly.
- Earthworms move by alternate extension and contraction of the body using muscles. Tiny bristles on the underside of the body help in gripping the ground.
- Snails move with the help of a muscular foot.

Exercises

1. Fill in the blanks:

   (a) Joints of the bones help in the _____ of the body.

   (b) A combination of bones and cartilages forms the _____ of the body.

   (c) The bones at the elbow are joined by a _____ joint.

   (d) The contraction of the _____ pulls the bones during movement.

2. Indicate true (T) and false (F) among the following sentences.

   (a) The movement and locomotion of all animals is exactly the same. ( )

   (b) The cartilages are harder than bones. ( )

   (c) The finger bones do not have joints. ( )

   (d) The fore arm has two bones. ( )

   (e) Cockroaches have an outer skeleton. ( )

3. Match the items in Column I with one or more items of Column II.

Column I	Column II
Upper jaw	have fins on the body
Fish	has an outer skeleton
Ribs	can fly in the air
Snail	is an immovable joint
Cockroach	protect the heart
	shows very slow movement
	have a streamlined body

4. Answer the following:

   (a) What is a ball and socket joint?

   (b) Which of the skull bones are movable?

   (c) Why can our elbow not move backwards?

THINGS TO THINK ABOUT

We discussed the many movements our bodies are capable of. Healthy bones, muscles, joints and cartilages are needed by the body for all these movements. Some of us suffer from conditions that could make these movements not so easy. In a whole class activity, try to find ways that one would manage everyday activities, if any one of our body movements was not possible. In Activity 1, for instance, you tied a scale on your arm and disabled the elbow movement. Think of other ways of restricting normal body movements and find ways that everyday activities could then be managed.

9 The Living Organisms and Their Surroundings

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

They tried to think of a place on Earth where there may not be any living creatures. Boojho thought of places near his home. Inside the house, he tried the cupboards. He had thought that there may not be any living organisms here, but he found one tiny spider in the cupboard. Outside the home too, there did not seem to be any place, he could think of, that did not have living creatures of some kind or the other (Fig. 9.1). Paheli started thinking and reading about far away places. She read that people have even found tiny living organisms in the openings of volcanoes!

Fig. 9.1 *Search for living organisms*

9.1 Organisms and the Surroundings Where They Live

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

in these different regions? Were they the same?

Activity 1

Let us start with a forest. Think of all the plants, animals and objects that can be found there. List them in Column 1 of Table 9.1. List things, animals and plants, found in the other regions that are also shown in the table. You can collect the examples scattered through this chapter to fill Table 9.1. Discuss also with your friends, parents and teachers, to find more examples to fill the tables. You can also consult many interesting books in libraries that talk of animals, plants and minerals of different regions.

Try and include many plants, animals and objects, big and small, in each of the columns in this table. What kind of objects will we find that may not be animals or plants? Perhaps parts of plants like dried leaves, or parts of animals, like bones. We may also find different kinds of soils and pebbles. Water in the oceans may have salts dissolved in it as discussed in Chapter 5. There could be many more objects.

As we go through the chapter, keep adding more examples to Table 9.1. We will discuss the table as we travel through many more interesting places.

9.2 Habitat and Adaptation

What do you find from the plants and animals listed in Activity 1? Did you find a large variety in them? Look at what you have entered in the column for the desert and the column for the sea in Table 9.1. Did you list very different kind of organisms in these two columns?

What are the surroundings like, in these two regions?

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

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

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

Table 9.1 Animals, plants and other objects found in different surroundings

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