

Preface



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ScienceSpark

Book 6



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1

Sources of Food



You will learn about

Can we survive without food? No, we cannot. Food is necessary for all living beings. We all need food to live.

Food is any substance that can be eaten or drunk by animals, including humans, for nourishment.



- Functions of food
- Different varieties of food present in our country
- Plant and animal sources of food
- Herbivores, carnivores, and omnivores

Protection: We need food to protect our body from diseases and keep it healthy.

Variety of food

‘What’s for dinner today, mom?’ You often ask your mother at home. Do you like to eat the same food every time?

Find out what your friends have got for lunch today.

You will find a variety of food in the lunch boxes of different students. We all eat different kinds of food at different times.

There is also a lot of variety in the food that people eat in different parts of our country. For example, pulses and chapattis are major food items eaten in the northern parts of India. Similarly, rice is eaten most in the southern and eastern parts of our country.

Functions of food

Food performs the following functions for our body.

Growth: Food is essential for growth.

Repair: We need food to repair the damaged cells and tissues, e.g., healing of wound.

Energy: We spend our energy when we work. That’s why after doing a lot of work we get tired. Thus, we need food to produce energy.



Fig 1.1 Variety of food

ACTIVITY 1

Given below are the names of some states. On a political map of India, identify the states and write down their names. Draw the major food items eaten in each state.

Punjab Maharashtra Goa 
 Jammu and Kashmir Tamil Nadu

The food item consumed most by people in a region is called the staple food.

In southern India, rice is the staple food of the people living there. Rice is used to make idli, dosa, curd rice, etc.

There is so much variety in the food that people eat across the country. Have you ever thought of what these food items are made of?

ACTIVITY 2

The column A below contains the names of some food items. Encircle the ingredients in column B which are required to make each food item.

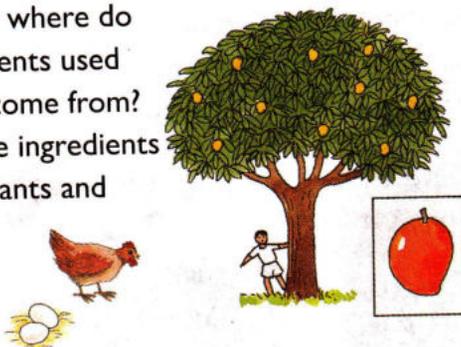
A	B
Soup	Water, fish, onion, rice, tomato, dal, milk, sugar, tea leaves, carrot, salt
Tea	Water, mint, onion, rice, tomato, dal, milk, sugar, tea leaves, carrot, salt
Idli	Water, fish, onion, rice, wheat, dal, turmeric, sugar, potatoes, carrot, salt
Fish curry	Water, fish, onion, rice, turmeric, dal, oil, sugar, ginger, carrot, salt
Ice cream	Water, fish, onion, rice, tomato, dal, milk, sugar, tea leaves, carrot, salt

Some food items are made of just one or two **ingredients** while others are made of many ingredients. An ingredient is one of the components or substances that is used to make a food item.

After doing Activity 2, you will observe that there are some ingredients which are common for most food items.

Sources of food

Do you know where do all the ingredients used in Activity 2 come from? Some of these ingredients come from plants and some from animals.



Write the sources of the ingredients that are listed below.

Ingredient	Source
Fish	
Onion	
Rice	
Tomato	
Dal	
Milk	
Sugar	
Tea leaves	
Butter	

Thus, we find that plants as well as animals are sources of food.

Plants as sources of food

Plants form a major source of food for animals including humans. Plants are called **producers** because they can prepare their food using carbon dioxide, water, and sunlight. They use only a small quantity of food for performing their activities. The rest of the food gets stored in different parts of the plants. These parts are eaten by us. Majority of food consumed by humans are seed-based food.

...now that's a fact

Scientifically speaking, the term *vegetable* does not exist. What you might consider to be vegetables, such as carrot, beet, corn, tomato, bean, radish, cabbage, broccoli, cauliflower, and celery, are edible plant parts like roots, seeds, fruits, leaves, flowers, or stems. Thus, the term *vegetable* is a non-scientific, all-inclusive term.

The parts of the plant which are safe to be eaten are known as edible parts.

Many parts of plants are eaten as food. Plant parts such as leaves, roots, stems, seeds, and fruits are edible.

Examples of different edible parts in different plants are:

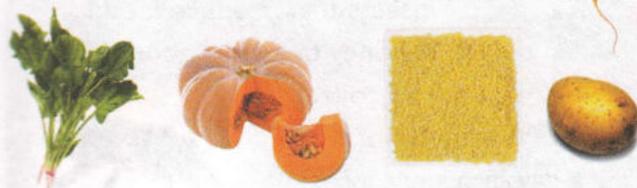
Leaves – spinach and lettuce

Roots – carrot and radish

Stems – potato and ginger

Fruits – pumpkin and tomato

Seeds – rice and wheat



Discuss with your partner some more edible plants and their parts.

Can you think of some plants in which more than one part is edible? One such example is mustard. All the plant parts except the root of the mustard plant are used as food. Seeds are used to extract oil whereas leaves, stem, and flowers are used to make a dish called *saag*. Think of some more examples of such plants.



Fig 1.2 Mustard field

You must have seen your mother adding spices like cumin, coriander, chilli, cardamom, ginger, saffron, fenugreek, fennel, clove, etc., while cooking food. These spices add flavour to our food. These are also different parts of plants.



Fig 1.3 Different spices

Names of some spices are given in the next page. Write the plant part which is edible in these spices.

Spice	Edible plant part
Chilli	
Black pepper	
Cinnamon	
Coriander	
Ginger	
Saffron	
Fenugreek	
Fennel	
Clove	

Food can also be obtained from non-green plants. These include edible fungi such as mushrooms.



Fig 1.4 Mushrooms

Sprouted seeds of some plants are used as food. These seeds are very nutritious and rich in protein.



Fig 1.5 Sprouts

ACTIVITY 3

To understand sprouting

Things required: A handful of moong or chana seeds, a piece of cloth, water

Method: Soak the seeds in water overnight. Next day drain the water, rinse the seeds in fresh water, and wrap it in a wet cloth. Leave it for one day.

Conclusion: You will see some white threadlike structures coming out of the seeds. These are sprouted seeds. This process is known as sprouting.

HIGHER ORDER THINKING SKILLS
HOTS

Perform Activity 3 with Bengal gram dal. Will the seeds sprout? Why or why not?



Animals as sources of food

Animals can be used as food either directly or indirectly.

Meat is an example of the direct product taken from an animal. Other food products obtained indirectly from animals are milk, cheese, butter, eggs, etc.



Fig 1.6 Food we get from animals

Another animal product used as a food is honey produced by honey bees. The honey bees make honey from nectar of flowers. The sweet juice present in the flowers is called the nectar. Bees collect and convert this nectar into honey and store it in their hive as food. The rearing of honey bees on a large scale is called *apiculture*.



Honey bees are the only insects that produce food for human beings. A honey bee visits about 2000 flowers in a day to collect nectar. What a lot of work for a day by a small insect!



Food habits of animals

Humans are dependent upon both plants and animals to meet their food requirements. You know that animals cannot prepare their own food. What do the animals eat then? Like humans, they are also dependent upon plants either directly or indirectly.

Different animals have different eating habits. Based on the food habits, animals are divided into three categories, herbivores, carnivores, and omnivores.

Herbivores

Some animals such as cows, deer, elephants, and horses eat only plants. They are called *herbivores* or grass-eating animals.



Fig 1.7 Herbivores

Carnivores

Some animals such as lions, wolves, eagles, and vultures eat only flesh of other animals. They are called *carnivores* or flesh-eating animals.



Fig 1.8 Carnivores

Omnivores

Some animals such as humans, bears, crows, and cockroaches can eat plants as well as animals. These animals are called *omnivores*.



Fig 1.9 Omnivores

Scavengers

Some carnivores and omnivores eat dead animals. These are known as *scavengers*. Crow, jackal, and hyena are some of the scavengers. Scavengers are very important for us because they help in keeping our surroundings clean.



Fig 1.10 A scavenger

Parasites

There are some very small animals which live on or inside other animals and get their food from them. These are known as *parasites*. Fleas, leeches, mosquitoes, and bed-bugs are some of the parasites.



Fig 1.11 Parasites

In the table given below, write the name of the food eaten by each animal.

Animal	Food
Hen	
Frog	
Insect	
Fox	
Bear	
Octopus	
Pig	
Rat	

Go Green

A **carbon footprint** is a measure to know how our day-to-day life activities impact the environment. The lesser the carbon footprints, the better would be the environment. Here are few ways of reducing our carbon footprint by changing our grocery-buying habits.

- Buy local fruits and vegetables. Fruits and vegetables from far away places have to be carried in trucks which run on fuel.
- Buy fruits and vegetables which are in season. Non-seasonal fruits and vegetables have to be stored in cold storages which use electricity.
- Reduce your consumption of meat if you are a non-vegetarian.
- Don't buy over-packaged products.
- Don't buy packaged drinking water if your tap water is safe to drink.

e



Food: any substance that can be eaten or drunk by animals, including humans, for nourishment

Staple food: a commonly or regularly eaten food in an area

Ingredients: substances that are used to make a particular food item

Edible: the parts of the plant which are safe to be eaten

Herbivores: animals that eat only plants

Carnivores: animals that eat only flesh of other animals

Omnivores: animals that eat both plants and animals

Scavengers: animals that eat dead animals

Parasites: animals that live on or inside other animals for food

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i



- Food is necessary for all living beings. We need food for energy, growth, repair of damaged body parts, and protection from diseases.
 - There is a lot of variety in the food that people eat in different parts of our country.
- Some food items are made of just one or two ingredients while others are made of many ingredients.
 - Food is obtained from both plants and animals.
 - Plant parts such as leaves, roots, stem, seeds, and fruits are edible.
 - Animals can be used as sources of food either directly or indirectly. For example, milk, meat, eggs, cheese, and honey.
 - Grass-eating animals are called herbivores. Flesh-eating animals are called carnivores. Animals eating both plants and animals are called omnivores.

▲ Put on your **THINKING CAP!**

I. Select the correct option.

- a) Which of the following food items is *not* obtained from plants?
- | | |
|---------------|-----------|
| i) honey | ii) sugar |
| iii) mushroom | iv) milk |
- b) The sources of products such as milk, curd, eggs, paneer, and ghee are
- | | |
|--------------|------------------|
| i) plants | ii) insects |
| iii) animals | iv) all of these |
- c) The two seeds which are most commonly used for sprouting are
- | | |
|---------------------------------|-----------------------------------|
| i) mustard and sunflower | ii) chana and mustard |
| iii) sunflower and <i>moong</i> | iv) <i>moong</i> and <i>chana</i> |
- d) Which of the following groups includes all herbivores?
- | | |
|------------------------------------|--|
| i) cow, bear, pig, and squirrel | ii) humans, bear, goat, and squirrel |
| iii) pig, goat, squirrel, and bear | iv) squirrel, cow, goat, and grasshopper |
- e) Cockroach, dog, bear, and humans are
- | | |
|---------------|----------------|
| i) herbivores | ii) carnivores |
| ii) omnivores | iv) scavengers |
- f) Plants are known as
- | | |
|------------------|----------------|
| i) consumers | ii) producers |
| iii) decomposers | iv) scavengers |
- g) Majority of food consumed by humans is
- | | |
|-----------------|-----------------|
| i) meat-based | ii) fish-based |
| iii) seed-based | iv) fruit-based |

- h) What are spices?
- i) they are staple food of southern India
 - ii) they are required to repair the damaged cells
 - iii) they are essential for growth of the body
 - iv) they add flavour to our food

2. State the following as true or false and correct the false statements.

- a) The fruits of carrot plants are eaten.
- b) The root of bamboo is edible.
- c) Meat is a direct animal product.
- d) Sprouts are made by germination of leaves.
- e) Mushroom is an animal.
- f) Honey is a plant product.
- g) Animals cannot prepare their own food.
- h) Omnivores are the animals that eat both plants and animals.
- i) Grass-eating animals are called parasites.
- j) Scavengers help us to keep our surroundings clean.

3. Fill in the blanks.

- a) Food protects us from _____.
- b) Parts of plants which are safe to eat are called _____ parts.
- c) For sprouting, _____ of the plant is used.
- d) The sweet juice of the flower is called _____.
- e) Based on food habits, animals are divided into _____ categories.
- f) _____ are animals that eat both plants and meat.
- g) _____ are small animals dependent on other animals for their food.
- h) _____ help us to keep our surroundings clean.
- i) Some non-green plants called _____ are edible.
- j) _____ get their food from other animals by living on or inside them.

4. Write the analogy.

- a) Cow : Herbivore :: Human : _____
- b) Snail : _____ :: Butterfly : Plant juice
- c) _____ : Lizard :: Lizard : Frog
- d) Carrot : Root :: _____ : Leaves
- e) Sugar : Plants :: Honey : _____

5. The names of some plants with edible plant parts are given below. Unscramble them to get the names of the plants.

- a) Edible leaves – BGECAABA, ETCELTU
- b) Edible roots – PTUNIR, TEWES TATOPO
- c) Edible stem – IGRENG, TATOPO
- d) Edible fruits – GTEMEAAPRON, PLEPA

6. Write short answers.

- a) Why is it important to eat food?
- b) Define the following terms. Give one example for each.
 - (i) Herbivores (ii) Carnivores (iii) Omnivores
- c) How are scavengers different from parasites?
- d) How are scavengers useful for human beings?

7. Write answers in detail.

- a) Define 'food'. What are the functions of food?
- b) A vegetable seller has carrots, potatoes, pumpkins, and peas in his shop. Which part of these vegetables do we eat? Draw the diagram of each vegetable.
- c) Animals are sources of food. Explain with examples.

Extended learning

Observe and name the insects/animals found in your house. Write down what they eat and into what category they can be placed, based on their food habits. Are they of any use to you?

HIGHER ORDER THINKING SKILLS
HOTS

- 1. Sprouted seeds provide more nourishment than non-sprouted seeds. Give reasons.
- 2. Ankit falls sick very often. What could be the reason for his sickness?
- 3. Seema took boiled black grams and wrapped them in a wet cloth for sprouting. Would those seeds sprout? Why or why not?
- 4. Raju soaked *chana* seeds overnight in water. Next day, he wrapped them in a wet cloth. He does not know if the seeds have sprouted. How will you help him to know if the seeds have sprouted?



For more information
<http://www.vtaide.com/png/foodchains.htm>



Components of Food

All living organisms need food, but they show variation in the kind of food items they eat. However, these food items are alike in one important way—they all contain nutrients. *Nutrients are the substances that living beings need to live and grow.* The energy from nutrients is the fuel that is used by the body for various activities. These nutrients are used for growth and general upkeep of the body.

Types of nutrients

There are five main types of nutrients. These are carbohydrates, fats, proteins, vitamins, and minerals.

These nutrients perform different functions and are found in a variety of food.

Carbohydrates

Carbohydrates are the main source of energy to our body. Sugar and starch are the two important carbohydrates found in our food.

Carbohydrates are divided into two groups—simple carbohydrates and complex carbohydrates.

Simple carbohydrates are also known as *sugars*. Sugars are found in fruits like apples, grapes, plums, bananas, and pears. Honey also contains sugar. Sugar is also added in sweet food items like biscuits and candies.



You will learn about

- Types of nutrients
- Carbohydrates, fats, proteins, vitamins, and minerals
- Functions of each nutrient
- Simple food tests to identify the presence of nutrients
- Balanced diet
- Deficiency of specific nutrient(s)
- Deficiency diseases



Fig 2.1 Food rich in simple carbohydrates

Complex carbohydrates are made of several sugar molecules linked together in a chain. *Starch* is a complex carbohydrate found in food items such as rice, cornflakes, breads, noodles,



Fig 2.2 Food rich in complex carbohydrates

pasta, chapattis, potatoes, and sweet potatoes. Complex carbohydrates need to be broken into simple carbohydrates for digestion, e.g., starch needs to be broken into simple sugar, that is why bread tastes sweet after chewing.

Testing the presence of starch We can test the presence of starch in a food item by the following method.

Take two test tubes and mark them as A and B. Put starch solution in test tube A and water in test tube B. With the help of a dropper, put a few drops of iodine in both test tubes.

Do you observe any changes in the two test tubes?

You will notice that the starch solution turns blue black whereas water becomes yellowish, which is the colour of iodine solution.

During digestion, the carbohydrates break down into simple sugars. The sugar is absorbed by the blood and is transported to the cells. During respiration, a cell breaks down the sugar molecules to release energy. This energy is used by the cells to carry out different functions inside our body. The energy released is measured in terms of *calories*.

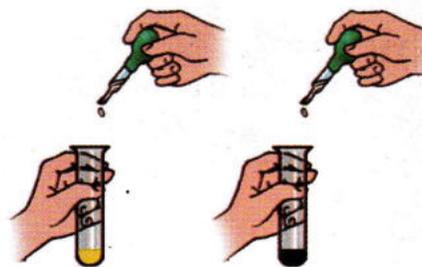


Fig 2.3 Test for starch

The following table shows the average calorie requirement of people in different age groups.

Table 2.1

Age group	Calorie requirement
10–12-year old child	2000 calories per day
12–14-year old girl	2200 calories per day
14–16-year old boy	2600 calories per day
15–18-year old girl	2600 calories per day
15–18-year old boy	3000 calories per day
A grown-up man	2500–4000 calories per day
A grown-up woman	2000–3000 calories per day

ACTIVITY 1

Perform the test to determine the presence of starch in the food items listed below. Record your observations. (You can make paste of the food items with water.)

Food item	Colour change	Presence/absence of starch
Potato		
Bread		
Cucumber		
Onion		
Cooked rice		
Powdered rice		
Tomato		
Flour		



A can of fizzy drink may contain about 6 or 7 teaspoons of sugar.

Fats

Like carbohydrates, fats too provide energy to us. They are considered as a storehouse of energy. In fact, fats provide almost double the amount of energy as compared to carbohydrates. Fats stored in the body act as insulation to keep the heat inside our body. They are found in food items like oil, butter, ghee, and nuts.



Fig 2.4 Food rich in fats

Testing the presence of fats We can test the presence of fat in a food item by the following method.

Take a brown paper and draw a line to divide it into two sections. Put a drop of any cooking oil in one section and a drop of water in the other section. Allow the paper to dry. Hold the paper towards a source of light and look for a translucent spot. Do you find it in both the sections?

The appearance of a translucent spot in the section where you put oil shows the presence of fat in the substance tested.

Proteins

Proteins are the main building materials of cells inside our body. They provide our body with materials for cell growth. They also repair the damaged and worn out tissues. Meat, fish, eggs, peas, beans, milk, and pulses are some rich sources of proteins.



Soya bean is the richest source of plant protein.



ACTIVITY 2

Test the presence of fats in the following food items and record your observations.

Food item	Appearance of translucent spot	Absence of translucent spot	Presence/absence of fats
Butter			
Ghee			
Cucumber			
Onion			
Hair oil			
Potato			
Peanut			
Flour			



Fig 2.5 Food rich in proteins

ACTIVITY 3

(To be demonstrated by the teacher)

Things required: Egg white, dilute nitric acid, test tubes

Method: Put a small quantity of egg white in a test tube. Add a few drops of dilute nitric acid (HNO_3) in it and heat.

Observation: It turns yellow.

Conclusion: It shows the presence of protein in egg white.

Vitamins

Vitamins are nutrients that are required by our body in small amounts. They are substances with no energy value but are needed every day for good health and proper growth. Vitamins help in various chemical reactions taking place inside our body.

Most vitamins are made by green plants. They are found in many food items but there is no single food item that contains all the vitamins. To fulfill our requirement of all the vitamins, we need to eat a variety of foods.

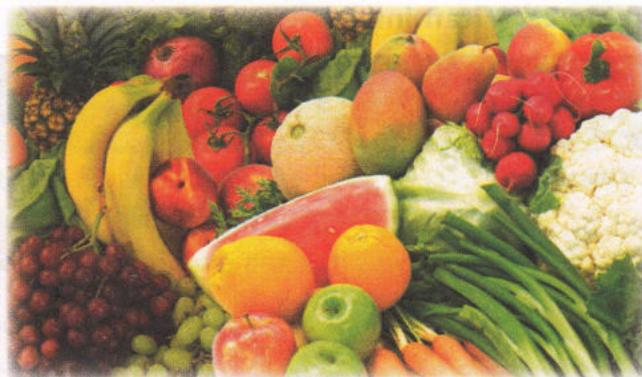


Fig 2.6 Food rich in vitamins

Vitamins are divided into two groups based on the material in which they dissolve: fat soluble and water soluble.

Fat-soluble vitamins dissolve in fat before being absorbed into the blood. They are stored in our body and used whenever the body needs them. As they are stored in the body, we do not need them every day in our diet. Vitamins A, D, E, and K are examples of fat-soluble vitamins.

Water-soluble vitamins dissolve in water and are not stored in our body. We need a continuous supply of these vitamins in our diet. Vitamins B and C are examples of water-soluble vitamins.

Some vitamins like vitamin C can be destroyed due to heat. We should, therefore, include some raw food like fruits and vegetables containing these vitamins in our diet.

In a similar way, some vitamins may also get lost during washing of fruits and vegetables. We should, therefore, take care to wash fruits and vegetables before they are cut.

Table 2.2 mentions some important vitamins, their functions, diseases which can occur due to deficiency of these vitamins, and their sources.

Table 2.2 Vitamins

Vitamins	Uses	Deficiency disease	Sources
Vitamin A	For good eyesight, provides resistance to infections, keeps hair and the skin healthy	Night blindness— not able to see clearly in dim light	Yellow- and orange-coloured fruits (papaya, mango) and vegetables (carrot, pumpkin), green leafy vegetables, fish liver oil, liver, whole milk products (yogurt, cream, butter, and ghee)
Vitamin B	Helps in digestion, proper functioning of the heart and nerves	Beriberi	Grains like rice and whole wheat, green leafy vegetables, peas, milk, eggs, fish, poultry
Vitamin C	Helps in healing wounds, builds resistance to common cold, and maintains healthy gums	Scurvy—swelling and bleeding of gums	Gooseberry (amla), lemon, orange, grapes
Vitamin D	Keeps the bones and teeth healthy and strong	Rickets—soft bones	Exposure to sunlight activates synthesis of vitamin D beneath the skin. Foods like milk and butter are rich sources
Vitamin E	Keeps the skin healthy	Skin and reproductive system is affected	Nuts like almond, egg yolk, wheat germs, vegetable oils, green leafy vegetables
Vitamin K	Required for normal blood clotting	Haemorrhage	Green leafy vegetables, wheat bran, cheese, egg yolk

ACTIVITY 4

Take one tablet each of vitamins A, B, C, and E. Put them in four test tubes containing water. Note the vitamins which are soluble in water.

Minerals

Minerals too, like vitamins, are needed in small quantities and have no energy value. Minerals provide material for the growth and development of the bones and teeth, growth

of cells, and formation of red blood cells. They are also important for proper functioning of the circulatory system and the nervous system. Table 2.3 shows some minerals, their functions, diseases which can occur due to deficiency of these minerals, and their sources.

ACTIVITY 5

Take a packet of oral rehydration solution (ORS) from a chemist's shop. Make a list of all the minerals present in it. Why do you think it is given to people suffering from diarrhoea and vomiting?

Table 2.3 Minerals

Minerals	Uses	Deficiency disease	Sources
Calcium	Required for strong bones and teeth	Rickets—soft bones	Milk, milk products, tofu, leafy vegetables, legumes
Phosphorus	Required for the development of bones and teeth	Bad teeth and weak bones	Milk, meat, nuts, beans, grains
Iron	Forms haemoglobin which carries oxygen to all the cells of the body	Anaemia	Meat, green leafy vegetables, dried dates
Sodium and Potassium	Essential to maintain the water balance in body, proper functioning of muscles and nerves, healthy bones	Muscle cramps	Common salt, sea food, cereal, pulses, vegetables, fruits

Infobit Camel's milk, which is widely drunk in Arab countries, has 10 times more iron than cow's milk.

Besides carbohydrates, fats, proteins, vitamins, and minerals, our body needs water and roughage. Although they do not have any nutritive value, yet they are extremely important for good health.

Water

Water is the most abundant substance in our body. About 70 per cent of the human body is made up of water. Almost 90 per cent of our blood is composed of water. Water helps in eliminating waste in the form of sweat and urine from the body. The chemical changes that take place in the body use water as the medium. It regulates the body temperature. Water is found in most foods. One needs to drink about two litres of water every day.

ACTIVITY 6

Things required: 100 grams each of cucumber, onion, brinjal, wheat, and rice grains

Method: Spread all the items separately on a sheet of paper and keep in the sunlight for a few days till all the food items are completely dry. Weigh them again.

What is the weight loss? Which food item has the maximum water content?



Infobit An average adult loses about 2-5 litres of water each day. Only one litre of water is replaced by drinking water and other fluids. The remaining amount is replaced by eating food that contains water.

Roughage

Roughage is the dietary fibre present in the food we eat. It is the part of the food that is not digested by the human digestive system. Yet, it plays an important role in keeping the digestive system healthy. It helps the food move through the digestive tract. It helps in the bowel movement and prevents constipation. Roughage adds bulk to the food and thus satisfies your appetite. Vegetables like spinach, cabbage, cucumber, pulses, and cereals with seed coats are rich sources of roughage.

Balanced diet

Different food items contain different nutrients. To get all the nutrients that are necessary for our body, we have to eat a variety of food items. A diet that contains sufficient quantities of all the nutrients that are required for proper growth and functioning of the body is called a *balanced diet*.

The requirement of nutrients differs from one individual to another. It depends on factors like age, gender, health condition, and level of activity of a person. For example, a labourer needs more carbohydrates and fats in comparison to a person doing routine office work. A growing child needs more proteins than an old person. A teenager needs more energy than a baby.

Malnutrition

Different foods supply different amounts of energy. Every activity of the body uses some amount of energy. A person taking a balanced diet will generally take in the same number of calories as are used up. Such a person maintains a good health condition and his or her weight will generally remain constant.

An improper diet may, however, cause an imbalance in the amount of nutrients required by the body and the amount that is received. This may give rise to a condition called

malnutrition. Malnutrition may be caused by both *undernutrition* and *overnutrition*.

For example, if a person takes in food that contains more calories than are used up by his body, he gains weight and may become obese. *Obesity* is a condition in which the weight of a person is at least 10 per cent more than the normal weight for his or her height. Such people have a higher risk of getting a heart attack.

Eating too little food, on the other hand, leads to weight loss, weakness, restlessness, and lethargy. This normally happens when people start dieting and do not eat properly.



(a) An obese man



(b) An underweight child

Fig 2.7

Deficiency diseases

Improper intake of nutrients over a long period of time leads to deficiency of these nutrients in our body. The deficiency of essential nutrients in our body may cause certain diseases called *deficiency diseases*.

Deficiency of protein in diet causes stunted growth, swelling of face, discolouration of hair, skin diseases, and diarrhoea. Find out the name of the disease.

Deficiency of carbohydrates in diet causes a person to become very thin and weak.

Deficiency of minerals and vitamins also causes certain diseases. Tables 2.2 and 2.3 show the

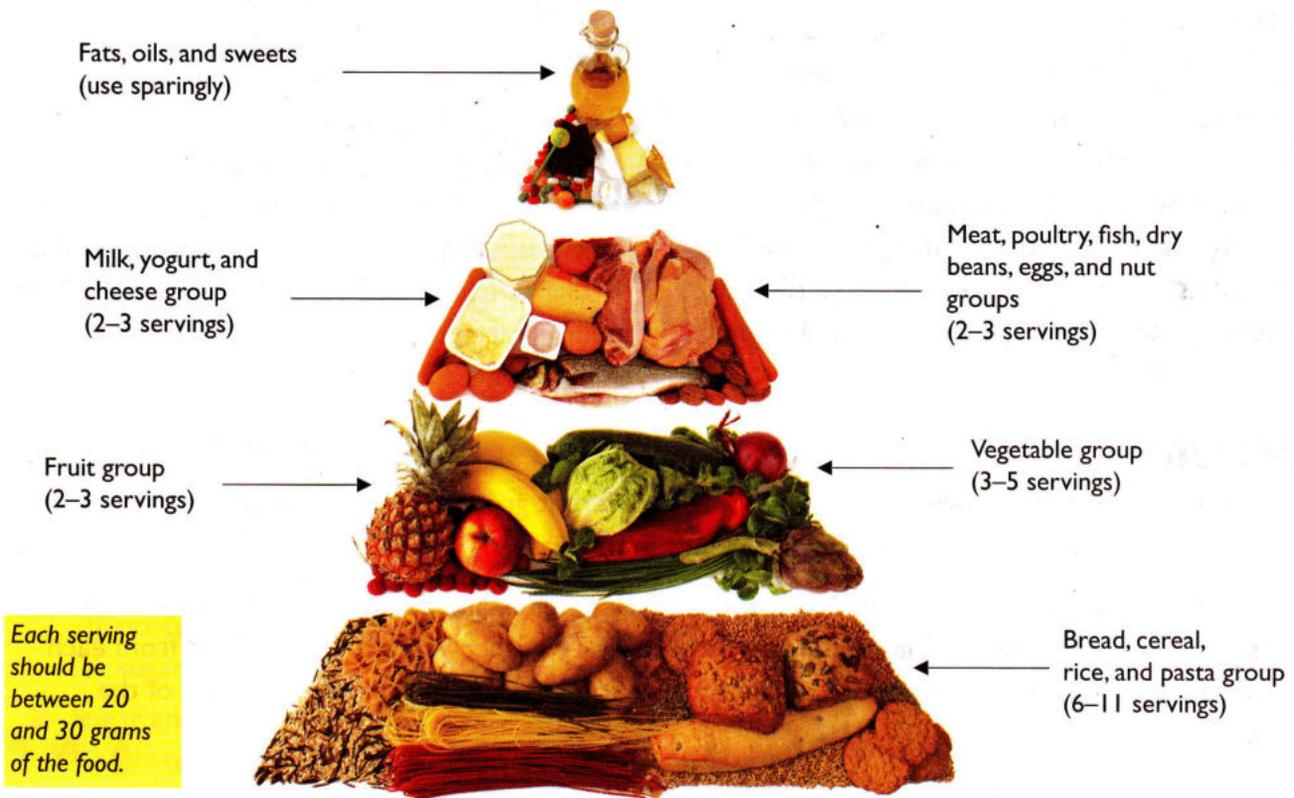


Fig 2.8 Food pyramid

diseases caused by deficiency of important minerals and vitamins.

Food pyramid

A food pyramid is a diagrammatic representation of food classified into six groups. It shows how many servings from each group should be eaten everyday to maintain a balanced diet.

Grain group

Grain group is present at the base of the food pyramid. This group includes food items like cereals, oats, whole wheat breads, pastas, brown rice, white rice, and other whole grains which supply carbohydrates and dietary fibre—roughage. One can have 6–11 servings per day from this group.

Vegetable and fruit groups

Fruit and vegetable groups form the next level of the food pyramid. These groups contain plant parts like the stem, root, flower, and fruit.

Different vegetables contain different types of minerals and vitamins. So, one should consume a variety of vegetables.

Fruits are sources of natural sugar, roughage, and vitamins.

3–5 servings of vegetables and 2–3 servings of fruits are recommended every day.

Milk group

It forms the third level of the pyramid. All the dairy products like milk, yogurt, and cheese are the major components of this group. These products are rich in phosphorus and calcium.

Meat group

Meat group is also at the third level of the food pyramid along with the milk group. Eggs, meat, fish, and poultry are important components of this group. Non-meat foods such as peas, beans, pulses, and lentils too are a part of this group. 2–3 servings of cooked items from this group are recommended.

Fats and sweets

Fats and sweets form the tip of the pyramid. The foods in this part of the pyramid should be eaten sparingly because they provide calories but not much nutrition. These foods include salad dressings, oil, cream, butter, margarine, sugar, soft drinks, sweets, and desserts. In fact, foods in other groups already contain fats and sugars.

So, limited quantities of fats and sugars should be consumed.

Each group contains some of the nutrients that are needed by the body. By taking the proper amount of food from each group, the body gets all the nutrients that it needs for a balanced diet. Eating a healthy diet is a little easier if you base your choices on the food pyramid.



ACTIVITY 7

- Make a nutritious sandwich that has food from different groups. Write the ingredients and the recipe. Share your sandwich with your friends in the class.
- Make a list of foods you had yesterday for breakfast, lunch, and dinner. Do not forget to include snacks eaten in between the two meals. Now, check whether you ate enough food from each food group. Make a food pyramid by placing each food item at the appropriate level of the pyramid.



Let's Talk

Compare your food pyramid with that of your friend in the class. Discuss whether you are eating a balanced diet by consuming enough servings from different levels of the pyramid. If required, suggest changes that would make it a balanced diet.



Nutrients: the substances needed for growth and proper functioning of the body

Balanced diet: a diet containing the right quantity of all the nutrients as per the age, gender, and type of work of an individual

Food pyramid: a diagrammatic representation of food classified into six groups that guides you to eat a balanced diet

Deficiency diseases: the diseases caused due to lack of essential nutrients in the body



- Nutrients are the substances present in food that living beings need to live and grow.
- Carbohydrates and fats provide energy; proteins provide materials for growth and repair.
- Vitamins and minerals help the body to function normally and keep it healthy.
- Water and roughage although essential for health have no nutritive value.

- A balanced diet provides the body with the required amounts of all the basic nutrients.
- Balanced diet depends on age, work, and gender of an individual.
- Lack of vitamins and minerals leads to deficiency diseases.
- The food pyramid helps us in planning a balanced diet.
- The basic food groups—grain group, fruit and vegetable groups, milk and meat groups, and fats and sweets group are present at different levels of the food pyramid. Appropriate servings from each group help us consume a balanced diet.



Put on your **THINKING CAP!**

I. Choose the correct option.

- The nutrient used for growth and repair of cells is
 - protein
 - carbohydrate
 - sugar
 - fat
- Sugar and starch are
 - proteins
 - fats
 - carbohydrates
 - vitamins
- Dilute nitric acid is used to test the presence of
 - sugar
 - starch
 - minerals
 - proteins
- Which of the following food items has high protein content?
 - apple
 - orange
 - fish
 - onion
- When iodine solution turns blue black, it shows the presence of
 - sugar
 - minerals
 - starch
 - vitamins
- This vitamin helps in maintaining healthy gums.
 - vitamin A
 - vitamin K
 - vitamin D
 - vitamin C
- It is an important component of food but has no nutritive value.
 - vitamin C
 - calcium
 - water
 - fat
- This mineral is required to form haemoglobin.
 - iron
 - calcium
 - phosphorus
 - sodium
- Calcium and phosphorus are required for
 - healthy teeth and bones
 - long and black hair
 - forming haemoglobin
 - healthy nerves and muscles
- This food item has more roughage.
 - sea food
 - milk
 - banana
 - cabbage

2. Match the nutrients with the food items.

Nutrients

carbohydrates
fats
proteins
vitamins
minerals

Food items

fish
gooseberry
green vegetables
ghee
noodles

3. Find the odd one out. Give reasons.

- a) Proteins, carbohydrates, fats, vitamins, milk
- b) Rice, wheat, soybean, noodles, bread
- c) Meat, egg, beans, spinach, milk
- d) Butter, cucumber, oil, ghee, almonds
- e) Iron, sodium, potassium, iodine, vitamin A

4. Fill in the blanks.

- a) _____ are body building nutrients.
- b) _____ get stored in the body to provide energy if required later.
- c) Starch and sugar are examples of _____.
- d) Fresh fruits contain plenty of _____.
- e) Eggs and fish are rich in _____.
- f) _____ and _____ have no nutritive value but are essential for good health.
- g) _____ and _____ are needed for strong bones and teeth.
- h) _____ is needed for red blood cells.
- i) Lack of vitamin _____ causes rickets.
- j) Lack of vitamin C causes _____.

5. Name three foods rich in

- a) fibre _____, _____, _____
- b) sugar _____, _____, _____
- c) fats _____, _____, _____
- d) starch _____, _____, _____
- e) protein _____, _____, _____

6. Name the food needed

- a) for strong bones _____
- b) to avoid scurvy _____
- c) to avoid constipation _____
- d) for warmth _____
- e) for growth _____

7. Write short answers.

- a) What are nutrients?
- b) List the four main nutrients which the body needs.

- c) How is water important for the body? Give three points.
- d) What is a balanced diet?
- e) Name the water-soluble and fat-soluble vitamins.
- f) What might happen if you do not consume a variety of food items?
- g) What might happen if you consume more calories than your body needs?
- h) Is the balanced diet for a labourer and a child the same? Justify your answer by giving reasons.
- i) Why is roughage extremely important even though it has no nutritional value?

8. Write answers in detail.

- a) List the main functions of carbohydrates, fats, and proteins.
- b) How is the presence of protein tested in a food item?
- c) i) What is malnutrition? What are its types?
ii) What are deficiency diseases? Mention three of them and how they occur.

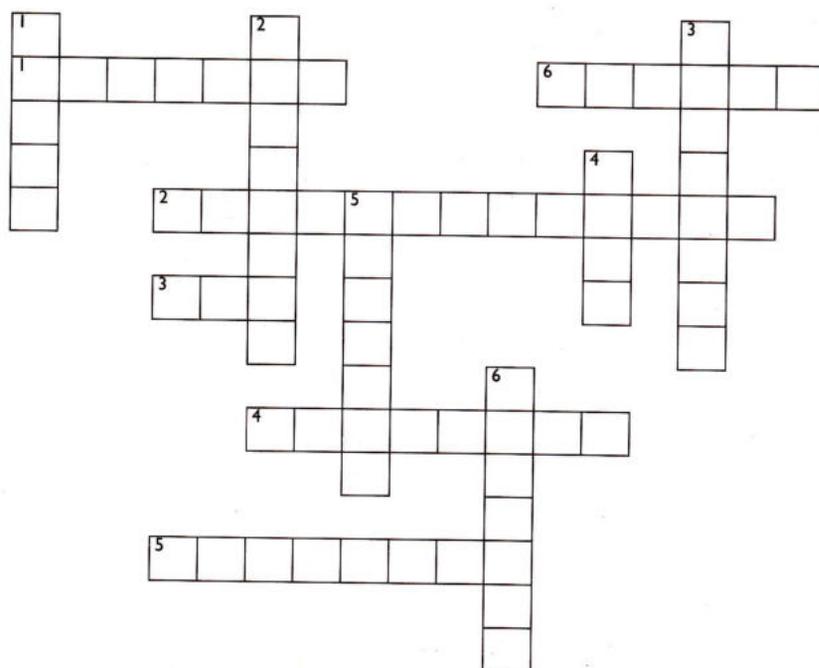
9. Complete the crossword with the help of the clues provided.

Across

- 1. Deficiency of iron causes this disease.
- 2. It is the main source of energy.
- 3. It is a rich source of fat used in cooking.
- 4. Some of these are water soluble and some are fat soluble.
- 5. It prevents constipation by adding bulk to the food.
- 6. Deficiency of vitamin C causes this disease.

Down

- 1. It is the medium of all chemical reactions in the body.
- 2. It is needed in small quantity.
- 3. It is needed for growth.
- 4. Provide twice the amount of energy as compared to carbohydrates.
- 5. Overweight leads to this condition.
- 6. Deficiency of calcium and phosphorus causes this disease.



Extended learning

1. Take raw potatoes, boiled potatoes, baked potatoes, potato chips, and fried potatoes. Rub a small amount of each type of potatoes on a brown paper. Write the type of potato below the spot. Wait for five minutes for the spot to dry. Hold the paper towards the light and record your observation. Which types of potatoes contain maximum fat? Which type of potato is healthiest to eat? Why?
2. To interpret the nutrition information listed on packets of food, take small packs of three different cereals. Make a data table with various headings like Proteins, Carbohydrates, Fats, Vitamins, and Minerals. Compare the nutritional values of the three foods. Which is the most nutritious? Can reading food labels help you to plan a balanced diet?

HOTS

1. Krishan goes to work by his cycle. He does a lot of physical work in the office. He takes six chapattis with him for lunch. Why?
2. Sneha is eight years old. Her mother makes sure that she eats pulses every day. Why?
3. Rahul eats french fries, fried burgers, cakes, and chocolates every day. He watches television and plays computer games for three hours. What are the dangers to his health?
4. Rekha was diagnosed with rickets. Name the symptoms the doctor must have observed in her. What type of diet should she take to recover from the disease?
5. The foods in the grain group are placed at the bottom of the food pyramid. Why?
6. Ankit's mother cuts vegetables and then washes them before cooking. Is this a good practice? Explain why.
7. Maria takes vitamin A and E pills every day without doctor's advice. Is this good for her health? Explain.





Fibre to Fabric

The story of clothing material

You must have watched the cartoon show called 'The Flintstones.' It is about two families during the Stone Age. What clothes did Fred and his friend Barney wear?

People at that time wore skin or fur of animals and bark or leaves of trees. Later on as they began to settle down at a place and started agriculture, they learnt how to twist grass and vines, and animal fleece into long strands and weave them into cloth.



In India and Africa, people wrap a large piece of cloth around themselves in various ways, like a sari in India or a kanga in Africa.

The sewing needle was invented about 40,000 years ago. After its invention people learnt how to stitch a fabric into clothes.

Variety of fabrics

There are many varieties of fabrics. People choose these fabrics depending on the climate of the place they live in.



You will learn about

- The variety in fabrics
- Natural and synthetic fabrics
- Fabrics made from plants and animals
- Processes related to fabrics



Fig 3.1 Kanga



Fig 3.2 Sari

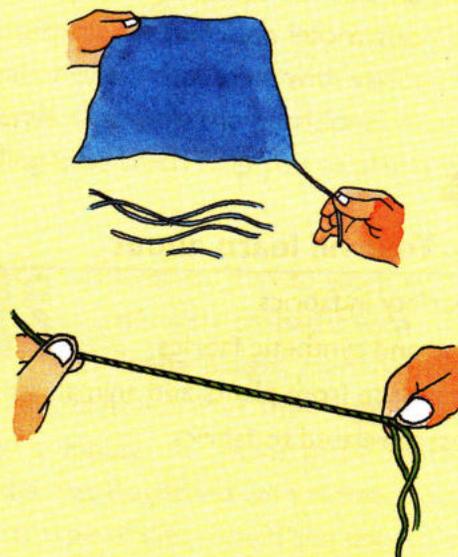
Fabric is the material which is used to make clothing or household articles. If you go to a shop to buy fabric for your dress, you would find a variety of fabrics there. The shopkeeper will show you cotton, silk, woollen, and polyester fabrics to choose from.

Do you know what these fabrics are made of?



ACTIVITY 1

Take a cloth and using a needle pull out a thread from it. Untwist to loosen its end. What do you see?



In the above activity, you will see that a thread is made up of smaller threads or hair-like strands. Pull out one of these strands.

This single hair-like strand is called a *fibre*. All fabrics are made of fibres.

Based on their length, fibres can be classified into two types—filament fibres and staple fibres. The fibres which are short in length are called staple fibres. Cotton fibre is one such example. The fibres which are long in length are called filament fibres. All man-made fibres are filaments. Nylon fibre is an example of a filament fibre.

Sources of fibres

Fibres differ in their origin. Some fibres are obtained from natural sources, i.e., plants and animals. Fibres from such sources are called *natural fibres*. Cotton, jute, coir, silk, and wool are examples of natural fibres.

Cotton is obtained from the seed pods of the cotton plants, jute is obtained from the stem

of the jute plants, and coir is obtained from the outer covering of the coconut fruit.

Silk is obtained from the cocoon of the silkworm and wool is obtained from the fleece of goat, sheep, or lamb. Wool is also obtained from the hair of rabbit, camel, llama, and yak.



(a) Yak



(b) Llama

Fig 3.3 Sources of animal fibres

With the passage of time man learnt to make fibres from sources other than plants and animals. These fibres are made from chemical substances and are called *man-made* or *synthetic fibres*. Rayon, polyester, nylon, and acrylic (cashmilon) are examples of synthetic fibres.

Advantages of synthetic fibres

You must have noticed that cotton shirts tear faster than nylon shirts. This is because nylon fibres are stronger than cotton fibres.

Fabrics made from synthetic fibre dry faster and do not get wrinkled.

One disadvantage of using these fabrics is that they contain less air space between their fibres and therefore do not absorb sweat. So, we cannot wear clothes made of synthetic fabric in hot and humid weather.



ACTIVITY 2

Take any cloth made out of cotton and another made out of nylon. Soak them in water, wring them out, and dry them in the Sun. Make a note of the time you start. How long did it take for them to dry?



The first man-made fibre was rayon, which was produced in the latter part of the 19th century.

At times, synthetic fibres are mixed with natural fibres like cotton and wool to weave a fabric. One such fabric is called *polycotton*. It is a mixture of polyester and cotton. The polycotton fabric has strength, can absorb sweat, and does not get wrinkled fast.

Production of plant fibres

Jute

Jute fibre is obtained from the stem of the jute plant which grows best in both sandy and clayey soils. West Bengal, Bihar, and Assam are the major jute producing states in India.

Jute is sown in the rainy season and harvested after six months when the plant starts to flower. After harvesting, the stems are tied in bundles and soaked in water for two to three weeks. This process is called *retting*. Once the retting is complete, the softened fibres are removed from the stem by hand. The fibres are then washed under clean running water and hung up or spread out for drying.

Jute fibre is used to make a number of things like ropes, bags, carpets, door mats, ornamental toys, wall hangings, and footwear.



Fig 3.4 Jute plant and the items made of jute

Coir

Coir fibre is obtained from the outer covering of the coconut fruit that grows on the coconut palm. The outer covering of the coconut is called *husk*.

To obtain coir fibres, the husk is removed from coconut and soaked in water for up to ten months. The softened husk is then beaten to get the coir fibres. The golden coir fibres are then spun into yarns.

These yarns are used to make mats, floor coverings, garden articles, aquarium filters, ropes, etc.

India and Sri Lanka are world's major producers of coir fibre.



Coconut palm tree bearing the coconut fruit

▲ Where do coconut palms grow in India? What type of soil do they need?

Cotton

Cotton is a soft fibre obtained from the seed pods of the cotton plant. Cotton plant grows best in black soil and warm climate.

Cotton seeds are planted in the spring season. When the plant matures, it starts flowering, the flowers develop into spherical walnut-sized fruits or seed pods called *bolls*. Seeds are present inside cotton bolls. Each boll matures and the cotton fibres on seeds grow to their full length. When the boll ripens, it splits open to reveal the seed with cotton fibres on it.



The world's leading jute producing countries are India, Bangladesh, Nepal, China, and Thailand. India is the world's largest producer of raw jute and jute products.

Infobit

- The word 'cotton' is an English version of the Arabic 'qutun' or 'kutun', meaning fancy fabric. But one of cotton's original popular names was 'vegetable wool'.
- Cotton was originally grown in several different colours, including brown, rust, and even light purple.

Picking of cotton bolls or harvesting occurs only after the fibres inside the bolls have fully dried up by the heat of the Sun. Once the harvest is complete, the cotton is made into bales to be stored until it is ready to be ginned. *Ginning* is a process to separate the cotton fibres from the seeds. The de-seeded and cleaned cotton is once again pressed into bales for shipment. Harvesting and ginning is usually done by hand, but nowadays machines are also being used.

Cotton fibres are thin and small so cannot be made into a fabric directly. They are first converted into yarns, which are longer, thicker, and stronger. The yarn is then woven into a fabric.



Fig 3.5 Cotton plant and items made of cotton

ACTIVITY 3

Take some cotton and start pulling out a few fibres. While pulling out a fibre, keep twisting it.

After some time, you will see that a yarn is formed.

Making cotton yarn The process of making yarn from fibres is called *spinning*. This process involves drawing out fibres from the bundles of cotton and twisting them to make a yarn.

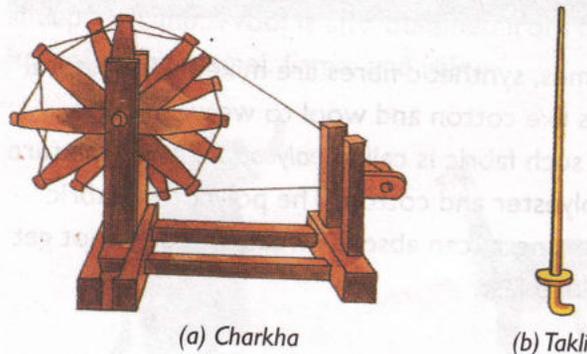


Fig 3.6

The spinning process helps to hold the fibres together and makes the yarns strong, smooth, and fine. Spinning can be done by using a *takli* (spindle), a *charkha*, or a spinning machine.

▲ Which great leader of India used to spin cloth using a charkha. Why did he do so?

After spinning, the cotton yarn is used to make fabric.

Making cotton fabric There are a number of ways by which yarns are made into fabrics. The two most popular processes are weaving and knitting.

Weaving You must have seen the seat of a chair or a *charpoy* which is made of nylon or cotton. These are made with tapes by interlacing two sets of tapes with each other at right angles.

Similarly, a fabric is also made by interlacing two sets of yarns at right angles. The whole process of interlacing two sets of yarns at right angles to make a fabric is called *weaving*.

Weaving is done on looms, which can be hand operated or power operated.



Fig 3.7 Handloom

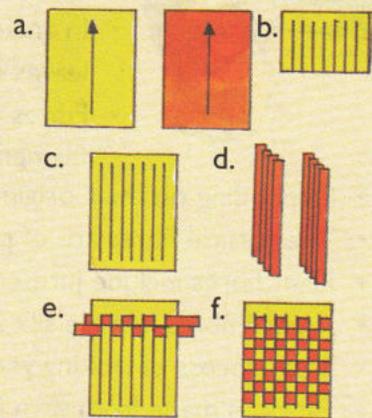
ACTIVITY 4

To understand weaving by making table mat

Things required: Chart papers of two different colours, scissors, pencil, and scale

Method:

1. Take one chart paper and fold it into half.
2. Draw lines on the folded paper as shown (b).
3. Cut the paper along the lines and then unfold (c).
4. Take the other chart paper and cut 1 inch (2.5 cm) wide strips (d).
5. Weave the cut strips in the first chart paper (e).
6. Your table mat is ready.



Knitting Pick up a sweater and any other woven fabric and compare the two. You will notice that in case of a sweater, there is interlocking of loops.

Knitting is interlooping of one or more sets of yarns. Knitted fabrics are more stretchable than woven fabrics.

They are used to make T-shirts, sports pants, socks, etc. Knitting can be done by hand as well as by machines.



Fig 3.8 Knitting



Natural fibres: fibres obtained from plants and animals

Synthetic fibres: man-made fibres

Retting: soaking of jute stems in water

Harvesting: the process of collecting mature crops from the fields

Ginning: the process to separate cotton fibres from the seeds

Spinning: the process of making yarn from fibres

Weaving: the process of interlacing two sets of yarns at right angles to make a fabric

Knitting: interlooping of one or more set of yarns



- In ancient times, people used to wear skin or furs of animals and bark or leaves of trees before they learnt the art of weaving cloth.
- Fibres can be classified according to their length into two types—staple and filament fibres.
- Depending on their origin, they can be classified as natural and synthetic, or man-made, fibres.
- The natural fibres are of plant and animal origin.
- Plant fibres include jute, coir, and cotton.
- Animal fibres include silk and wool.
- The process of making yarn from fibres is called spinning.
- Fabric is made from yarn by the process of weaving or knitting.

▲ Put on your **THINKING CAP!**

1. Write **S** for man-made and **N** for natural fibre.

- | | |
|--------------------|----------------|
| a) Nylon _____ | b) Wool _____ |
| c) Cotton _____ | d) Silk _____ |
| e) Polyester _____ | f) Rayon _____ |
| g) Acrylic _____ | h) Jute _____ |

2. Select the correct option.

- a) The fibres of cotton are very
- | | |
|------------|----------|
| i) short | ii) long |
| iii) thick | iv) weak |
- b) Which of the following fibres is *not* a man-made fibre?
- | | |
|-----------|---------------|
| i) rayon | ii) polyester |
| iii) coir | iv) nylon |
- c) Jute is obtained from the
- | | |
|-----------|-----------|
| i) leaf | ii) seed |
| iii) stem | iv) fruit |
- d) Coir is obtained from the
- | | |
|---------------------------|-------------------------------------|
| i) root of coconut tree | ii) outer covering of coconut fruit |
| iii) stem of coconut tree | iv) leaf of coconut tree |
- e) Synthetic clothes
- | | |
|---------------------|---------------------------|
| i) absorb water | ii) tear easily |
| iii) do not wrinkle | iv) have large air spaces |
- f) Which fabric is made of staple fibre?
- | | |
|-----------|-----------------------|
| i) cotton | ii) nylon |
| iii) silk | iv) both (i) and (ii) |

- g) The fibre which is obtained from plant is
- i) silk
 - ii) wool
 - iii) nylon
 - iv) coir
- h) Which of the following processes is a part of production of jute fibre?
- i) retting
 - ii) ginning
 - iii) knitting
 - iv) weaving

3. Circle the correct word to complete the sentence.

- a) The outer covering of coconut is called husk/shell.
- b) Yarns are made when fibres are separated/twisted together.
- c) Spinning/Ginning is the process of making yarns.
- d) Harvesting is picking/planting of crop.
- e) In ginning, the bolls/bales are cleaned to separate the cotton fibres from the seeds.

4. Complete the story of cotton by using the words given in the box.

Cotton grows in _____ soil.
 Seeds are present inside _____.
 Farmers use machines to _____ cotton.
 The cotton is sent to a _____.
 _____ are used to clean the cotton.
 The cleaned cotton is combed and twisted into _____.
 A _____ weaves the cotton yarn into fabric.
 People sew the _____ into clothes.

loom	black
harvest	fabric
machines	bolts
factory	yarn

5. Write short answers.

- a) What is a fibre?
- b) What is spinning? How does spinning help the fibres?
- c) What is coir used for?
- d) Distinguish between
 - i) natural fibre and synthetic fibre
 - ii) staple fibre and filament fibre
 - iii) weaving and knitting

6. Write answers in detail.

- a) How is jute fibre extracted from the plant?
- b) Under what conditions does cotton grow best? How are cotton bolls harvested?
- c) What are the advantages and disadvantages of synthetic fibres? What is polycotton?

Extended learning

- I. Let us make a pen and pencil holder.

Things required: A small round container (you can take a box of talcum powder after cutting the top portion), a colourful piece of cloth, scissors, glue, laces, mirrors, glitters of different colours

Method:

- Paste the piece of cloth on the container, covering it entirely.
- Paste the lace on the top and the bottom.
- Decorate it using glitters and mirrors. Your pen and pencil holder is ready.

2. Identify the following fibres.

- | | | | |
|-----------|---------------|--------------|----------|
| i) Cotton | ii) Rayon | iii) Silk | iv) Wool |
| v) Nylon | vi) Polyester | vii) Acrylic | |

Method:

(Note: To be done under the supervision of an adult)

Take out a thread from the fabric.

Burn one end of the thread either using a matchstick or a candle. Check the following:

- How fast does the fibre catch fire?
- Type of flame
- Smell after burning
- Ash left behind

Refer the following chart to identify the fibre.

Fibre	In flame	Type of flame	Smell	Ash
Cotton and rayon	Catches fire easily	Continues to burn with a bright yellow flame	Smell of burning paper	Light feathery ash
Silk and wool	Does not catch fire easily	Burns with a yellow flame. Does not continue to burn	Smell of burning hair	Black crushable bead
Nylon, polyester, and acrylic	Does not catch fire easily, melts away	Shrinks away from flame. Burns with sputtering	No definite smell	Hard uncrushable bead

3. Find out if these fibres are natural or synthetic, what these fibres are made from, and what they are used for:

Fibre	Natural/Synthetic	Obtained from	Used for
Wool	N	Sheep wool	Sweater, carpets, blankets, gloves
Flax			
Mohair			
Polyester			
Ramie			
Acrylic			
Hemp			
Denim			
Corduroy			



Sorting Materials into Groups



You will learn about

- Grouping objects on the basis of different properties of materials used to make them

When you look around, you observe things of different shapes and sizes: small, big, round, rectangular, etc. Also, some objects are soft while some are hard. There may be a lot of other similar or dissimilar features in different objects. You can divide the objects in various groups based on such features. This is called sorting.

 Look at the pictures given below. Divide them into groups as you like. Write down how you have grouped them in your notebook.



But you may ask, why do we need to sort things into groups?

Most of the time, we group things as per our own convenience. Sorting makes our life more organized and orderly. For example, in

a supermarket there are separate sections for items of different types. You will find food items kept in one section, toiletries kept in another section, and stationery items in a separate section. Arranging things in different groups makes it easier to find items of different types.



ACTIVITY 1

Visit your school library and ask the library teacher about the system used to group books.



You can also group objects on the basis of the material they are made of. There is a large variety of materials that can be used to make different objects. For example, glass, metal, plastic, wood, cotton, and soil are some materials that are used to make different things.

Looking at the objects around us, we find the following things.

- *Different objects are made from different materials.* To make an object the properties of the material used are usually kept in mind. For example, a carpenter would use wood to make a door rather than paper or rubber because wood is stronger and lasts longer.
- *Certain objects can be made from different types of materials.* For example, a chair can be made using iron, wicker, wood, plastic, or brass.
- *Sometimes, a single material can be used to make different objects.* For example, iron is used to make tools, doors, gates, pipes, etc.

The table given below lists a few objects. Write down the different materials that can be used to make these objects.

Object	Materials used
Ring	
School bag	
Window	
Photo frame	
Water bottle	
Wall clock	
Garland	
Chair	

The table given below lists a few materials. Now think and write down the different objects that can be made from each material.

Material	Objects
Wood	
Steel	
Brass	
Plastic	
Nylon	
Leather	
Glass	

Properties of materials

Every material has some special features, called its *properties*, which distinguish it from other materials.

You can put certain materials in a group on the basis of some common properties. We use dissimilarities between materials to put them in different groups.

The method of grouping objects on the basis of certain similarities and dissimilarities is called *classification*.

There are various properties like appearance, hardness, conductivity, solubility, flotation, and transparency which help us to arrange objects into different groups.

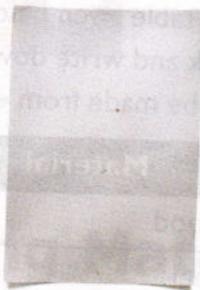
Appearance

You can group materials on the basis of the appearance of their surfaces. Lustre and smoothness are the two characteristics that allow you to distinguish the appearance of different materials.

Lustre The surfaces of some materials are shiny while others are rather dull. This shine of the materials is called *lustre*. For example, a page from your notebook has no lustre and appears dull when compared to a kettle made of metal.



(a) Kettle made of metal



(b) Sheet of paper

Fig 4.1 Lustre

⚠ The table given below lists the names of some objects. Put a tick if they possess lustre and a cross if they do not.

Material	Lustre
Leather	
Marble	
Silver	
Copper	
Iron	

If you carefully look at a variety of objects, you will observe that the materials that generally show lustre are metals. Gold, silver, copper, aluminium, and iron are some examples of metals. Wood, on the other hand, is not a metal so it does not have lustre.

Some materials lose their lustre with time or when they are exposed to air and moisture. You must have noticed that brass and silver items at home have to be polished from time to time. This helps these items regain their shine and look new. If this is not done they appear dull and tarnished.

Smoothness To understand this property

- touch the petals of a flower.
- move your hand over the surface of a clean window pane.



- take a small stone and move your thumb over it.

You will notice that the surfaces of the flower petals and window pane are very smooth. The surface of the stone, on the other hand, is very rough. Similarly, an egg is smooth to touch whereas a coir mat is rough.

Hardness

Hardness is another property which helps us to group different materials.

ACTIVITY 2

Collect the following objects—cotton, wool, a wooden bat, a rubber ball, a small stone, a piece of iron, and a piece of sponge. Now, press these objects one by one with your hand. Write down your observation.

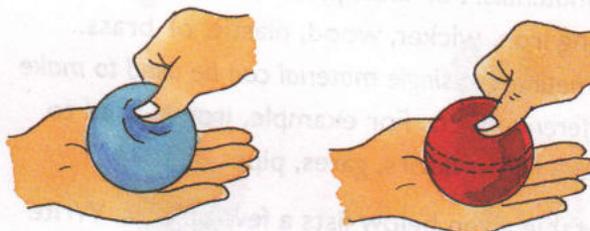


Fig 4.2 Soft and hard materials

In Activity 2, you will notice that objects like cotton, wool, rubber ball, and sponge are very easy to press. They change their shape when pressed. These materials are called *soft materials*. However, you will find it hard to press materials like cricket ball, wood, stone, and iron. These are called *hard materials*.



Infobit Diamond is the hardest known material in the world. It is used to cut glass.

ACTIVITY 3

Try to scratch the surface of the following objects with a piece of iron—a candle, a piece of wood, a stone, a piece of plastic, and an iron rod.

Note down your observation.

In the above activity, you will observe that hard surfaces are difficult to scratch while soft surfaces can be easily scratched.

Transparency

This property of materials is dependent on whether the material allows light to pass through it. When an object allows light to pass through it, you can see through it.

This property allows you to divide materials into three groups—transparent, opaque, and translucent.

There are certain materials which allow you to see what is there on the other side. Such materials are called *transparent materials*. For example, you can



Fig 4.3

see things on the other side of a glass window. Thus, clear glass is a transparent material.

ACTIVITY 4

Try to see things on the other side through a wooden door. You will notice that you are not able to see through the door.



Such materials through which you cannot see are called *opaque materials*. These materials do not allow light to pass through them.

ACTIVITY 5

Switch on the electric bulb in your room. Take a sheet of butter paper and hold it against the light of the bulb. Try to look through it.



You will notice that you are able to see the bulb, but not so clearly. Such materials that allow you to see through them partially are called *translucent materials*.

ACTIVITY 6

Collect the following things and list them in the table given below as transparent, translucent, or opaque material.

Tissue paper, plastic wrap, cardboard, clear plastic lids, tin foil, coloured plastic lid, wood, waxed paper, clear glass.

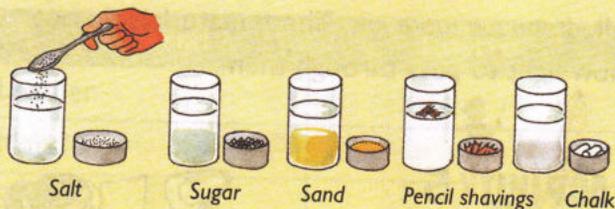
Transparent	Translucent	Opaque

Solubility

Let us perform an activity to understand this property.

ACTIVITY 7

Take some solid materials like salt, sugar, sand, pencil shavings, and chalk in small quantities. Now take five glasses of water and dissolve each material separately in each glass. Use a spoon to mix the contents of each glass.



You will find that salt and sugar dissolve completely in water. Such materials that completely dissolve in water are called *soluble materials*.

On the other hand, sand, pencil shavings, and chalk did not dissolve in water even after vigorous stirring. Such materials that do not dissolve in water are called *insoluble materials*.

You will notice that some liquids like orange juice dissolve in water. These liquids are said to be *miscible*. The liquids that do not dissolve in water are said to be *immiscible*.

ACTIVITY 8

(Note: To be done under the supervision of an adult)

Take liquids like mustard oil, milk, kerosene oil, ink, vinegar, and orange juice. Now take separate glasses of water and dissolve each liquid in a separate glass. Keep them aside for some time.

Write down the names of the liquids which dissolve in water and those which do not in the table given below.

Dissolve	Does not dissolve

Flotation

Let us perform the following activity to understand this property.

ACTIVITY 9

Take a table tennis ball, a golf ball, a dry leaf, an eraser, an iron nail, pencil shavings, a pebble, and a plastic spoon. Take a bucket of water and gently put all the objects in water.

Observe carefully what happens to each object. Note down your observation.

You will observe that some objects like dry leaf, pencil shavings, plastic spoon, and table tennis ball stay on the surface of water, i.e., they float. On the other hand, objects like golf ball, iron nail, and pebble sink to the bottom of the bucket.

Repeat the above activity with a cork, a few drops of oil, and a coin. You will see that the cork floats on water while the coin sinks. The oil forms a layer on the water surface and floats.

This property of objects to float or sink is called *flotation*. Objects float or sink depending on the material they are made of and their shape. Thus, we can now group things on the basis of whether they float or sink in water.

Conductivity

Some materials can conduct electricity and are called *conductors*. Metals like silver and copper are good conductors of electricity. Non-metals

like plastic and wood are bad conductors of electricity and are called *insulators*. Plastic is used to cover electric wires because it is an insulator that does not allow electricity to pass through it.



Lustre: shine of materials

Transparent: a material which allows light to pass through it

Translucent: a material through which things can be only partially seen

Opaque: a material through which you are not able to see things

Flotation: the property of a material to float or sink

Conductors: materials that allow electricity to pass through them

Insulators: materials that do not allow electricity to pass through them



- Objects are made of different materials.
- Materials have different properties.
- Materials can differ in the following properties:
 1. Appearance
 2. Hardness
 3. Transparency
 4. Solubility
 5. Flotation
 6. Conductivity

Put on your THINKING CAP!

I. Select the correct option.

- What property is not to be considered while purchasing a cooking utensil?
 - i) appearance
 - ii) hardness
 - iii) flotation
 - iv) conductivity
- While choosing a material for a window pane, what property of the material should be kept in mind?
 - i) solubility
 - ii) conductivity
 - iii) transparency
 - iv) hardness
- Which property does a jeweller consider while choosing a metal for jewellery?
 - i) flotation
 - ii) hardness
 - iii) transparency
 - iv) lustre

- d) What property should a blacksmith keep in mind while making a hammer?
- i) flotation
 - ii) appearance
 - iii) hardness
 - iv) transparency
- e) Mustard oil is _____ in water.
- i) miscible
 - ii) immiscible
 - iii) both i) and ii)
 - iv) none of these
- f) This characteristic is used to group materials on the basis of appearance of their surface.
- i) lustre
 - ii) transparency
 - iii) conductivity
 - iv) none of these
- g) Sand, pencil shavings, and chalk are
- i) immiscible materials
 - ii) insoluble materials
 - iii) soluble materials
 - iv) none of these
- h) Objects float or sink depending on
- i) their size
 - ii) material they are made of
 - iii) both i) and ii)
 - iv) none of these

2. Fill in the blanks.

- a) Metals like gold and copper have _____.
- b) Plastic is used to cover electric wires as it is an _____.
- c) The property of an object to float or sink in water is called _____.
- d) Liquids that dissolve in water are said to be _____.
- e) Materials through which we can see things only partially are called _____.
- f) The method of grouping objects on the basis of certain similarities and dissimilarities is called _____.

3. Write short answers.

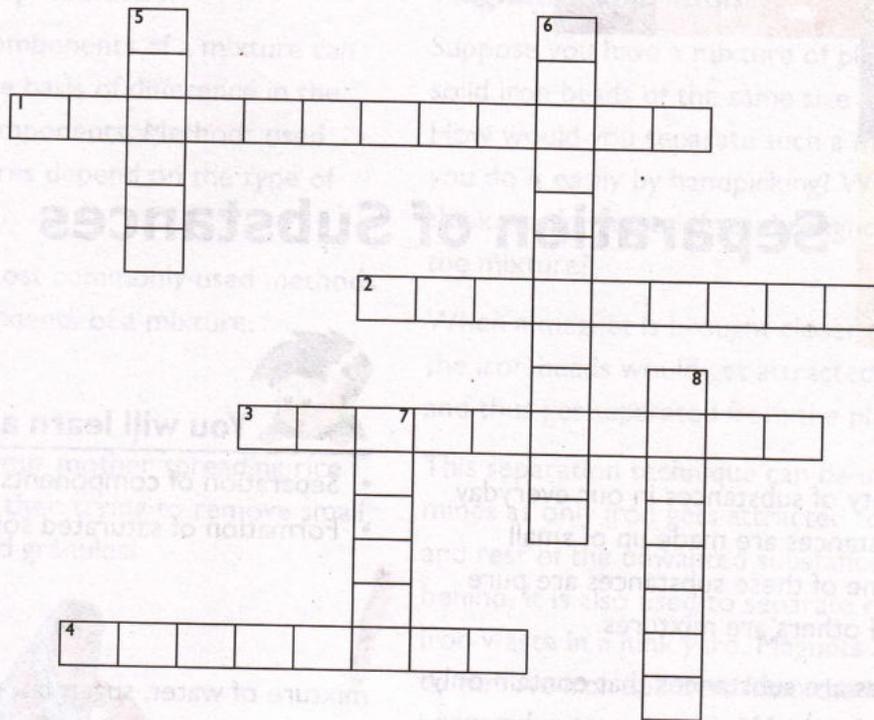
- a) How is grouping of materials advantageous?
- b) Differentiate between miscible and immiscible liquids.
- c) What is the difference between soluble and insoluble materials?
- d) List the properties of matter which help in sorting of materials.

4. Write answers in detail.

- a) Differentiate among transparent, translucent, and opaque materials. Give two examples of each.
- b) How can you distinguish the appearance of different materials. Explain with examples.
- c) i) What is flotation?
ii) What are conductors and insulators? Explain with examples.



5. Solve the crossword given below.



Across

1. The property based on whether or not one can see through objects
2. The property of objects to sink or float
3. The property that allows a material to either dissolve or not
4. The property that helps you to distinguish a stone from wool

Down

5. A material through which you cannot see objects on the other side
6. The ability or inability of materials to conduct electricity
7. Shine of materials
8. A liquid which dissolves in another liquid

Extended learning

1. Find out how all the animals present in the world are grouped in a scientific manner.
2. Give two examples where grouping of materials helps in bringing order at home.

HOTS

1. A nail file, emery paper, a vegetable grater, and a pumice stone all have a common property. Identify the property which is lost with continuous usage.
2. Harshit took a jar of water and added a little of the following to it.
 - a) Orange juice b) Oil c) Milk d) Lassi e) Melted ghee
 Then he stirred the solution. Which of the given liquids were miscible in water?
3. Mrs. Kohli applied tamarind juice on her brass lamp. Which property of the lamp was she trying to restore?
4. Whenever you go to fix a new bulb in your lamp, it is advisable to wear plastic slippers. Why?
5. There have been a number of robberies in the area where Mr. Behl lives. Therefore, he got an iron grill fitted. Which property of iron will ensure him security?





5 Separation of Substances

We use a variety of substances in our everyday life. These substances are made up of small molecules. Some of these substances are pure substances and others are mixtures.

Pure substances are substances that contain only one kind of molecule. Water is a pure substance because it contains only water molecules. On the other hand, if we add a teaspoon of salt in a glass of water and let it dissolve, is it still a pure substance? No, now we have some salt molecules here and there between the water molecules. So, the salted water isn't a pure substance. It consists of more than one kind of molecule, thus it is a *mixture*.

Mixture is a combination of two or more substances that mix together without any chemical reaction taking place.

Separation of substances

Mixtures of various types are used for different purposes by all of us. But sometimes we need to separate the different components of a mixture. It may be required to separate some impurities or non-useful components to obtain different useful components, or to remove harmful components.

Lemonade is a mixture of water, sugar, and salt, and it is perfectly fine as a mixture. But sometimes, we need to separate the different substances in a mixture. For example, milk is a



You will learn about

- Separation of components of a mixture
- Formation of saturated solutions

mixture of water, sugar, fat, protein, vitamins, and calcium. Calcium and protein are two things your body needs, but fat, while good for growing children, can be unhealthy for adults. To make healthier milk for adults, we separate most of the fat from the milk, creating low-fat or skimmed milk.

When your mother pours tea into a cup, she separates the insoluble tea leaves from the tea by using a strainer.



Fig 5.1 Pouring tea in a cup using a strainer

Sea water has salt in it. Is it possible to separate water and salt? Can we use the same method which was used for separating tea and tea leaves?

To separate the components of a mixture, we need to find a separation process which could be used to transform a mixture of components into distinct components.

Methods of separation

The separation of components of a mixture can be carried out on the basis of difference in the properties of the components. Methods used for separating mixtures depend on the type of mixture.

Let us study some most commonly used methods for separating components of a mixture.

Handpicking

Have you observed your mother spreading rice or dal on a plate and then trying to remove small stones, husks, or mud granules?



Fig 5.2 Handpicking

Sometimes fruit sellers separate oranges or apples of different sizes and stack them separately in two different heaps. They sell the bigger ones for a higher price. They also pick the rotten pieces from the heap.

This process of manual removal of components based on the difference in their sizes, shapes, appearances, or qualities is called handpicking.

Think of two more mixtures where handpicking is used to separate two or more components.

ACTIVITY 1

Take 10 marbles and lots of black beads. Separate the marbles and the black beads. How would you do it?

Marbles and black beads are of different sizes. So they can be easily picked by hands.

Magnetic separation

Suppose you have a mixture of plastic beads and solid iron beads of the same size in a container. How would you separate such a mixture? Can you do it easily by handpicking? What do you think would happen if you brought a magnet near the mixture?

When a magnet is brought closer to the mixture, the iron beads would get attracted to the magnet and thus get separated from the plastic beads.

This separation technique can be useful in iron mines as only iron gets attracted to a magnet and rest of the unwanted substances can be left behind. It is also used to separate recyclable iron waste in a junk yard. Magnets are also used to remove iron splinters from the body of an injured person.



Fig 5.3 Magnetic separation

Threshing

Have you ever seen the stalks of harvested crops stacked on the field?



Fig 5.4 Harvested crop stalks

The next step after harvesting is *threshing*. It involves separating the grains from the stalks

either by beating the stalks on a hard surface, or by rubbing them (friction), or by the combination of both methods.



Fig 5.5 Manual threshing

Another traditional method of threshing is to make donkeys or oxen walk in circles on the stalks on a hard surface. This process is now done by threshing machines such as a combine harvester.



Fig 5.6 A combine harvester

Winnowing

Winnowing is the next step after threshing. It is a process used to separate heavier seeds from lighter components like dry straw pieces and chaff by wind or by blowing air. The simplest way is to stand on a higher level and allow the mixture to fall on the ground. The wind blows away the light components while the heavier grains fall down to form a heap.

The separated chaff can be used as a fodder for cattle.



Fig 5.7 Winnowing

Sieving

Rachna was trying to bake a cake in the kitchen. She put some flour in a pan.

While taking out the jar of sugar she put some beans in the flour by mistake. Should she throw away the mixture and waste the ingredients? Is there a way to avoid the wastage?

She can surely avoid wastage by separating the two components by sieving.

Sieving is a method of separation of particles of different sizes using a sieve. A sieve is like a net or mesh which has holes of the same size.



A plastic sieve

Sieving is also used extensively at construction sites to remove pebbles from red sand. It is also used in the fields to remove solid impurities of different sizes.

Take a spoonful of flour and add some chalk powder in it. Is it possible to separate the two using sieving?

Particles of chalk and flour are almost of equal sizes so, it is not possible to separate these two substances by this method.

Sedimentation, decantation, and filtration

When it is a mixture of a solid and a liquid, then simple methods like handpicking, threshing, winnowing, or sieving are not appropriate to

separate the components. In that case we use processes such as sedimentation and decantation, or filtration to separate the substances of a mixture.

Sedimentation Sedimentation is the process by which insoluble heavy particles in a liquid are allowed to settle down.

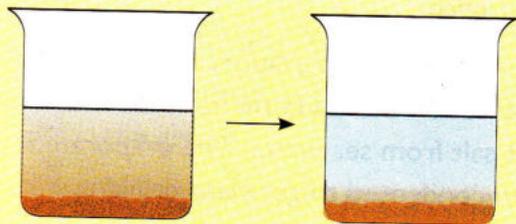
Your mother uses a strainer to separate the tea leaves as she pours tea into a cup. Now, if for some reason your mother did not have a strainer what would she have done?

Leave the tea undisturbed for a few minutes. The tea leaves would settle down at the bottom. After the leaves settle down, the clean tea from the top can be carefully poured into a cup to prevent the leaves from flowing with the clear liquid.

ACTIVITY 2

Take a beaker full of water and add two spoonfuls of soil. Mix it and leave the beaker undisturbed for some time. What happens to the soil?

The soil settles down at the base of the beaker.



Decantation After sedimentation, the heavier particles which settle down in the liquid constitute *sediments*. The clear liquid obtained after sedimentation can then be slowly transferred into another container without disturbing the settled particles or sediments. This process is called decantation.

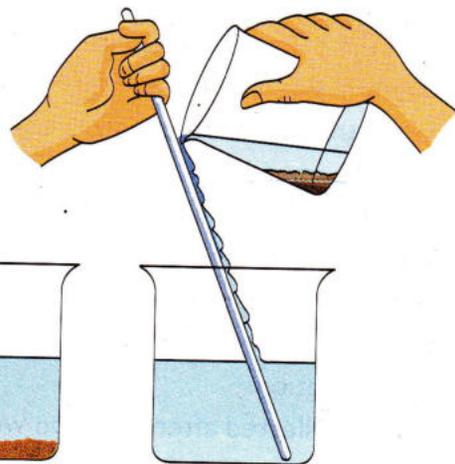


Fig 5.8 Decantation

Filtration Is there any method to further purify the water obtained after decantation? Yes, it can be purified through filtration.

Filtration is a physical process which is used for the separation of solids suspended in liquids by putting a device called a filter, through which only the liquid can pass. Solid impurities bigger than the perforations of the filter are retained on the surface of the filter. These are called the *residue*. The liquid obtained after filtration is called the *filtrate*.

Have you ever had sugarcane juice? The juice seller uses a cloth to remove some husk or other bigger particles which may be left in the juice. Is this process similar to filtration?

The inner lining of your nose has fine hair. These hair trap the dust particles from the air we breathe in to allow only the clean air to pass through. This is also filtration.

ACTIVITY 3

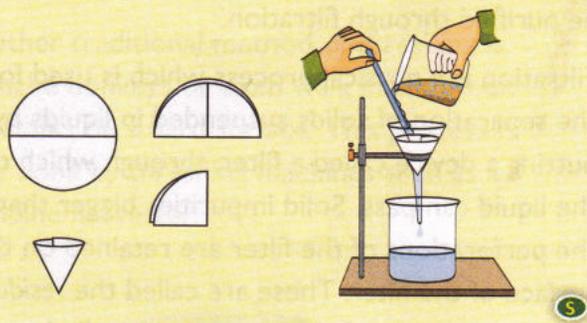
To understand filtration

Things required: Filter paper, funnel, beaker.

Method:

- Take a filter paper available in the laboratory.

- Fold the paper as shown in the given diagram. Put it in a glass funnel; the filter paper should be folded into a cone and should be put a few millimetres below the rim of the glass funnel.
- Take the water collected after decantation.
- Gradually pour water in the funnel.
- Observe the water collected in the beaker after filtration.
- Water collected after filtration would be clearer as compared to the water obtained after decantation. Minute impurities which were not separated by decantation are retained in the filter paper.



Evaporation and condensation

In all the above examples, the components of various mixtures separated are not soluble in water so they can be separated by filtration. How do we separate the components which are soluble in water?

Sprinkle a few drops of water on a plate. Blow air over it using a hair dryer. What happens to the water?

The water disappears after a while. There is no magic in it. Water in the plate was in a liquid state. When you blow air, it changes into water vapour which is the gaseous state of water. *This process of conversion of water into water vapour is called evaporation.* It can be used when we want to get back a substance that has been dissolved in water. This process is used to get salt from sea water.

ACTIVITY 4

Take a bowl of distilled water and dissolve a teaspoonful of salt in water. Continue to add salt gradually and dissolve it till the time you are not able to dissolve any more salt. Pour the salt solution in a flat pan. Leave it overnight in a slightly warmer place under the fan, for the water to evaporate. What is left in the pan after evaporation?



ACTIVITY 5

Take a glass of water and add a few single ice-cubes. Do you observe anything on the outer surface of the glass? We observe the presence of water droplets on the outer surface of the glass.

Water is present in air in the form of water vapour. When water vapour touches the cold surface of the glass, it changes into water droplets.

This change of water vapour into water is called *condensation*.

The phenomenon of evaporation and condensation is used in the United Arab Emirates to get salt from sea water. The evaporated water is then condensed to get clear drinking water.

Solution and solubility

A solution is a homogeneous mixture of a solvent and a solute. The solvent is the substance present in greater amount. The solute is the substance present in lesser amount. If both components in a solution are 50 per cent, the term solute can be assigned to either component. When gas or solid material dissolves in a liquid, the gas or solid material is called the solute. When two liquids

dissolve in each other, the major component is called the **solvent** and the minor component is called the **solute**.

Many chemical reactions are carried out in solutions, and solutions are also closely related to our everyday lives. The air we breathe, the liquids we drink, and the fluids in our body are all solutions.

Solubility

The maximum amount of a substance dissolved in a given volume of solvent is called **solubility**. Often, the solubility in water is expressed in gram/100 mL.

A solution that has reached the maximum solubility is called a **saturated solution**. It means you can no longer add solute to the solution.

Solutes can be separated from a saturated solution by the method of *crystallization*. Crystallization refers to separation of solid solute crystals from a homogeneous solution.

This phenomenon is used for the commercial manufacture of salt.



Fig 5.9 Manufacturing of salt

ACTIVITY 6

Take a pot of boiling water and add table salt. Stir to make a water-salt solution. Continue adding salt until no more salt dissolves in the solution (this is a saturated solution). Now add one final teaspoon of salt. The salt that will not dissolve will help the first step in crystallization to begin. The salt resting at the bottom of the pot will provide a base for crystallization.



Handpicking: manual removal of components from a mixture

Threshing: the process of separating grains from the stalks and loosening the chaff from the grains

Winnowing: the process of separating heavier components of a mixture from the lighter components by wind or blowing air

Sieving: separation of components of a mixture of different sizes using a sieve

Sedimentation: settling down of insoluble and heavier component in a liquid

Decantation: the process of transfer of clear liquid from the sediment

Filtration: separation of solids suspended in a liquid using a filter

Evaporation: change of liquid (water) into gas (water vapour) at any temperature

Condensation: change of gas (water vapour) into liquid (water) on cooling



- Separation of components of a mixture is carried out to either remove impurities or to obtain two different useful components.
- Difference in properties of the components of the mixture is the main deciding factor for the method of separation to be used.
- Handpicking is a manual process to separate the components based on difference in size, shape, appearance, or quality of the components.
- Magnetic separation is possible only if one of the components of a mixture is magnetic in nature.
- The process of separating grains from the stalks and loosening the chaff from the grains is called threshing.
- The process in which heavier components of a mixture are separated from the lighter components by wind or blowing air is called winnowing.
- Sieving is used to separate components of a mixture of different sizes using a sieve.
- Sedimentation, decantation, and filtration are used to remove suspended components in a liquid.
- Evaporation and condensation are used to separate dissolved components from their solution.
- Saturated solutions are required for the process of crystallization.

Put on your **THINKING CAP!**

I. Select the correct option.

- a) Substances can be divided into pure substances and mixtures. Which of the following substances is a mixture?
- | | |
|------------|---------------|
| i) gold | ii) air |
| iii) water | iv) aluminium |
- b) A mixture of water and talcum powder is poured through a filter paper placed in a funnel. Which of the following statements is true?
- talcum powder will form the filtrate
 - talcum powder will form the residue
 - both the water and the talcum powder will pass through the filter paper
 - water will evaporate during filtration
- c) The appropriate process to separate a mixture of mud and water is
- | | |
|------------------|---------------------|
| i) sedimentation | ii) handpicking |
| iii) winnowing | iv) crystallization |
- d) Winnowing is the process that can be used to separate
- | | |
|-----------------------------|----------------------|
| i) iron fillings and stones | ii) stones and chaff |
| iii) potatoes and tomatoes | iv) sugar and salt |
- e) A bowl of dal accidentally fell into wheat flour. You will separate them by
- | | |
|-----------------|---------------------|
| i) winnowing | ii) sieving |
| iii) filtration | iv) crystallization |

- f) Ability of a substance to dissolve in a given liquid is known as
- i) solvent
 - ii) solubility
 - iii) solution
 - iv) none of these
- g) Which factor plays an important role in the process of winnowing?
- i) quantity of the mixture
 - ii) size of the component
 - iii) the direction of the wind
 - iv) none of these
- h) When matter changes from its gaseous state into liquid state, it is called
- i) evaporation
 - ii) distillation
 - iii) condensation
 - iv) none of these

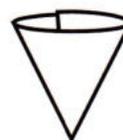
2. What method(s) of separation would you use to separate the following substances?

- a) Sand and iron filings
- b) Sand, water, and salt
- c) Sawdust and sand
- d) Five-rupee and two-rupee coins
- e) Peanuts and beans
- f) Water and sugar
- g) Wheat grains and straw pieces
- h) Water and mud

3. Write short answers.

- a) What is a mixture?
- b) Name one general rule that helps in separating the components of a mixture.
- c) What is filtration? Can filtration be used to separate a mixture of two solids?
- d) What is a saturated solution?
- e) Some equipments used to separate substances are drawn below. Label them and write the method of separation under each diagram.









4. Differentiate between:

- a) Evaporation and condensation
- b) Filtration and decantation
- c) Threshing and winnowing
- d) Residue and filtrate
- e) Solute and solvent

Extended learning

Take some muddy water of equal quantity in two beakers A and B. Filter both of them separately. To beaker A add a small amount of alum. Leave the beaker undisturbed for some time.

Do you notice any difference in the two beakers? If so, what is the process that took place?

Find out where this is done on a commercial scale.

HIGHER ORDER THINKING SKILLS
HOTS

1. Yesterday you and a couple of your friends threw some solid substances like poppy seeds, sand, salt, and iron filings into buckets filled with water. You were not aware that these substances were part of some materials that your father needed for a project at work. Now, the substances are all mixed in the water. When your father found out about this he was not happy. He wants you to separate all the components back. Design the procedure to recover all the substances.
2. Sugar and chalk are mixed together in water. How would you separate them to end up with dry sugar crystals and dry chalk dust?



For more information and pictures <http://www.wiziq.com/tutorial/38393-Separation-of-Substances>



6 Changes Around Us

There are many types of changes that take place all the time. Changes can be in you or around you. For example, you will notice that you have grown taller than when you were in class V. If you look outside, you may find trees shedding their leaves. If you have a pet at home you will realise that it has grown over a period of time. Let us study about some of these changes.

Fast and slow changes

ACTIVITY 1

Take a pencil and a sharpener. Sharpen half the pencil. How long did it take you to sharpen the pencil?



In the first activity you would have seen that sharpening a pencil takes a minute or two. In the



You will learn about

- Fast and slow changes
- Reversible and irreversible changes
- Expansion and contraction in the three states of matter

ACTIVITY 2

Bring a picture of yourself when you were two years old. How many years did it take you to grow to your present age?



second activity it would have taken you about nine years to reach your present age.

Changes that take place over a short duration of time are called **fast changes**.

Changes that take a long time to complete are called **slow changes**.



ACTIVITY 3

Table given below shows some changes that take place around us. Categorize them as *slow* or *fast* changes.

Change	Slow/fast
Growing of a seed into a seedling	
Burning a dry leaf	
Growing of hair	
Growing of nails	
Shredding of paper	
Bursting a balloon	
Rusting of a nail	
Boiling potatoes	



ACTIVITY 4

Take some butter in a petri dish and keep it in the sun for a few minutes. What happens to the butter? Observe the butter and put it back into the fridge. Remove it after one hour and observe again.

What did you notice?



Reversible and irreversible changes

When you put the butter in the sun, it melts very fast. When you put it back into the fridge it becomes hard again.

The activity you performed shows that the material you started with could be got back at the end of the experiment. In other words, the change can be reversed.

Such changes in which the objects or materials can be obtained back in their original form are called *reversible changes*.

In Chapter 5, you learnt about different methods to separate constituents in a mixture which show reversible change. Some examples are as follows:

- We can get back salt or sugar that is completely dissolved in a liquid by heating.
- We can get back non-soluble substances by sedimentation, decantation, and filtration.

Let us consider another example. When you blow air into a balloon it becomes inflated. When you let the air out of the balloon, it comes back to its normal shape.



ACTIVITY 5

Take some wheat flour dough to make *puris*.

Take a small portion of the dough and make it into a round ball and roll it into a *puri*. You may or may not be able to roll it perfectly round like your mother does. If your *puri* comes out shapeless, roll the dough back into a ball and start over again. What kind of change do you think this is?



At home your mother fries the *puris* in oil. Do you think it can be changed back into dough?

Break a chalk into two pieces. Can you join it back?

Can you become a two-year old again?

The answer to all these questions is obviously NO.



ACTIVITY 6

(Note: To be done under the supervision of an adult)

Take a candle and light it. With the help of a holder hold a small piece of paper over the candle flame.

What happens to the piece of paper? What is the name of the new substance produced? Can you get the paper back from this substance?



Such changes from which we cannot get objects or materials back in their original form are called irreversible changes.

In some cases, irreversible changes result in the formation of new materials, which may be desirable.

When you bake a mixture of flour, eggs, milk, sugar, and butter you get a cake which is an example of the formation of a new material and this kind of irreversible change is desirable.

When you leave your bike out in the open for a long time, it gets rusted. This is an irreversible and undesirable change.

Infobit

The massive iron pillar at the Qutab Minar in Delhi has remained rust proof for more than 16 centuries.

Changes due to expansion and contraction of materials

In summer, you may have seen telephone wires sagging between the poles. Have you noticed how they look in winter? The wires would be tightly stretched.

The reason for this is that materials expand as they get hotter and shrink or contract as they cool down.

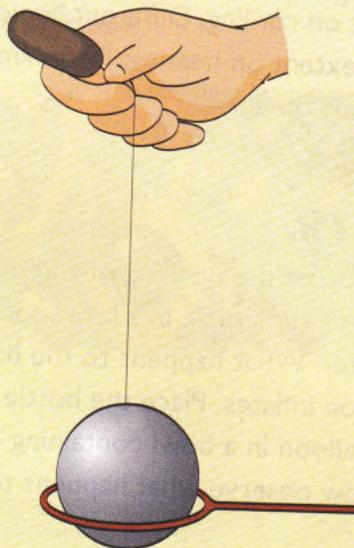
ACTIVITY 7

To understand expansion and contraction

(Note: To be done under the supervision of an adult)

Materials required: Metal ball, ring set, bowl of ice-cold water, Bunsen burner

Method: Take a metal ball and ring set. Fit the ball into the ring. It can go through it easily. Now heat the metal ball over a Bunsen burner for two minutes. Try to pass the heated ball through the ring. What do you observe? Now dip the metal ball while it is still hot into a bowl of ice-cold water. Try to fit the ball through the ring. Does the ball pass through the ring easily?



Metals, when heated, expand more than other kinds of solids do. Because of this, engineers have to be especially careful while designing and building large metal structures like bridges. When railway tracks are built narrow gaps are left at regular intervals. This prevents the tracks from buckling during hot weather. Liquids and gases also show expansion and contraction on heating and cooling, respectively. Let us perform activities 8 and 9 to know about this concept.



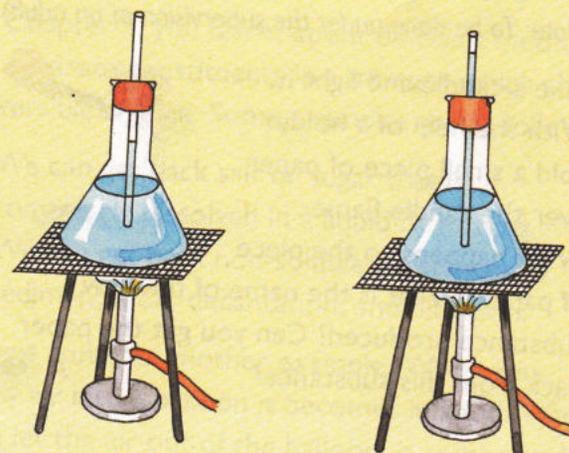
ACTIVITY 8

To show that liquids expand on heating and contract on cooling

Things required: A conical flask, wire gauze, tripod stand, one holed cork, glass tube.

Method: Take a flask with coloured water in it. Place a one-holed cork into the mouth of the flask. Insert a glass tube into the flask through the hole in the cork. Note the level of liquid in the glass tube. Heat the flask for some time.

Observation: You will notice that the level of the coloured water in the tube goes up on heating. Let the flask cool. You will notice that the level of the coloured water in the tube comes down.

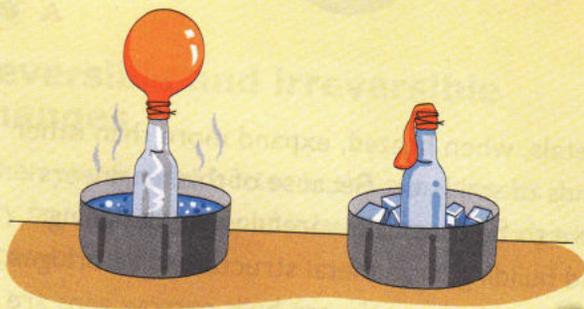


This activity shows that liquids expand on heating and contract on cooling. Different liquids expand to different extent on heating; for example, water expands the least.



ACTIVITY 9

Fit a balloon to the opening of an empty glass bottle. Place the bottle in a bowl containing warm water. What happens to the balloon? The balloon inflates. Place the bottle with the inflated balloon in a bowl containing ice-cold water. Now observe what happens to the balloon.



When the bottle is placed in warm water the balloon becomes inflated. This is because the air

in the bottle becomes warm and rises to fill up the balloon. When the bottle is placed in ice-cold water the balloon becomes deflated because the air in the bottle becomes cool and contracts. The air in the balloon then rushes out of it to fill the empty space in the bottle.

Changes due to change of state

Let us observe this in the following activity.



ACTIVITY 10

Take a beaker containing hot water. Cover it with a petri dish, making sure that it covers the mouth of the beaker completely. Put a few ice cubes into the petri dish. After a minute or two, remove the ice cubes. Turn the petri dish over and observe what you see at its base. Can you see water droplets forming?

The hot water in the beaker evaporates into water vapour and rises up. It touches the cooler base of the petri dish and cools down to condense into tiny water droplets.

So you can see how water evaporates and condenses. Is this an example of a reversible reaction? What happens when ice melts? Can it be converted back into ice? Is this a reversible reaction too?

Physical and chemical changes

Changes that take place around us, and in which no new substances are formed, are called *physical changes*. They are temporary in nature and may be reversible by simple means.

Change in state or phase like melting, freezing, evaporation, and condensation are physical changes. For example, cooling makes liquid water change to ice.



The ice has the same particles that the liquid water has. It can revert to water by melting. Here no new substances are formed. So it is an example of physical change.



Fast changes: changes that take place over a short duration of time

Slow changes: changes that take a longer duration of time to complete

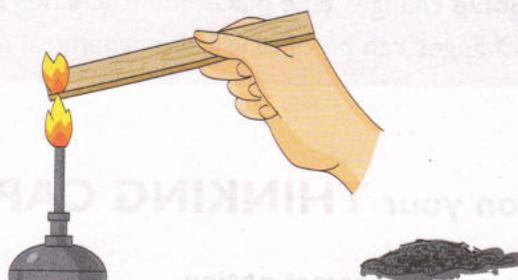
Reversible changes: changes in which the objects or materials can be obtained back in their original form

Irreversible changes: changes from which we cannot get objects or materials back in their original form

Expansion: increase in the size of the substance due to exposure to heat

Contraction: decrease in the size of the substance due to exposure to cold

Changes which result in formation of new substances with different properties are *chemical changes*. Examples of chemical changes include burning, cooking, rusting, etc. When wood burns, it combines with oxygen in air and forms new materials: smoke and ash.



You may have noticed an orange brown coating on things made of iron when they come in contact with moisture. This is called *rust*. Rusting is a chemical change. Chemical changes are irreversible in nature.





- Changes can be classified into slow and fast.
- Some changes are reversible whereas some are irreversible.
- Some changes take place due to expansion and contraction of solids, liquids, and gases.
- Some changes take place due to change in state.
- Changes can be of physical or chemical nature.

▲ Put on your **THINKING CAP!**

I. Select the correct option.

- a) Which of the following represents a slow change?
- i) a puppy growing into a dog
 - ii) tearing a piece of paper
 - iii) blowing a balloon
 - iv) cooking of rice
- b) Which of the following is a fast change?
- i) weathering of a big rock
 - ii) rusting of an iron rod
 - iii) burning a piece of paper
 - iv) a sapling growing into a tree
- c) Which of the following is an example of reversible change?
- i) a tomato ripens when it is left in open
 - ii) when a woollen cloth is washed in hot water, it shrinks
 - iii) when sugar is put in water, it dissolves
 - iv) when biscuit mix is heated, it becomes hard
- d) Which of the following is an example of irreversible change?
- i) batter being made into a dosa
 - ii) when peas are put in a freezer, they turn hard
 - iii) when water is boiled, it turns into vapour
 - iv) when salt is mixed with water, it dissolves
- e) Which of the following can be termed as a chemical change?
- i) cement hardens when exposed to air
 - ii) water vapour condenses as rain
 - iii) a car runs when powered by petrol
 - iv) chocolate melts when left outside during summer
- f) Which of the following can be termed as a physical change?
- i) when a matchstick is struck it burns
 - ii) milk curdles into curd
 - iii) food left outside spoils in summer
 - iv) a glass bottle is broken into small pieces
- g) A mixture of sugar and milk is called a
- i) solid
 - ii) rock
 - iii) solution
 - iv) none of these

h) Ice can be reverted back to water by

i) freezing

iii) breaking

ii) melting

iv) none of these

2. Look at each of the changes given below. Fill in the blanks to say whether the changes are reversible or irreversible. For the reversible changes, draw a second arrow below the first pointing in the opposite direction.



a) Baking a cake is _____ change.



b) Melting chocolate is _____ change.



c) Rusting of a nail is _____ change.



d) Toasting a bread is _____ change.

3. Given below are a number of changes. Identify each of them as physical or chemical changes.

- When whisked egg is heated, it scrambles.
- When a candle is lit, the wax burns.
- When coal is burnt, it turns to ashes.
- When jelly cubes are heated, they melt.
- When wood comes in contact with water for a long time, it rots.
- When chicken is heated, it gets cooked.
- When the Sun shines on a puddle of water, the water evaporates.

4. Given below are a number of reversible changes. Write whether they represent evaporation, condensation, or both evaporation and condensation.

- Henna dries on your hand.
- If you spill a little petrol on the ground, it rapidly disappears.
- Paint dries on walls after a few hours.
- If you breathe on the inside of a window when it is cold outside, a mist appears.
- When you boil potatoes in the kitchen, water droplets run down the windows or walls.
- Clothes dry even when the Sun is not shining.
- Clouds form on a hot day over the sea.

- h) A hair dryer dries your hair.
- i) Sometimes grass is wet in the morning even if it has not been raining during the night.
- j) If you leave a slice of bread on the table, it dries out.

5. Write short answers.

- a) Differentiate between reversible and irreversible changes.
- b) Changes take place due to contraction and expansion of materials. Give an example.
- c) What are physical and chemical changes? Give an example of each.

Extended learning

▲ 1. Physical or chemical?

(Note: To be done under the supervision of an adult)

You will need a toothpick, a beaker with lemon juice, paper, tongs, and a candle. You might want a friend to help you for this activity.

- a) Dip the toothpick into the lemon juice.
- b) Write your name on the paper.
- c) Light the candle.
- d) Use tongs to hold the filter paper close to the candle flame. Do not let the paper burn.

Was the change physical or chemical?

Indicate the reasons or characteristics that helped you to decide if it was a chemical or physical change.

2. Try this experiment, it's fun.

Take a bottle and a boiled egg. The mouth of the bottle should be slightly smaller than the egg so that the egg does not fall into the bottle.

Let's see if we can fit the egg into the bottle without breaking it.

Place the bottle in boiling water and leave it for a few minutes. Ensure that the bottle gets heated evenly. Pour some hot water into the bottle too.

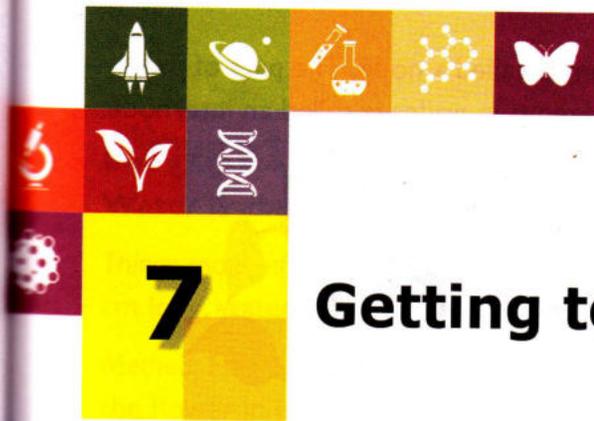
Remove the bottle and place it in a bowl containing water and ice. Place the egg over the bottle and observe what happens.

What happens to the egg once it is removed from the cold water? Check if you can get the egg out of the bottle.

HIGHER ORDER THINKING SKILLS
HOTS

- 1. Seema bought a new skirt for school. When she came home she realized that it was too long so she asked her mother to hem it. What kind of a change is this?
- 2. Kumar, the potter, used clay to shape a vase on his wheel. Then he baked it in the oven. What kind of changes are these? Give reason.
- 3. Your mother cooks dal for the family. What kind of a change is this?





Getting to Know Plants



You will learn about

- Types of plants
- Parts of a plant and their functions
- How to conserve biodiversity

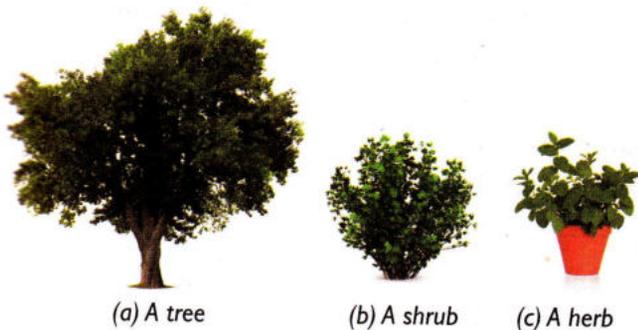
Look outside the window of your classroom. What do you observe? You will observe different kinds of plants all around. Some may be very tall while others might be very short, some may bear bright flowers while some others might have no flowers at all.

Let us get an insight into the world of plants.

Types of plants

Look at the pictures of some plants given below. What difference do you observe in terms of (a) height; (b) branches; and (c) colour of the stem?

Depending upon the height and the kind of stem, plants can be categorized into three types—herbs, shrubs, and trees.



(a) A tree

(b) A shrub

(c) A herb

Fig 7.1 Types of plants

Herbs

These are plants which are usually short and may not have many branches. They have soft and flexible stems. The colour of the stem is green.

Cabbage, *tulsi*, and coriander are some examples of herbs.

Shrubs

A shrub lies in between a herb and a tree in size and thickness of the stem. They have hard stems which are not very thick. The branches grow near the base of the stem.

Trees

A tree has a firm, single main stem which is brown in colour. It is called trunk. The trunk divides into many branches at a particular height.



A banana plant is not a tree. It is actually the biggest herb.

Climbers and creepers

Observe the plants of watermelon or gourd. In which category of plants will you put them?

There are some plants which do not fall under the herb, shrub, or tree categories. We can group these plants as climbers and creepers.

Plants such as watermelon, pumpkin, and gourd spread out on the ground because their stems are very weak and they cannot stand upright. These plants are called *creepers*.

Plants such as pea and grapevine also possess weak stems but they can climb up with the help of a support. These plants are called *climbers*.



(a) Creeper

(b) Climber

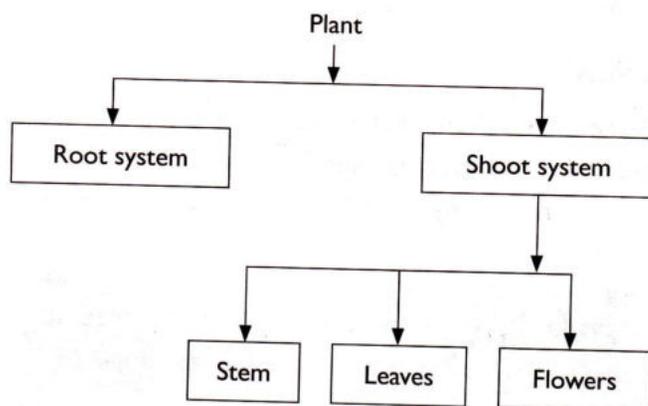
Fig 7.2

Parts of a plant

A plant has two important systems:

- the shoot system, above the ground, and
- the root system, below the ground.

The shoot system consists of stem, flowers, and leaves, whereas the root system consists of a main root and its branching roots.



Shoot system

Stem It is the major part of a plant. The stem bears branches, leaves, flowers, and fruits. The leaves on the branches are arranged in such a way that they are exposed to maximum sunlight. The point from where a leaf or a branch arises

on the stem is called a node. The part of the stem between two nodes is called an internode.

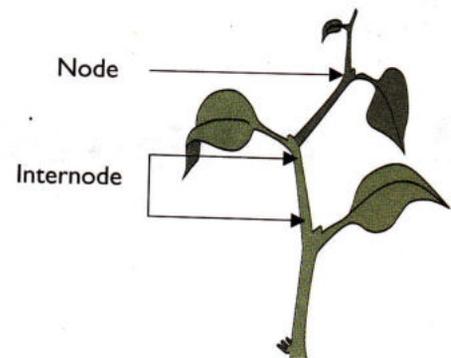


Fig 7.3 Node and internode in a stem

In trees and shrubs, the colour of a young stem is green. However, when it grows older, it does not remain green and turns brown. It also becomes thick, hard, and woody.

Functions of a stem

- It provides support to the different parts of a plant and helps the plant to stand upright.
- It conducts the food prepared by the leaves to different parts of the plant.
- It transports water and minerals from the roots to aerial parts of the plants.
- Stems of some plants like ginger and onion grow underground. These stems store food made by the leaves.

Leaves Look at the different plants around you. You will find a wide variety in the shapes and sizes of leaves. However, all leaves have some common parts. The flat

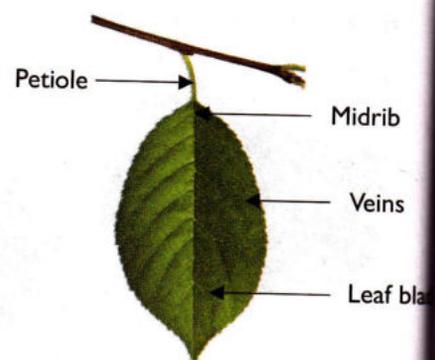


Fig 7.4 Parts of a leaf

green portion of a leaf is called *leaf lamina* or *leaf blade*. Leaves grow at the nodes of the stem. They are attached to the stem by a stalk called *petiole*. Some leaves like grass do not have a petiole. They are directly attached at the node.

ACTIVITY 1

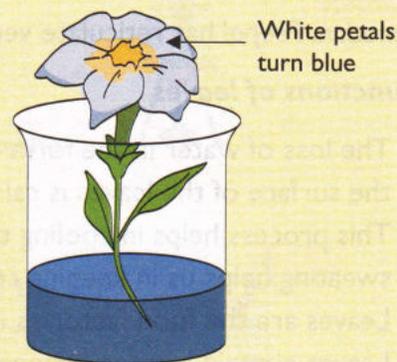
Water is absorbed through the stem

Things required: A freshly plucked white flower with stem at least 15 cm long, water, food colour, and a glass.

Method: Fill the glass with water and add some food colour to it. Put the flower in it and place the set-up near a window. Watch what happens to the flower over the next couple of days.

Observation: You will see that the flower will take up the colour of the solution.

Conclusion: This happens because the water solution has been absorbed by the stem of the flower.



ACTIVITY 2

To make a leaf skeleton

(Note: To be done under the supervision of an adult)

Things required: Few green leaves of good shape, e.g., peepal, 4 teaspoons (20 gm) of sodium carbonate (washing soda), 2½ cups (500 ml) of water, burner, metal vessel, paint brush.

Method: Dissolve sodium carbonate in water in the vessel. Heat the mixture on a burner. When the mixture is almost ready to boil and bubbles appear on it, take the vessel off the burner and put the leaves into it. Let the leaves soak for 30 minutes. Remove the leaves from the solution and gently wash them with cold water. The part of leaf you now see is the pattern of hollow lines making the leaf skeleton. Use a paint brush to carefully lift away the small bits of leaf cells remaining around the skeleton.

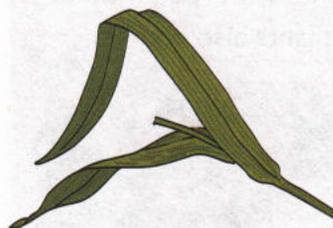
Once the leaves get dry, paint and use them for decoration.



See the lines on the leaves. These are called *veins*. A thick vein runs in the middle of the lamina. It is the *midrib*. The arrangement of veins on a leaf is called *venation*. Veins transport water and minerals to the leaves. They also provide support to the leaves.

Compare a leaf of a grass with that of a *tulsi*. What do you observe?

In some plants, veins run parallel to each other. Such a venation is called *parallel venation* and the examples are maize and wheat.



(a) Parallel venation



(b) Reticulate venation

Fig 7.5 Venation in leaves

If the arrangement of veins is net-like on both sides of midrib, then venation is called *reticulate venation*. *Peepal* has reticulate venation.

Functions of leaves

- The loss of water in the form of vapour from the surface of the leaves is called *transpiration*. This process helps in cooling the leaves, just as sweating helps us in keeping cool.
- Leaves are the food factories of the plants. Leaves contain a green pigment called chlorophyll which gives green colour to the leaves.

- Leaves make their own food in the presence of sunlight and chlorophyll. They use water from the soil and carbon dioxide from the air for this process. The process is known as **photosynthesis**. Food prepared by the leaves is the *starch* which is stored in different parts of the plants. Oxygen is also given out during this process.
- Leaves also help in exchange of gases through the small pores present under their surface. These minute pores are called **stomata**.

ACTIVITY 3

To show transpiration in leaves

Things required: Rectangular cardboard, a leaf with stem, vaseline, 2 bell jar flasks, water

Method: Fill 3/4th of a bell jar with water. Make a hole in the middle of the cardboard. Insert the stem of the leaf in the hole in such a way that the stem is down into the water and the leaf is on top of the cardboard. Apply vaseline on the hole (Why have you applied vaseline? Can you think of a reason?). Now put the second bell jar upside down over the leaf, resting against the mouth of the other jar as shown in the picture. Put this set-up in sunlight for 3–4 hours. What do you observe?

You will notice little drops of water on the top portion of the bell jar. This is because leaves lose water in the form of water vapour and this process is known as transpiration.



Infobit

You might have observed some plants with red or violet coloured leaves. These plants also contain chlorophyll but the amount of chlorophyll is less than the amount of coloured pigment. Thus, they appear non-green.



Infobit

Top Secret by John Reynolds Gardiner (author of *Stone Fox*) is a read-aloud book. The book tells the story of a boy who decides to solve the mystery of photosynthesis for a school science project. You can learn more about photosynthesis from this book.

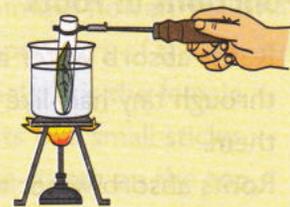
ACTIVITY 4

To show that leaves contain starch

(Note: To be done under the supervision of an adult)

Things required: Green leaf, spirit burner, test tube, beaker, forceps, iodine solution

Method: Take a leaf from a healthy potted plant. Put it in a test tube containing spirit. Put this test tube in a beaker filled with water. Keep the set up over the burner and let it boil till all the chlorophyll is removed from it. Now carefully take the leaf out and wash it with water. Put a few drops of iodine solution on the leaf. You will see the leaf turning blue black in colour. Why is it so? Which nutrient gives a positive iodine test? What does this indicate?



Let's Talk

Can you think of some other advantages of transpiration? Find out and discuss with your teacher.

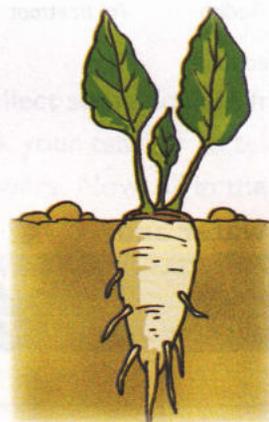
fibrous roots have parallel venation. So next time, if you want to know the type of root a plant has, simply look at its leaves.

Root system

Roots The underground part of the plant is called the root. There are two types of roots—tap root and fibrous root. In some plants, there is a main root from which a number of branching roots arise. The main root is called the **tap root** and the branched out roots are called the **lateral roots**. Rose, neem, and mustard are some plants that have tap roots.

Some plants do not have a main root. There is a cluster of roots arising from the base of the stem. Such roots are called **fibrous roots**. Wheat and maize are plants that have fibrous roots.

Pluck a grass plant and a mustard plant. Observe the leaves. We know that grass has fibrous roots and mustard has a tap root. You will observe that there is a relation between the type of roots and the venation of the leaves. Plants with tap roots have leaves of reticulate venation and plants with



(a) Tap root



(b) Fibrous roots

Fig 7.6 Types of roots

ACTIVITY 5

Given below are the names of some plants. Find out which of them have fibrous roots and which have tap roots.

Carrot, maize, marigold, mint, chrysanthemum, rose, grass, sugarcane

Functions of roots

- Roots absorb water and minerals from the soil through tiny hair-like structures present on them.
- Roots absorb water and transport it through the stem to the leaves. Leaves use this water and carbon dioxide from the atmosphere to prepare food. Plants use some of this food to perform their important life functions. The rest is transported through the stem to be stored in different parts of the plants including stem, fruits, and roots. Thus, some of the roots are modified to store food. Carrot, radish, and turnip are some modified roots.

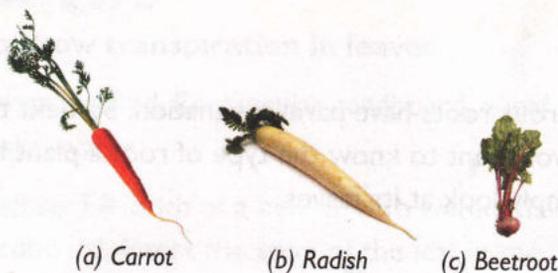


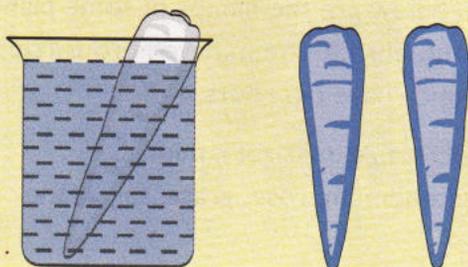
Fig 7.7 Modified roots

ACTIVITY 6

To show roots absorb water and minerals

Things required: Radish, beaker, water, food colour

Method: Dissolve food colour into a beaker containing water. Put a radish in the coloured water. Put the set-up near the window for a few hours. Now take out the radish and cut it into two halves lengthwise. What do you observe?



- Roots fix the plants firmly to the ground. This is known as *anchorage*.
- Roots prevent soil erosion.

Flower

Let's go for a nature walk!

As you take a walk around your school garden or park, you will observe greenery and various colours all around you. You know now which part of the plant provides greenery. What about the colours? Which is the most colourful part of the plant? It is the flower.

Let's Talk

A plant can be recognized by the colour, shape, and smell of its flowers. Are flowers of all plants colourful and bright? Discuss.

Flowers have colourful petals to attract insects.

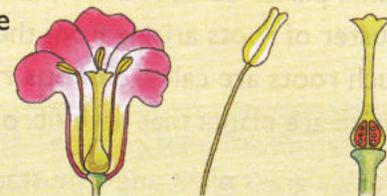
If you look at the bud of the same flower you will notice that the petals in a bud are enclosed inside the green leaf-like structures called the *sepals*. Sepals provide protection to the flower when it is in a bud stage.

ACTIVITY 7

To study parts of a flower

Things required: Brightly coloured flower like rose or hibiscus. Do not pluck the flower, instead pick the fallen ones.

Method: Observe the different parts of the flower. How many parts can you observe? What is the colour of the petals? How many petals does the flower have? Are the petals joined or separated from each other?



Record your observations.

What is the colour and number of the sepals in the bud of your flower?

Are the sepals joined or separated?

Let us view what's inside the flower!

Take a China rose and remove its sepals and the petals. What do you observe?

In plants like China rose, if we remove the petals we can see the stamen inside. *Stamen* is the male part of the flower. Each stamen consists of a hair-like structure called the *filament* and a lobed bag like structure called the *anther* at the tip of the filament. The anther contains dust like particles called the *pollen grains*. These pollen grains take part in reproduction.

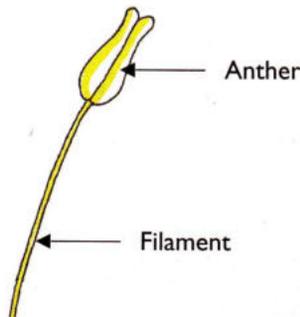


Fig 7.8 The stamen

Remove all the stamens from the flower. You will see the innermost flask-shaped part of the flower. This is called the *pistil* (carpel). It is the female part of the flower. It consists of a small sticky disc-like structure called the *stigma* on the top. Stigma runs into a long tube-like structure called the *style* and a swollen base called the *ovary*. Ovary has a number of small bead-like structures called the *ovules*.

Transfer of pollen grains from the anther to the stigma of a flower is called *pollination*. The ovule becomes the seed and the ovary becomes the fruit after fertilization.

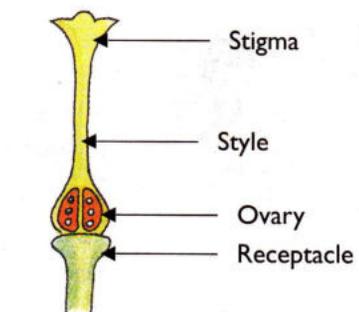


Fig 7.9 The pistil

Collect some flowers from the surroundings. Ask your teacher to tell you the names of all the flowers. Now, fill in the following table.

Name of the flower part	Name of flower	Colour	Number	Joined/ separated	Present/ absent
Sepals					
Petals					
Stamen					
Pistil					



Herbs: plants which are usually short and may not have many branches

Shrubs: plants with hard and not very thick stems which have branches growing near the base of the stem

Trees: tall plants with firm single stem

Nodes: the point where the leaf arises on the stem

Lamina: the flat green portion of the leaf

Parallel venation: veins of leaf run parallel to each other

Reticulate venation: veins of leaf form a network on leaf

Transpiration: the loss of water in the form of vapour from the surface of leaves

Photosynthesis: the process by which leaves make their own food with the help of water from the soil and carbon dioxide from air in the presence of sunlight and chlorophyll

Tap root: a main root from which a number of branching roots arise

Fibrous roots: a cluster of roots arising from the base of the stem

Pollination: transfer of pollen grains from the anther to the stigma of a flower



- Based on the type of stem and their sizes, plants are of three types—herbs, shrubs, and trees.
- The plant body has two systems—the root system and the shoot system.
- The roots help the plant in absorbing of water from the soil and also make the plant stand firmly on the ground.
- Shoot system consists of stem, leaves, and flowers.
- The stem helps in conduction of water and nutrients to different parts of plant.
- The leaves synthesise food for the plants by the process of photosynthesis.
- The flowers of a plant are involved in reproduction. The male part of a flower is called the stamen and the female part is called the pistil.
- Transfer of pollens from the stamen to the pistil is called pollination.

Put on your **THINKING CAP!**

I. Select the correct option.

- a) This plant has a thick, hard, brown stem
- | | |
|-----------|-------------|
| i) herb | ii) shrub |
| iii) tree | iv) creeper |
- b) The outermost part of the flower is the
- | | |
|-------------|------------|
| i) petal | ii) sepal |
| iii) stamen | iv) pistil |
- c) The male reproductive part of a flower is
- | | |
|-------------|-----------|
| i) ovule | ii) ovary |
| iii) stamen | iv) sepal |

- d) The leaves of the maize plant show
- i) parallel venation
 - ii) reticulate venation
 - iii) both i) and ii)
 - iv) no venation
- e) The two end products of photosynthesis are
- i) starch and carbon dioxide
 - ii) chlorophyll and carbon dioxide
 - iii) starch and oxygen
 - iv) oxygen and carbon dioxide
- f) A medium-sized plant with a hard, brown, thin stem describes a
- i) herb
 - ii) shrub
 - iii) tree
 - iv) creeper
- g) In which plant the stem is used to prepare food during photosynthesis, rather than the leaves?
- i) potato
 - ii) carrot
 - iii) cactus
 - iv) none of these
- h) Anther contains dust-like particles called
- i) pollen grains
 - ii) thalamus
 - iii) pedicel
 - iv) stamens

2. Write T for true or F for false. Also correct the false statements.

- a) Fruit is the only edible part of the plant.
- b) Roots conduct water to the aerial part of the plant.
- c) Loss of water from the leaves is called transpiration.
- d) The stem anchors the plant firmly to the soil.
- e) The sepal is the male reproductive part of a flower.

3. Match the following:

- | | |
|-----------|---|
| a) Root | i) Protects the flower in the bud stage |
| b) Leaves | ii) Conducts water and nutrients to the plant |
| c) Flower | iii) Gives rise to a new plant |
| d) Stem | iv) Food factories of plants |
| e) Seed | v) Transports food to all part of plants |
| f) Sepals | vi) Reproductive part of plants |

4. Give one word for the following:

- a) Arrangement of veins on the leaf.
- b) Transfer of pollen grains from anther to stigma.
- c) Loss of water in the form of vapour from the leaves.
- d) Small plants with flexible green stem.
- e) Green pigment in plants responsible for photosynthesis.



5. Write short answers.

- a) In which part of the plant will you find the following:
i) node ii) lamina iii) ovary iv) petiole v) filament
- b) Name the male and the female reproductive parts of a plant.
- c) Give one example of each of the following:
i) Fibrous roots _____
ii) Herb _____
iii) Shrub _____
iv) Climber _____
v) Flower with both male and female parts _____
- d) Differentiate between:
• Herb and shrub
• Tap root and fibrous roots
• Pistil and stamen
- e) How is transpiration useful to plants?

6. Write answers in detail.

- a) Explain the process of photosynthesis in plants.
- b) Draw a well-labelled diagram and describe in brief the male and female parts of a flower. What are the changes that occur after fertilization?
- c) i) Differentiate parallel and reticulate venation. Give examples.
ii) State the important functions of roots. What is a modified root? Give suitable examples.

Extended learning

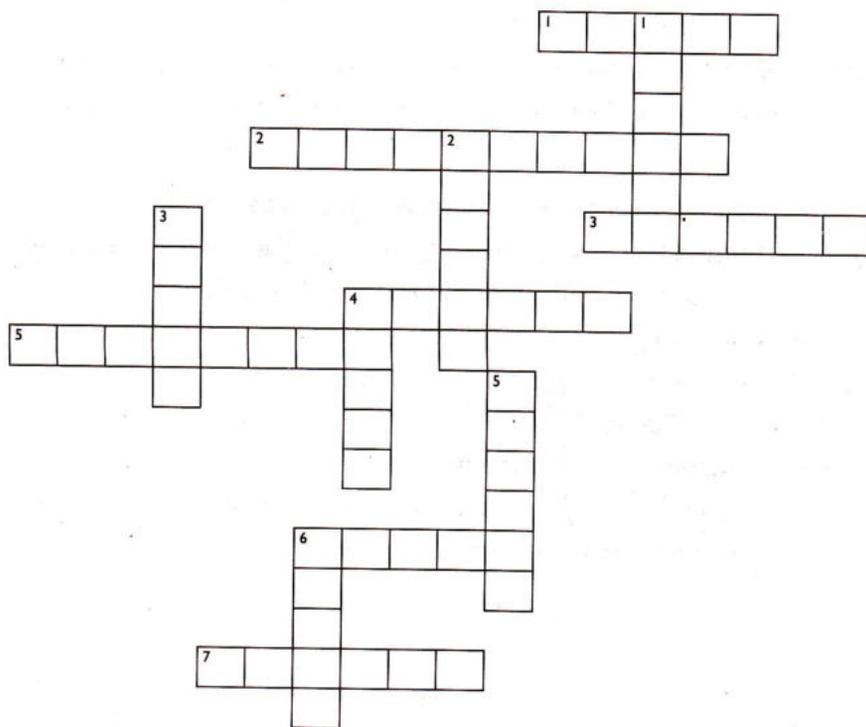
1. Read the clues and solve the crossword.

Across

1. Leaf-like protective covering enclosing the flower bud
2. A green part at the base of a flower
3. Holds the pollen grains
4. Sticky part of the carpel which receives the pollen grains
5. Holds up the anther
6. Part of the ovary that contains an egg cell
7. Female part of a flower

Down

1. Male reproductive cells
2. Consist of one or more carpels
3. Often brightly coloured
4. Neck of the carpel, connects the stigma to the ovary
5. Male part of a flower
6. Develops into a fruit after fertilization



2. Identify the terms using the key given below.

1.

$-125+141$	$3999-3989$	$144\div 12$	$-100+109$	$-11\times(-1)$	$81-75$

2.

$7859-7871$	$128\div 16$	$-7+14$	$96\div 16$	$-1000+1003$

3.

$10000\div 1000$	$131-124$	$105\div 7$	$153\div 9$	$126\div 9$	$-259+266$

4.

$625\div 125$	$300\div 25$	$1000\div 100$	$2000-1990$	$-3597+3608$	$-6+20$

5.

$39\div 3$	$154\div 14$	$1356-1350$	$1000\div 500$

Key

O	E	H	B	M	F	R	A	L	V	Y	W	I	N	P	G
12	11	13	2	15	16	6	7	10	8	3	9	17	14	5	4

3. Leaf rubbing is a fun art. First place a leaf flat on the table. Then place a sheet of tracing paper over the leaf. Use a soft pencil or a crayon and gently rub over the tracing paper until the outline of the leaf shows through it. Use different leaves and different colours for a beautiful design.

HIGHER ORDER THINKING SKILLS
HOTS

1. Read the passage given below and answer the question that follows.

You come home from school one hot summer day and notice that your favourite potted plant, kept near your window, looks dull and droopy.

You get a jug of water and lovingly pour the water into the soil around the plant. Then with concerned glances during the rest of the afternoon you notice how your plant slowly picks itself up and by the evening looks like its old self.

What brought about the changes in your plant?

2. Rahul wants to know the type of root a particular plant has. However, being a nature lover he does not want to destroy the plant by pulling it. How will you help him to know more about the roots?



e) How is transpiration useful to plants?



3. Write answers in detail.

a) Explain the process of photosynthesis in plants.

b) Draw a well-labelled diagram and describe the light-dependent reaction.

c) Write the chemical equation for photosynthesis.

1	1000+1000	1000+1000	1000+1000	1000+1000
2	1000+1000	1000+1000	1000+1000	1000+1000

Extended Learning

1	1000+1000	1000+1000	1000+1000	1000+1000
2	1000+1000	1000+1000	1000+1000	1000+1000

1	1000+1000	1000+1000	1000+1000	1000+1000
2	1000+1000	1000+1000	1000+1000	1000+1000

1	1000+1000	1000+1000	1000+1000	1000+1000
2	1000+1000	1000+1000	1000+1000	1000+1000

1	1000+1000	1000+1000	1000+1000	1000+1000
2	1000+1000	1000+1000	1000+1000	1000+1000

1	1000+1000	1000+1000	1000+1000	1000+1000
2	1000+1000	1000+1000	1000+1000	1000+1000

Key

1	1000+1000	1000+1000	1000+1000	1000+1000
2	1000+1000	1000+1000	1000+1000	1000+1000



Body Movements

Movement and locomotion

Look at the pictures given below.



Locomotion in different animals

The animals shown in the pictures differ greatly in the way they look. But they all need food to carry on life processes. They all move from one place to another in search of food and shelter, to escape from predators, to look for their mate, or to move away from unfavourable conditions.

This movement of the entire body of animals from one place to another is called *locomotion*.

Move from your seat to go near the door and then come back. What kind of movement is this? This is *locomotion*. Now, rotate your arm and close your fist. Are these movements different from moving the entire body from one place to another? Yes, these movements are not locomotion because you did not shift from your place.

Animals as well as human beings move different body parts in relation to the body axis. This is



You will learn about

- Function of bones in the skeletal system
- Different types of joints in the body
- Locomotion of different animals

called *movement of curvature*. The two systems of the body that help in movement are the skeletal system and the muscular system.

Skeletal system

Have you ever visited a site where a building is under construction? You must have observed a strong framework being created by joining iron pieces. Do you see the framework once the building is complete? The framework is no more visible once the building is complete.

Likewise the human body too has a framework of 206 bones called the *skeleton*.

The bones of the skeleton and the cartilages form the skeletal system. Bones are hard while cartilages are elastic and soft.

The skeletal system in our body performs several important functions.

- The skeletal system provides support and gives shape to the body. How will your body be without the bones? Your body would just be a big mass of tissues and muscles. Do you think you would be able to stand straight?



Fig 8.1 The human skeleton

- It protects the soft and delicate vital organs of the body. For example, the skull protects the brain, the ribs protect the lungs and the heart. Which part gets protected by your backbone?
- It plays a very important role in the movement of the body. Muscles are attached to the bones. Bones and muscles work together to move all parts of the body.
- Some bones enclose a soft tissue called bone marrow which is a blood-forming tissue.



Infobit Humans are born with 300 bones in their body. However, when humans reach adulthood, they only have 206 bones. This occurs because many of the bones join together to make a single bone.

- Bones store important minerals such as calcium and phosphorus which make them strong and hard.

The skeletal system is made up of bones, joints, and connective tissue.

Bones

There are two types of skeletons—an exoskeleton and an endoskeleton.



(a) Cockroach



(b) Snail

Fig 8.2 Exoskeleton of two animals

An exoskeleton is a skeleton that covers the outer surface of an animal's body. Animals like cockroaches and snails have an exoskeleton.



(a) Dog



(b) Fish

Fig 8.3 Endoskeleton of two animals

An endoskeleton is a skeleton which is inside an animal's body. All vertebrates such as fish, birds, and mammals have an endoskeleton.

The endoskeleton of human beings consists of five main parts.

The skull The skull is made up of 22 bones of the head and the face. The head is made up of eight bones which are fused together and the facial region has 14 bones. The skull protects the brain from injury. The facial region is made up of upper



Fig 8.4 The skull

jaw, lower jaw, and a few bones. Except the lower jaw, all other bones are fixed. The movement of the lower jaw allows us to eat, talk, and sing.

The vertebral column The vertebral column or the backbone starts from the base of the skull and ends in the pelvis. It is made up of 33 small ring-shaped bones called *vertebrae*. *Cartilage*, a type of tissue, is present between two vertebrae. It is like a cushion that acts as a shock absorber. The vertebral column encloses and protects the spinal cord.



Fig 8.5 The vertebral column

The ribs There are 12 pairs of ribs. All of them are connected to the vertebral column at the back. However, 10 ribs are connected to the flat breast bone called *sternum* present in the middle of the chest. The last two pairs are attached only to the vertebra and not to the sternum. These two pairs of ribs are called *floating ribs*. All the ribs form a cage called the *rib cage* and protect the heart and the lungs.

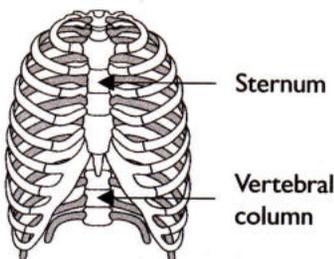


Fig 8.6 The rib cage

The limbs There are two pairs of limbs in our body. The arms are called the *forelimbs* and the legs are called the *hindlimbs*. Each limb consists of three bones.

The upper arm of the forelimb has one bone called the *humerus* and the lower arm has two bones called *radius* and *ulna*.

The upper part of the hindlimb has one bone called *femur*. It is the longest bone in the body. The lower leg has two bones called *tibia* and *fibula*.

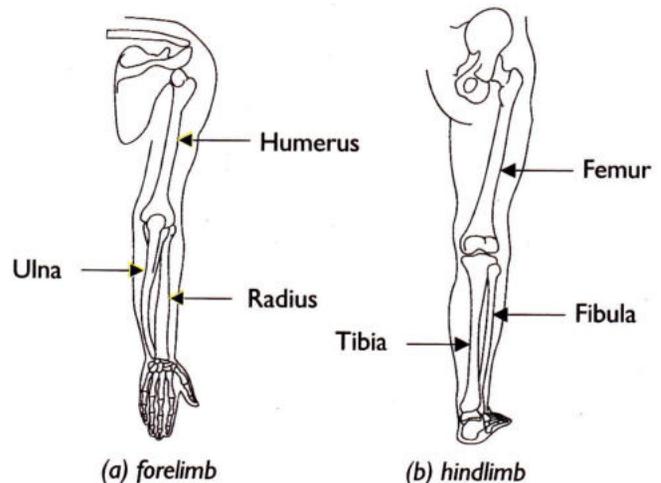


Fig 8.7 The two types of limbs

Girdles The forelimbs and hindlimbs are attached to the girdles. The forelimbs are attached to the *pectoral girdle* which consists of a shoulder blade and a collar bone. The hindlimbs are attached to the *pelvic girdle* which has a hip bone called pelvis.

Joints

Can you imagine your arms or legs made of a single bone? How would you put food in your mouth? How would you run in the playground? Fortunately the human body is not made of only a few large bones. It has many small bones which are joined to one another.

How are bones joined to one another?

The points at which two or more bones come together are called *joints*. Joints and muscles allow

all the movements of the body. The body has three types of joints—fixed or immovable joints, partially movable joints, and movable joints.

Fixed or immovable joints Bones at the fixed joint lie against each other and are fused. Fixed joints do not allow the movement of bones. Joints that attach the ribs to the sternum and those found in the skull are all immovable joints.

Fixed joints in the skull

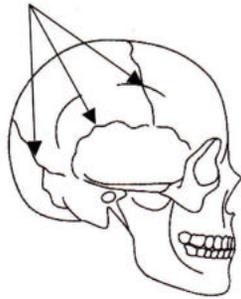


Fig 8.8 Fixed or immovable joints

Partially movable joints These joints allow only limited movements. Such joints are found in the vertebral column.

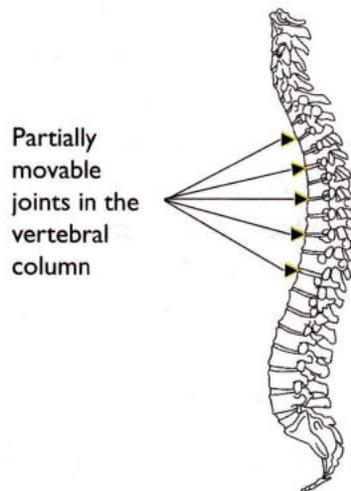


Fig 8.9 Partially movable joints

Movable joints A joint that allows wide range of movements of bones is called a *movable joint*. These joints are held together by strong bands of connective tissues called *ligaments*. They are found at the knees, elbows, wrists, ankles, neck, shoulders, and hips. Some body parts are listed in the table given below. Try moving these parts. Is

the movement of these parts different from one another? Note your observation in the table.

Body part	Direction of movement
Knee	
Elbow	
Wrist	
Ankle	
Neck	
Shoulder	

There are different kinds of movable joints. These are as follows:

Ball and socket joint It allows movement in almost all directions. The shoulders and hips have this joint. In this type of joint, the rounded end of one bone gets fitted into the cup-shaped end of the other bone.

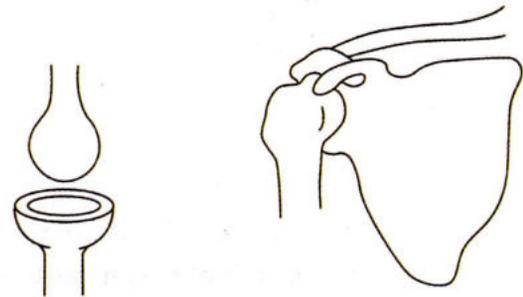


Fig 8.10 Ball and socket joint in the shoulder

Hinge joint It allows movement in one direction only. Observe a hinge of a door or your pencil box. It moves in one direction. Rotate your arms and legs. Bend your knees and elbows. Which joints are you able to move in only one direction?

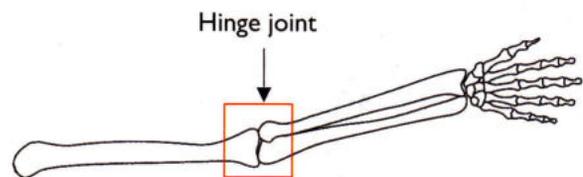


Fig 8.11 Hinge joint in the elbow

Pivot joint It allows rotating movement. It is present between the first and the second

vertebrae directly under the skull. It allows you to turn your head from side to side.

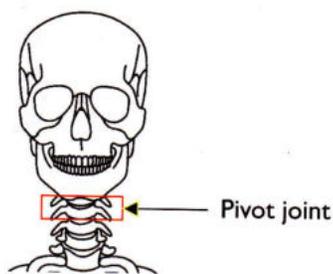


Fig 8.12 Pivot joint in the neck

Gliding joint A gliding joint allows one bone to slide over another. This joint is found between the small bones of wrists and ankles. It allows simple movement of gliding back and forth or sideways.

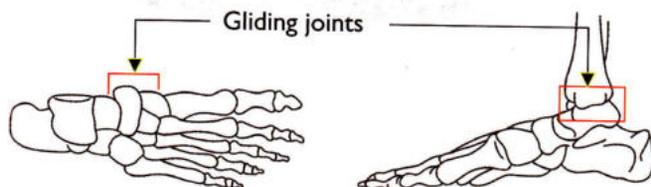


Fig 8.13 Gliding joints in wrist and ankle

ACTIVITY 1

Perform each of the activities listed below and determine the type of joint or joints involved in performing each activity.

- Move your arm in a circle
- Push open a door
- Lift a notebook from a table
- Wave your hand
- Close your fist
- Kneel down
- Move your head from side to side



There are over 230 movable and semi-movable joints in our body.

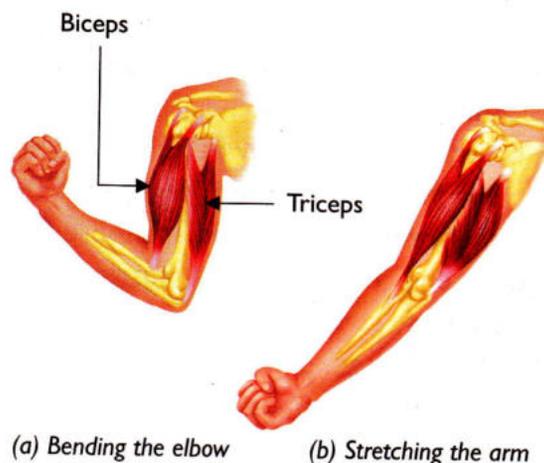
Connective tissue

Besides bones, there are three types of connective tissue in the skeletal system. These are tendons, ligaments, and cartilage.

Tendons attach muscles to the bones. *Ligaments* are strong and elastic bands of tissues that join bones together. *Cartilage* is present at the ends of the bones. It is like a cushion which acts like a shock absorber and prevents rubbing of bones at the joints.

Movement in human body

Body movements are the result of bones and muscles working together. Bones cannot move on their own. Only muscles have the ability to move. They work in pairs. Muscles can only contract, not extend. While one muscle contracts the other muscle in the pair returns to its original length. Look at the figure given below. It shows the muscle action in moving your arm.



(a) Bending the elbow (b) Stretching the arm

Fig 8.14 Function of muscles in the movement of arm

The muscles on the front of the upper arm are called *biceps*. The muscles on the back of the upper arm are called *triceps*. These are attached to the bone of the lower arm by a tough band of connective tissue called tendon. The biceps and triceps work together as a pair to raise and lower the arm. To bend the elbow and raise the lower arm, biceps muscles contract.

The contraction or shortening of this muscle pulls the lower arm upwards. At the same time when biceps contract, the triceps return to their original length. To straighten or stretch the arm, the triceps contract and biceps return to their original length. This shows that the pull of muscles on the bones cause movement. Muscles move bones only by contracting and never by relaxing. Similar pairs of muscles work together to bend and straighten the legs.

Body movement of different animals

Earthworm

Earthworms do not have bones. They move by the action of two groups of muscles and bristle-like structures called setae. One group of circular muscles surrounds the earthworm like a set of rings. The other group of longitudinal muscles runs along the length of the body. The setae act as anchors to grip the surface the earthworm moves on.

To move forward the earthworm first grips the surface at the posterior (tail) end. The circular muscles contract and the body becomes longer and narrower. Now the earthworm grips the surface at the anterior (head) end and loosens the posterior end. The lengthwise muscles contract, the body gets thicker, shorter and moves forward. The action of these muscle groups causes a wavelike motion that moves the earthworm through the soil.

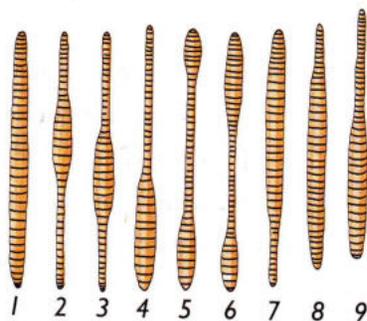


Fig 8.15 Movement of earthworm

Snail

Snails have a soft body protected by a hard shell. It moves by creeping with the help of a muscular flat foot underneath the body. The bands of muscles in the foot contract and relax. This creates a kind of rippling movement which pushes the snail forward.

The foot has a special gland that produces slimy mucus to make a slippery track. The snail is able to move even on sharp edges without any injury because of the mucus.



Fig 8.16 Snail

Fish

Aquatic animals need to have certain adaptations to move through water efficiently. These adaptations either allow them to push against water forcefully or limit the resistance of the water they are moving through.

The body of a fish is broader in the middle and narrow at both ends. This is called a streamlined shape. A streamlined shape offers least resistance, so the fish can cut through water more efficiently.

Fish have special structures called *fins* which help them to move through water.

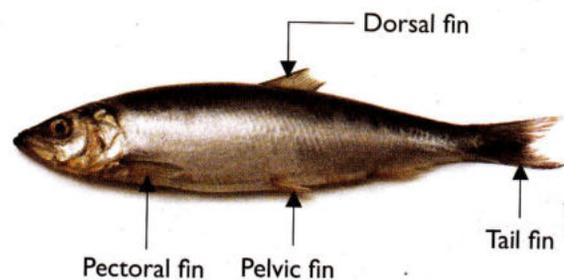


Fig 8.17 Fins of a fish

The *tail fin* helps the fish to move forward quickly by displacing water with each stroke. The *dorsal fin* stabilizes the fish against rolling and helps in sudden turns. The *pectoral* and *pelvic fins* occur in pairs. These are not used for fast swimming and are held close to the body. They are used when the fish is turning or are moving slowly. They help the fish to keep its balance.

Insects

Insects have three pairs of jointed legs which help them to move. A flying insect like a honey bee has two pairs of wings whereas a housefly and a mosquito have only one pair of wings.



Fig 8.18 Insects

Though a cockroach has two pairs of wings, it can only fly very short distances. It can run very quickly with the help of its three pairs of legs. It can also climb up the walls.

Birds

Birds too have streamlined body to help overcome air resistance. The skeleton of birds is highly adapted for flying. They have hollow bones to reduce weight. They lack teeth and instead have a lightweight beak. The two hindlimbs are used for walking and perching. The two forelimbs of the birds are modified as *wings* which are used for flying. The whole body including the wings is covered with feathers.

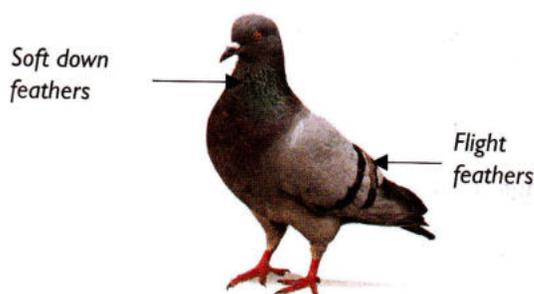


Fig 8.19 Feathers of a bird

Each kind of feather on a bird serves a different purpose. *Soft down feathers* grow close to the skin. Air is trapped between the spaces of these down feathers. The bird's body gives off heat that warms the air in these spaces. Over the down feathers lies a second kind of feathers called *contour feathers*. The third kind of feathers is the large *flight feathers* that are found in the wings and tail. The flight feathers give birds the lift and balance needed for flying.

Snakes

Snakes don't have legs so they use their muscles and their scales to do the 'walking'. If you put a snake on a smooth surface, like glass, the snake will not be able to move because there is nothing to grab on to. The scales on their bellies also act as anchors.

Snakes have four ways of movement:

Concertina method In this method, the snake bunches itself up and then throws itself forward.

Serpentine method In this method, the snake moves in a wavy motion.

Sidewinding In this method, the snake lifts the middle of its body up and then pushes it down forcing its head to move forward.

Rectilinear method This is a slow, creeping, straight movement. The snake uses some of the wide scales on its belly to grip the ground while pushing forward with the others.



Sidewinding



Serpentine method

Fig 8.20 Movement in snakes



Locomotion: movement of organisms from one place to another

Skeleton: a framework of bones

Exoskeleton: skeleton present outside the body

Endoskeleton: skeleton present inside the body

Joint: a point where bones meet

Cartilage: a kind of tissue present between the joints

Ligament: a kind of tissue which joins two bones

Tendon: a kind of tissue which joins a muscle to a bone

Streamlined body: body with narrow tapering ends



- Animals move from one place to another for food, shelter, and protection from predators and unfavourable conditions.
- Movement of animals as a whole from one place to another is called locomotion whereas movement of body parts in relation to the body is called movement of curvature.
- The human skeleton consists of 206 bones. These bones form the framework of the human body.
- The skeleton gives shape and provides support to the body besides helping in movement and protection of delicate internal organs.
- The skull, vertebral column, limbs, and girdles are the important parts of the skeleton.
- A joint is a point where two bones meet.
- Joints may be immovable, partially movable, or movable.
- Ball and socket joints, hinge joints, and gliding joints help in movement of different body parts.
- Bones are able to move with the help of muscles.
- Different animals have special adaptations and body structures which help them in locomotion.

Put on your **THINKING CAP!**

I. Select the correct option.

- a) Muscles are attached to bones by
- | | |
|----------------|------------|
| i) ligament | ii) tendon |
| iii) cartilage | iv) nerves |
- b) The joint which allows movement in one direction only is
- | | |
|--------------------------|-------------------|
| i) ball and socket joint | ii) hinge joint |
| iii) pivot joint | iv) gliding joint |

- c) The number of ribs in the body is
- | | |
|---------------|--------------|
| i) 22 pairs | ii) 14 pairs |
| iii) 12 pairs | iv) 10 pairs |
- d) The number of bones in the facial region is
- | | |
|--------|--------|
| i) 4 | ii) 41 |
| iii) 8 | iv) 14 |
- e) Immovable joints are present in the
- | | |
|------------|-----------|
| i) ankle | ii) elbow |
| iii) skull | iv) toes |
- f) The number of vertebrae in the vertebral column is
- | | |
|---------|--------|
| i) 23 | ii) 33 |
| iii) 13 | iv) 3 |
- g) Bones are able to move only because of muscular
- | | |
|--------------------|--------------------------------|
| i) contraction | ii) relaxation |
| iii) push and pull | iv) contraction and relaxation |
- h) The muscles in the earthworm which enable it to become thicker and shorter are
- | | |
|--------------------------------|--------------|
| i) longitudinal | ii) circular |
| iii) longitudinal and circular | iv) oblique |

2. Fill in the blanks.

- a) The movement of the entire body from one place to another is called _____.
- b) The framework of bones in the body makes the _____.
- c) The human skeleton has _____ bones.
- d) The human skull is made up of _____ bones.
- e) The spinal cord gets protected by _____.
- f) _____ is the largest bone of the human body.
- g) The point at which two bones meet is called a _____.
- h) Earthworm moves by the stretching and contraction of _____.
- i) _____ acts as a shock absorber between two bones.
- j) _____ and _____ fins help a fish to keep its balance.

3. Write short answers.

- a) Why do animals need to move from one place to another?
- b) What is a skeleton?
- c) What are joints?
- d) Why are the last two ribs called the floating ribs?
- e) What role do movable joints play in the body?
- f) How does the earthworm move without bones?
- g) Why do birds and fish have a streamlined body?
- h) Which fin helps the fish to remain in a straight line as it moves forward?

4. Write answers in detail.

- a) List four functions of a skeleton. What are the characteristic features of birds which help them to fly?
- b) Describe how the muscles in your upper arm work together to bend and straighten your lower arm.

5. Differentiate between:

- a) locomotion and movement of curvature
- b) endoskeleton and exoskeleton
- c) ligament and tendon
- d) ball and socket joint and hinge joint

6. Match the following:

- a) forelimb
- b) breast bone
- c) hindlimb
- d) pectoral girdle
- e) pelvic girdle
- i) pelvis
- ii) collar bone
- iii) humerus
- iv) sternum
- v) femur

7. Find the odd one out. Give reasons.

- a) bones, tendons, cartilage, lungs
- b) tibia, ulna, radius, humerus
- c) hinge joint, fixed joint, pivot joint, gliding joint
- d) hollow bones, beak, teeth, wings

Extended learning

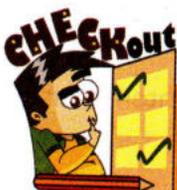
1. Take a chicken bone and soak it in a bowl filled with water. Soak a second bone in a bowl filled with vinegar. After a week put on a pair of gloves and remove the bones from the bowl. Compare how the two bones look and feel. What could be the difference between the two bones? Based on your observation, explain the importance of eating calcium.
2. What is osteoporosis? What are its causes? Who is most likely to suffer from this disease? What should be done to prevent it?
3. What are artificial joints? What material is used to make them? Find out about an organization involved in manufacturing artificial joints.

HIGHER ORDER THINKING SKILLS
HOTS

1. Rajesh was hit hard on his chest by a cork ball while playing cricket. He felt pain but his heart and lungs were not injured. Why?
2. Rekha could touch her hip with her heels but was not able to touch her lower abdomen with heels of her sandal. Why?
3. An earthworm kept on a glass tile was not able to move. Why?
4. Underwater divers wear flippers. Why?
5. What difficulties would one experience if the backbone was made of a single bone?
6. It is difficult for us to walk in waist deep water. Why?



Make a health club. Make a poster on how to keep our bones healthy and strong.

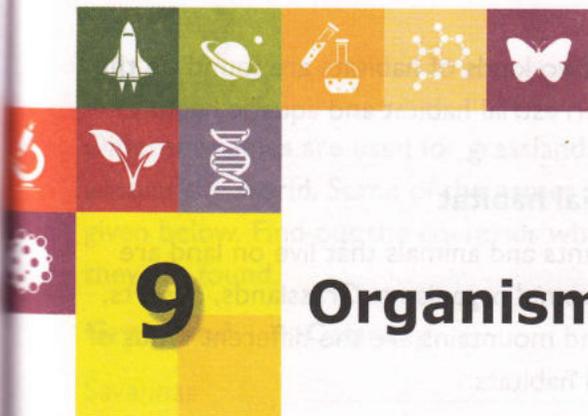


For more information

<http://www.innerbody.com/image/skel07.html>

http://kidshealth.org/misc/movie/bodybasics/bodybasics_knee.html



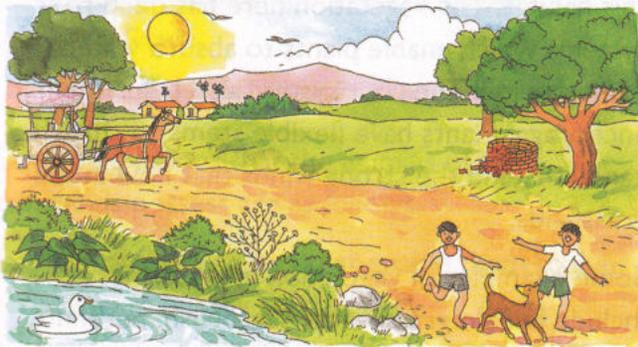


9 Organisms and Their Surroundings

Go out to the school playground. Make a list of all the animals, plants, and other things that you see.

If the same activity is done by the students of different schools, then, depending on the area where your school is located, the list you make may be quite different from that prepared by the students of the other schools. In other words, your environment is likely to be different from that of the others.

Our environment is our surroundings. It includes both living and non-living things.



Environment includes all the factors that affect the form and growth of the organisms. These factors are of two kinds—abiotic and biotic.

ACTIVITY 1

From the list you made at the beginning of the chapter, identify the abiotic and biotic components.



You will learn about

- Our surroundings
- Abiotic and biotic factors
- Habitats
- Different types of habitats
- Diversity in nature

Abiotic factors are the physical or non-living factors like rainfall, temperature, wind, humidity, soil, water, sunlight, and air.

Biotic factors include all living things like plants and animals.

Habitat

A *habitat* is a place where plants and animals live. Many different kinds of plants and animals are found in a particular habitat.

A good habitat must also provide space to find food, water, shelter, and opportunities for breeding. Habitats have both living and non-living things, often in different quantities.

For example, a desert has a harsh environment and therefore in this habitat the non-living things dominate. In a tropical rainforest, however, there are so many living organisms that they outnumber the non-living things.

What comes to your mind when you try to draw the picture of a desert? A wide expanse of sand,



Tigers mark their territory by spraying urine and a foul smelling fluid from their anal glands on trees, bushes, and rocks. They also leave scratch marks on trees and on the ground.

the scorching Sun, sandstorms, and very few plants and animals.

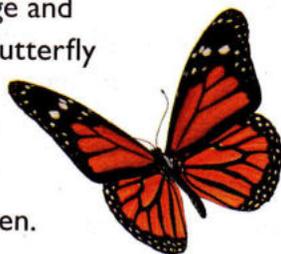
Have you ever thought how these plants and animals survive in such a harsh environment?

These living organisms possess special characteristics to withstand the harshness of the environment. These special characteristics that enable plants and animals to survive in a particular environment are called *adaptations*.

For example, beetles that are found in dry habitats have thick and hard outer shells that prevent them from drying out.



Camouflage is defined as an ability of an organism to blend in with its surroundings. It is a common example of an adaptation in some animals. The combination of bright orange and black spots on a monarch butterfly is an adaptation to warn potential predators that the butterfly is poisonous, preventing it from being eaten.



Thus, adaptations give the organisms a better chance to survive in their surroundings.

Types of habitats and adaptations

Let us now explore the different types of habitats and the adaptations that the organisms living there exhibit.

Primarily two kinds of habitats are found on the Earth—terrestrial habitat and aquatic habitat.

Terrestrial habitat

All the plants and animals that live on land are called *terrestrial organisms*. Grasslands, deserts, forests, and mountains are the different types of terrestrial habitats.

Grasslands Grasslands are grassy, windy, and partly dry areas. It mainly has grasses with very few shrubs and trees.



Fig 9.1 Grassland

Cold winters and frequent fires are common in this habitat. The vegetation here has deep root systems which enable plants to absorb water from the soil. The root system also helps them in anchorage. Plants have flexible stems so that they can withstand the strong winds that flow in the grasslands.

Some examples of vegetation in grasslands include buffalo grass, cacti, sagebrush, perennial grasses, sunflowers, clovers, and wild indigos.

Grasslands are open habitats full of food for animals but they provide little space for shelter.

Many types of animals are found in grasslands. They are homes to many herbivores such as bison, gazelles, zebras, giraffes, rhinoceroses, wild horses, deer, and rabbits. Carnivores such as lions and wolves are also found in grasslands.

ACTIVITY 2

Different names are used for grasslands around the world. Some of the names are given below. Find out the countries where they are found.

Grassland	Country
Savannas	_____
Pampas	_____
Campos	_____
Plains	_____
Steppes	_____
Prairies	_____
Veldts	_____



(a) Gazelle



(b) Bison

Fig 9.2 Some animals found in grasslands

Some adaptations that the animals of the grasslands possess are as follows:

- They have strong legs that enable them to run away from hungry predators.
- They have long ears that enable them to hear their predators from a distance.
- They have keen eyesight to spot danger.
- The body colour of these animals mostly gets camouflaged with the surroundings, making them less susceptible to predators and also helps them in hunting their prey.
- Animals in the grasslands are usually more active in the rainy season.

Infobit

In herbivores, the eyes are placed on the sides of the head to allow them to spot danger in all directions. In carnivores, the eyes are placed in front of the head to locate the prey correctly.



Read the following poem and complete the table given after it.

Plants survive in their surroundings
Because they adapt
To conditions that are found in
The desert habitat.
There it's always hot and sunny
The air is very dry
Soil is sandy and it's rocky
And the winds go blowing by.

How have desert plants adapted
To their habitat?
Roots are long for finding water
That they store in stems so fat.
Leaves lose water so they're smaller
Some plants have none, you know
Cacti have spines that will protect them.

Other kinds of plants are living
Where they must adapt
To the tropical rain forest
A wet, shady habitat.
There it's always warm and rainy
Soil is shallow and poor
There's so many plants it's shady
On the forest floor.

In the tropical rain forest
How do plants adapt

Buttresses support tall trees
 Drip-tip leaves shed water.
 Prop and stilt roots can be found here—
 Supporting while they feed.
 Some plants climb or live on others
 For the light they need.

—Nadine Chua Jie Yi

Character	Desert	Rainforest
Climate		
Soil		
Types of roots		
Types of leaves		

Deserts Deserts are places where the environment is generally hot and extremely dry, providing many striking examples of how plants and animals are adapted to their surroundings. Here rainfall is less than 10 inches per year.

Plants have many adaptations to cope with the lack of water. These are as follows:

- Some desert plants store water in their stems.
- As maximum loss of water takes place through the leaves, they are reduced to spines. Photosynthesis, which occurs in green leaves, is then carried out by the stems.
- In some plants, leaves are covered by a waxy coating and are small in size to minimise water loss.

Many varieties of cactus are found in deserts.



Fig 9.3 Some desert plants

Camels, lizards, and desert toads are some animals found in deserts.

Desert animals also have many adaptations that help them survive in the hot and dry climate.

- The light-coloured fur of the jackrabbit blends with the surroundings and protects it from predators. Its large ears help it to keep cool. The blood vessels in the ears expand to allow the blood to cool before re-entering the body.
- The kangaroo rat conserves water by excreting a solid, rather than liquid urine.
- Many small animals hide under rocks or dig underground burrows and stay there during the day to escape the heat of the Sun.
- Most desert animals are *nocturnal*—they avoid the extreme mid-day heat by feeding at night, when the temperature drops down and the air becomes much cooler. Some of them remain dormant (inactive) in the summer.
- Large desert animals try to stay in shady areas during the day. They obtain water from the food they eat and from the few water holes that exist in the deserts.
- The camel stores its food as fat in large humps on its back. The stored fats make the camel survive for long periods without food and water.

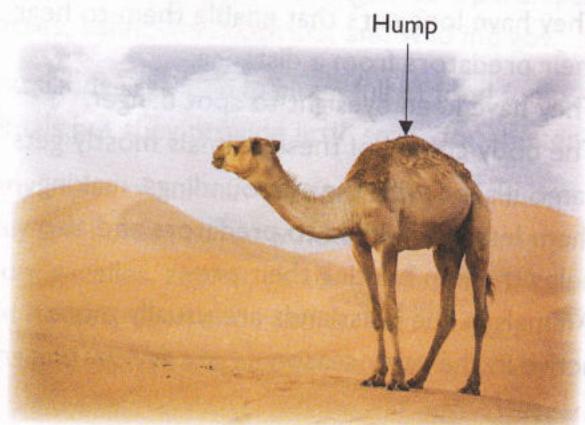


Fig 9.4 Camel—The ship of the desert

Forests Forests can be hot or wet. They are usually dense and dark due to little reach of sunlight. As little sunlight is available on the dark forest floor, plants have large leaves to capture the maximum amount of sunlight. Plants like orchids and ferns grow on trees to get more sunlight.

Animals in the forest include chimpanzees, anacondas, snakes, jaguars, lions, tigers, and toucans.

These animals are adapted to survive in forests. For example, a jaguar has spotted skin which enables it to camouflage in its surroundings and hunt for its prey.



Fig 9.5 Some animals found in forests

Mountains Have you ever been to any hill station like Shimla, Mussourie, or Darjeeling for a holiday?

You must have noticed that as you go up the mountains, the weather becomes colder. You may have even seen or played in the snow if you were there in winter.

Infobit

- Half of the forests that originally covered 48 per cent of the Earth's land surface have disappeared. Only one-fifth of the Earth's original forests remain undisturbed.
- The Amazon Rainforest is the largest and most diverse tropical rainforest in the world. It is often called the 'Lungs of the World'.

Sal, teak, bamboo, fir, oak, maple, deodar, spruce, and cedar are some plants that grow abundantly in the mountains. Moss and fungi also grow in abundance.

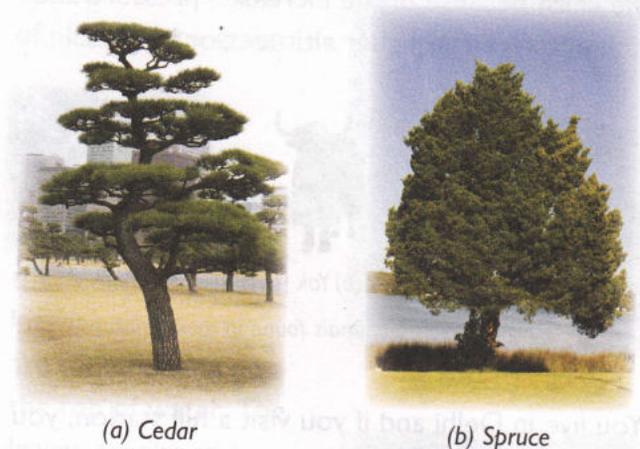


Fig 9.6 Some trees found in mountains

Some of the adaptations in plants found in mountains are as follows:

- These plants have shorter stems so that they can avoid the harsh wind and not get knocked over. They have a wide root system in order to gather more nutrients.
- Most of the trees are cone shaped and bear cones. These trees are called *conifers*. The Christmas tree that you know is a conifer. They have needle-like leaves that slide off the snow and rainwater easily.
- Some mountain trees possess few leaves and very bright flowers so that they can attract more insects for pollination. The leaves usually are very tough and have waxy surface to prevent drying out.

The mountains provide natural habitat to a large number of animal species like the tiger, yak, deer, musk deer, wild goat, sheep, wolf, and the snow leopard.

The animals adapt to the cold climate by *hibernating* (winter sleep), migrating to warmer areas, or insulating their bodies with layers of fat. They have shorter legs, tails, and ears in order to reduce heat loss. Their body is usually covered

with long hair like the yak or with thick fur like the snow leopard. Animals living in the mountains also have larger lungs, more blood cells, and more haemoglobin (helps in carrying oxygen to the cells) because of the increased pressure and lack of oxygen at higher altitudes or heights.



(a) Snow leopard (b) Yak (c) Musk deer

Fig 9.7 Some animals found in mountains

You live in Delhi and if you visit a hill station, you may experience difficulty in breathing for a short while. This is because there is less oxygen in the atmosphere in hilly areas so we tend to breathe faster. After sometime our body undergoes small changes and adjusts to the changed surroundings. We get used to the place and start to breathe normally. The small changes that take place in the body of an organism over a short period of time to overcome problems arising due to changes in the surroundings is called *acclimatization*. These changes are different from adaptations which take place over thousands of years.

Aquatic habitats

Oceans The oceans cover three-fourths of the Earth's surface. They contain salty or marine water. The oceans have a large variety of organisms living in them.

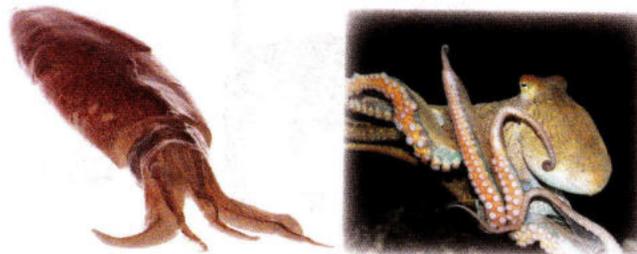
The bodies of the animals like fish living in the marine environment are streamlined, that is, the front and back of the body is narrow while the middle region is broader. This body shape helps in reducing the resistance provided by water and helps them cut through water and swim fast. They also have fins on the body which help them move and change the direction. In addition, the body is covered with scales and mucous, thereby making it waterproof.



Fig 9.8 Fish

Most animals living in oceans breathe through their gills. Fish also have air bladders to help them float in water. Fish without air bladders, like sharks, need to swim constantly to avoid sinking.

Some animals in the ocean do not have streamlined bodies. They avoid swimming and live close to the bottom of the ocean. They wait for the prey and catch it when it moves towards them. Squid and octopus are examples of *bottom dwellers*.



(a) Squid (b) Octopus

Fig 9.9 Bottom dwellers

Some animals like dolphins and whales do not breathe through gills. They come to the surface of the water from time to time to breathe in air. They breathe through the nostrils or blowholes located on their heads. They can remain inside water for a long time without breathing.

Freshwater habitat Have you ever visited a pond? If you have, you must have seen lots of plants and animals in it. Write down the names of animals that live:

- in water

- above water

- in the surrounding area

Frogs live near water because they need to return to the water to lay their eggs. They begin their lives as tiny eggs laid in clusters on water. The eggs hatch into tadpoles that swim in freshwater and breathe through their gills. As the tadpole grows, it develops legs and loses its tail to become a frog. When the tadpole changes into a frog, it starts to breathe through the lungs and starts living on land. It can also breathe through its moist skin.

Frogs have long, powerful jumping legs. This helps them move and also catch their prey. Their hind legs are webbed.

Plants living in water are called aquatic plants. In plants, roots are used to absorb water and minerals from the soil to be transported to other parts of the plant. Since aquatic plants are surrounded by water, the roots are reduced in size and mainly serve to anchor the plant. Air-filled cavities are present in the leaves and stems of aquatic plants that help them to float.

Aquatic plants can be divided into three types—fully submerged plants, partially submerged plants, and floating plants.

In fully submerged plants, all parts of the plant are present under water. The leaves are narrow

and long, helping the plants to resist water currents and not to get damaged. An example of this kind of plant is tape grass.

In partially submerged plants like the water lily, the stems are rooted in the sediment but the leaves and flowers are seen floating on the top of water. The leaves are flat and large in size. They are covered with a waxy coating to make them waterproof and have stomata (air pores) for exchange of gases on their upper surface.

Floating plants float on the surface with their roots hanging submerged in the water. Their leaves are broad and round and form bunches on the surface of water. Floating leaves are generally tough because they have to withstand the weather and water movement. An example of such a plant is water lettuce.



Fig 9.10 Tape grass



Fig 9.11 Water lily



Fig 9.12 Water lettuce



Strawberry poison dart frogs, which live in Central America and Puerto Rico, lay their eggs on land, and male frogs keep them moist with urine. Once the eggs hatch, the mother carries each tadpole on her back to its own tiny pool of water that has collected anywhere, such as knots and leaves in trees, small puddles, etc. Till the tadpoles grow up, their mother feeds them her own eggs.





Abiotic factors: physical or non-living factors of an environment

Biotic factors: all living things like plants and animals of an environment

Habitat: a place where plants and animals live

Adaptations: the special characteristics that enable plants and animals to survive in a particular environment

Camouflage: ability of an organism to blend in with its surroundings

Nocturnal: active during the nights

Hibernation: being inactive during winter

Acclimatization: small changes in an organism over a short period to adjust to a new surrounding



- Our environment is our surroundings.
- Abiotic factors are the physical or non-living factors such as rainfall and temperature.
- Biotic factors are the living things like plants and animals.
- A habitat is a place where plants and animals live.
- Special characteristics that enable plants and animals to be successful in a particular environment are called adaptations.
- There are mainly two types of habitats—terrestrial and aquatic.
- There are many living things which inhabit various types of terrestrial and aquatic habitats and show a variety of adaptations.

Put on your THINKING CAP!

1. Pick the abiotic and the biotic factors from the list given below and write them in their respective columns.

rainfall, hail, hare, dew, deer, fog, temperature, tiger, frog, kangaroo, rat

Abiotic factors

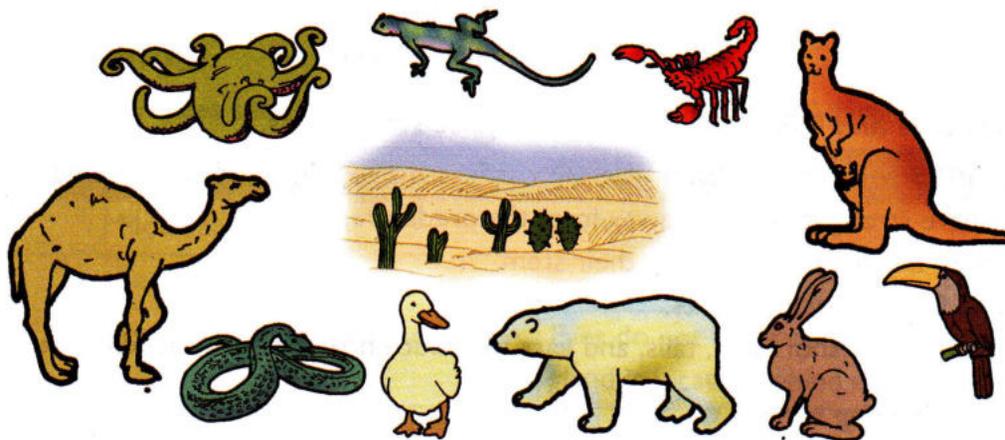
Biotic factors

2. The animals given below have wandered out of their habitats. Place them back in their proper habitat.

tiger, wild goat, giraffe, squid, camel, leech, chimpanzee, shark, duck, lizard, kangaroo, rat, yak, frog, bison, snow leopard, octopus, anaconda

Grassland	Desert	Forest	Mountain	Ocean	Pond

3. Many animals are surrounding the desert in the picture given below. Circle the animals that live in the desert and write their names.



4. Fill in the blanks.

- Many herbivores are found in _____.
- Nocturnal animals are found in the _____.
- _____ and _____ roots are found in plants growing in forests.
- Conifers grow in _____.
- The body of a fish is _____ to help it cut through the water and swim fast.
- Air-filled cavities are found in _____ plants.

5. Select the correct option.

- The monarch butterfly exhibits
 - migration
 - acclimatization
 - camouflage
 - hibernation
- Cold winters and fires are common in
 - grasslands
 - deserts
 - mountains
 - forests
- Leaves are reduced to spines in plants found in
 - grasslands
 - deserts
 - mountains
 - forests

- d) For plants to shed water efficiently in forests, the leaves have
- i) spines
 - ii) waxy coating
 - iii) drip tips
 - iv) air pockets
- e) Bunches of leaves are found on the surface of water in
- i) water lettuce
 - ii) water lily
 - iii) tape grass
 - iv) none of these
- f) Which of the following factors is not an abiotic factor?
- i) deer
 - ii) hail
 - iii) dew
 - iv) fog
- g) In which habitat conifers are found?
- i) desert
 - ii) mountain
 - iii) forest
 - iv) grassland
- h) Tadpoles, the young ones of frog breathe through their
- i) gills
 - ii) lungs
 - iii) skin
 - iv) trachea

6. Write T for true and F for false. Correct the false statements.

- a) The plants growing in grasslands have very stiff stems to withstand strong winds.
- b) Zebras have strong legs to run away from the predators.
- c) Cacti carry out photosynthesis in their stem.
- d) Moss and ferns grow in deserts.
- e) Animals that have short legs, tails, and ears to reduce heat loss, are found in oceans.

<input type="checkbox"/>

7. Define the following terms.

- a) Habitat
- b) Adaptation
- c) Acclimatization
- d) Camouflage
- e) Hibernation

8. Suppose you work at a National Museum. In the museum, you find a box with descriptions of animals on pieces of paper given below. Can you identify the habitat in which these animals live?

Stays in the shade during the day as it is very hot and comes out to feed in the night

Swims in the ocean and breathes in oxygen dissolved in the water

Flies from tree to tree and loves to eat fruit

Roams around eating grass and is always on the look-out for danger

Jumps and sits on stones in a pond, catching insects

9. Write short answers.

- a) Pines grow in the mountains. What features make their survival at such heights possible?
- b) Differentiate between the leaves of a submerged plant and a partially submerged plant in a pond.
- c) What are the adaptive features of bottom-dweller fishes? Give examples.
- d) Give some examples of plants and animals in the grasslands.
- e) Mention the adaptive features of the desert jackrabbit.

10. Answer in details.

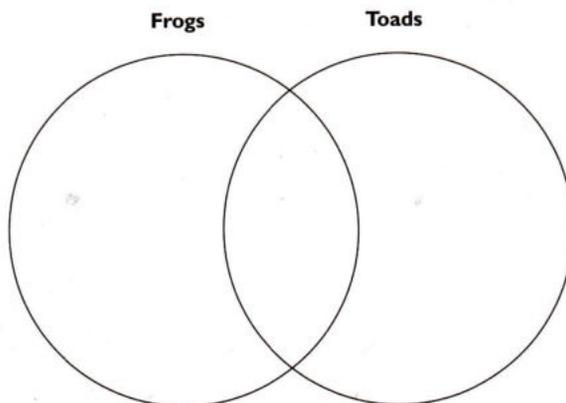
- a) What are the adaptation features of plants that are generally found in grasslands? Name a few plants that grow in this habitat.
- b) Why is it difficult to survive in a desert? What adaptations are present in the plants growing in a desert?
- c) List the adaptations in a camel that make it possible to survive in a desert.

Extended learning

1. Here are a few differences seen in frogs and toads. Go through the table carefully.

Feature	Frog	Toad
Skin	Moist and smooth	Bumpy and dry
Teeth	Teeth in upper jaw	No teeth
Eyes	Eyes bulge out from the body.	Eyes do not bulge out from the body; a poison gland is located behind each eye.
Hind legs	Long, powerful jumping legs; most frogs have webbed hind feet	Shorter legs
Eggs	Eggs laid in clusters	Eggs laid in long chains

Look at the diagram given below. The characteristics to be put into this diagram are provided in the next page. Write the characteristics of frogs in the first circle, toads in the second circle, and characteristics which are common to both in the middle section.



1. Are amphibians	7. Have a brain	13. Hatch from eggs
2. Have a backbone	8. Dry, warty skin	14. Have a heart
3. Adults have lungs	9. Slimy, smooth skin	15. Poison glands behind eyes
4. The young have gills	10. Lay eggs in clusters	16. Have no teeth
5. Jump	11. Lay eggs in chains	17. Have teeth in top jaws
6. Walk	12. Bulging eyes	18. The young live in water

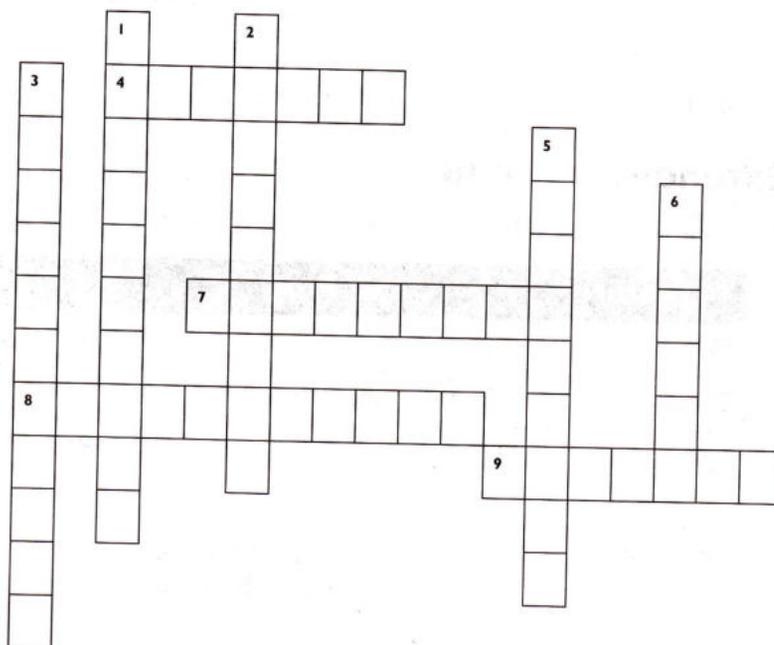
- Research the meanings of the terms 'food chain' and 'food web'. Draw one food chain and one food web found in the grasslands.
- Solve the crossword puzzle with the clues given below:

Across

- The physical factors in an environment
- Animals that hunt and kill other animals
- Special characteristics which help living beings to survive
- The place where an animal lives for food, shelter, and breeding

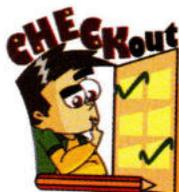
Down

- Ability of an organism to blend with its surroundings
- Active during night
- Winter sleep
- The habitat that is grassy and windy and has few trees
- The habitat that is very hot and extremely dry



HIGHER ORDER THINKING SKILLS
HOTS

- Piyush and his friend did a small experiment. They took a potted cactus plant and a potted broad leafed plant. They watered them regularly and covered the pots with polythene bags. They kept both the pots in the sun for a couple of hours. What do you think they observed and why?
- Why are eyes of a tiger placed in front of the head and those of a zebra placed on the sides of the head?
- Why do you find varieties of plants and animals in a forest?



For more information and games http://www.bbc.co.uk/schools/ks2bitesize/science/living_things/food_chains/play.shtml

Little Encyclopaedia

DID YOU KNOW ?

A dinosaur that is not an animal!

The 'dinosaur' here is not the extinct animal. It is a pre-historic fern plant! The dinosaur plant (*Selaginella lepidophylla*) has lived on Earth for 290 million years. It can survive without water for years. It looks like a lifeless ball of leaves but unrolls when the wet season begins! It has the ability to come back to life over and over again for several years.

It is also called the 'resurrection plant' or 'resurrection fern.'



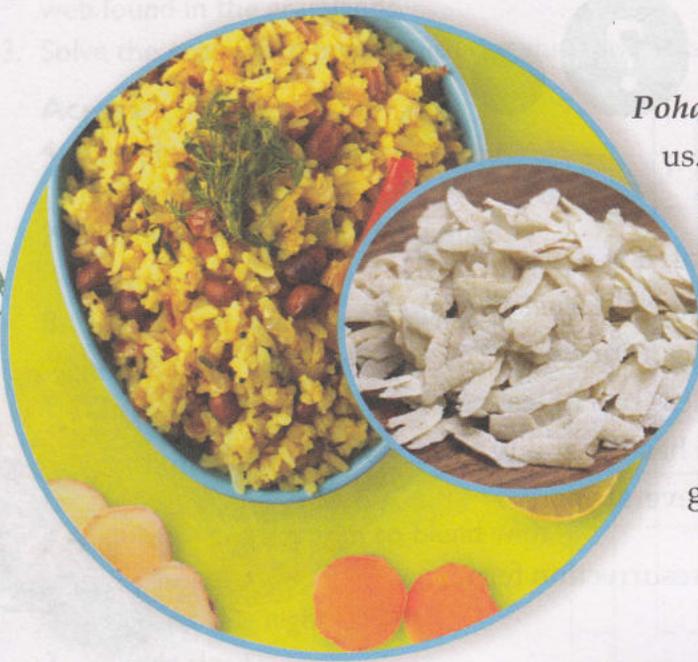
Starry night

There are about 6,000 stars visible to the naked eye from Earth. Only 2,000 can be seen from any given spot, even from the tallest observatory.

The star with the largest mass determined to date is R136a1 with a mass 265 times that of the Sun.

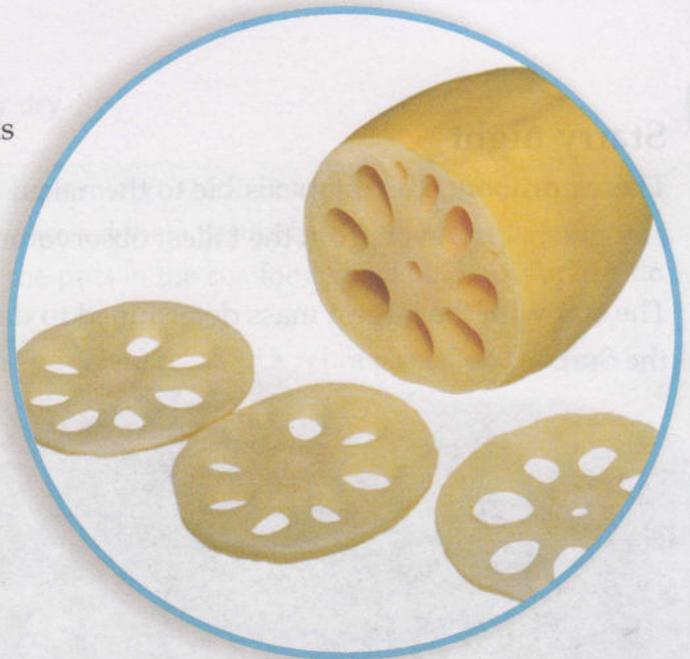


HEALTHY EATING



Poha makes a yummy breakfast for many of us. It is made from flattened rice flakes and is also called beaten rice. The husk (outer shell or cover) of rice is removed and it is flattened into flat, light, and dry flakes. When a liquid, such as water or milk, is added, these flakes of rice swell up as they absorb it. These flakes have all the goodness of rice and can be eaten raw too.

The stem of lotus is often eaten in various forms in different parts of the world. It is eaten with vegetables, used in soups and salads, and is also made into crispy chips. Dried and finely ground lotus stem powder can be used in making cakes and other desserts. The lotus-stem is a rich source of iron and calcium and also provides a lot of fibre.



SAVE SOIL TO SAVE LIFE !

We all know that soil sustains plant life and plants support animal life on this Earth. Soil conservation is very important to maintain a balance in nature. We should do our best to save soil in our own surroundings.

Would you like to know how?

1. We can plant grass and trees around our house. This will help to keep the soil healthy by retaining moisture and protecting it from too much rain and wind.
2. In a hilly area, trees can be planted in a line on the slope which will break the speed of wind. It prevents the wind from blowing the soil away.
3. We can place a container to store the rain water that runs off the roof of houses. This will prevent the water from washing the soil away. The stored water can be used to water plants and trees. In this way, you can conserve both water and soil.



PALINDROME

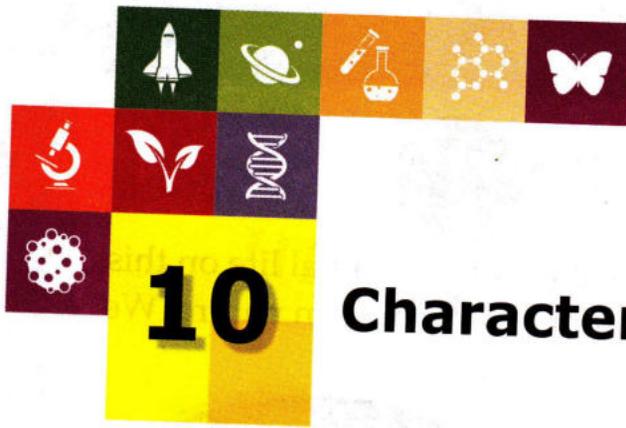
A palindrome is a word, phrase, or sentence that reads the same forward or backward, for example, DAD, CIVIC, and GAG.

Let's try some palindrome riddles.

1. I am a part of your body. I am pronounced as one letter but written with three.
2. I am a type of lightweight boat used for recreation and sport.
3. During summer, the Sun is higher in the sky at this time of a day. When written in capital letters, it is the same forward, backward, and upside down.
4. A system that uses radio waves to find the position and movement of objects, for example, planes and ships, when they cannot be seen.

1. EYE 2. KAYAK 3. NOON 4. RADAR

Answers:



Characteristics of Living Things



You will learn about

In your previous classes you have learnt about living and non-living things. Name five living and five non-living things around you.

Living things	Non-living things
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

We are surrounded by living and non-living things. All animals and plants are living things. For example, a dog playing with a ball is a living thing and a crow flying from one tree to another is also a living thing.

Sometimes it is very difficult to decide whether a thing is living or non-living. We say that plants are living things but they do not play with a ball nor do they fly like living things. Likewise, a car and a washing machine are non-living things but they can move.

So how can you identify whether something is living or non-living?

Let us find out the answer to this question in this chapter.

Some characteristics make living things different from non-living things. They are as follows:

- Living organisms have a cellular organization.
- They all possess chemicals of life.

- The difference between living and non-living things.
- The characteristics common to all living organisms.
- Organisms on the boundary of living and non-living things.

- They all are engaged in various life processes such as nutrition, respiration, excretion, and reproduction.
- They show movement.
- They grow and develop.
- They respond to stimuli.
- They have a definite life span.

Cellular organization

All living organisms starting from microscopic bacteria to a mango tree are all made up of cells. A cell is the basic structural and functional unit of life. The cells are so small in size that you can fit a million of them in the full stop at the end of this sentence. Cells can be viewed only under a microscope as seen in Activity 1.

If an organism is composed of only one cell it is called **unicellular** organism and if it is made of many cells it is called **multicellular**. Bacteria, amoebae, and viruses are some unicellular organisms. Single cell carries out all the functions for these organisms to stay alive. Both blue whale and a mango tree are multicellular.



ACTIVITY 1

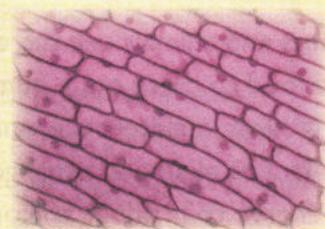
To observe plant cells

(Note: To be done under the supervision of an adult)

Things required: Onion, glass slide, cover slip, safranin stain, glycerine, water, three droppers

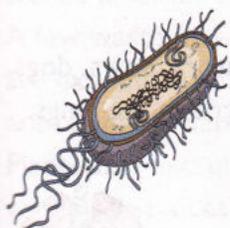
Method:

- Slice an onion. Take one small piece and using a tweezer peel off the inner section of the skin.
- Place it on the centre of a clean glass slide. Make sure that the peel is not folded or curled up. Add a drop of water to the peel.
- Add a drop of safranin stain and a drop of glycerine to the peel.
- Place a cover slip on the peel. This has to be done slowly so that no air bubble enters the cover slip.
- Clean the slide of any extra stain or glycerine using a filter paper.
- Observe the slide under the microscope.



5

You will find the cell structure as shown in the picture.



(a) Unicellular organism



(b) Multicellular organism

Fig 10.1

The cells of multicellular organisms are specialised to perform certain tasks. For example, nerve cells and muscle cells work together to keep us alive.

Nerve cells carry messages from the surroundings to your brain. Other nerve cells carry messages from the brain and transfer them to your muscle cells, which make our body move in response.

The chemicals of life

The cells of all living organisms are composed of chemicals. The most abundant chemical in the cells is water. There are other important chemicals which perform different functions in



ACTIVITY 2

To observe bacterial cells

- With the help of a toothpick put a small amount of yogurt on a clean glass slide.
- Add a small drop of water to the yogurt and mix the two using the toothpick.
- Add a drop of crystal violet stain and cover with a cover slip.

Observe the slide under the microscope.

5

our body. Proteins and lipids are the building materials of the cells. They resemble wood and bricks in function. As wood and bricks are the building materials of houses, proteins and lipids are building materials of cells. Cells also contain the nucleic acid DNA. It is the genetic material which controls and directs the functioning of the cells.

Nutrition

All living organisms need food to survive. You have studied that green plants make their own

food using raw materials by the process of photosynthesis.

- ▲ List the raw materials needed by the plants to perform photosynthesis.

You also know that animals cannot make their own food. They depend on plants and other small animals for their food. Can you tell into how many categories can animals be grouped according to their food habits?

Plants and animals use the energy obtained from the food to carry out a number of activities such as growth, maintenance, and repair of the injured parts. For example, a mango seed requires a lot of energy to produce trillions of cells that will make the body of a mango tree. This energy is provided by nutrition.

Infobit Assassin bugs live on the carnivorous plants such as sundew. These bugs crawl around the plant and eat the poor insects that have been captured by the plants. It is amazing that the assassin bugs do not get caught themselves. The bugs then excrete waste and the excrement is absorbed by the plant.



Respiration

Respiration is a key feature of all living organisms. It takes place in two stages:

- External respiration
- Internal respiration

The exchange of gases between the environment and the body is called *external respiration* or gaseous exchange. At this stage, oxygen is taken in and carbon dioxide is given out. This is generally referred to as *breathing*.

Internal respiration or cellular respiration is involved in the breakdown of food within the cells to release energy. The oxygen that is taken in during breathing breaks down the food to give energy to the organisms. In this process carbon dioxide is released.

Internal respiration is common to all living organisms. However, the mechanism of external respiration is different in different animals. For example, plants breathe through the pores present on the leaves whereas fish have gills to breathe. Fish use the oxygen that is dissolved in water and give out carbon dioxide into the water.

Amphibians such as frogs and salamanders use their lungs and moist skin to breathe. Earthworms which live in the soil also breathe through their skin.

Insects breathe through special openings called spiracles which are present on the sides of their body.

Animals such as crocodiles, alligators, cows, dogs, cats, and the humans breathe through the lungs.

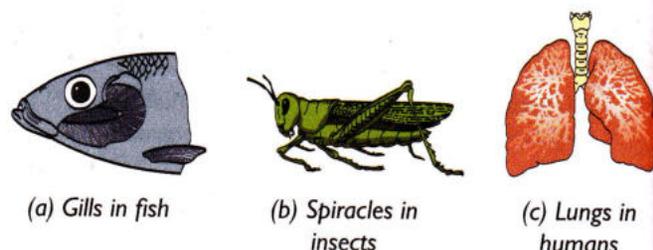


Fig 10.2 Respiratory organs of different animals

Excretion

Excretion is one characteristic common to all living things. A large number of waste materials is produced in the animal body by different life processes such as digestion and respiration. These waste materials are of no use to the body and if allowed to accumulate in the body, may become toxic. Therefore, they need to be removed from the body. *The process of elimination of waste products from the living body to maintain a constant environment in it is called excretion.*

When proteins are broken down in the body, ammonia, urea, and uric acid are produced. Carbon dioxide is produced as a waste product during respiration. During digestion the undigested food is eliminated from the body as faeces. Extra salt is eliminated as sweat.

In plants, breakdown of substances is much slower than in animals and the waste is produced in a very small quantity. Therefore, plants do not have special organs of excretion. Green plants in the absence of sunlight or plants that do not contain chlorophyll produce carbon dioxide and water as respiratory waste products. Carbon dioxide released during respiration is used during photosynthesis. Oxygen itself can be thought of as a waste product generated during photosynthesis. Plants can get rid of excess water by transpiration.

Waste products may be stored in leaves that fall off. A few waste materials that are exuded by some plants are resin, sap, latex, and gum. Plants also excrete some waste substances into the soil around them.



Latex exuded from trees

Reproduction

Living organisms have the ability to reproduce or produce offsprings that are similar to the parents. It helps to carry the characteristics of each type of organism from one generation to the other. Plants and animals reproduce by two different methods.

The first method is called *asexual reproduction* which involves only one parent for the formation of new individuals. The resulting cells are generally identical to the parent cell. For example, bacterium grows and quickly reaches maturity, after which it splits into two bacteria.

In plants, asexual reproduction takes place by vegetative parts such as roots, stem, or

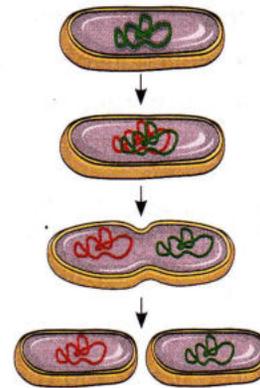


Fig 10.3 Asexual reproduction in bacterium

leaves. The formation of new plants from the vegetative parts of parent plants is called vegetative reproduction or *vegetative propagation*. Underground roots of some plants like carrot, turnip, and beetroot develop new plants by producing shoots. You must have seen potatoes and onions developing into new plants when left outside for a long period of time. This is because they are underground stems and have buds present on them. The underground stem of potato is called *tuber* (Fig 10.4a) and that of onion is called *bulb* (Fig 10.4b). How do gardeners grow rose plants? It is done with the help of stem cuttings (Fig 10.4c).

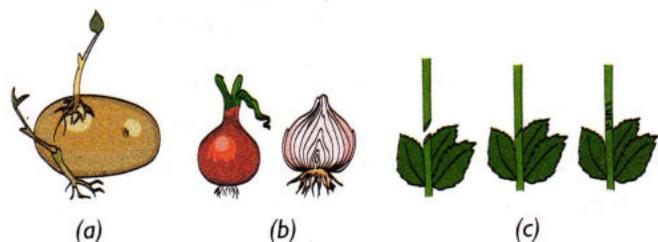


Fig 10.4 Asexual reproduction in plants

ACTIVITY 3

Take a carrot and a potato. Plant them in moist soil. Water the soil regularly and observe what happens after ten days.



The second method of reproduction is called *sexual reproduction*, which involves two parents or gametes for the formation of a new individual.

During this process, a new combination of characteristics can be produced. The process is generally more complex than asexual reproduction. Out of the two parents, the male parent produces the *sperm* and the female parent produces the *egg*. The sperm and egg combine to produce a new organism. Development can take place inside the mother's body or outside.

Animals either lay eggs or give birth to young ones. For example, hens lay eggs while kangaroos, cats, dogs, and human beings give birth to young ones.

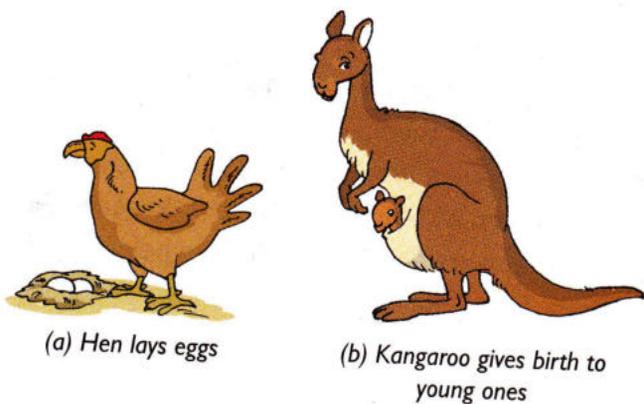


Fig 10.5 Sexual reproduction in animals

In plants, flowers are required for sexual reproduction. They produce seeds that develop into new plants.

Movement

All living organisms show movement. They also show internal movement, which means that they have the ability to move substances from one part of their body to another. For example, in plants, food manufactured by the process of photosynthesis moves from the leaves to all other parts of the plant. Flowers open and close on a plant. Some carnivorous plants even move

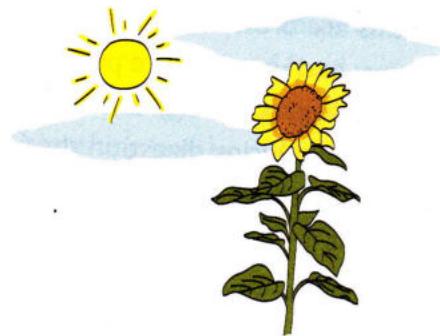


Fig 10.6 Movement of sunflower towards the Sun

to trap their prey. The stem of the plant moves towards the Sun.

Similarly, in animals, blood carries the digested food to every cell in the body. Some living organisms show external movement as well. They can move from one place to another by walking, flying, or swimming. A number of ways in which animals move was studied by you in Chapter 8.

Infobit Do you know why a walking fern is called so?

It is because whenever the tips of the parent plant touch the moist ground, a new fern sprouts. It appears that the fern 'walks' across the ground.



Growth and development

Growth is defined as an increase in size and mass of an organism. Living things grow in an organised manner.

During the process of development the parts of the organisms take shape, mature, and start performing functions. Bacteria and amoebae being simple organisms show very little development. In more complex organisms like a human being, a horse, or a banyan tree, development is a complicated process and takes many years.

ACTIVITY 4

Stick three pictures of yourself, of when you were three months old, three years old, and a recent one, in your activity book. What differences do you notice in all the three stages?



ACTIVITY 5

To understand germination

Things required: Two types of seeds, tissue papers

Method: Dampen the tissue papers.

Put one type of seed on each of the moist tissue papers and fold them into half. Keep the tissue paper moist.

What is the germination pattern that you observe? Have both the seeds germinated at the same rate? Which type of seed germinated faster?



Response to stimuli

All living things react to changes around them. We react to touch, light, heat, cold, and sound, as do other living things.

Any change in the organism's environment that causes it to react is called a stimulus. How an organism reacts to a stimulus and brings about a change in its behaviour is called a response.

For example, if a dog is feeling cold it will move to a warmer place. Here the stimulus is the cold and the response is moving into the sun.

- Identify the stimulus and the response in the following examples.

A rabbit is scared, so it runs away.

You are thirsty, so you drink water.

Plants too respond to their environment. The movements of plants in the direction of stimulus is known as tropism. A plant bends towards light. This movement of plants is called *phototropism*. Roots grow towards the soil. This is called *geotropism*. The leaves of the touch-me-not plant fold when someone touches them. This movement of plants is called *nasticism*. Most flowers bloom during the day. Some flowers bloom only at night.

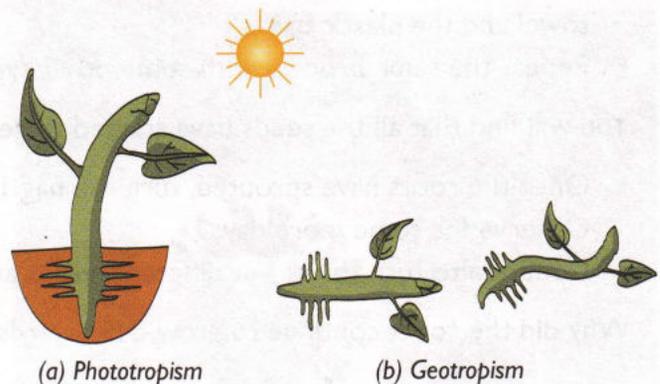


Fig 10.7 Plants respond to stimuli



In 1970, a New York dentist, George Milstein, released *Music to Grow Plants By*, a record of songs to play for plants. In fact, a few studies seemed to confirm that classical or soothing music could benefit plants, while loud aggressive music could cause them to wither and die.

A definite life span

The period of time that an organism is expected to live is called its life span.

The life span of living things can vary significantly. Different organisms have different life spans. For example, some bacteria and insects perform all their life activities and then die, all within a couple of hours. Other living things can live for many years. For example, an elephant can live for 70 years, whereas a human can live for

ACTIVITY 6

To demonstrate geotropism in plants

Things required: Paper towel, plastic bag, seeds, a bulletin board

Method:

- Fold a paper towel so that it will fit inside a plastic bag. Soak it thoroughly with water.
- Place several seeds on top of the paper towel and carefully put the paper towel inside the bag. Close the bag partially to allow some air to get in. Label the plastic bag.
- Attach the bag to a bulletin board taking care that the seeds stay in place between the paper towel and the plastic bag.
- Repeat the same process with some other types of seeds.

You will find that all the seeds have started to germinate.

- Once the roots have sprouted, turn the bag 180 degrees and attach to the bulletin board. Observe for some more days.
- Continue to turn the bag at different angles and record the pattern of root and stem growth.

Why did the roots continue to grow downwards even after the bag was turned over?



over 100 years. The bristlecone pine tree has the longest life span. It can live for about 5,500 years. Even these long-lived organisms will eventually die.



(a) A human being



(b) A bristlecone tree



(c) An elephant

Fig 10.8 Organisms having definite lifespan

Find out the life span of the following organisms and fill in the table.

Organism	Life span
1. Dog	
2. Cat	
3. Tortoise	
4. Parrot	
5. Banyan tree	
6. Chimpanzee	
7. Tiger	
8. Mosquito	

Organisms on the boundary of living and non-living things

There are some organisms which show both living and non-living characteristics. They are the **viruses** and are like a puzzle to people who study biology.

Viruses need to be inside living cells to grow and reproduce. Most viruses cannot survive for long if they are not inside a living thing.

When viruses get inside living bodies, they multiply and make people sick.

Some viruses can live for a while on a doorknob, mobile phone, remote, keyboard, or a table, so remember to wash your hands regularly!

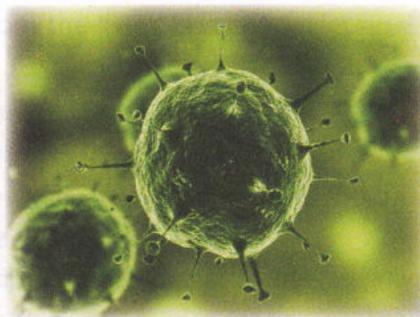
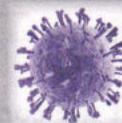
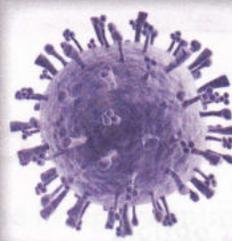


Fig 10.9 Virus



Swine flu is an infection caused by a virus. The name of the virus is H1N1.



Viruses can cause chickenpox, measles, flu, and many other diseases. They also cause many diseases in plants. They can make leaves and flowers change colour, or make leaves and stems twisted.



Unicellular: composed of only one cell

Multicellular: composed of many cells

Breathing: the exchange of gases between the environment and the body

Cellular respiration: breakdown of food in the cells

Excretion: the process of elimination of waste products from the body

Asexual reproduction: reproduction which involves only one parent

Sexual reproduction: reproduction that involves two parents

Stimulus: change in the organism's environment that makes it react

Response: reaction to the stimulus resulting in a change of behaviour

Phototropism: bending of plant towards light

Geotropism: bending of plant roots towards the soil

Life span: the period of time an organism is expected to live



- Our environment has non-living and living things.
- All living organisms are made up of cells.
- All living organisms are composed of chemicals such as carbohydrates, proteins, and lipids.
- All living organisms are capable of obtaining nutrition.
- All living organisms respire.
- All living organisms excrete waste materials.
- All living organisms are capable of reproduction.
- All living organisms show movement.
- All living organisms grow and show development.
- All living organisms respond to stimulus.
- All living organisms have a definite life span.
- Viruses are the organisms which show characteristics of both living and non-living things.

▲ Put on your **THINKING CAP!**

1. Select the correct option.

- a) Which of the following is a unicellular organism?
- i) amoeba
 - ii) cat
 - iii) dog
 - iv) tree
- b) The genetic material of a cell is
- i) lipid
 - ii) DNA
 - iii) protein
 - iv) silver
- c) Which of the following functions is *not* performed by food?
- i) growth
 - ii) repair of body parts
 - iii) maintenance of the body
 - iv) reproduction
- d) Frogs breathe with the help of
- i) lungs
 - ii) gills
 - iii) both gills and lungs
 - iv) both lungs and skin
- e) Which is not a waste material in plants?
- i) urea
 - ii) latex
 - iii) resin
 - iv) gum
- f) The spiracles present in insects help them in
- i) sweating
 - ii) breathing
 - iii) reproducing
 - iv) all of these



For more activities

http://www.bbc.co.uk/schools/ks2bitesize/science/living_things/microorganisms/play.shtml

6. Write short answers.

- Differentiate between the cellular organisation seen in amoeba and man.
- Why is nutrition an important characteristic of a living organism?
- Why should waste products be removed from the animal body?
- Identify the type of reproduction seen in each of the following:
 - cat
 - onion
 - rose
 - mango
 - parrot
- How is growth different from development?
- What is meant by the term *life span*? What is the life span of the following:
 - elephant
 - human being
 - bristlecone tree

7. Answer in details.

- Do plants undergo excretion? Explain the various methods of excretion in plants with examples.
- What is meant by breathing?
 - How is external respiration different from internal respiration?
 - How do fishes breathe? Draw a diagram showing the organ and its exact location in the body of fish.

Extended learning

-  It is a common myth that banana plants may 'walk' or move as they grow. This myth originates from South American banana plantations. Research and write down the fact.
-  On Earth, the roots of a plant always grow downwards and the stem and leaves grow upwards. This is due to gravity. In space, plants do not know which way is 'down', because they do not receive any clues from gravity. Find out how they would grow in space.
- You can buy yeast to make bread from the grocery store. This yeast consists of little brown grains. What is yeast, and what are some common uses of yeast? Do you think that these little brown grains of yeast are alive? Why or why not?

HIGHER ORDER THINKING SKILLS
HOTS

1. What will happen if living organisms did not have a definite life span and had the power to live forever?
2. A snowball grows when you roll it over fresh snow. Why isn't it a living thing?



11

Measurement and Motion

Need for measurement

If you want to get a dress stitched, then you need to know the length of the cloth that would be required to make it. Similarly, if you want to travel from one state to another, then you need to know the distance between the two states in order to estimate the time (depending on the mode of transport) required to reach the other state. To make a cake, the ingredients have to be put in the right quantity. From these examples, it is clear that measurement forms an integral part of our daily life.

Standard units of measurement

Any physical quantity for measurement is compared to a standard known quantity called a *unit*. In earlier times, people used different parts of the human body such as hand span, cubit (forearm), and foot to measure length. But all these units of measurements had different measures for different persons and this is where the need to have a standard set of units for the measurement of different physical quantities arose. The *metric system* created by the French is one such standard set of units.

Ancient Egyptians used *cubit* to measure length, wherein a cubit was the distance between the elbow and the tip of the middle finger of the outstretched hand. But this measure too varied from person to person. So, a certain length was



You will learn about

- Need for measurement
- Measurement of length and distance
- Standard units of measurement (SI)
- SI unit of length, time, mass, and temperature
- Correct way of measuring length
- Motion and rest
- Different types of motion
- Motion and graphs

taken as the standard cubit and was marked on a piece of stone. Measuring sticks equal in length to this standard were made and circulated so that the same measure of cubit was used all over Egypt.

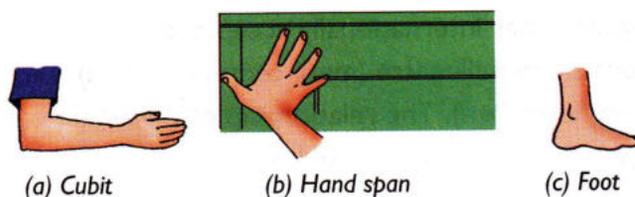


Fig 11.1 A few measures used to measure length in ancient times

The use of different units of measurement by different countries created a lot of problems in commercial dealings. So the scientists all over the world, for the sake of uniformity, agreed to have a common set of units for different physical quantities. The common set of units that all

the countries follow today is referred to as the *International System of Units* or the *SI units*. With the adoption of SI units, it became easier to exchange scientific data and the results of various experiments among the scientists of different countries.

Standard unit of length

In order to measure the length of a blackboard in a class or the length of the classroom, we need to find out how many times the standard length is contained in it. Thus, for any kind of measurement the following are required.

- A suitable standard unit of measurement for the physical quantity under consideration
- The number of times the standard unit is contained in the physical quantity

Measurement can now be defined as the comparison of a physical quantity to a given standard unit. For example, the SI unit of length is metre (m). So, the measurement of a length that is equal to the standard SI metre will be expressed as 1 m. Similarly, if measurement of a length is 10 times the standard SI metre, then it will be expressed as 10 m.

Thus, a measurement is completely specified by an appropriate unit along with a numerical value.

Some other internationally acceptable units of length are millimetre (mm), centimetre (cm), and kilometre (km). The relationship of these units with the SI unit is given below:

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

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

$$(1/1000) \text{ km} = 1 \text{ m} \text{ or } 1000 \text{ m} = 1 \text{ km}$$

Smaller units like 'cm' and 'mm' are used to measure smaller lengths. Larger units like 'm' and 'km' are used to measure larger lengths and long distances.

Correct measurement of length

Devices used to measure length Apart from different units of measurement, there are different standardised devices used to measure lengths and distances. The simplest standard device for measuring length of a line is the *ruler* or *metre scale*.



Fig 11.2 A ruler

A correct metre scale should have an arrow (\leftarrow) at the left end and another (\rightarrow) at the right end, with a stamp of the Department of Weights and Measures.

A *measuring tape* is used to take chest measurements, and a metre rod is used to measure the length of a piece of cloth.

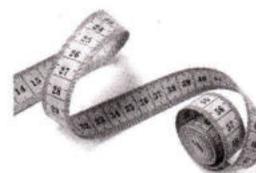
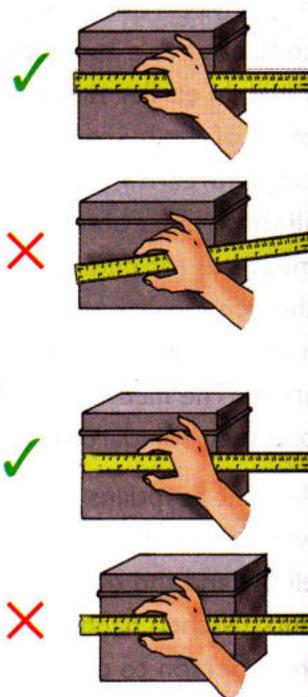


Fig 11.3 A measuring tape

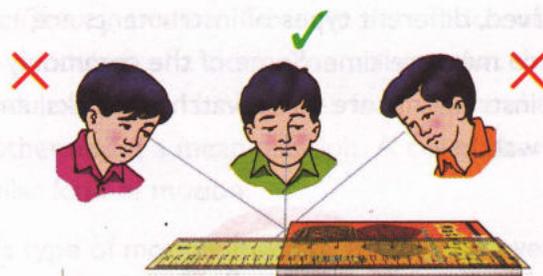
To make correct length measurements, follow the steps given below:

- The measuring instrument must always be kept parallel and as close as possible to the length to be measured.
- If the first major mark is unclear or broken, then the measurement can be made from any other major mark. The



reading at this mark should then be subtracted from the final reading to obtain the exact measure of length.

- The eye should be positioned exactly above the point where the measurement is being taken.



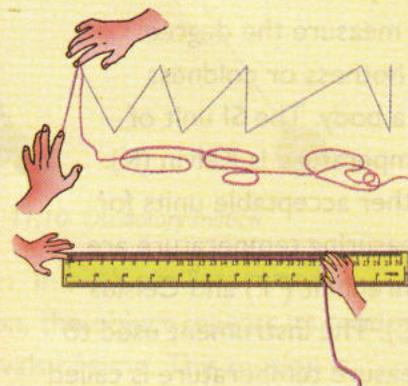
ACTIVITY 1

You will need the help of your friend to do this activity. Measure the length of the classroom, the length and breadth of the desk, and the length of a register by using a hand span, a non-standard unit of measurement. Then, ask your friend to repeat the same measurements using a ruler or measuring tape. Compare your results with those obtained by your friend.

Finding the length of a curved line

The length of the curved line can be measured by using a divider (from your geometry box) or a thread. Let us perform an activity using thread to understand this.

To do this activity, take a thread and place one of its ends at the beginning of the curved line. Now, slowly curve the thread along the line. Mark the point on the thread which overlaps the other end of the line. Now, straighten the thread and measure it using a ruler.



Finding the thickness of a one-rupee coin

Collect 10 one-rupee coins. Stack them in a neat pile and place a scale next to the pile. Measure the height of the pile. Let it be x cm. The thickness of one coin will be $x/10$ cm.

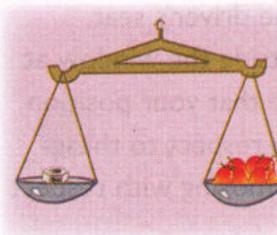


S

Measurement of other physical quantities

Let us now look at the units used to measure other physical quantities like mass, time, and temperature that we frequently use in our daily life.

Mass It is the quantity of matter contained in an object. The SI unit of mass is kilogram (kg). To measure the mass of an object, a *balance* is used. Beam balance and digital (electronic) balance are the two commonly used balances.



(a) Beam balance



(b) Digital balance

Fig 11.4

Time It is the duration elapsed between one event and the next. The SI unit of time is second (s). Depending on the kind of event being

observed, different types of instruments are used to measure time. Some of the commonly used instruments are wrist watches, clocks, and stop watches.



Fig 11.5 Wall clock

Temperature It is used to measure the degree of hotness or coldness of a body. The SI unit of temperature is Kelvin (K). Other acceptable units for measuring temperature are Fahrenheit ($^{\circ}\text{F}$) and Celsius ($^{\circ}\text{C}$). The instrument used to measure temperature is called a *thermometer*.

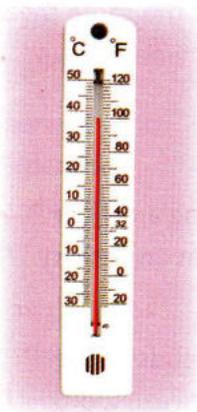


Fig 11.6 Thermometer

Motion and rest

Observe your surroundings while sitting in a moving bus. When you look at things inside the bus like the driver's seat, you realise that your position with respect to such objects does not change. Here, it will be said that you are stationary with respect to the driver's seat. However, when you look outside the window at buildings or trees, you realise that your position is continuously changing with respect to these objects. In this case, you are moving with respect to the trees and buildings.

Thus, we come to the conclusion that when the position of an object with respect to stationary things in its surroundings changes with time, the

object is said to be in *motion*. On the other hand, when the position of an object with respect to stationary things in its surroundings does not change with time, it is said to be at *rest*.

Types of motion

Look at various moving objects around you like a car moving on the road, a boy moving down a slide, a fly buzzing around, a train moving on the track, and the moving pendulum of a clock. You will find that different objects show different types of motion.

Translational motion When all parts of an object move the same distance in a given time, the object is said to have *translational motion*. This kind of motion can be categorized into two kinds: rectilinear motion and curvilinear motion.

If all parts of an object cover the same distance along a straight line in a given time, then the object is said to have *rectilinear motion*. It is also known as *linear motion*. For example, a train moving on a straight track will have rectilinear motion.

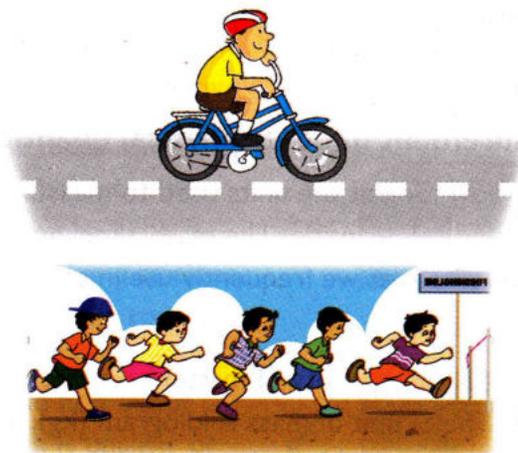


Fig 11.7 Rectilinear motion



At this point, the teacher can ask how the same object can be at rest as well as in motion, or how motion and rest are relative terms.

If all parts of an object move along a curved path in a given time, then the object is said to have *curvilinear motion*. For example, a ball thrown upwards at an angle will have curvilinear motion. Similarly, a train moving along a curved track shows curvilinear motion.



Fig 11.8 Curvilinear motion

Rotational motion When all points on a moving object move about a fixed point or axis of rotation, it is said to have *rotational motion*. The distance of any point on the object from the fixed axis always remains same. For example, the motion of the blades of a fan shows rotational motion.

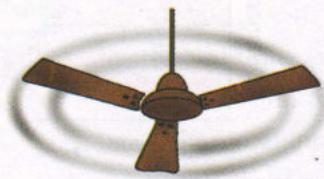


Fig 11.9 Rotational motion



Observe other things which undergo rotational motion. Is there any other motion associated with it? Talk about this with your teacher.



Oscillatory motion Observe the motion of the pendulum of a clock. You will see that the pendulum of the clock moves from one end to another about a mean position. A swing shows a similar kind of motion.

This type of motion in which an object moves to and fro about a mean or rest position is known as *oscillatory motion*.



Fig 11.10 Oscillatory motion

Periodic motion In both oscillatory and rotational motion, the object repeats its motion after fixed intervals of time. This motion is referred to as *periodic motion*.

Some examples of periodic motion are as follows:

- Motion of the Earth
- The blades of an electric fan
- Motion of the pendulum of a clock
- Motion of the needle of a sewing machine
- Motion of a swing

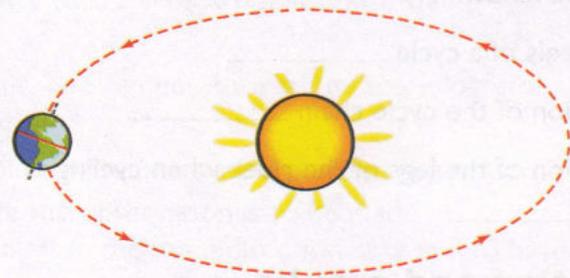


Fig 11.11 Periodic motion

The objects which do not repeat their motion after a fixed interval of time are said to have *non-periodic motion*. The objects moving in a straight line show non-periodic motion.



Fig 11.12 Non-periodic motion

Random motion The type of motion in which an object does not move along a fixed path or direction is called *random motion*. For example, the movement of flies in the sky shows random motion.



Fig 11.13 Random motion

More than one kind of motion Most objects, which we see in our daily life, perform more than one kind of motion at the same time. For example, a ball rolling on the floor shows rotational motion as well as rectilinear motion.

⚠ Can you identify the kind of motion taking place in the following?

Wheels of a cycle _____

Motion of the cycle chain _____

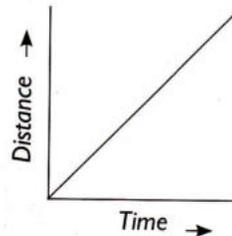
Motion of the legs of the rider when cycling _____

Motion and graphs

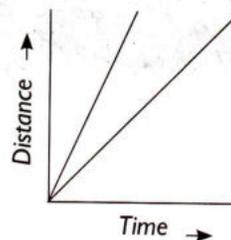
The motion of objects can be easily represented in distance–time graphs which are easy to understand at a glance. While making a graph, the independent variable which is usually time, is taken on the x -axis and the dependent variable, i.e., distance, is taken on the y -axis.

A few fundamental graphs are being discussed here.

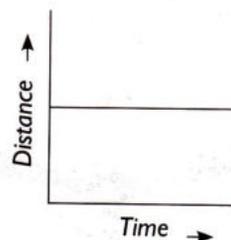
This graph of distance versus time shown below is a straight line implying that the body is moving in such a way that it covers equal distances in equal intervals of time. In other words the body has uniform motion.



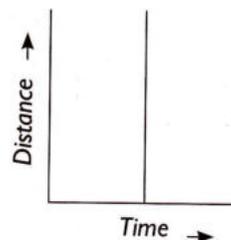
In the above distance–time graph the inclination that the line makes with the x -axis, also called the slope of the graph, is an easy way of finding the speed of the vehicle. The more the inclination of the line, the higher is the speed. So, such graphs can be used for comparing the speed of more than one vehicle.



In the graph shown below where the inclination of the line with the x -axis is zero, the speed of the object is zero or the object is at rest.



In the graph shown below the slope is infinite which is not actually possible. The graph shown here is unrealistic.

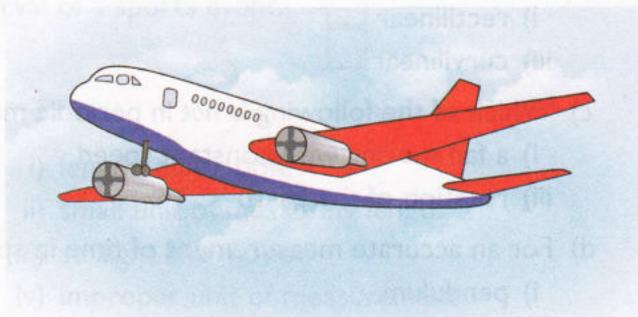


The story of transport

In older times, man used to travel from one place to another on foot. As he domesticated animals, he started to use them for transportation and for travelling faster between two places. The revolution in transport and travelling came in with the invention of the wheel. Wheel carts were the first wheeled vehicles in history. Gradually chariots were attached to animals and were used for transportation and travelling.



A very important turnaround in transportation history came with the invention of steam-powered engines. Today, there are fast moving trains involving the principle of magnetic levitation. Air planes are the fastest mode of transport that have significantly reduced the time taken to travel between two places.



Measurement: the process of comparison of a given physical quantity with a standard unit of that quantity

Motion: when an object changes its position with respect to a stationary object with time, it is said to be in motion

Rest: when an object does not change its position with respect to a stationary object with time, it is said to be at rest

Periodic motion: a motion that repeats itself after fixed intervals of time



- Comparison of a physical quantity with a standard unit is known as *measurement*.
- The SI units of length, mass, time, and temperature are metre, kilogram, second, and Kelvin, respectively.
- When making any kind of measurement, one should position the eyes vertically above the point where the observation is to be made.
- When all parts of an object move by the same amount in the same direction, it is said to have a *translational motion*.
- When all points on a moving object move around a fixed point or axis of rotation, it is said to have a *rotational motion*.
- When an object moves to and fro about a fixed position, it is said to have an *oscillatory motion*.
- *Periodic motion* is the motion that repeats itself after fixed intervals of time.

Put on your THINKING CAP!

I. Select the correct option.

- a) Which of the following is not matched correctly?
 - i) mass—kg
 - ii) length—metre
 - iii) time—second
 - iv) temperature—litre
- b) The motion of the wheels of a bicycle is
 - i) rectilinear
 - ii) circular
 - iii) curvilinear
 - iv) none of these
- c) Which of the following is *not* in periodic motion?
 - i) a fan moving with constant speed
 - ii) a swinging pendulum
 - iii) rotation of the Earth
 - iv) a flying kite
- d) For an accurate measurement of time in sports, we use a
 - i) pendulum
 - ii) stopwatch
 - iii) watch
 - iv) clock
- e) The motion of a striker across a carom board is an example of a
 - i) periodic motion
 - ii) oscillatory motion
 - iii) rectilinear motion
 - iv) circular motion
- f) Which unit of length is most suitable for measuring the height of a tree?
 - i) mm
 - ii) cm
 - iii) m
 - iv) inch
- g) This is duration elapsed between one event and the next.
 - i) length
 - ii) mass
 - iii) time
 - iv) temperature
- h) A quicker way of comparing motions of two or more objects is
 - i) scales
 - ii) graphs
 - iii) rulers
 - iv) none of these

2. Identify the kind of motion taking place in the following:

- a) Motion of a bicycle wheel
- b) Motion of a car along a straight road
- c) Rotation of the Earth
- d) A flying kite
- e) A butterfly moving from flower to flower
- f) Motion of a striker on the carom board
- g) Motion of dust particles in a beam of light
- h) Motion of the needle of a sewing machine when in use

3. Write T for true and F for false.

- a) One metre contains 10 cm.
- b) Motion of a pendulum is periodic motion.
- c) Motion of the string of a guitar when plucked is oscillatory motion.
- d) SI unit of temperature is Celsius.
- e) One millimetre is equal to 1,00,000 m.
- f) The motion of planets around the Sun is curvilinear motion.
- g) We use a clock to measure accurate time interval of a sports event.
- h) The SI unit of mass is grams.

<input type="checkbox"/>

4. Match the columns.

- | | |
|---|------------------------------------|
| a) SI unit of time | i) length, mass, time |
| b) Rotational motion | ii) small unit of measuring length |
| c) Three fundamental physical quantities | iii) straight line motion |
| d) A length which is (1/1000)th part of a metre | iv) improper unit of measurement |
| e) Hand span | v) 10 km |
| f) A length equal to 10,000 m | vi) motion about an axis |
| g) Rectilinear motion | vii) millimetre |
| h) Millimetre | viii) second |

5. Write short answers.

- a) Define measurement.
- b) Define rest and motion. Why are they called relative terms?
- c) Arrange the following in their increasing magnitude.
10 mm, 100 m, 0.5 km, 20 cm
- d) Convert the following:
 - i) 22.4 cm into mm
 - ii) 568 cm into m
 - iii) 18 cm into km
 - iv) 8300 km into m
- e) While measuring the length of a pencil, the reading of the scale at one end is 5.5 cm and that at the other end is 17.2 cm. What is the length of the pencil?

6. Answer in details.

- a) Differentiate translational motion and rotational motion. Give proper examples.
- b) The motion of objects can be easily represented in distance–time graphs. Draw and explain the following graphs.
 - i) When an object has uniform motion.
 - ii) When an object is at rest.
- c) What is the difference between periodic and non-periodic motion? Give an example for each.

Extended learning

Look around and name at least two things that are measured in

- milligrams
- grams
- kilograms
- millilitre
- litre
- millimetre
- centimetre
- metre

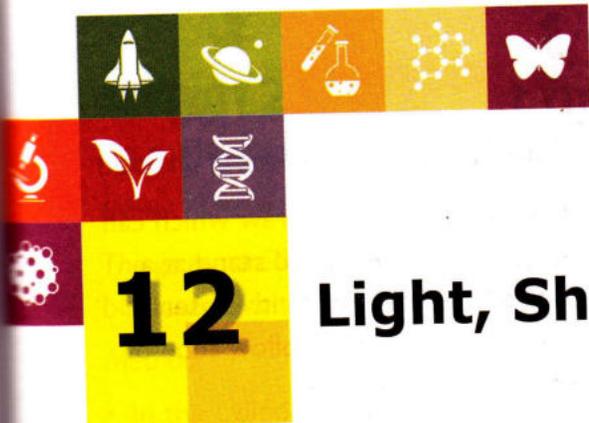
_____	_____
_____	_____
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_____	_____
_____	_____
_____	_____
_____	_____
_____	_____



- What is the difference between 5 square centimetre and 5 centimetre square?
- How many times a day do the hour and minute hands on a clock line up exactly with each other?



For more information and converters
<http://www.aaamath.com/mea.html>



12 Light, Shadow, and Reflection

When you are in a dark room, you are unable to locate objects kept in the room. However, when you look outside the window into a well-lit street you will be able to see things. This implies that light helps us to see objects. Therefore, *light* can be defined as a form of energy that gives us the sensation of sight.

Luminous and non-luminous objects

Have you ever thought why you are able to see objects in a well-illuminated street? This is possible because of the presence of some source of light. There are certain objects in our surroundings which emit light of their own. These are referred to as *luminous* objects. Sun, stars, bulbs, and tube lights are some examples of luminous objects.



Fig 12.1 A luminous object

On the other hand, objects like tables, cricket balls, and walls do not emit their own light but make light falling on them from other sources to bounce back. Such objects are known as *non-luminous* objects.



You will learn about

- Luminous and non-luminous objects
- Sources of light
- Rectilinear propagation of light
- Pinhole camera
- Transparent, translucent, and opaque objects
- Shadow formation
- Solar and lunar eclipse
- Reflection of light
- Types of reflection
- Image formed by a plane mirror



Fig 12.2 A non-luminous object

The Moon is an example of a non-luminous object as it does not have light of its own. It makes light from the Sun to bounce from its surface. We can see the Moon because of the light that bounces off its surface and reaches us.

Sources of light

The objects that give out light are called *sources of light*. These sources can be categorized into two types: natural and man-made or artificial. Sun, glow-worm, and firefly are the *natural* sources of light. Other sources like bulb and candle are *man-made* or *artificial* sources of light.

Light is usually produced along with heat. Because of this, the sources of light can be classified as *hot* or *cold* sources of light. Sun, bulb, and candle produce light along with heat and are therefore called hot sources of light. On the other hand, firefly and glow-worm are the objects that produce light but are not hot. They are called cold sources of light.



(a) Hot source of light



(b) Cold source of light

Fig 12.3



Objects like the filament of an electric bulb that give out light when heated to a very high temperature are called *incandescent objects*.

Light moves along a straight line

Light travels in a straight line. Let us perform the following activity to show this property of light.

Thus, Activity 1 proves that light moves in a straight line, *i.e.*, it cannot bend around an obstruction. Otherwise, you would have been able to see the flame even through a bent tube. This tendency of light to travel in a straight line is called *rectilinear propagation of light*.



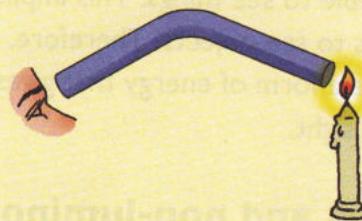
ACTIVITY 1

(Note: To be done under the supervision of an adult)

Take a hollow plastic tube or straw which can be bent easily. Light a candle and stand at a distance of about 2–3 feet from it. Observe the candle flame through the hollow tube or straw, as shown in the picture.



Now, bend the tube from the centre and again try to see the candle flame through it.



Are you able to see the flame now?

Your answer would definitely be NO.

Thus, the candle flame can be seen through the straight tube but not through the bent tube.

This shows that light travels in a straight line.

5

Pinhole camera

A pinhole camera is a simple application of rectilinear propagation of light. Let us learn to make a pinhole camera through Activity 2.

Transparent, opaque, and translucent objects

There are certain objects that allow light to pass through them. Such objects are known as *transparent* objects. Transparent objects allow us to see things on the other side. For example, glass that is used to make window panes in buildings is a transparent material.

Allow white light (a light made of seven colours) to fall on a red cellophane sheet. You will find

ACTIVITY 2

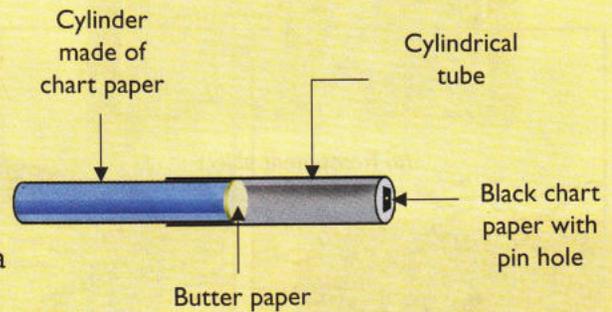
To make a pinhole camera

(Note: To be done under the supervision of an adult)

Things required: A cylindrical tube, a sharp needle, black and white chart papers, butter paper, a candle

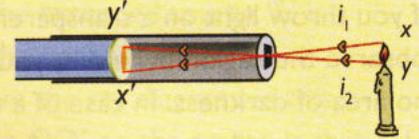
Method:

- In the cylindrical tube, make a hole on one side with a nail. Then, cover the hole with a piece of black chart paper and make a small hole in it with a sharp needle.
- Make a cylinder of the white chart paper of such size that it fits into the tube and can be rolled in and out easily.
- Place a sheet of butter paper on one side of the cylinder made of the chart paper and put the cylinder back inside the tube allowing the butter paper part to face the tube where the hole has been pierced.
- Place a lighted candle in front of the pinhole and look through the chart paper cylinder, move it in and out so that a sharp image of the candle flame can be seen on the butter paper.
- Is the image formed on the butter paper identical to the flame?



Analyzing the image

Let us consider the tip of the flame as point x and the bottom of the flame as point y . Since the candle flame gives out light rays in all directions, consider two rays i_1 and i_2 moving from the points x and y towards the pinhole.



As light travels in a straight line, the ray i_1 after passing through the pinhole will strike the butter paper screen at point x' . Similarly, ray i_2 after passing through the pinhole will strike the butter paper screen at point y' .

Thus, the image of the flame is seen as $x'y'$. This image is upside down or inverted. Note the size of the image.

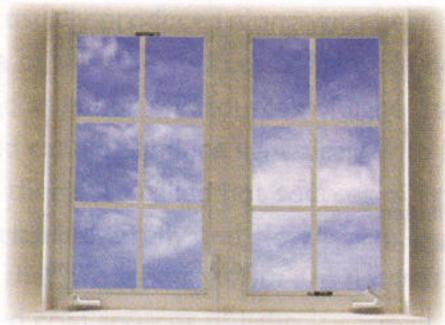
Note the changes taking place in the image of the flame as the chart paper cylinder is moved forward and backward in the tube.

only red colour on the other side. Do you know why?

The red cellophane sheet absorbs all other colours of white light only allowing red light to pass through it. This phenomenon is called *absorption*. The objects that absorb some part of light while allowing the rest of the light to pass through them are known as *translucent* objects.

If you allow light to fall on a thin piece of wood, then you will find that no light comes out from the other side of the object. The area behind the piece of wood is dark.

Such objects that do not allow light to pass through them are called *opaque* objects. A concrete wall is another example of an opaque object.



(a) Transparent object



(b) Opaque object



(c) Translucent object

Fig 12.4

Shadow

If you throw light on a transparent object and observe the region behind it, you will find no area of darkness. In case of a translucent object, you will see a region of partial darkness. However, in case of an opaque object, you will find an area of complete darkness behind the object. This region of darkness behind the object where no light is able to reach is known as the *shadow* of the object.



Fig 12.5 Formation of shadow by an opaque object

Characteristics of a shadow

- It is always black, no matter what the colour of the object is. This is because the shadow is formed in the absence of light rays.
- It gives an idea about the shape of an object. It, however, gives no detail of the object.

ACTIVITY 3

To study the shadow by varying the distance between the light source, object, and the screen

Things required: An opaque object, source of light, a sheet of paper

Method:

- Take the opaque object and the sheet of paper which will act as a screen. Now, move the source of light towards the object and observe its shadow on the screen.
- Keeping the distance between the object and the source of light fixed, change the distance between the object and the screen. Now, observe the nature and size of the shadow.



Shadow formation

The size of a shadow varies depending on the distance between the source and the object as well as the distance between the object and the screen.

1. When the source is a point source of light and the object is bigger than the source.

You can obtain a point source of light by placing a cardboard piece with a pinhole in front of a bulb or any other source of light (Fig 12.6). When the source is lighted, the pinhole will act as a point source of light. Now, place a ball between the point source of light and a white screen.

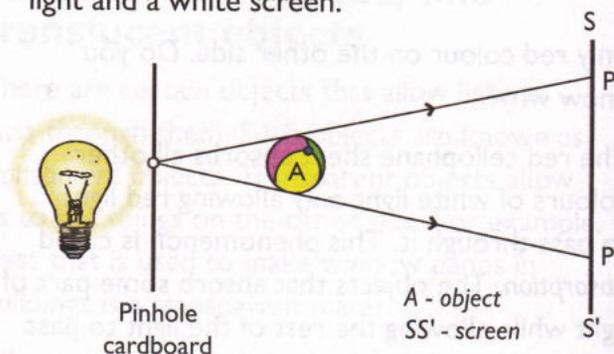
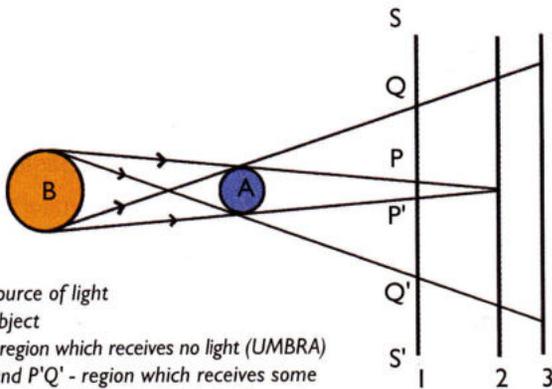


Fig 12.6

The region PP' obtained on the screen is completely dark with sharp edges as it does not receive light from the source. This region is referred to as the *umbra* region or the region of complete darkness. If the screen is moved closer to the object, the size of the shadow decreases and vice versa.

- When the source of light is bigger than the object. Place a ball between the source of light and the white screen (Fig 12.7). The shadow obtained on the screen will have two parts.



B - source of light
A - object
 PP' - region which receives no light (UMBRA)
 PQ and $P'Q'$ - region which receives some partial light (PENUMBRA) 1, 2, 3 are three different positions of the screen SS' , which tell us about the change in size of umbra and penumbra

Fig 12.7

On the screen, the region PP' does not receive any light from the source and so forms the *umbra* of the shadow. QP and $Q'P'$ are regions which receive some light from the source. This region of the shadow which is partially lit is called the *penumbra*.

If you move the screen away from the object to position 2, as seen in Fig 12.7, you will see that umbra has been reduced to a point and the penumbra has increased in size. If the screen is moved further away to position 3, as shown in Fig. 12.7, then you will observe only penumbra which is large and faint while umbra is absent from the shadow.

Such kind of shadow formation is observed when a bird or an aeroplane is flying high above the ground; we only see a large and faint penumbra being formed on the Earth.

In this case, the source of light is the Sun, the opaque object is the bird or aeroplane, and the screen is the Earth that is at a great distance from the opaque object.

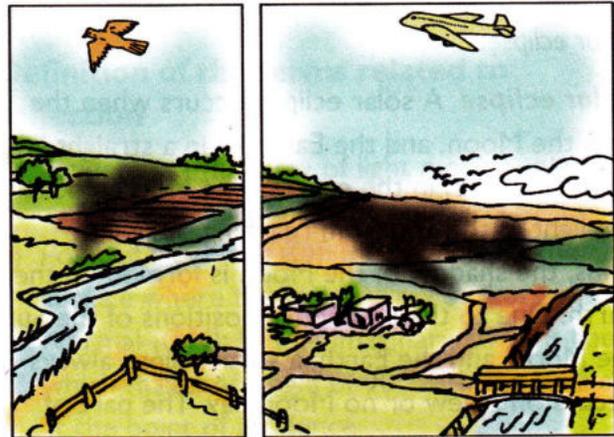
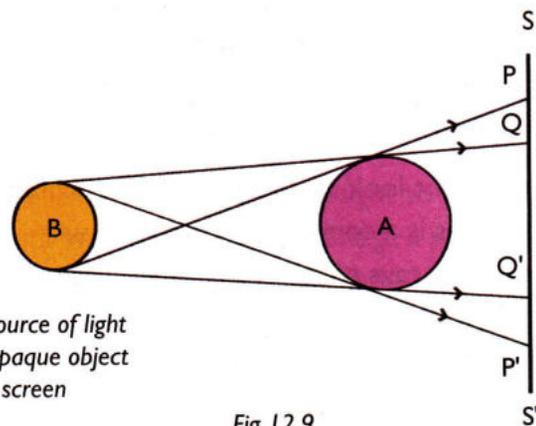


Fig 12.8

- When the object is bigger in size than the extended source of light.

See Fig 12.9, the extended source 'B' is smaller than the opaque object 'A'.

As is clear from the ray diagram, in this case the region QQ' on the screen is that of complete darkness or umbra while PQ and $Q'P'$ are regions of partial darkness or penumbra. If the screen is moved away from the object, then both umbra and penumbra would increase in size.



B - source of light
A - opaque object
 SS' - screen

Fig 12.9

Shadow formation in nature

Shadow formation takes place in nature also. When the Moon blocks the light from the Sun, a

shadow of the Moon is cast on the Earth. This is called *solar eclipse*.

Similarly, when the Earth comes between the Sun and the Moon, then the Moon passes through the shadow of the Earth. This is referred to as *lunar eclipse*.

Solar eclipse A solar eclipse occurs when the Sun, the Moon, and the Earth lie in a straight line, with the Moon in the centre. The Moon blocks the light of the Sun from reaching the Earth. Thus, the shadow of the Moon is formed on the Earth. Due to the respective positions of the Sun, the Moon, and the Earth, a solar eclipse always occurs on a new or no Moon day. The part of the Earth which lies in the umbra region of the Moon's shadow experiences a total solar eclipse and the part of the Earth lying in the penumbra of the Moon's shadow experiences a partial solar eclipse.

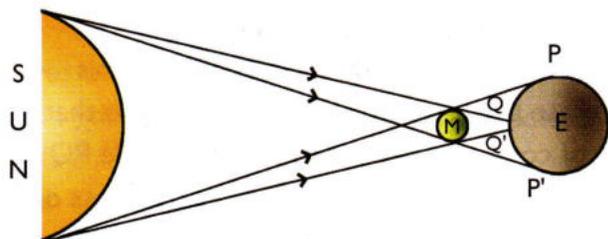


Fig 12.10 Solar eclipse

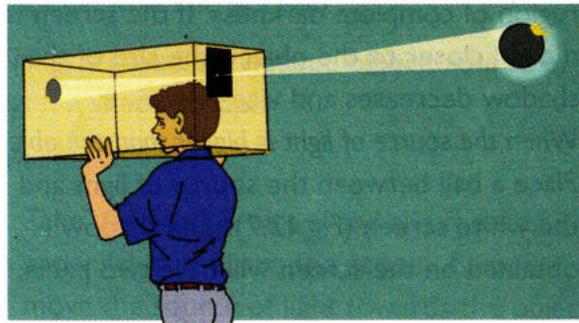
In Fig 12.10 you will find that the region of the Earth lying between QQ' experiences a total solar eclipse while the regions marked PQ and P'Q' experiences a partial solar eclipse.

One must not look at the Sun without protection. The eye lens is a converging lens which will converge the rays of the Sun to a point on the retina, burning that part of it. This will cause a permanent damage which cannot be rectified.

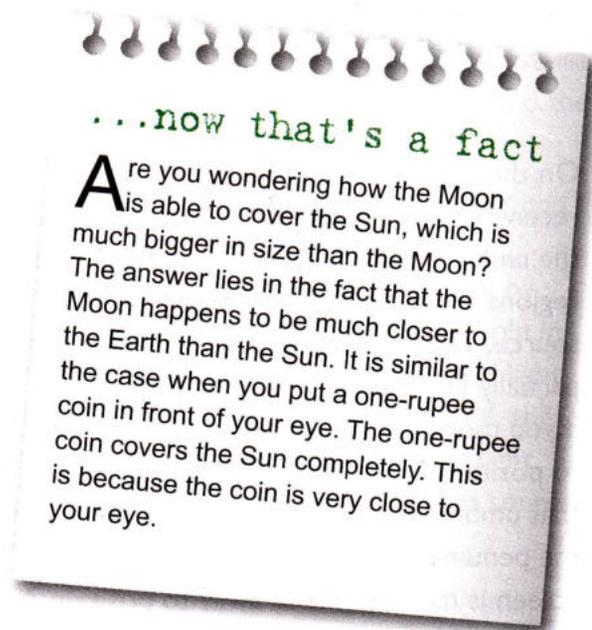
The following are safer ways to view the eclipse.

- A device similar to a pinhole camera can be used, only the length of the camera has to be at least six feet (i.e., the distance between the pinhole and the butter paper should be at least

six feet). Point the pinhole at the Sun to get the image on the butter paper at the viewing end. With your back towards the Sun, observe the image that forms on the butter paper.



- Use correct solar filters to view the solar eclipse. Solar filters are easily available at planetarium, observatories, or science museums.
- Use a welder's glass of rating 14 or higher to view the solar eclipse.
- Use binoculars or telescopes with specially designed solar filters to view eclipse.



Lunar eclipse Lunar eclipse occurs when the Sun, the Earth, and the Moon are in a straight line, with the Earth in the centre. In this position, we have a full Moon day on the Earth. As the Moon passes through the Earth's shadow, we experience a lunar eclipse.

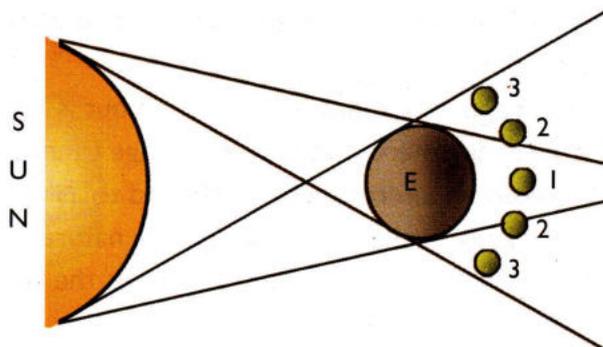


Fig 12.11

The different stages of the lunar eclipse are discussed below.

- When the Moon lies completely in the umbra region of the Earth's shadow, it is a total lunar eclipse. This is shown in position 1, Fig 12.11.
- When the Moon lies partly in the umbra region and partly in the penumbra region, as shown in position 2, it is a partial lunar eclipse.
- When the Moon lies completely in the penumbra region of the Earth's shadow, as shown in position 3, there is no lunar eclipse. It is so because the penumbra region is a region which is partly illuminated and the Moon in this region receives some light.

Reflection of light

When light falls on a surface, it is made to bounce back in the same medium in which it was travelling earlier. This phenomenon is referred to as *reflection*. The amount of light reflected depends on the nature of the object. If the object is opaque, maximum light gets reflected. While being reflected, it follows certain laws that are known as *laws of reflection*. They are stated as follows:

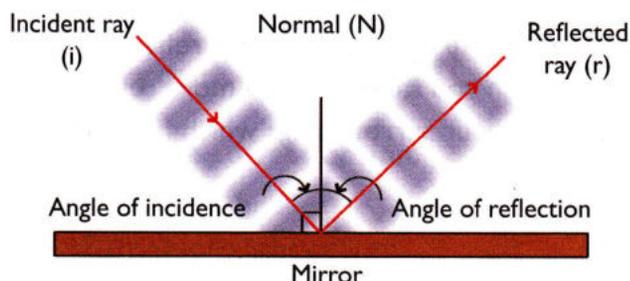


Fig 12.12 Reflection

- The angle of incidence is equal to the angle of reflection.
- The incident ray, the normal at the point of incidence, and the reflected ray, all lie in the same plane.

Definition of the terms related to reflection

- Incident ray (i): A ray of light moving towards a surface is called incident ray.
- Point of incidence (O): It is a point on the surface where the incident ray strikes.
- Normal (ON): It is an imaginary straight line which makes an angle of 90° with the surface at the point of incidence.
- Angle of incidence ($\angle i$): It is the angle between the incident ray and the normal.
- Reflected ray (r): On striking the surface, the incident ray bounces back or is reflected along a different direction in the same medium in which it was travelling earlier. This ray moving away from the surface is known as reflected ray.
- Angle of reflection ($\angle r$): It is the angle between the reflected ray and the normal.

Types of reflection

Depending on the nature of the surface from which reflection takes place, it can be categorized into two kinds: regular and irregular.

Regular reflection

If we allow a parallel beam of light to fall on a smooth well-polished surface, e.g., a plane mirror, then it is reflected in such a manner that the reflected rays are also parallel to each other. When these parallel reflected rays are received by the eye, they produce a 'glare'. This kind of reflection is known as *regular reflection*. It is also known as *specular reflection*.

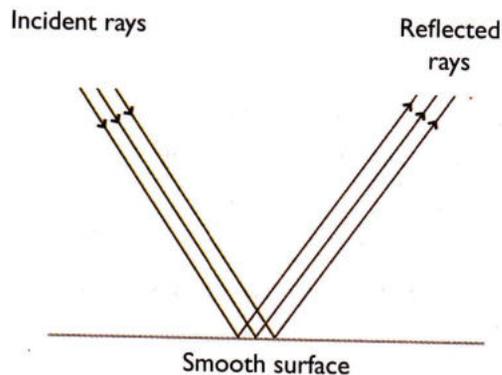


Fig 12.13 Regular reflection

Irregular reflection

Irregular reflection occurs from surfaces which are rough and have many irregularities in them. When a parallel beam of light falls on a rough uneven surface, the reflected rays are scattered in different directions. This is known as *irregular* or *diffused reflection*. It is the irregular or diffused reflection that enables us to see objects without a glare (Fig 12.14).

It must be noted here that the laws of reflection are obeyed in all types of reflection.

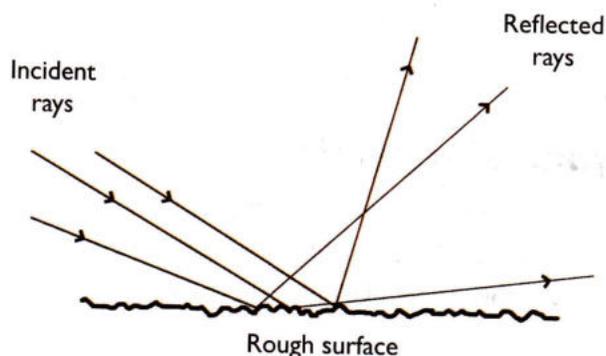


Fig 12.14 Irregular reflection

Image formed by a plane mirror

When we stand in front of a plane mirror, we see our image in it. The characteristics of the image formed by a plane mirror are listed below:

- The image is formed as far behind the mirror as the object is in front of it.

- The size of the image is the same as that of the object.
- The image only appears to be there but is actually not there. Such type of image cannot be taken on a screen and is referred to as a *virtual image*. It is upright or erect in nature.
- The image shows lateral inversion, i.e., the right appears left and vice versa.

Uses of plane mirrors

- Plane mirrors are used as looking glass.
- They are also used to make kaleidoscopes, periscopes, and box-type solar cookers. Periscope is a useful instrument which enables us to see around the corners and above the barriers. It is used in submarines. Box-type solar cookers trap solar energy to cook food without creating pollution.

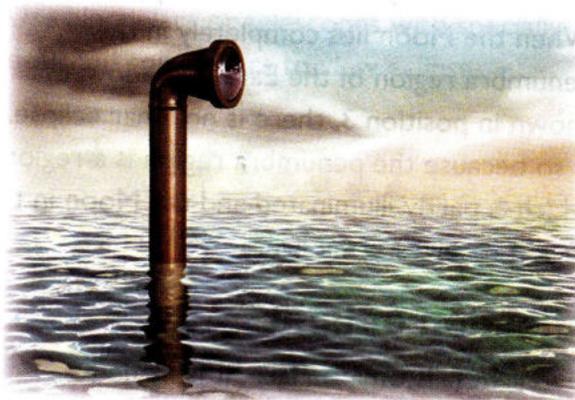


Fig 12.15 Periscope

Differences between a shadow and an image

While the shadow of an object is always black, the image is coloured. The image gives details and outline of the object but the shadow gives only the outline of the object.

A still water surface also acts as a reflecting surface. Can you think of some more reflecting surfaces in your surroundings which form images?



Rectilinear propagation: a straight line movement of light rays

Shadow: a dark region behind an object where light is not able to reach

Umbra: the region of the shadow which is totally dark

Penumbra: the region surrounding the umbra which is partially illuminated

Reflection: the process of sending back light from a surface in the same medium



- Luminous objects are those which emit light of their own.
- Non-luminous objects are those which do not emit light of their own but reflect light from other sources.
- Light shows rectilinear propagation.
- Shadow is the region behind the object where no light is able to reach.
- Transparent objects are those which allow most of the light to pass through them.
- Translucent objects are those which allow some of the light to pass through them. They form a faint shadow.
- Opaque objects allow no light to pass through them. They form a dark shadow.
- Shadow always lies on the opposite side of the object as compared to the source.
- A shadow gives the outline of the object but no details.
- The size of the shadow depends on the distance between the source and the object as well as the distance between the object and the screen.
- Eclipses are examples of shadow formation in nature.
- Solar eclipse occurs when the Sun, the Moon, and the Earth lie in a straight line, with the Moon in the centre.
- Lunar eclipse occurs when the Sun, the Earth, and the Moon lie in a straight line, with the Earth in the centre.
- Reflection of light causes the formation of images.
- Image in a plane mirror is virtual, erect, of the same size as the object, and as far behind the mirror as the object is in front of it.

Put on your **THINKING CAP!**

I. Select the correct option.

- a) Luminous bodies
- i) absorb light energy
 - ii) emit light energy
 - iii) are always a natural source
 - iv) are transparent

- b) A window glass is
- i) transparent
 - ii) translucent
 - iii) both (a) and (b)
 - iv) opaque
- c) The property of light travelling in a straight line is known as
- i) reflection
 - ii) rectilinear propagation
 - iii) rays
 - iv) beam
- d) A pinhole camera uses the principle of
- i) rays
 - ii) pencil beam
 - iii) reflection of light
 - iv) rectilinear propagation of light
- e) A shadow is formed when
- i) a transparent body is kept near a light source
 - ii) a translucent body is kept near a light source
 - iii) an opaque body is kept near a light source
 - iv) none of the above
- f) Angle of reflection is
- i) The angle between the incident ray and the normal
 - ii) The angle between the incident ray and the reflected ray
 - iii) both i) and ii)
 - iv) The angle between the reflected ray and the normal
- g) Mirror reflects the light in
- i) the same direction
 - ii) a different direction
 - iii) both i) and ii)
 - iv) none of these
- h) A beam of light consists of
- i) a single ray of light
 - ii) several rays of light
 - iii) both i) and ii)
 - iv) none of these

2. Fill in the blanks.

- a) Objects which emit their own light are known as _____.
- b) _____ objects form no shadow.
- c) The property of light travelling in a straight line is referred to as _____.
- d) Light is a form of _____ which gives us the sensation of sight.
- e) Bouncing back of light from a surface is called _____ of light.
- f) Pinhole camera is based on the principle of _____ of light.
- g) Sun is a _____ object whereas Moon is a _____ object.

3. Write T for true and F for false.

- a) Glass is a transparent object.
- b) Gold is a translucent metal.
- c) Images are also known as shadows.
- d) A shining metal spoon is a plane mirror.
- e) Translucent objects form a faint shadow.

4. Match the following:

- | | |
|--|-------------------------|
| a) A body that allows light to pass through it | i) Translucent material |
| b) A sheet of red cellophane | ii) Non-luminous object |
| c) Bouncing back of light from a surface | iii) Luminous body |
| d) A body emitting its own light | iv) Reflection |
| e) Moon | v) Transparent body |

5. Write short answers.

- Why is it not safe to see the Sun directly?
- What is a shadow? How is it formed?
- Define reflection and differentiate between regular and irregular reflection.
- What are transparent, translucent, and opaque objects?
- Differentiate between an image and a shadow.

6. Answer in details.

Draw the shadows formed in the following cases. Explain the terms used in the diagrams.

- An object placed in front of a point source of light.
- An extended source of light with an object smaller than the source kept in front of it.
- An extended source of light with an object larger than the source kept in front of it.

Extended learning

- Ancient people used the sundial to know the time. The shadow of the pointer in the centre of the dial gives the idea of time. Try making your own sundial using an opaque material placed on a dial.



- Place a stick of known length in an open area. Measure the length of the shadow of the stick in the morning, late morning, at noon, afternoon, evening, and late evening. Compare the position and size of the shadow in all the cases.

HIGHER ORDER THINKING SKILLS
HOTS

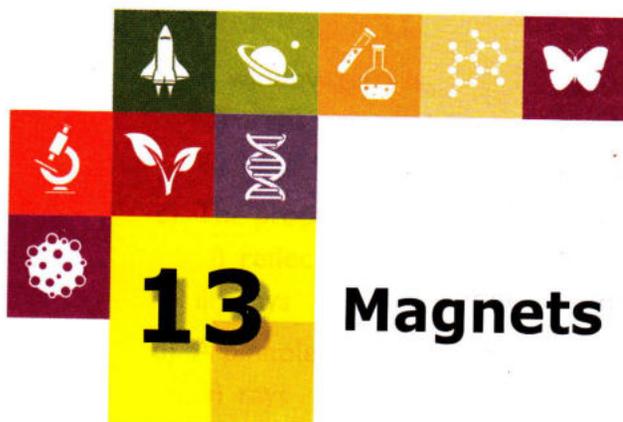
The clock in Ritu's room in its mirror image showed as if the time is quarter past four. What is the actual time?



For more information and games

http://www.bbc.co.uk/schools/ks2bitesize/science/physical_processes/how_we_see_things/play.shtml

<http://zonalandeducation.com/mstm/physics/light/rayOptics/reflection/reflectionI.html>



13 Magnets

Discovery of magnets

The most popular legend related to the discovery of magnets is that of an elderly Cretan shepherd named Magnes. Legend has it that about 4,000 years ago Magnes was herding his sheep in an area of Northern Greece called Magnesia. Suddenly, both the nails in his shoes and the metal tip of his staff got firmly stuck to the large, black rock on which he was standing. To find the source of attraction, he dug up the Earth and found lodestone beneath. Lodestones contain magnetite, a natural magnetic material Fe_3O_4 . This type of rock was subsequently named magnetite, after either the name of the place Magnesia or Magnes himself.



Magnetic and non-magnetic materials

Magnets can be temporary or permanent. A *permanent* magnet retains its magnetic properties for a long time. Some materials such as iron, nickel, and cobalt can be easily magnetized.



You will learn about

- History of magnet
- Magnetic and non-magnetic materials
- Poles of a magnet always exist in pairs
- Properties of a magnet
- Uses of a magnet
- Making of a magnet

If a magnet is brought near a piece of iron, it causes the iron to become a magnet with poles at either end. This piece of iron is said to be an induced or a *temporary* magnet. If the piece of iron is approached by the north pole of the magnet, then its end facing the magnet becomes south pole, which gets attracted to the magnet. The other end of the piece of iron becomes north pole.

To find out whether a piece of iron is a magnet, try approaching it with both ends of a magnet. If one of the poles of the magnet repels the piece of iron, then the piece of iron is a magnet.

To see the magnetic behaviour of different materials, let us perform Activity 1 and analyse the observations.

You will observe that some materials attract or get attracted towards a magnet while others do not. Based on this property, materials can be classified as either magnetic or non-magnetic.

ACTIVITY 1

To observe the magnetic behaviour of different materials

Things required: A bag full of objects like pencil, eraser, paper clip, butter knife, coins, piece of cloth, piece of paper, small comb or other plastic objects, nail, an aluminium can, tin can, marble (any classroom objects may be used in place of or in addition to these), a bar magnet

Method:

- Divide the class into different groups and distribute different objects among them.
- Ask each group to classify the objects into magnetic and non-magnetic on the basis of whether they get attracted to a magnet.
- As each object is classified, the students record the results. The students then record what material each object is made of (wood, plastic, metal, glass, etc).
- After the groups have completed the activity, bring the class together for discussion: Were more objects magnetic or non-magnetic? Do you see anything in common among the objects that are attracted by the magnet? Were all the metal objects magnetic? What conclusions can we draw from our observations?

The materials that are easily attracted by a magnet are known as *magnetic materials*. The materials that are not attracted by a magnet are usually known as *non-magnetic materials*.

Different shapes of magnets

Magnets can be made in many shapes. They can be made into round bars, rectangular bars, horseshoes, rings or donuts, disks, etc.

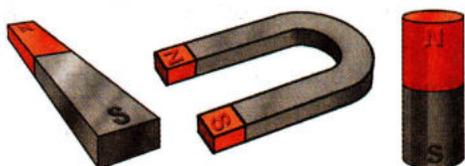


Fig 13.1 Different shapes of magnet

Poles of a magnet

A magnet always has two poles. These are the regions where the magnetic strength is the strongest (Activity 2). The two poles are always different. If a magnet is freely suspended, it will swing until one end points towards the geographic North Pole of the Earth. This end of the magnet is referred to as the north-seeking pole or the *north pole* of the magnet. The other end of the magnet is the *south pole*, which points towards the geographic South Pole of the Earth. We distinguish between the two ends by marking N on the north-seeking pole and S on the south-seeking pole.

The poles of a magnet are inseparable. If a magnet is divided into two, then both of them will have north poles and south poles. If we keep on dividing the magnet, we will keep finding the two poles in each piece. The poles always exist in pairs. No matter how many pieces you break the magnet into, even the tiniest piece will have the two poles.

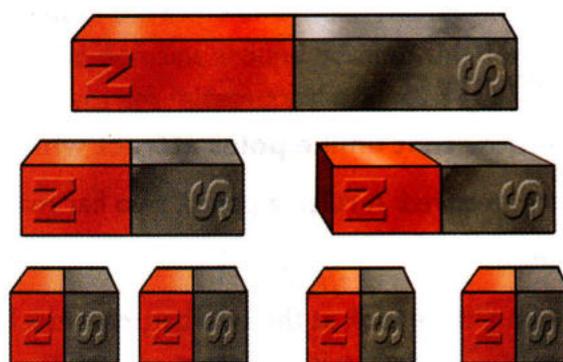


Fig 13.2 Poles of a magnet

Attraction and repulsion between magnets

A strong force exists between the two magnets when you bring them close together. When unlike (opposite) poles are facing each other, this strong force attracts the magnets towards each other. When like (similar) poles face each other, this force repels them, *i.e.*, pushes them apart. The force gets weaker as the magnets

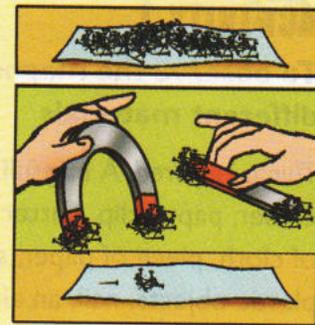
ACTIVITY 2

To determine the poles of a magnet

Things required: A bar magnet, a sheet of paper, iron filings

Method: Place the magnet on a sheet of paper and sprinkle iron filings on the paper. Tap the paper gently with your fingers and observe.

Observation: You will see the iron filings arrange themselves in a pattern around the magnet which is said to represent the magnetic field. Also, the concentration of the iron filings is maximum near the ends of the magnet, i.e., the magnetic strength is maximum at the ends of the magnet. These ends represent the poles of the magnet.



get further apart. Activity 3 demonstrates the attraction or repulsion between poles of magnets.

Finding direction with a magnet

A freely suspended magnet always points in the geographic north-south direction (Activity 4). This property is useful in finding directions.

Ancient travellers were aware of the direction-

finding property of magnets. The device used for finding direction on the surface of Earth is called *magnetic compass*.



Fig 13.3 Magnetic compass

ACTIVITY 3

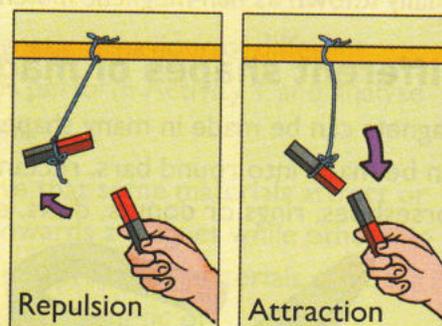
To show that unlike poles attract while like poles repel

Things required: A ruler, a pencil, two bar magnets

Method:

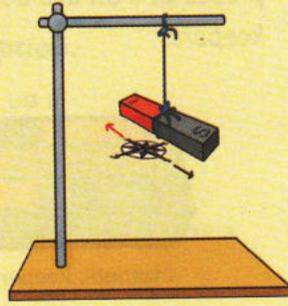
- Take a close look at the two bar magnets. Label the north and south poles of the two magnets or simply paint them with different colours.
- Bring unlike poles of the two magnets close together. *Can you feel the force that pulls them together?*
- Turn one of the magnets around so that two like poles face each other. *What is the kind of force that you feel now? This time you will experience a force that pushes the magnets apart.*
- Hold the magnets at distances of 3 cm, 6 cm, and 9 cm apart. Find out how close the magnets have to be so as to feel the force.

Observation: This activity shows that like poles repel each other while unlike poles attract.



ACTIVITY 4

Hang a bar magnet freely using a thread, away from all magnetic materials. Note the direction when it becomes stable. Gently disturb the magnet again and observe. You will observe that the magnet becomes stable in the same direction again.



S

Uses of magnets

Magnets are used in a number of applications. Some of them are as follows:

- Compass needles, used to find directions, are made with magnets.
- They are used in electromagnets to pick up iron scrap in junkyards and in hospitals to remove iron or steel splinters from wounds.
- Magnets are used in electric bells, motors, and telephones.
- Magnets are used in maglev trains. Maglev stands for magnetic levitation. Maglev is based

on the fact that like poles repel to levitate or raise a train so that it is not touching the rails. This reduces friction and noise and allows trains to run at very high speeds.

How to make your own magnet?

Do you know that each molecule of a magnet also behaves like a magnet? It is referred to as a *molecular magnet*. In a magnet or a magnetic material, there are many molecular magnets. There are regions in the magnet or the magnetic material where all molecular magnets point in the same direction. These regions are known as *domains*. In a magnet most of the domains point in the same direction whereas the domains in a magnetic material are arranged haphazardly, thus cancelling each other's effect. If you have a magnet, you can make the domains of magnetic materials to face in the same direction. In this way, you can make more magnets of your own.

When you stroke a magnetic material again and again in one particular direction, the magnet pulls the domains of the magnetic material until they all point in the same direction. The magnet can move the domains around because the domains themselves are microscopic magnets.

ACTIVITY 5

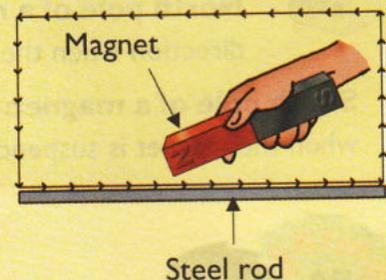
To make a magnet

Things required: A steel rod, a magnet, modelling clay

Method:

- Put the steel rod on a firm surface. Fix it in place with some modelling clay.
- Hold the bar magnet in one hand, and move it through the air in a loop, close to the steel rod. Repeat this several times. Take care to keep your magnet facing the same way. Also, never change the direction of the loop.
- Move your magnet out of the way, pick up your steel rod and test it. Can you pick up paper clips with it?

Observation: Yes, it attracts paper clips.



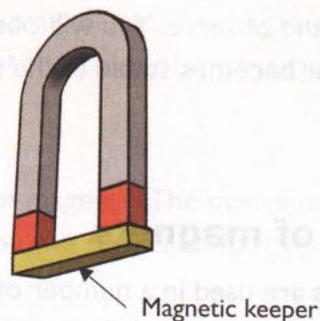
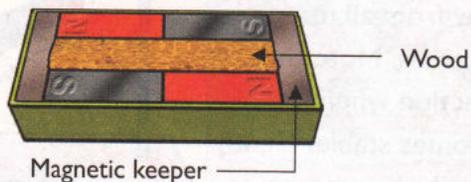
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Some tips to keep the magnets safe

1. Magnets lose their properties of attraction or repulsion if heated strongly, hammered, or handled roughly.



iron should be placed across their ends. These pieces of iron are commonly called *magnetic keepers*.



2. Magnets lose their magnetism if not properly stored. They should be stored in pairs in a wooden box, with unlike poles on the same side. The two magnets must be separated by a piece of wood. In addition, two pieces of

Note: Electronic devices such as computer, television, MP3 player, music system, compact disc, audio tape, cell phone, transistor, etc, are very sensitive to powerful magnets. Care should be taken that no powerful magnet is around them otherwise they may malfunction or get damaged.



Magnetic compass: a device containing suspended magnetic needle used to find directions

Magnetite: an iron ore which has magnetic properties

North pole of a magnet: end of a magnet that points towards the geographic north direction when the magnet is suspended freely

South pole of a magnet: end of a magnet that points towards the geographic south direction when the magnet is suspended freely



- Magnetite is a natural magnet.
- A magnet attracts materials like iron, nickel, and cobalt. These are called magnetic materials.
- Materials that are not attracted towards a magnet are called non-magnetic materials.

- Each magnet has two magnetic poles—north and south.
- A freely suspended magnet always aligns in the N–S direction.
- Opposite poles of two magnets attract each other while similar poles repel each other.

▲ Put on your THINKING CAP!

1. Select the correct option.

- a) A magnet will pick up a
- i) piece of chalk
 - ii) paper clip
 - iii) piece of wood
 - iv) plastic ruler
- b) Magnets should not be placed near a
- i) computer
 - ii) book
 - iii) table
 - iv) pen
- c) Which of the following materials is made of a non-magnetic substance?
- i) common pin
 - ii) a stainless steel plate
 - iii) a sewing needle
 - iv) an iron nail
- d) Which of the following will help to retain the strength of the magnet?
- i) hammering it several times
 - ii) dropping it on the floor several times
 - iii) storing it along with keepers
 - iv) heating it to very high temperatures
- e) A bar magnet is made of
- i) steel
 - ii) aluminium
 - iii) wood
 - iv) iron
- f) When we bring like poles of two magnets close, they
- i) attract each other
 - ii) repel each other
 - iii) lose their magnetic strength
 - iv) none of the above
- g) Which of these is a non-magnetic material?
- i) iron
 - ii) nickel
 - iii) cobalt
 - iv) plastic
- h) When a magnet is exposed to heat, its magnetism will
- i) decrease
 - ii) stay the same
 - iii) increase
 - iv) none of these

2. Write short answers.

- a) What will happen if a bar magnet is cut into half?
- b) What is a magnetic compass?
- c) Magnets are used in Maglev trains. Explain.

3. Answer in details.

- a) How are magnets stored? Explain.
- b) How will you magnetize an iron piece and test that it is magnetized?
- c) List various shapes of magnets that you can find.

4. Write T for true and F for false

- a) The north poles of two magnets attract each other.
- b) A magnet can attract all types of materials.
- c) Poles of a magnet always exist in pairs.

- d) A magnetic compass is a device which is widely used by the navigators.
- e) There exists only one shape of a magnet, i.e., bar magnet.

5. Fill in the blanks.

- a) The first magnetic material to be discovered was named _____.
- b) Sailors used _____ to help them navigate. They had found that when a piece of _____ was suspended from a thread it came to rest in a _____ direction.
- c) Magnetism is concentrated in the _____ of a magnet.
- d) The Law of the Magnet states that like poles _____ and unlike poles _____.
- e) The area around the magnet in which magnetic materials are attracted by the magnet is called the _____.
- f) Magnets are usually made of _____ or _____.
- g) Magnets can be _____ or _____ magnets.
- h) In an unmagnetized piece of iron or steel, the _____ magnets are arranged at random with the poles pointing in different directions.
- i) The magnet theory suggests that in a magnet all the _____ magnets are lined up with their own north-seeking poles all pointing in the same direction and with all the south-seeking poles pointing in the opposite direction.
- j) A permanent magnet can be demagnetized by _____ or _____.

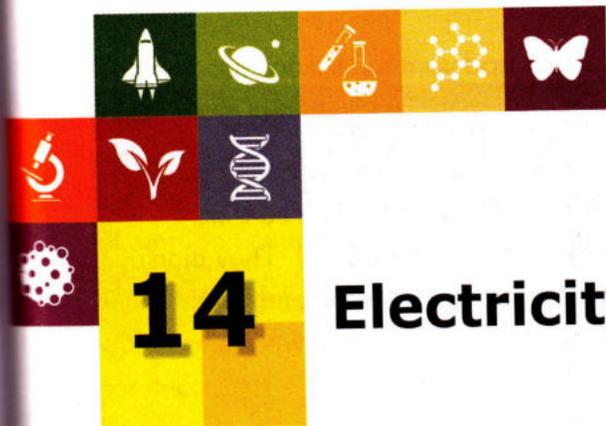
Extended learning

Find out information on magnetic levitation and its applications.

HIGHER ORDER THINKING SKILLS
HOTS

1. A bar magnet has no markings to indicate its poles. How would you find out near which end is its north pole located?
2. How is a compass used to find directions?





Electricity and Circuits

Electricity—a boon

Electricity is the most widely used form of energy in the world today. We use it in all spheres of our life. Over the years, the number of electrically powered items has increased hugely. We use electricity almost continually every day. It is used so much that we take it for granted. However, when there is a power cut, we begin to realize just how much we need electricity and how dependent we have become on it!

Some applications of electricity in various fields are described below:

- It is used to light up our homes, offices, and streets.
- It is used to run devices like toaster, geyser, electric iron, television, radio, computer, telephone, etc.
- In the field of communication, electricity is used as a medium for the transmission of signals.
- Manufacturing industry relies heavily on electricity to drive virtually every moving part in a factory—saws, cutters, conveyor belts, furnaces, chillers, etc.
- The use of frozen food available from different parts of the world is possible due to refrigeration, which again runs on electricity.

The various spheres of our lives which depend on electricity are rather wide.



You will learn about

- Uses of electricity
- Electric current
- Sources of electric current
- Electric circuit
- Symbols of a few electrical components
- Electric switch
- Conductors and insulators

Electric current

Electricity or electric current is defined as the flow of charges (electrons) through a conducting wire in a unit time. There are various devices such as cells, batteries, and generators which can be used to produce electric current. Such devices are called the *sources of electric current*.

Cell

A cell is a device that is used to generate electricity.

It is an arrangement of two electrodes (which are strips of different metals or substances) kept in a conducting solution known as an electrolyte. A cell produces electric current by a chemical reaction that changes chemical energy into electrical energy. Cells are of two kinds: primary and secondary.

1. *Primary cells* are the cells that produce electricity from the chemicals stored inside



Do you know that the word 'electricity' came from the Greek word *elektron*, meaning 'amber'. Amber is a very pretty golden brown 'stone' that sparkles orange and yellow in sunlight. Amber is actually a fossilized tree sap! Ancient Greeks discovered that amber behaved oddly—like attracting feathers—when rubbed by fur or other objects. They didn't know what it was that caused this phenomenon. The Latin word *electricus* means 'resembling amber'. So, we get our English word electricity from the Greek and Latin words that were about amber.

them. When the chemicals are all used up, the cells stop working, *i.e.*, they stop producing electricity. These cells cannot be used again.

Dry cell and simple voltaic cell are two examples of primary cell. They are mainly used in torches, wall clocks, toys, etc.

2. *Secondary cells* are the cells that provide electrical energy to the gadget as a result of chemical reactions taking place in them. In these cells, the chemical reaction is reversible and the electrical energy can be restored in them. Such cells are also called *rechargeable cells*. Lead accumulator and nickel-iron accumulator are two examples of secondary cells. They are mainly used in mobile phones, car batteries, etc.



Fig 14.1 Secondary cells

Nowadays, we see one more kind of cell called *solar cell*. The current generated by a single solar cell is very small, so a number of solar cells are connected together to form a solar panel. These are used in calculators, traffic signals, and satellites. They are also used to provide electricity to an area where laying power transmission lines is not commercially viable. A solar cell converts solar energy to electrical energy. So, it is also referred to as a *photo-voltaic*

cell, where 'photo' stands for light (solar) energy and 'voltaic' is used with reference to electrical energy.



Fig 14.2 The solar panel

Let us now study dry cell, a primary cell, in detail.

Dry cell You must have used a torch during a power failure at night. Have you ever thought what provides electricity to the bulb in the torch? The answer is the dry cell (also called electric cell or battery cell). The dry cells are available in different shapes and sizes.



Fig 14.3 Dry cells

The dry cell consists of a carbon rod, called a *cathode* at the centre. The carbon rod is surrounded by a layer of manganese dioxide and carbon black. The next layer is an aqueous paste of ammonium chloride and zinc chloride.

The cell is finally sealed inside a zinc container which acts as an *anode*. When a dry cell is connected to a circuit then the electric current flows from the carbon cathode (positive terminal of the cell) to zinc anode (negative terminal of the cell).

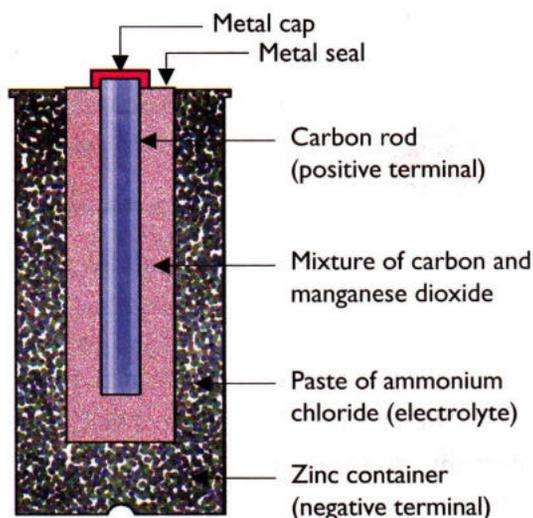


Fig 14.4 The inner structure of a dry cell

Infobit Dry cell is not really dry. It actually contains the damp paste of a chemical called *electrolyte* instead of liquid electrolyte which is present in many cells.

Battery

There are some devices like a radio which need more voltage than provided by a single cell. In such cases, two or more dry cells are placed in such a manner that the positive terminal of one cell remains in contact with the negative terminal of the other cell. This combination of cells is known as battery of cells or simply *battery*.



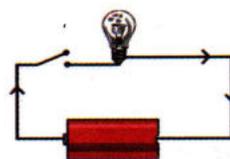
Fig 14.5 Battery

Electrical circuit

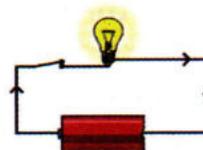
A cell kept close to a bulb will not make it glow because the air (a bad conductor of electricity) present in between them does not allow the charge to flow through it. So, to light up the bulb, there has to be a conducting medium between them. This is provided by the wires that we use. The bulb will not glow if it is not properly connected to the electric cell. This means that the bulb lights up only when the cell, the wires, and the bulb form a complete path.

The complete path of the flow of electric current from one terminal of the cell to the other terminal through all the components is known as an *electric circuit*.

The electric circuit in which contact among any of the components of the circuit is broken is called an *open circuit*. The electric circuit in which the current flows from one terminal of the cell to another terminal is known as a *closed circuit*.



(a) An open circuit



(b) A closed circuit

Fig 14.6 The electrical circuit

Symbols of a few electrical components

Cells, bulbs, switches, and wires are some components of electric circuits. A circuit with two electric cells (batteries), a switch, and a lamp (the torch bulb) can be drawn. One way is to draw the circuit with an actual drawing of the components, which will be very cumbersome. Another way is to use symbols for the various components. The symbols for the commonly used components of a circuit are given here.

Symbol	Electrical component
	Cell
	Battery
	Key closed (Switch on)
	Key open (Switch off)
	Tapping key open (Bell switch off)
	Tapping key closed (Bell switch on)
	Bulb
	Wires joined at a point
	Wires overlapping

A *circuit diagram* is a diagram which shows the arrangement of various components in an electric circuit with the help of their symbols.

Electric switch

An electric switch is a device which is used in every electric circuit. It controls the flow of electric current through an electric circuit. When the switch is in the *off* position, the current will not flow because the circuit is open. When the switch is in the *on* position, the current will flow because the circuit is now closed.

ACTIVITY 1

Draw the circuit diagram of an electric circuit consisting of a bulb, a battery of three cells, an open switch, and the connecting wire.

A simple switch can be made by using board pins with an open gem (paper) clip mounted on it as shown in Fig 14.7.

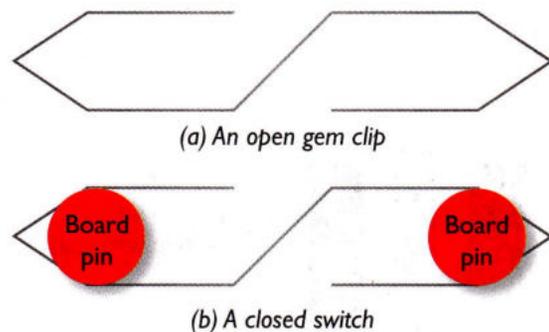


Fig 14.7

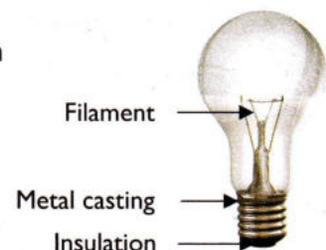
This arrangement will function as if the switch is *on*, i.e., the circuit is closed. To switch off the current, disengage the clip from one of the board pins.

Electric torch

An electric torch is a simple device. It consists of the following components.

Bulb: It produces light when electricity passes through it.

A bulb consists of a thin tungsten wire called filament. The filament is enclosed in a glass enclosure. The bulb has two terminals. When



current flows through the filament, it heats up. As the filament gets hot, it starts glowing. This glow is the source of light of the bulb.

Reflector and lens: They focus the light produced by the bulb.

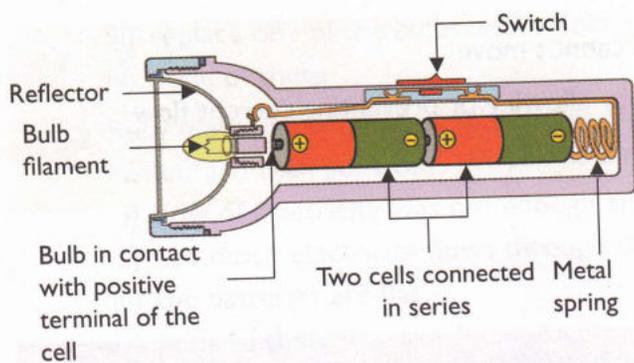


Fig 14.8 Working of electric torch

Battery: It acts as a source of electricity.

Plastic body: It holds all the parts of the torch.

Switch: It is used to switch the torch on or off. A switch controls the flow of current through the bulb.

Working of an electric torch

When the switch is in *on* position, the circuit behaves as a closed circuit. Current flows through the bulb and it glows, thus producing light.

When the switch is in *off* position the circuit behaves as an open circuit. As there is no flow of current, no light is produced.

Conductors and insulators

All materials around us can be classified into two categories—conductors and insulators. The materials that allow the current to flow through them are called *conductors*. All metals are conductors. The only non-metal which is a conductor is graphite. The materials which do not allow the flow of current through them are called *insulators*. All non-metals except graphite are insulators. The handle of an electrician's screw driver is made of plastic because it is an insulator, which protects the person from getting an electric shock while working with live wires.



HIGHER ORDER THINKING SKILLS
HOTS

Another point of difference between conductors and insulators is that insulators can be charged but conductors cannot be charged. Can you think of a reason for this?

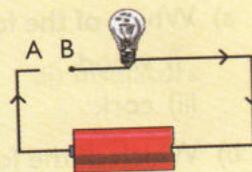


ACTIVITY 2

To find out which material is a conductor and which is an insulator

Things required: Three small pieces of wires, a torch bulb, a cell, plastic, copper wire, eraser, metal spoon, a small piece of wood

Method: After setting up the circuit as shown in the picture put the various materials available with you in the gap between points A and B. Make sure that the materials touch the points. If the bulb glows, the material placed between A and B is a conductor, otherwise it is an insulator.



5



Circuit: a closed loop of conductors through which charges can flow

Conductor: a substance through which electrical charges can easily flow

Current: flow of electrical charges

Generator: a device for producing electric current by moving a coil of wire in a magnetic field

Insulator: a material through which electric charges cannot move

Switch: a device that closes or opens a circuit, thereby allowing or preventing current flow

Voltage: the pressure behind the flow of electrons in a circuit



- Electric current is defined as the flow of charges through a conducting wire in a unit time.
- A cell is an arrangement of two electrodes (strips of different metals) dipped in an electrolyte (conducting solution) which, when connected in a circuit, give rise to electric current.
- There are two kinds of cells—primary and secondary. Primary cells convert chemical energy to electrical energy. In secondary cells, the reaction which gives rise to electric current is reversible. Therefore, they are also referred to as rechargeable cells.
- Electric circuit is a closed continuous path for an electric current to flow.
- Circuit diagram is a symbolic representation of all the components used in a circuit.
- A switch/key is a device which enables us to make or break the circuit at will so that the flow of charge can be regulated.
- Conductors are materials that allow the flow of current through them.
- Insulators are materials that do not allow the flow of current through them.

Put on your **THINKING CAP!**

I. Select the correct option.

- Which of the following materials is an electric conductor?
 - wood
 - plastic
 - cork
 - gold
- Which of the following materials is an electric insulator?
 - aluminium
 - gold
 - rubber
 - graphite
- In which circuit will the bulb or bulbs glow brightest?
 - a simple circuit with one bulb and one battery
 - a simple circuit with one bulb and two batteries
 - a simple circuit with two bulbs and one battery
 - none of these
- Ruby has connected two bulbs across two batteries in a simple circuit. How can she make the bulbs dimmer?
 - replace one of the batteries with a section of wire
 - replace one of the batteries with a cork

- iii) replace one of the bulbs with a section of wire
 - iv) none of these
- e) Ruby makes a complete simple circuit with one bulb and three batteries. The bulb lights for an instant and then goes out. Why?
- i) flow of electricity was not enough around the circuit
 - ii) too much electricity flows through the bulb's filament
 - iii) the batteries are flat
 - iv) none of these
- f) Why is electric wiring usually made from copper?
- i) because copper is shiny
 - ii) because copper conducts electricity
 - iii) because copper is non-magnetic
 - iv) none of these
- g) Why is electric wiring usually covered with a layer of plastic?
- i) to make it look good
 - ii) to help electricity flow along the wire
 - iii) to make it safe
 - iv) none of these
- h) Why is a bulb brighter when it is powered with two batteries rather than one?
- i) because the flow of electricity in the circuit is less
 - ii) because the flow of electricity in the circuit is the same
 - iii) because the flow of electricity in the circuit is greater
 - iv) none of these

2. Fill in the blanks.

- a) A material that lets electricity pass through it is called _____.
- b) A material that does not let electricity pass through it is called _____.
- c) Lots of appliances are fitted with _____ that can be inserted into a _____.
- d) Many small electrical appliances use _____. Some of these are _____.
- e) Electricity will only flow in a _____ circuit.

3. Write short answers.

- a) Give the function of the following:
 - i) Electric switch
 - ii) Conductors
 - iii) Insulators
- b) What is the significance of a switch?
- c) When is a bulb said to be fused and why?
- d) Conductors and insulators are equally important for us. Give reasons.
- e) Rubber or plastic are used for covering electrical wires. Why?
- f) What is the direction of electric current in an electric circuit?

4. Answer in details.

- a) Write short notes on:
 - i) Electric cell
 - ii) Electric bulb
- b) List few uses of electricity.
- c) Differentiate between conductors and insulators using examples.

Extended learning

- 5 Make your own electric cell.

Things Required:

1. Citrus fruit—e.g., lemon
2. 1 copper screw about 5 cm long
3. 1 zinc screw about 5 cm long
4. 1 LED with 5 cm leads

Method:

1. Roll the lemon on a piece of paper or soft towel.
2. Insert the screws into the fruit about 5 cm apart. Don't allow the screws to go through the bottom-skin of the fruit.
3. Carefully remove about 1 cm of the insulation from the leads on the LED. Do not cut into the wire beneath the insulation.
4. Twist one end of the wire around one screw and the other end around the other screw. Wow! You have light!



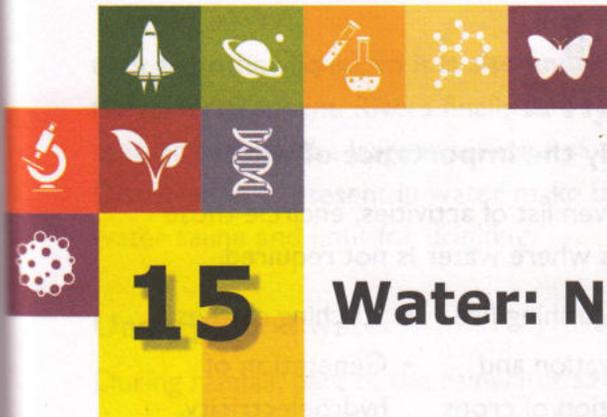
You must use low-voltage light bulbs and batteries which are safe to touch. Never touch household light bulbs—they can become very hot! The low-voltage light bulbs and batteries used in this lesson are safe to touch and cannot draw large currents or reach hazardous temperatures. Glass bulbs are relatively strong but should be handled with care to avoid breakage.



For more information and activity ideas

http://www.essortment.com/hobbies/magnetslearning_sopi.htm

<http://www.creativekidsathome.com/science/magnet.html>



15 Water: Nature's Magician

Water covers three-fourth of the total surface of the Earth. That is why Earth is called the *blue planet*.



Water is called the '*Nature's Magician*' since it is found in nature in three different states of matter. It is a colourless, tasteless, and odourless compound.

Even though water is abundant, about 97 per cent of it is present in seas and oceans and not suitable for use. Water is essential for all living beings on this Earth. Plants need water for photosynthesis and for germination of the seeds. We need water not only for drinking but also to perform a number of functions in our day-to-day life.

Water is also used by the human body to perform the following functions.



You will learn about

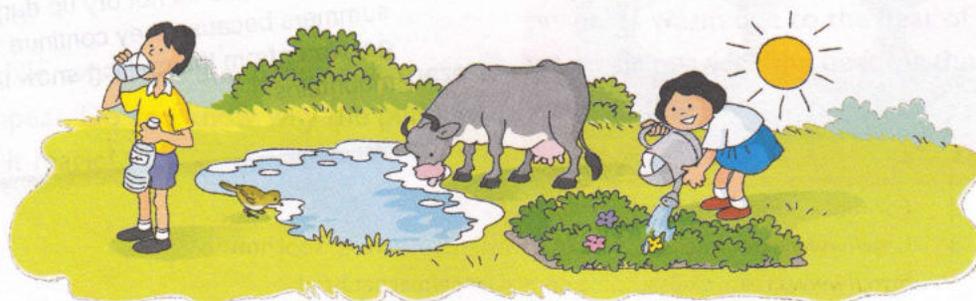
- The importance of water
- Uses of water
- Different sources of water
- Water cycle

- It allows blood to flow through the blood vessels.
- It controls and regulates the blood pressure.
- It helps in eliminating waste from our body as sweat and urine.
- It helps to regulate the temperature of the human body.
- It helps in transporting different substances.

Water is called a renewable resource because it can be replenished. But if this renewable resource is used excessively without giving it a chance to regenerate, it might get exhausted. Every effort should, therefore, be made in the renewal of this resource because it is very useful to us.

Uses of water

Water is essential for life. It is used for many day-to-day activities.



ACTIVITY 1

To estimate our water consumption

With the help of your mother find out how many litres of water are used daily for the following activities. (Note: you can use any 1 litre container or a 1 litre mineral water bottle as reference)

- Cooking
- Washing clothes
- Washing utensils
- Gardening
- Cleaning the floor
- Any other activity

This activity helps you to calculate the consumption of water by your family in a day, in a month, and also in a year.



ACTIVITY 2

To study the importance of water

In the given list of activities, encircle those activities where water is not required.

- Extinguishing fire
- Cultivation and irrigation of crops
- Talking
- Mopping the floor
- Cooking food
- Celebrating Holi
- Reading
- Transport
- Stitching clothes
- Generation of hydroelectricity
- Sleeping
- Swimming
- Praying
- Fishing
- Recreation
- Preserving aquatic life



Sources of water

Rain is the major and the purest source of natural water. Water which is suitable for drinking is called *potable water*. Where does drinking water come from?

People in the villages draw water from the wells, tube wells, rivers, ponds, etc., while in cities people mostly get it from the taps.

Have you ever wondered from where and how the water reaches the taps?

Water is drawn from some nearby water source such as a river through a network of pipes and carried to the taps.

Water sources are of two types—surface water and underground water.

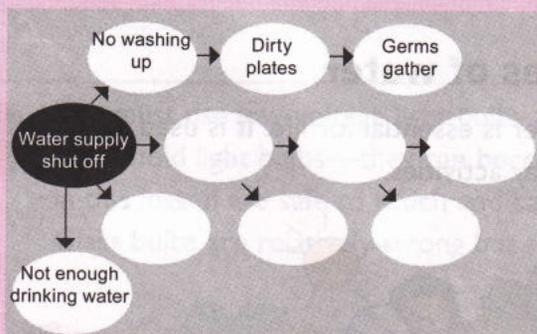
Surface water

As the name suggests it refers to water occurring on the surface of the Earth in the lakes, rivers, streams, etc. These sources get water from the rain and melting snow from the mountain peaks. Water from the river flows across the land and dissolves a large number of substances (solutes) in it. Water can dissolve more substances

Let's Talk

Imagine that one day you wake up in the morning and find that the water supply has been shut down. How would this situation affect you? Talk about it with your friends and fill in the bubbles.

How would this situation affect you? Talk about it with your friends and fill in the bubbles.



...now that's a fact

Rivers originating from the Himalayas do not dry up during summers because they continue to get water from the melting snow in the mountains.

than any other liquid, so it is also known as the *universal solvent*. Rivers finally flow into the seas or oceans, the large reservoirs of water. Dissolved salts present in water make the sea water saline and unfit for drinking.

Underground water

During rainfall, part of the rainwater seeps through the soil till it meets the bedrock. As water cannot penetrate further, it gets accumulated there to form a reservoir of underground water. It is also known as an *aquifer*. The level of groundwater is known as the *water table*. Groundwater can be pumped out through tube wells and hand pumps for our use.

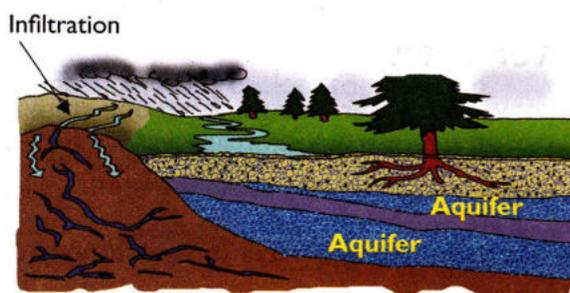


Fig 15.1 Underground water

Why is it not advisable to install many tube wells in an area?

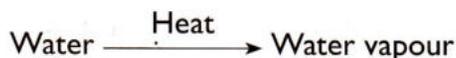
- ▲ Rapid increase in population, fast development of the industrial sectors, and the construction of buildings has left practically no or little land that is not covered by concrete. As a result, a very small quantity of rainwater has a chance to get absorbed in soil and help raise the water table. Installing too many tube wells will only bring down the water table further.

Evaporation

You must have seen puddles here and there after a splash of rain.

But after a while, when the Sun peeps out, these puddles disappear. Do you know why the puddles disappear? Is it magic?

When water gets heated, its temperature rises. As the temperature of water increases, it changes into a gaseous state (water vapour). This is called *evaporation*.



Factors affecting evaporation



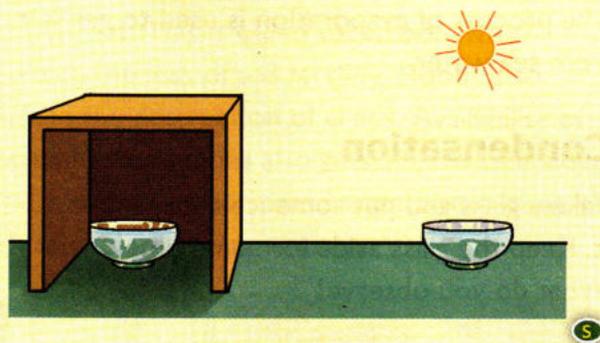
To study that temperature affects evaporation

Things required: Two saucers of the same size, water

Method: Take a small but equal amount of water in two saucers. Keep one saucer in the Sun and the other in the shade. Observe both the saucers after some time.

Observation: You will find that the water evaporates faster from the saucer that was placed in the Sun as compared to the saucer placed in the shade.

Conclusion: Higher the temperature, faster is the evaporation.



Do you know that evaporation takes place even in shady areas? The air surrounding the saucer becomes warm due to the heat of the sun. This warm air provides the heat for the evaporation of water in the shade.

ACTIVITY 4

To study that surface area affects evaporation

Things required: A glass, a bowl, a shallow dish (all made of the same material)

Method: Pour a small but equal quantity of water into the glass, the bowl, and the dish. Keep them in the Sun. Observe the rate of evaporation.

Observation: You will find that water evaporates slowest from the glass, faster from the bowl, and fastest from the shallow dish.

Conclusion: Larger the exposed surface, faster is the evaporation.



S

In addition to temperature and surface area, humidity and wind also affect evaporation.

Now, it must be clear to you why wet clothes dry faster when they are spread out in the Sun.

The process of evaporation is used to get salt from sea water.

Condensation

Take a glass and put some ice cubes in it. Keep the glass aside for some time. What do you observe?

You will observe droplets of water on the outer surface of the glass. These droplets combine to form bigger drops that trickle down and collect at the bottom of the glass.

Do you know where the water droplets came from? The air around the glass contains water vapour. When water vapour comes in contact with the

Infobit

You must have seen that the grass in your lawn is wet on a cold winter morning. You can also see tiny droplets of water shining on the leaves. What are these? Does condensation play any role in their formation? Discuss with your teacher.

t

cold glass surface, it changes into water due to cooling.

The change of water vapour into water on cooling is called condensation.



Water cycle

We know that water changes from one state to another on heating or cooling, due to change in its temperature.

How do these changes occur in nature? What brings about these temperature changes?

The Sun plays a major role in bringing about changes in the state of water. When the sunlight falls on rivers, lakes, or oceans, it heats up the

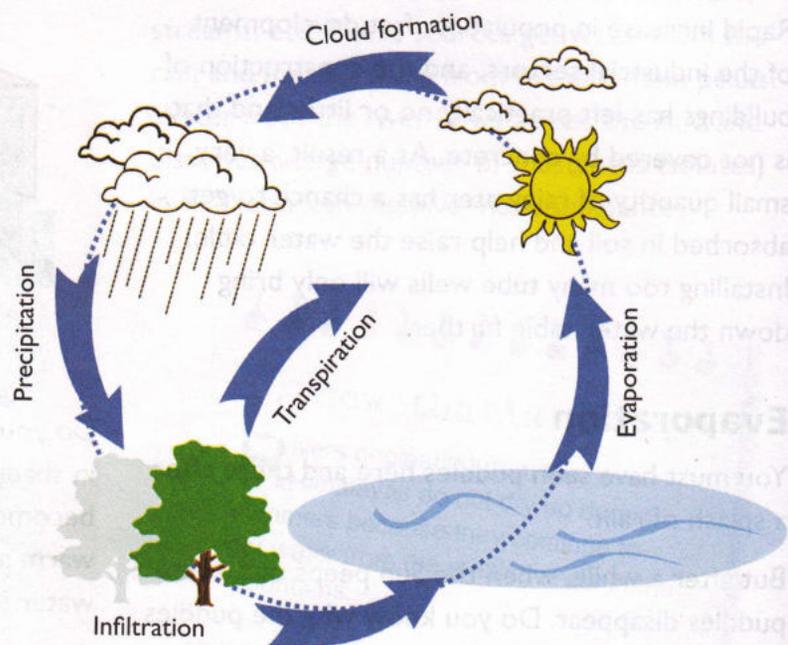


Fig 15.2 Water cycle

water and changes water into vapour by the process of *evaporation*. Most of the water vapour enters the atmosphere from the water bodies.

Leaves of the green plants also release water vapour into the air. This process is called *transpiration*.

Water vapour in the air rises up and on cooling condenses to form clouds. This is called *condensation*.

When the clouds become too heavy, the water falls back to the Earth in the form of rain, hail, sleet, or snow. This is called *precipitation*. Most of the rainwater runs down the surface and becomes a part of the water bodies like rivers and streams, which eventually lead to the oceans. Water is again heated by the sunrays. It again evaporates, condenses, and falls back onto the Earth.

This constant circulation of water in nature is called the *water cycle*. The water cycle is a continuous process.

How are clouds formed?

The air containing water vapour is light, so it rises up. At higher altitudes, it becomes cooler. The water vapour present in air condenses around the dust particles to form tiny droplets of water. These droplets combine to form clouds. Clouds consist of billions of tiny water droplets that remain floating in the sky.

As more and more of these droplets combine, the clouds get heavier. Eventually, the clouds cannot hold the heavy water droplets in the air and they begin to fall. When these water droplets hit the ground, we call it *rain*.

Monsoon is one of the most awaited seasons as it brings rain. Rains are a big relief from the hot summer days. Farmers also depend on the rains for a healthy growth of crops.

Sometimes you see the Sun when it is still raining. What do you generally observe when you look up into the sky on such occasions?

It is fun to look at the white and grey clouds of different shapes and sizes in the blue sky!

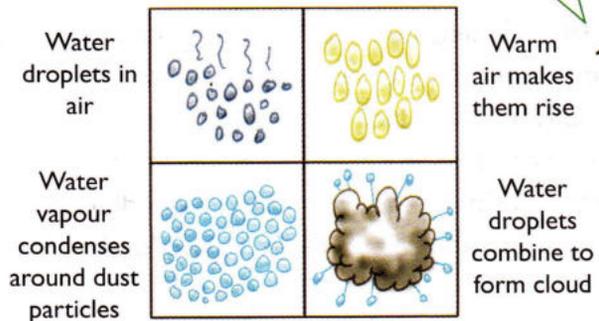


Fig 15.3 Formation of clouds

You must have heard of several flights getting cancelled during winters. Can you tell why? It is because of fog. Fog is the lowest cloud. It reduces visibility. In cities and industrial areas, fog combines with smoke to produce *smog*.

Flood—excessive rain

When it rains continuously for several days, water logging takes place. The rivers, ponds, and lakes overflow and cause the nearby areas to be submerged in water. This leads to *flood*.

Heavy floods cause massive damage to crops, animals, and human lives and property. Heavy flow of water carries away the top fertile soil along with it. This is called *soil erosion*, which results in the loss of soil fertility. Floods also result in the destruction of crops. Availability of essential commodities also gets affected. Receding flood water may also spread waterborne diseases such as cholera and dysentery.



Fig 15.4 A flood-hit area

Drought—no rain

The absence of rain in an area for a long time adversely affects the soil, plants, and animals including humans. The soil of that area becomes dry. Due to continuous evaporation, transpiration, and lack of rainfall, the water level goes down. The availability of water becomes scarce. This may lead to *drought*. In conditions of drought, it is difficult to get food and fodder. The aquatic life is also badly affected.

Can you imagine the kind of difficulties people go through in such conditions? Try to find out.

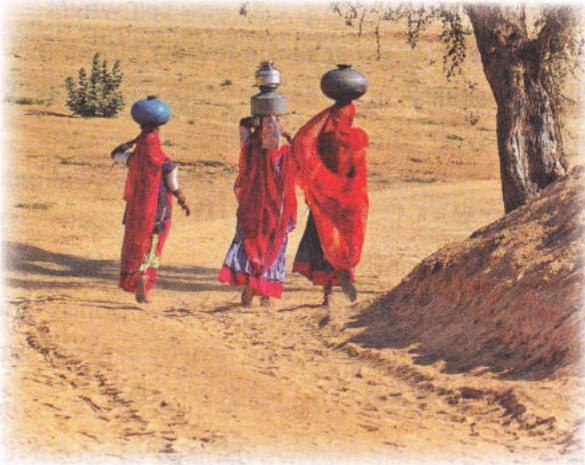


Fig 15.5 A drought-affected area

There are many causes for water shortage. Some of them are given below.

Conservation of water

The availability of water in terms of both quantity and quality is declining day by day. This is due to the continuous increase in human population and the rising demand of water by them. Some measures should be undertaken to reduce the gap between the requirement and availability of water. *Using a resource carefully so that we can make it last longer is called conservation.*

Water conservation methods help in reducing the scarcity of water and help to save it for the future.



What can you do to help the people of a flood-hit area? Discuss it with your friends and teacher.



Excessive irrigation



No rain



Excessive dam construction



Pollution

Following are some of the ways to conserve water:

- Prevent leakage of water from taps and pipes.
- Turn the tap off when not in use, especially when you brush your teeth or wash clothes.
- Spread awareness about conservation of water through media and wall posters.
- Reuse water wherever possible.
- Use a bucket and mug instead of a shower bath.
- Water your lawn only during early morning, and only when it is needed.
- Prevent overflow of water tanks.

- Do not leave the tap running while washing dishes in the kitchen.

Rainwater harvesting

Rainwater harvesting is a unique method to conserve water. It is the gathering and collection of rainwater for later use. The two ways to harvest rainwater are:

1. Surface run-off harvesting
2. Rooftop rainwater harvesting

Surface run-off harvesting

In urban areas, rainwater which falls on the surface flows away into the drains. This run-off water could be allowed to reach the ground directly from the drains.



Fig 15.6 Surface run-off harvesting

Rooftop rainwater harvesting

It is a system of catching rainwater where it falls. In rooftop harvesting, the rainwater is collected in tanks from the roofs of houses and buildings through pipes.

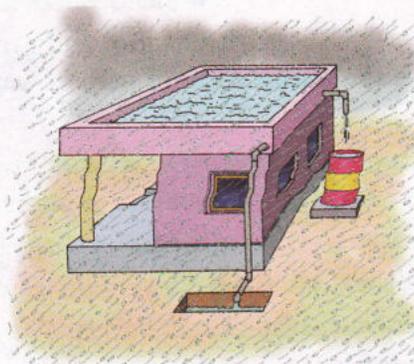


Fig 15.7 Rooftop rainwater harvesting

The collected water needs to be filtered before use. It can also be diverted into a pit in the ground. This helps in recharging the groundwater, thus increasing the groundwater level of the area.



Infobit Ancient Egyptians treated water by siphoning water out of the top of huge jars after allowing the muddy water (taken from the Nile river) to settle down.

Hippocrates, known as the father of medicine, directed people in Greece to boil and strain water before drinking it.



Potable water: water that is suitable for drinking

Renewable resources: resources which can be replenished

Evaporation: change of water into water vapour on heating

Condensation: conversion of water vapour into water on cooling

Water cycle: circulation of water from the Earth's surface to the atmosphere and back to the Earth

Transpiration: loss of water by the plants through their leaves

Flood: a condition produced by excessive rain

Drought: a condition caused by continuous lack of rain

Conservation: wise and careful use of resources



- Water is an everlasting renewable natural resource which is essential for life.
 - About 97 per cent of water on the Earth is present in the seas and oceans, and is not suitable for drinking and irrigation.
 - We need water for drinking, irrigation, recreation, preservation of aquatic life, transport, and generating hydroelectricity.
- Rain is the purest form of natural water which replenishes the surface water and underground water.
 - The level of groundwater is called the water table.
 - Water cycle is a continuous process by which water circulates between the sky and the Earth.
 - Evaporation is the process of changing water into water vapour on heating.
 - Condensation is the conversion of water vapour into water on cooling.
 - Excessive rainfall causes floods.
 - Drought is the condition produced by the absence of rain in a particular area over a period of time.
 - Using water carefully and preserving it for the future is called water conservation.
 - Rainwater harvesting is the method of collecting rainwater from the rooftops of buildings and storing it in storage tanks for later use.

Put on your **THINKING CAP!**

I. Select the correct option.

- a) Which of the following conditions is *not* associated with water?
- i) drought
 - ii) flood
 - iii) earthquake
 - iv) tsunami
- b) Which of these is *not* soluble in water?
- i) sand
 - ii) sugar
 - iii) salt
 - iv) milk
- c) Which of these is *not* a source of groundwater?
- i) well
 - ii) hand pumps
 - iii) stream
 - iv) tube well
- d) Which of these is *not* a source of fresh water?
- i) river
 - ii) lake
 - iii) ocean
 - iv) stream
- e) Water occurring on the surface of the Earth is called
- i) groundwater
 - ii) surface water
 - iii) aquifer
 - iv) potable water

- f) The process in which water changes into water vapour is called
- i) harvestation
 - ii) condensation
 - iii) evaporation
 - iv) precipitation
- g) Factors affecting evaporation are
- i) temperature
 - ii) surface area
 - iii) humidity and wind
 - iv) all of these
- h) Ways to conserve water include
- i) preventing overflow from the overhead water tanks
 - ii) turning the taps off when not in use
 - iii) using bucket and mug instead of a shower for bath.
 - iv) all the above
- i) Which of the following is not the correct way to conserve water?
- i) turn the tap off when not in use
 - ii) have bath once in a month
 - iii) reuse water
 - iv) prevent leakage from taps

2. Match the columns.

- | | |
|------------------|------------------------------------|
| a) drought | i) water from the ground |
| b) groundwater | ii) loss of water by plants |
| c) transpiration | iii) carrying away of the top soil |
| d) soil erosion | iv) visible body of droplets |
| e) clouds | v) lack of rain |

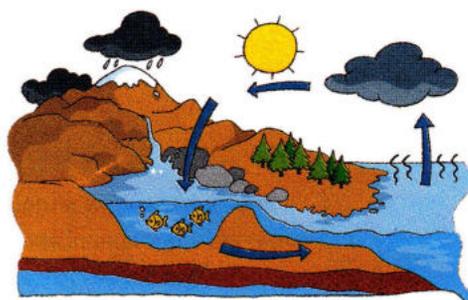
3. Write T for true and F for false. Correct the wrong statements.

- a) Rainwater is the purest form of water.
- b) The coming down of water in the form of rain, hail, and snow is called evaporation.
- c) We get hydroelectricity from wind.
- d) A substance that dissolves in water is called a solute.
- e) Larger the exposed surface lesser is the evaporation.

4. Give one word for the following:

- a) Change of water vapour into water by cooling _____
- b) Water that is fit for drinking _____
- c) Resources that can be replenished _____
- d) Level of underground water _____
- e) Condition caused by excess rain in a region _____

5. Look at the picture below and fill in the blanks to explain the water cycle.



The heat of the _____ causes _____ of _____ from the surface of the Earth and water bodies like _____, _____, etc. Water _____ is also added to the atmosphere through _____ from leaves of the trees. The water vapour _____ to form tiny droplets of _____. Higher up in the atmosphere the air is cool. The water droplets come together to form _____. The heavy water droplets in the air fall down as _____.

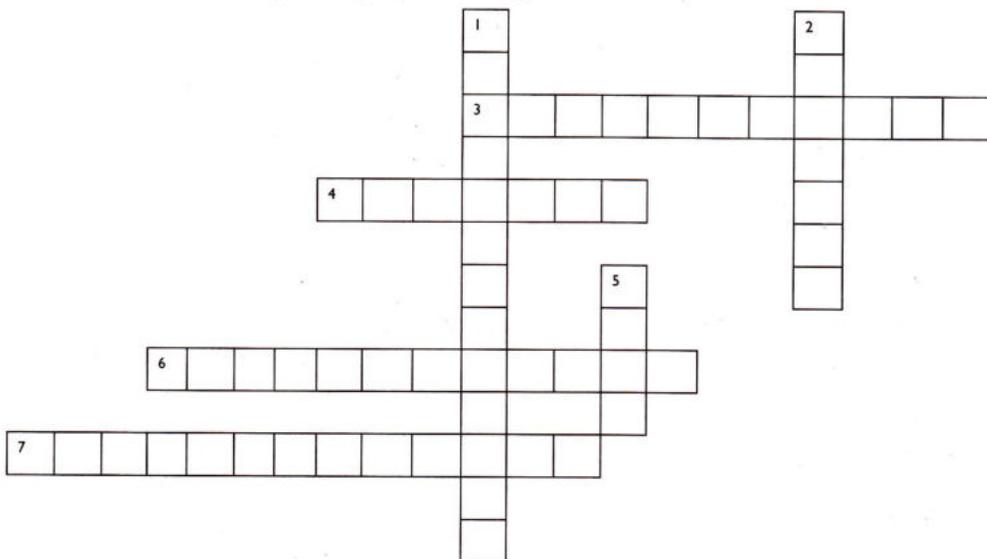
6. Write short answers.

- Why do we call water the 'universal solvent'?
- Write any four uses of water.
- What is rainwater harvesting?
- How are clouds formed?
- Write any four ways of conserving water.

7. Answer in details.

- How does it rain? What is the difference between fog and smog?
- Describe the water cycle with the help of an illustration.
- Differentiate evaporation and condensation.

8. Solve the crossword by using the clues given below.



Across

- Change of water to water vapour
- Underground water
- Change of water vapour to water on cooling
- Loss of water in the form of water vapour from leaves

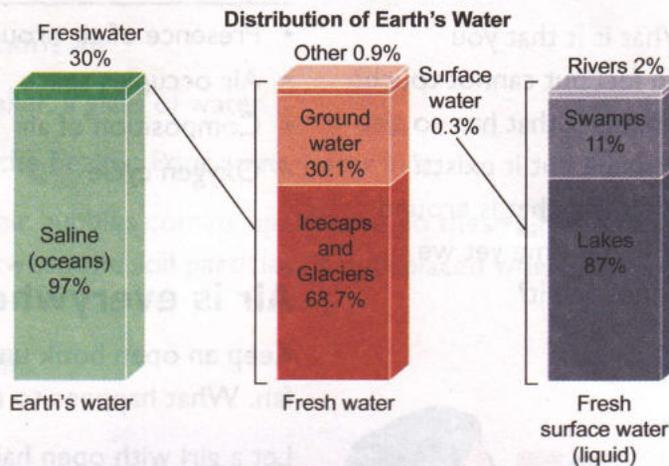
Down

- Water falling in different forms on the Earth from clouds
- Any liquid suitable for drinking
- Fog combined with smoke

1. Why are we not allowed to dig tube wells in urban areas?
2. Why is sea water not fit for drinking?
3. Deforestation is affecting the water cycle nowadays. Explain.
4. Ankit and Ajay are roommates. One day, they washed their shirts. Ankit dried his shirt in the Sun and Ajay dried his in the room. Out of the two shirts which one will dry faster and why?  

9. Study the water distribution graph of the Earth and complete the given table.

Per cent of fresh water _____
 Per cent of saline water _____
 Per cent of fresh water in glaciers and ice caps _____



Extended learning

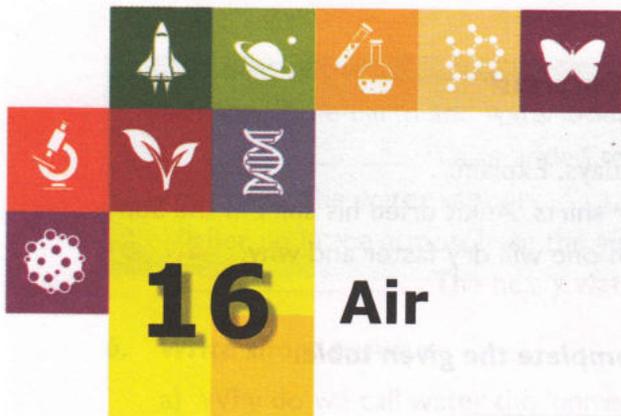
Make your own cloud in a bottle

(Note: To be done under the supervision of an adult)

- Take a bottle and remove its label. Rinse it thoroughly. Do not use soap and do not dry the inside.
- Add a small amount of warm water into the bottle. Place the cap and shake it well so that water droplets get stuck to the inside of the bottle. Pour out the excess water.
- Carefully light a match stick and drop it into the bottle. Shake the bottle so that the match stick burns out.
- Your cloud is ready.



For more information, activities and videos
<http://edugreen.teri.res.in/explore/water/water.htm>
<http://www.rainwaterharvesting.org/>



16 Air



What is it that you can feel but cannot touch?
 What is it that has no size or shape but it exists?
 What is it that is around us all the time yet we cannot see it?

Hold your hand in front of your mouth. Breathe in deeply and breathe out towards your fingers. What do you feel? What makes your fingers feel hot and tingly?

The answer to all these questions is *air*. You can feel it only when it is moving. Moving air is called *wind*.



You will learn about

- Presence of air around us, in water, and in soil
- Air occupies space
- Composition of air
- Oxygen cycle

Air is everywhere

Keep an open book under a fan. Switch on the fan. What happens to the pages of the book?

Let a girl with open hair stand under a moving fan. What happens to her hair?

Hold a handkerchief in your hand and stand under a moving fan. What happens to the handkerchief?

You will notice that the leaves of the book start fluttering. Also, the handkerchief and the hair start moving.

ACTIVITY 1

To show that an empty glass contains air

Things required: A plastic tub, an empty glass, water

Method: Fill the plastic tub with water. Take an empty glass and tilt it in the tub.

Observation: You will see bubbles coming out of the mouth of the glass. The glass which looked empty was actually filled with air. Air being colourless was not visible. Air being lighter than water is able to escape from the tilted glass.

Conclusion: The empty glass contains air.



What will happen if all the above activities are performed in a different room?

The answer remains the same. The objects show the same movement in every room since air is present everywhere.

Now, let us perform some activities to further feel the presence of air around us, in water, and in soil.

Try Activity 1 by pushing an empty glass straight into water. Do you still observe bubbles coming out of the glass?



ACTIVITY 2

To show that soil contains air

Things required: Soil, a beaker, a glass of water

Method: Put some soil in the beaker. Pour some water in it.

Observation: You will see air bubbles coming up. Where do these air bubbles come from? Air is trapped in the spaces between the soil particles. It is displaced when water enters these spaces, and forms bubbles.

Conclusion: Soil contains air.



Can you now think how insects and other small organisms that live in soil fulfil the need of oxygen for respiration?



ACTIVITY 3

To show that water contains air

(Note: To be done under the supervision of an adult)

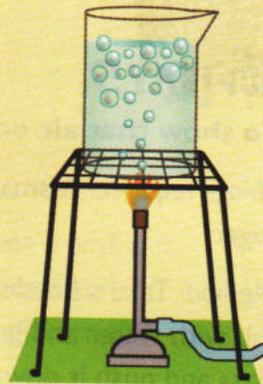
Things required: A beaker, tripod stand, spirit lamp, water

Method: Take a beaker full of water. Put it on a tripod stand. Heat the beaker using a spirit lamp.

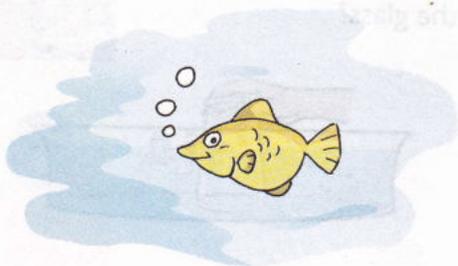
Observation: You will see bubbles on the surface of the beaker. These bubbles will gradually rise up and pop out. Where do these bubbles come from? The air dissolved in water escapes on heating.

Conclusion: Water too contains air.

Once the water starts boiling, allow it to cool. Reheat the same water. Do you see the bubbles coming out again?



Can you think how fish and other water animals use air for respiration?



Activities 1, 2, and 3 prove the presence of air around us, in soil, and in water. Thus, we can say that air is present everywhere.

Go Green

When taking a short trip, choose to walk or cycle instead of taking a car or a scooter. This reduces carbon emissions in air considerably.

Air occupies space

Let us perform two activities to prove that air occupies space.

ACTIVITY 4

To show that air occupies space

Take a glass jar and put a funnel on its mouth. Put plasticine around the top of the jar to hold the funnel in the middle of the glass jar. Ensure that there should be no holes in the plasticine. Pour coloured water slowly into the funnel. (Coloured water helps in observing the water level.) Does it flow down from the funnel to the jar? No. Make a hole in the plasticine. What happens to the water now? Does it flow down to the jar? Yes.

Initially, the water does not flow down in the jar because the jar is full of air. There is no space for water. The air in the jar pushes the water in the funnel and holds it there. When you make a hole in the plasticine, the air escapes the jar through the hole and that space is occupied by the water.



5

ACTIVITY 5

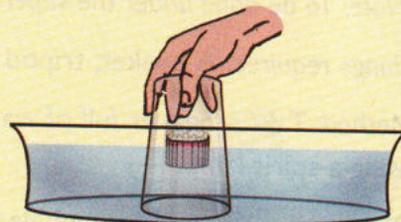
To show that air occupies space

Things required: A small plastic bottle cap, a tub, a glass, water, sugar

Method: Take a bottle cap and put some sugar in it. Half-fill the tub with water and let the bottle cap float on the surface of water. Cover the bottle cap with the glass and push it down straight into the water.

Observation: What happens to the sugar? Does it get dissolved in water? No. Air inside the glass occupies space and does not let water in. The sugar in the cap will remain dry even though the glass is pushed to the bottom of the tub.

Conclusion: Air occupies space.



5

Composition of air

Air is a mixture of gases. There are mainly 10 gases that make up the clean air. In the order of highest to lowest concentration, these are nitrogen, oxygen, argon, carbon dioxide, neon, helium, methane, krypton, hydrogen, and xenon.

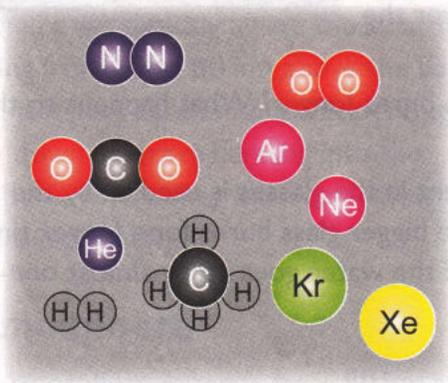


Fig 16.1 Gases present in clean air

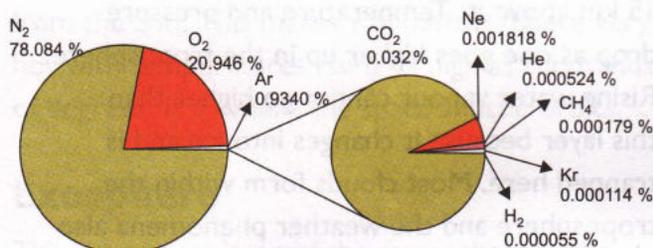


Fig 16.2 Pie chart to show composition of air

Look at the pie chart (Fig 16.2). It shows the amount of different gases present in the air.

Nitrogen, which makes about 78 per cent of air, is not used by animals including human beings directly. It is first converted by microorganisms into nitrate, which is then used by the plants. Animals including human beings get nitrogen through plants.

Oxygen, which constitutes about 21 per cent of air, is used by plants and animals directly for respiration.

Carbon dioxide, which constitutes about 0.03 per cent of air, is used by plants for photosynthesis. Animals cannot use carbon dioxide directly.

How do animals use carbon dioxide? Do you know the uses of other gases which are present in the air? Besides these gases, water vapour and dust particles are also present in the air.

Activity 6 shows the presence of water vapour in the air.

Activity 7 shows that one-fifth of the air is oxygen.

ACTIVITY 6

To show that air contains water vapour

Things required: Four steel tumblers, ice water, a refrigerator

Method:

- Fill one of the glasses with the ice water and set it on a table. Wait briefly.
- Feel the outside of the glass. How did it get wet? Where did the water come from? Is it necessary for the glass to be filled with water for moisture to form on the outside?
- Set one of the empty glasses on a table as a control. Place a second empty glass in the refrigerator, and the third in the freezer.
- After about 10 minutes, remove the glasses from the refrigerator and freezer. Line up the three glasses on the table and record your observations.

Conclusion: Air contains water vapour.

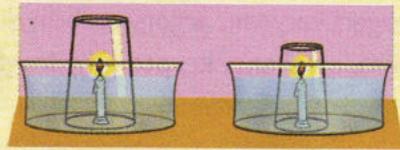


ACTIVITY 7

(Note: To be done under the supervision of an adult)

Things required: Two shallow bowls, two candles of same size, two glasses of unequal sizes, water

Method: Fix the 2 candles in the middle of the bowls. Fill the bowls with water up to a certain level. Light both the candles. Cover the lighted candles with two glasses.



Observation: Do the candles continue to burn? Which candle burns longer? What happens to the level of water in the glass?

Oxygen present in the air helps in burning. When oxygen present in the glasses is used up by the burning candles, they blow out. The candle covered with the bigger glass burns for a longer time because it contains more air. In both the glasses, the level of the water goes up by almost one-fifth of the space in the glasses occupied by air.

Conclusion:

- One-fifth of the air is oxygen.
- The other gases present in air do not support burning.

Atmosphere

Atmosphere is a layer of gases surrounding the Earth. It is divided into five layers—troposphere, stratosphere, mesosphere, thermosphere, and exosphere.

Troposphere

This layer of the atmosphere is closest to the Earth's surface, extending approximately up to

15 km above it. Temperature and pressure drop as one goes higher up in the troposphere. Rising water vapour cannot go higher than this layer because it changes into ice and is trapped here. Most clouds form within the troposphere and the weather phenomena also occurs here.

Stratosphere

This layer lies next to the troposphere. It extends from 15 to 50 km above the Earth's surface.

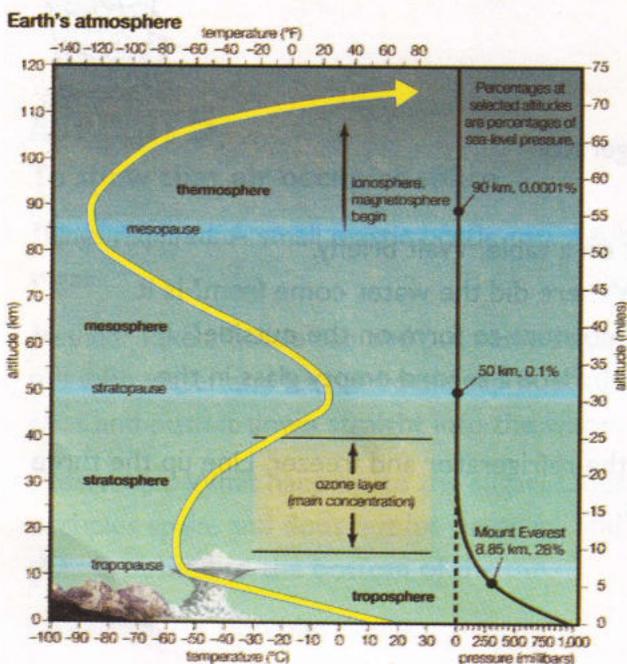


Fig 16.3 The layers of atmosphere

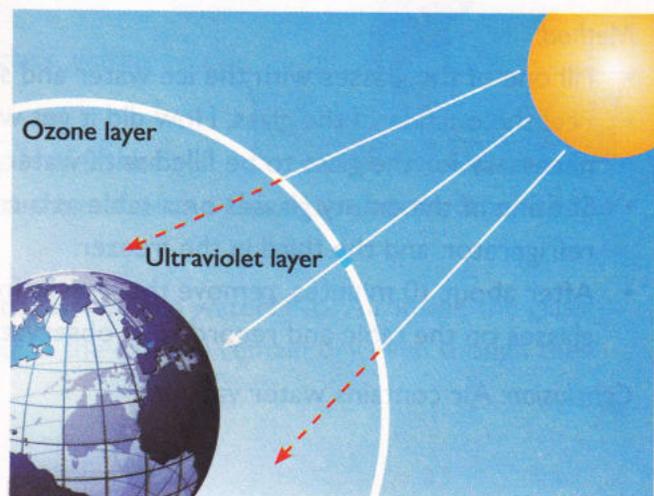


Fig 16.4 Ozone layer

This layer contains a thin layer of ozone that absorbs most of the harmful ultraviolet radiations coming from the Sun. The ozone hole is a reduction in concentration of ozone over the Antarctic region.

Mesosphere

Mesosphere lies directly above the stratosphere, extending from 50 to 80 km above the Earth's surface. It is very rarefied but thick enough to slow down meteors hurtling into the atmosphere, where they burn up, leaving fiery trails in the night sky.

Thermosphere

The thermosphere extends from 80 km above the Earth's surface to the outer space. It receives extraordinarily large amounts of energy from the Sun. This makes the thermosphere very hot with temperatures rising as high as thousands of degrees. It is where the space shuttle orbits.

Exosphere

The uppermost layer of the atmosphere is the exosphere. It is the layer where atmosphere merges into the space.

Oxygen cycle

We know that the amount of oxygen in the atmosphere is approximately 21 per cent. This percentage always remains constant in the

atmosphere. How do you think it maintains this percentage? This is because of the process of *photosynthesis* and *respiration*. Plants release oxygen during the process of photosynthesis. They use oxygen for respiration. However, the amount of oxygen released during photosynthesis is much more than the amount of oxygen consumed for respiration by the plants. Animals including human beings use oxygen released by plants through respiration and they in return, release carbon dioxide which plants use to prepare food and to release oxygen. Thus, we can say that animals cannot live without plants and plants cannot live without animals.

This cycle of consumption of oxygen by respiration and its release by photosynthesis is called oxygen cycle.

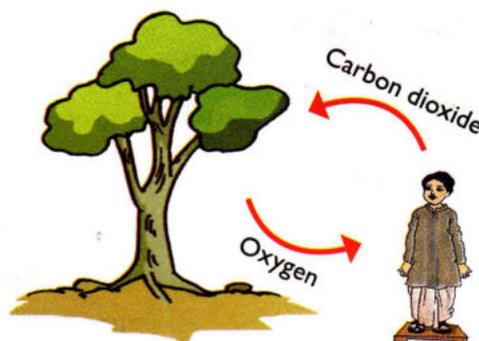


Fig 16.5 Schematic representation of oxygen cycle



How does large-scale deforestation and burning of fossil fuel affect the oxygen cycle? Discuss with your teacher.



Use CFC free products. Chlorofluorocarbons destroy the ozone layer which protects us from harmful UV radiations. CFC is used in many air conditioners and refrigerators.

Uses of air

- Oxygen present in air is essential for the process of respiration.
- Carbon dioxide present in air is required for the process of photosynthesis.
- The wind rotates the windmill, which is then used for drawing water from the tube wells, for running the flour mills, and for the generation of electricity.

- Wind helps in the movement of aeroplanes, kites, parachutes, and boats.
- Air is an important agent of pollination and seed dispersal.
- Air fills empty spaces in objects like balloons, tyres, and tubes to make them useful.
- Different musical instruments like guitar and flute are played with the help of air.



Atmosphere: a layer of gases surrounding the Earth

Troposphere: the layer of the atmosphere closest to the Earth's surface, extending approximately up to 15 km above it

Stratosphere: this layer lies directly above the troposphere. It extends from 15 to 50 km above the Earth's surface

Mesosphere: lies directly above the stratosphere, extending from 50 to 80 km above the Earth's surface

Thermosphere: it extends from 80 km above the Earth's surface to the outer space

Exosphere: it is the uppermost layer of atmosphere. It is the layer where the atmosphere merges into the space

Oxygen cycle: this is the cycle of consumption of oxygen by respiration and its release by photosynthesis



- Moving air is called wind.
 - Air is present everywhere—around us, in water, and in soil.
 - Air is trapped in the spaces between the soil particles. The small organisms that live in soil fulfil their requirement of oxygen needed for respiration through this trapped air.
- Air occupies space.
 - Air is a mixture of gases. Besides the gases, water vapour and dust particles are also present in it.
 - Oxygen present in air helps in burning of different materials.
 - Atmosphere is a layer of gases surrounding the Earth. It is divided into five layers—troposphere, stratosphere, mesosphere, thermosphere, and exosphere.
 - The cycle of consumption of oxygen by respiration and its release by photosynthesis is called *oxygen cycle*. This helps to maintain the percentage of oxygen in the atmosphere.

▲ Put on your **THINKING CAP!**

I. **Select the correct option:**

- a) The layer of atmosphere extending from 50 to 80 km above the Earth's surface is
- i) thermosphere
 - ii) stratosphere
 - iii) mesosphere
 - iv) exosphere
- b) Which of the following is *not* a component of clean air?
- i) carbon dioxide
 - ii) water vapour
 - iii) nitrogen
 - iv) carbon monoxide
- c) The gas which supports burning is
- i) carbon dioxide
 - ii) oxygen
 - iii) nitrogen
 - iv) methane
- d) Select the correct order of gases in air in the order of percentage.
- i) nitrogen < oxygen < carbon dioxide
 - ii) oxygen > nitrogen > carbon dioxide
 - iii) nitrogen > oxygen > carbon dioxide
 - iv) carbon dioxide > oxygen > nitrogen
- e) Animals use oxygen for
- i) photosynthesis
 - ii) burning
 - iii) respiration
 - iv) all of these
- f) Air is present
- i) around us
 - ii) in water
 - iii) in soil
 - iv) all of these
- g) Stratosphere extends from
- i) 10 km to 45 km
 - ii) 15 km to 75 km
 - iii) 15 km to 50 km
 - iv) none of these
- h) Which of the following is *not* a layer of the atmosphere?
- i) troposphere
 - ii) magnetosphere
 - iii) mesosphere
 - iv) exosphere

i) Which of the following is the most abundant gas in the atmosphere?

- i) oxygen
- ii) carbon
- iii) nitrogen
- iv) argon

2. Fill in the blanks.

- a) Air occupies _____.
- b) Air is a mixture of various _____.
- c) One-fifth of the air is _____.
- d) Moving air is called _____.
- e) _____ supports burning.
- f) The layer of atmosphere closest to the Earth's surface is _____.
- g) _____ extends from 15 to 50 km above the Earth's surface.
- h) _____ and _____ help to maintain oxygen cycle.
- i) _____ is the uppermost layer of the atmosphere.
- j) _____ released during respiration is used by plants for _____.

3. Write T for true and F for false. Correct the false statements.

- a) Aquatic plants do not need oxygen.
- b) Air is a mixture of gases.
- c) Stratosphere contains an ultraviolet layer which protects the Earth from harmful ozone.
- d) Plants use oxygen for respiration.
- e) Air acts as a medium for flying.

<input type="checkbox"/>

4. Give one word for the following:

- a) Layer of gases surrounding the Earth. _____
- b) Harmful radiations coming from the Sun. _____
- c) Maintenance of oxygen concentration in the atmosphere. _____
- d) Gas used by green plants to make their food. _____
- e) Gas present in air which cannot be used directly by animals. _____

5. Match the following:

- | | |
|--|--------------------|
| a) the uppermost layer of atmosphere | i) ozone |
| b) helps in burning of candle | ii) carbon dioxide |
| c) maintenance of oxygen concentration in the atmosphere | iii) oxygen |
| d) 0.03% of the air | iv) oxygen cycle |
| e) absorption of harmful radiations | v) exosphere |

6. Write short answers.

- a) In which layer of the atmosphere does the formation of clouds take place?
- b) How do the following organisms fulfil their oxygen requirement?
 - i) Fish
 - ii) Small organisms found in soil
- c) How is air used to generate electricity?
- d) Give reasons for the following:
 - i) Water vapours are not found in the layers above troposphere.
 - ii) On a rainy day, you see earthworms coming out.
- e) Nitrogen makes 78% of air but cannot be used by organisms. How is it made available to the organisms?

7. Answer in details.

- Draw and describe the oxygen cycle.
- Briefly mention the composition of air.
- List the major uses of air. Which musical instruments are played with the help of air?

Extended learning

- Rohan wants to tell his younger brother that air occupies space. How will you help him to demonstrate that? Suggest an activity.
- How is the concentration of oxygen maintained in the atmosphere? Make a flow chart to support your answer.

HIGHER ORDER THINKING SKILLS
HOTS

- Which gas is used in a fire extinguisher? What will happen if it is replaced with oxygen?
- Some wet iron wool was placed in a test tube. The test tube was inverted and kept in a beaker of water. After a week it was noticed that the level of the air column has reduced. Why did this happen?



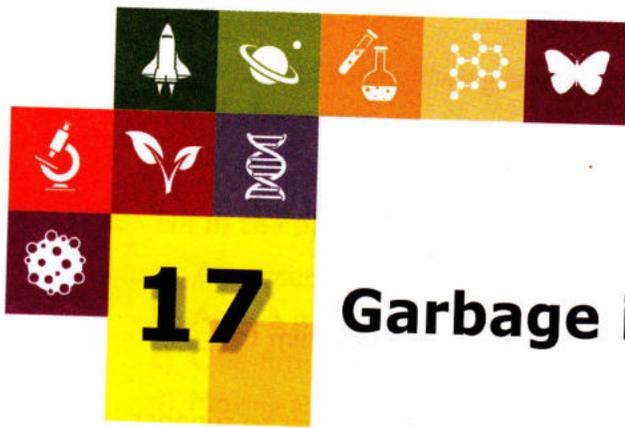
For more information

<http://kids.britannica.com/comptons/article-9272726/air>

<http://csep10.phys.utk.edu/astr161/lect/earth/atmosphere.html>

<http://www.enchantedlearning.com/subjects/astronomy/planets/earth/Atmosphere.shtml>

<http://edugreen.teri.res.in/explore/air/air.htm>



Garbage in Garbage Out



You will learn about

All of us generate garbage on a regular basis. From when the day begins till the end we have something to dispose like scrap of papers, newspapers, pencil shavings, leftover food items, or soiled plastic bags.

Lots of people help us to manage the waste that we create. In school, the sweeper collects garbage from all the classrooms. The garbage picker visits our homes every morning to pick up garbage. If he does not turn up even on a single day, managing the garbage generated at home proves to be a nuisance.

Biodegradable and non-biodegradable waste

Garbage or waste materials can be categorized into two types—biodegradable and non-biodegradable.

Let us now understand these two terms in detail.

Waste materials that can be broken down by microorganisms like bacteria and fungi into simpler substances are called *biodegradable* wastes. All dead plants and animals, and their products are biodegradable.

Waste materials that cannot be broken down by microorganisms are called *non-biodegradable* wastes. Plastics and metals are two such examples.

- Biodegradable and non-biodegradable garbage
- Segregation of waste
- Handling of non-biodegradable garbage by the authorities
- The methods used to deal with biodegradable garbage
- Compost and vermicompost pits

Separate the items given below into biodegradable and non-biodegradable substances.

- Cotton rags
- Paper
- Orange peels
- Plastic-coated paper cartons
- Leather shoes
- Nylon fabric
- Tin cans
- Glass bottles
- Plastic bottles

Biodegradable

Non-biodegradable

What happens to all the garbage once it is collected from schools, homes, offices, and factories?

The waste or garbage is collected by the Municipal Corporation. It is first segregated into biodegradable and non-biodegradable wastes. The non-biodegradable wastes are then taken to landfills. A landfill is a large low-lying open area for the disposal of non-biodegradable garbage. Garbage is dumped into the landfill, then it is covered with soil. Later on, this area is converted into a park or a playground. Try to find out the area used as a landfill in your city.



Fig 17.1 Landfill

The biodegradable component of the municipal waste that will break down is known as biodegradable municipal waste (BMW). It includes kitchen and garden wastes, papers, cardboards, paper bags, and newspapers.

To encourage garbage segregation among residents, the Municipal Council has come up with a new scheme to replace the old and dirty buckets generally used as dustbins with the new green and blue twin bins. The green bin is for



Fig 17.2 Dust bin

biodegradable wastes and blue bin is for non-biodegradable wastes.

In Delhi, these bins, marked as biodegradable and non-biodegradable, have been installed in the public and market places in the New Delhi Municipal Council (NDMC) area. The garbage from these bins is collected and taken to landfill sites.

Composting

The biodegradable waste can be recycled (making new things) by a method called composting, a very old method to dispose waste. This method is cheap and safe, and can significantly reduce the amount of disposable garbage.

Composting is the natural process of decomposition of kitchen and garden wastes into manure or compost, which is rich in nutrients. This is done by microorganisms like bacteria and fungi. The finished product obtained after composting is called humus, which looks like soil. It is rich in carbon and nitrogen and is excellent for growing plants.

Humus is useful to us in the following ways. It increases the ability of the soil to hold water and nutrients.

- It helps to keep the soil cool in summer and warm in winter.
- It aids in preventing soil erosion by keeping the soil intact.

Let us now learn to make compost by performing Activity 1.

Vermicomposting

- e You must have heard that the earthworm is called a farmer's friend. A type of earthworm called the redworm, *Eisenia foetida*, is used to convert biodegradable solid wastes into manure or compost.

Vermiculture means artificial rearing or cultivation of earthworms. Vermicompost is the excreta of



ACTIVITY 1

To make compost

Things required: Waste materials such as dried leaves, vegetable and fruit peel, leftover food, waste paper, cardboard, a pitchfork, a shovel

Method:

- Select a place which gets sunlight and partial shade during the day.
- Mark a square on the ground which is at least 3×3 sq. ft.
- Dig the marked area to a depth of at least 6 inches. Pile the removed soil near an edge of the pit to add into the pit later. Remove stones, roots, and debris from the pit and also from the stacked soil.
- Put household kitchen waste and other biodegradable material into the pit. Then cover it with soil.
- Turn the contents of the pit with a pitchfork after every two weeks. Heap the material to the centre of the pit each time.
- Add a shovel full of soil into the waste each time you turn it. This will allow the biodegradable pile to breathe while the material decomposes more evenly.
- Sprinkle water on the pit contents once in a while to keep the contents a little wet. In case of rains, cover the pit with a black plastic sheet to keep it away from getting too wet. Put heavy bricks or stones around the edges of the sheet to hold it down.



After a month, the biodegradable waste material decomposes into manure or compost. This is very rich in nutrients and can be added to the plants.

5

earthworms which is rich in humus and nutrients, and the method to prepare compost with the help of redworms is called vermicomposting. Earthworms eat plant waste, cow dung, or farmyard material. They pass the material through their body and in the process convert it into vermicompost. Earthworms, by consuming garbage and converting it into valuable manure, keep the environment healthy.

Let us now learn to make a vermibed by undertaking Activity 2.

Incineration

-  You must have seen that gardeners usually rake up leaves and burn them. This is called

incineration. This burning of dry leaves and other wastes results in increased levels of carbon monoxide and carbon dioxide in the air. These gases cause respiratory problems, especially among children and the elders.

Studies conducted by municipal waste management show that 72 per cent of municipal waste is landfilled, 19 per cent is converted into compost, and 9 per cent is incinerated.





ACTIVITY 2

To make a vermicompost

Things required: Bricks, redworms, dried leaves

Method:

- Choose a corner of your school garden or playground.
- The ground should have a slight slope so as to allow water drainage and avoid stagnation. The corner should have a source of water and a provision of shade above the beds.
- The vermibed needs to have a boundary wall of two bricks. The bricks must be lightly cemented to prevent shifting.
- The bed should be 3 feet in width, 3 feet in length, and 6 inches in height.
- Construct a feeder bed in exactly the same way.
- Fill the beds with dry leaves. Pour water till the leaves turn soft. The leaves have to be turned using a pitchfork or *panji* after every four days.
- After 15 days, add the redworms and a little cowdung to one of the pits. This has now become a vermibed. Cover it with gunny bags and keep it moist.
- Keep adding moist leaves from the feeder bed to the vermibed.

After six weeks, the manure is ready and can be harvested. You can harvest the vermicompost when the castings and the worms are not seen on the top layer. Stop watering the bed for a few days before harvesting.

e



Infobit Studies show that on an average, each person in an urban area produces half a kilogram of garbage each day. This does not include the garbage we make indirectly, i.e., through industry, agriculture, and mining. Twenty per cent of Indians live in urban areas. This calculates to more than 36 million tonnes of garbage each year in the cities alone!

running out of suitable land for new landfill sites. So, what is the alternative?

We need to turn to the 3 Rs—*Reduce, Reuse, and Recycle*.

First R stands for *Reduce*. We should reduce the amount of waste we create. Throwing garbage puts pressure on the environment—not only from the landfills and incinerators, but also because we have to extract and process even

Disposing the garbage by land filling or incineration is not the ideal solution to get rid of waste. Whenever we bury or burn garbage, we not only lose valuable natural resources but also waste energy, water, and transportation costs. Landfilling and incineration can harm the environment if not properly managed. Many landfill sites are nearly full and we are rapidly



more resources, and transport our new goods and our old rubbish. This increases vehicular emissions. Therefore, we should buy only the right quantity of what we really need and choose products with less packaging.

Second R stands for *Reuse*. We should reuse the waste as much as possible. Computers, furniture, clothing, and many other items can be reused. For example, setting the printer to print on both sides of a sheet of paper, repairing broken appliances and shoes, or finding a charity that will make use of them. This way, we help ourselves and others, and delay the point at which materials become waste.

Third R stands for *Recycle*. We should *recycle* the waste as much as possible. For example, plastic bottles can be recycled to make new things. By recycling used aluminium cans we can save 95 per cent of the energy required to make a new can.

Other things that can be recycled are glass, steel, paper, and cardboard.

New technologies have made it possible to recycle what was previously considered waste and turning it into a useful product.

You can see from the following story that things can be reused and recycled. What is required is creativity and innovation. We will be able to find ways to reduce, reuse, and recycle if we care about the environment we live in.

What do you do at the end of the month with all the newspapers you have at home? The



Scientists have made a bacterium that can digest sugars from plant waste and turn them into biofuels that can be used in place of petrol, thus helping to reduce pollution.

e Read the following story.

A disciple of the Buddha once asked a king for 500 garments. The following conversation took place between the two.

The King: 'What would you do with so many garments?'

The Disciple: 'Oh King, many of our brothers are in rags, I am going to distribute some garments among the brothers.'

The King: 'What will you do with the other garments?'

The Disciple: 'I will make bed covers out of them.'

The King: 'What will you do with the old bed covers?'

The Disciple: 'I will make pillow cases out of them.'

The King: 'What will you do with the old pillow cases?'

The Disciple: 'I will make floor covers out of them.'

The King: 'What will you do with the old floor covers?'

The Disciple: 'I will use them for foot towels.'

The King: 'What will you do with the old foot towels?'

The Disciple: 'Your Highness, I will tear them into pieces, mix them with mud, and use the mud to plaster the house walls.'





Santu started off as a ragpicker. Today, he recycles waste and has 25 people working for him. He represented Delhi's garbage collectors at the Climate Change Conference held at Copenhagen in December 2009. In faltering English, but with strong conviction, he informed world leaders about the important role played by ragpickers in reducing carbon emissions.

most probable answer is that you sell it to a *kabariwala*, the local waste paper/waste material purchaser. Recycled paper can be made from old newspapers. Recycling of paper makes use of cellulose (plant fibres) over and over again, uses less electricity, less water, causes less pollution, and saves trees from being cut down!

Ragpickers in cities collect and segregate garbage. A ragpicker with a large polythene sack flung over his shoulder begins work as early as 4 a.m., otherwise he/she will miss the waste. By late afternoon, or whenever the bag is full, the ragpicker returns to the store of a middleman, also called a *kabariwala*, and sells the waste but not before the waste is sorted out according to their types—materials of plastics, paper, and metals. These must be clean and dry to be accepted by a *kabariwala*.

Plastic—a boon or a curse

Make a list of ten things made of plastic that you use daily.

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

You will have no difficulty in listing down the ten items as plastic plays an important role in our lives. It is light-weight, durable, and low in cost. The only problem with plastic is that it is non-biodegradable, so once manufactured it cannot be destroyed in any way.

Plastics are a menace to humans, animals, and the environment because of the following reasons.

- Plastic waste accumulated in landfills accounts for a lot of soil pollution over the years since it is non-biodegradable.
- When plastic is burnt, the harmful fumes enter the atmosphere and have a bad effect on people who breathe it.
- Plastic also finds its way into drains and sewage pipes, and clogs them.
- Animals sometimes feed on plastic bags and choke to death.
- Sometimes little children suffocate while playing with plastic bags and toys.

Most of us are not aware that plastic comes broadly in two varieties—recyclable and non-recyclable. Recyclable plastic can be directly sent over to the recycling plants where they are melted and remoulded into different articles.

Government should ban the manufacture of non-recyclable plastic and people should be educated to avoid using non-recyclable plastic. Before buying a plastic article, always look at the label to find out if it is recyclable or not.



Parisaraa, an eco-friendly recycling unit on the outskirts of Bengaluru, makes full use of e-waste. The plant, which is India's first scientific e-waste recycling unit, will reduce pollution, landfill waste, and recover valuable metals, plastics, and glass from waste in an eco-friendly manner.

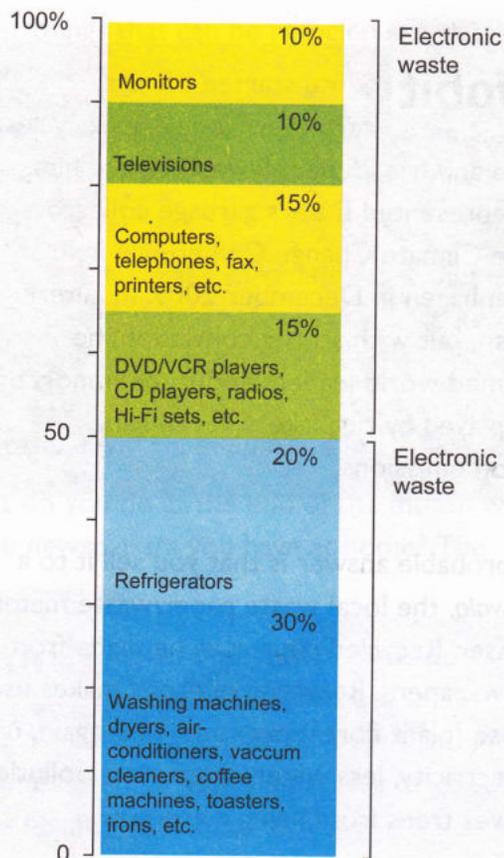
Electronic or electric waste

Electronic or electric waste, popularly known as 'e-waste', is made up of all the electronic and electric items that we throw away because they have become old or outdated.



Nokia launches e-waste management initiative

This initiative launched on 1 January, 2010, encourages mobile phone users to dispose of their used accessories such as chargers and handsets, regardless of the brand, at any of the recycling bins set up across Nokia Priority Dealers and Nokia Care Centres. Nokia India will plant a sapling for every old mobile handset or accessory deposited.



Go to the link—<http://www.youtube.com/watch?v=i3fOLL10yxY>, watch the video, and answer the following questions about e-waste.

1. What are the fumes of metals that the workers inhale while burning computer boards?
2. What did Dr. Kevin Bridgen analyse? What were his findings?
3. What precious metals are obtained from e-waste?
4. How is copper separated from electric cables?
5. Which metal is found in computer monitors?
6. What are the effects of heavy metals produced by recycling e-waste on human health?
7. Why does recycling a computer in India cost less than it does in the United States?
8. Which countries dump their e-waste in India?
9. What are the steps that companies should take to make e-waste less harmful for people and for the environment?
10. Which companies are developing environmentally safe electronic products?



Biodegradable substances: substances that can be broken down by the microorganisms like bacteria and fungi

Non-biodegradable: substances that cannot be broken down by microorganisms

Landfill: a large low lying open area for disposal of non-biodegradable garbage

Vermiculture: artificial rearing or cultivation of earthworms

Incineration: burning of waste



- Garbage can be categorised into two types—biodegradable and non-biodegradable.
- The non-biodegradable waste is disposed off in landfills.
- The biodegradable waste can be recycled by composting or by vermicomposting.
- Garbage can also be incinerated.
- People should practice the 3 Rs—Reduce, Reuse, and Recycle.
- Plastics and other non-biodegradable products need to be managed well because they can cause harm to humans, animals, and the environment.
- E-waste or electronic and electric waste needs to be managed well by recycling.

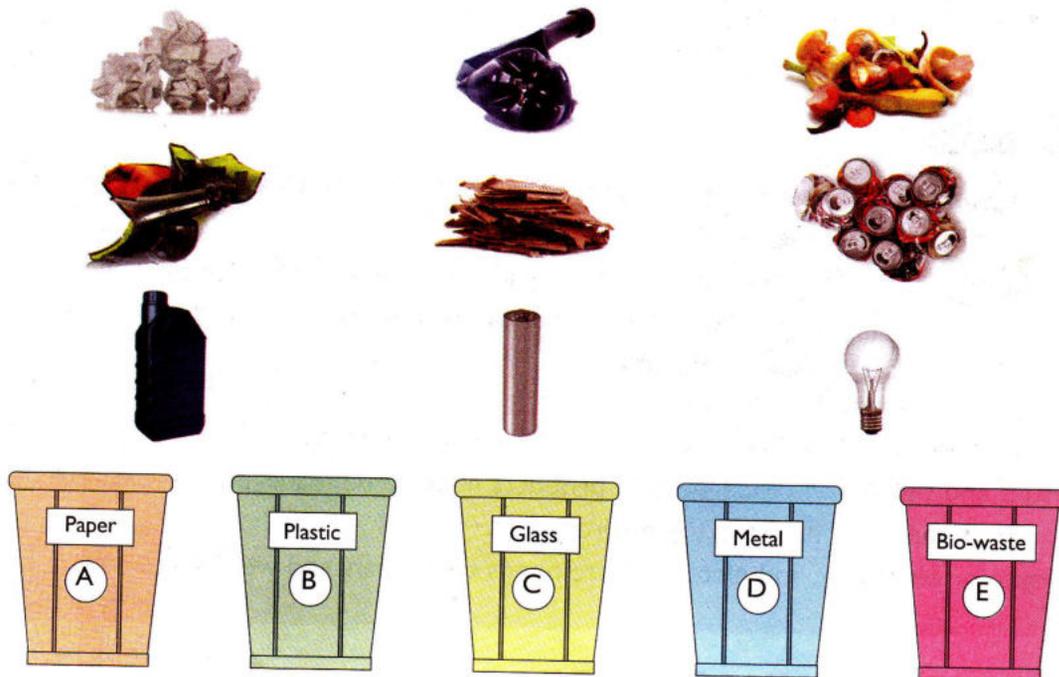
▲ Put on your **THINKING CAP!**

I. Choose the correct option.

- a) Electric waste is popularly known as
- i) ecosystem
 - ii) e-waste
 - iii) compost
 - iv) none of these
- b) The substances that can be broken down by bacteria and fungi are called
- i) non-biodegradable
 - ii) vermicompost
 - iii) biodegradable
 - iv) both i) and ii)
- c) A large low-lying open area for disposal of non-biodegradable garbage is called
- i) garbage bin
 - ii) compost pit
 - iii) landfill
 - iv) none of these
- d) BMW stands for
- i) big menace waste
 - ii) biodegradable municipal waste
 - iii) biological medical waste
 - iv) both i) and ii)
- e) Humus is obtained by
- i) composting
 - ii) recycling
 - iii) incineration
 - iv) land filling
- f) The method used to prepare compost with red worms is called
- i) vermicomposting
 - ii) recycling
 - iii) refilling
 - iv) all of these

- g) Incineration is defined as the
- i) rearing of earthworms
 - ii) indiscriminate burning of dry leaves
 - iii) collection and segregation of garbage
 - iv) recycling of plastics
- h) The waste that is made up of all the electronic and electric items is called
- i) e-waste
 - ii) e-compost
 - iii) landfill waste
 - iv) vermicompost

2. Sort out the waste products in the respective bins and answer the following questions.



- a) The contents of which bins do you think will be sent to the landfills and why?
- b) The contents of which bins are termed biodegradable and why?
- c) The contents of which bins can be recycled?

3. Five biodegradable and non-biodegradable items is hidden in the maze. Encircle them.

COTTON	BOTTLES	CANS	CARDBOARD	NAIL							
PLASTIC	PAPER	WIRE	VEGETABLES	GRASS							
C	R	C	O	T	T	O	N	E	R	T	G
A	P	A	P	E	R	O	I	L	E	R	R
R	C	V	M	S	O	I	L	R	U	A	A
D	R	E	S	O	U	R	C	E	S	S	S
B	I	G	C	E	E	U	S	T	E	H	S
O	I	E	N	A	I	L	R	A	W	O	E
A	L	T	N	D	F	I	L	L	I	T	D
R	R	A	C	Y	C	L	E	L	R	S	U
D	E	B	S	B	O	T	T	L	E	S	C
N	E	L	S	P	A	P	E	R	P	H	E
S	A	E	D	P	L	A	S	T	I	C	S
E	C	S	M	P	O	S	T	C	A	N	S

4. Unscramble to get a word. Also write its meaning.

- a) BAOGLDABEIDRE _____
Meaning: _____
- b) LIFLDNAL _____
Meaning: _____
- c) IERCTAONININ _____
Meaning: _____
- d) VMCTULRIERUE _____
Meaning: _____

5. Pick the odd one out and give reasons for your answer.

- a) banana peel, thermocol plate, steel glass, sand
b) book, leather jacket, apple pieces, silver coin
c) cotton towel, CFL bulb, wooden picture frame, glass beads
d) pillow case, rice, eggs, bottle
e) printer, keyboard, mouse, rat, radiator

6. Write short answers.

- a) Why is humus considered good for growing plants?
b) What is the name of the earthworm used in vermicomposting? How does it convert biodegradable solid waste into manure?
c) Why is incineration not a good practice of getting rid of garbage?
d) Distinguish between biodegradable and non-biodegradable wastes.
e) What is a landfill?

7. Answer in details.

- a) Using the chart given for e-waste in the chapter, name the types of electronic and electric wastes that are generated by humans. Which generate the maximum waste?
b) Why is plastic viewed as a menace?
c) What are the three Rs that should be followed. Explain.

8. Identify all the eco-friendly practices from the list given below and put a tick next to them.

- a) Ramu always carries a cloth bag when he goes to buy vegetables.
- b) Shiva throws away the empty soft drink bottles into the dustbin.
- c) Reshma always buys milk in cartons rather than in bottles.
- d) Seema maintains a compost pit at home.
- e) Rahul's household members dump all the garbage in a single dust bin.
- f) Bhavna's neighbourhood gardener put all the leaves in a pile and burnt them.
- g) Shalini buys recycled paper for all her project work.

- h) Ankit brings his lunch wrapped in tin foil.
- i) Shyam, the grocer, has refused to keep plastic bags in his shop.
- j) Meena wears slippers made of jute.



9. Suggest three ways in which you can reduce, reuse, and recycle garbage at school.

Reduce

Reuse

Recycle

Extended learning

 **Discuss with your teacher and write down the steps you can take as a responsible citizen to become more environment-friendly.**



1. You have the opportunity to build an environment-friendly 'green home'. What features will you provide in such a home? Draw a picture of the same.
2. If you were elected the president of the Residents Welfare Association of your colony, what steps will you take to reduce the amount of garbage in the colony?
3. Make a poster to educate people on how to manage waste.
4. Interview your local *kabariwala* about how he recycles the waste that comes to him or that he collects.
5. Contact a non-governmental organization (NGO) which is working for better management of garbage in your town or city. Find out about the work they do.
6. Weigh the garbage your family generates in a single day. Calculate the amount of garbage you generate in one year.

HOTS

1. Kalim, a ragpicker, collected used polythene bags from a housing colony. He put them in a pile and burnt them. Did he do the right thing? Give reasons.
2. Mrs Kapoor made a compost pit. Her maid put leaves, vegetable peels, left-over food, polythene bags, paper, aluminium foil, and broken glass bottles in it. What do you think happened to the things in the compost pit?
3. John took a big plastic flower pot and created a compost pit. He harvested the compost after some days. What could he have done differently?



Club Make a 3 Rs club. Compose your own poem or song on the 3 Rs. Also, design a logo for your club. Some of the samples are given below:



Following is a news report about recycling. With the help of the Internet find out more stories about recycling.

A class apart: This school is made of wastepaper

REUTERS, 6 January 2010, 11:51 pm IST

TAIPEI: An eco-conscious couple in Taiwan has opened a small schoolhouse built with donated newspapers

Canadian-born John Lamorie and his Taiwanese wife, Shelly Wu, used more than 1,000 kg of newspapers, many collected from students who would turn them over for points in class, to build the 75 sq-metre schoolhouse. "I'm very much into the way I feel about the environment, especially reusing things," said Lamorie, 59, a former building inspector. "It's something that's always been in me, a hangover from my hippie days."

The project took about a year. With the school now set to open ahead of schedule, news of the unusual construction method spread in the rural area of Pingtung county. After getting the idea from visiting friends, Lamorie said he built a blender using a truck bed and a lawnmower blade. Into it he fed newspapers, water, and cement to form what he calls "Papercrete", the backbone of his six-inch thick school walls. "Basically it's like a giant blender," he said.

Papercrete, though patented in 1928, remains far outside the mainstream of construction materials. It can be labour-intensive and tough to use despite its environmental friendliness. The walls of the schoolhouse are coated with a silicone coating to guard against rain damage. The school can accommodate about 16 students.

Lamorie and Wu are now building a paper-based restaurant where they plan to cook pizzas.



For more information <http://edugreen.teri.res.in/explore/solwaste/soliwaste.htm>

Summative Assessment 1

(Maximum Marks: 50)

1. Fill in the blanks.

(5×1 marks)

- Plants are also called _____ as they provide food to us.
- Deficiency of vitamin _____ causes night blindness.
- Jute fibre is obtained from the _____ of jute plant.
- Tissue paper is a _____ material.
- _____ is used to separate components of a mixture of different sizes using sieve.

2. Match the columns.

(5×1 marks)

- | | |
|-------------------------------|-----------------------|
| a) crow | i) joint |
| b) rusting of iron | ii) monarch butterfly |
| c) prevent soil erosion | iii) chemical change |
| d) point where two bones meet | iv) scavenger |
| e) insect that camouflages | v) roots |

3. State the following as true or false.

(10×1 marks)

- We need food to repair the damaged parts of our body.
- Sodium is required to form haemoglobin.
- Spinning is the process of making yarn from fibres.
- Insulators are the materials that allow electricity to pass through them.
- The process of conversion of water into water vapour is called condensation.
- Tearing a piece of paper is a fast change.
- Leaves are the food factories of the plants.
- Ball and socket joint allows movement in almost all directions.
- A habitat is a place where plants and animals live.
- Femur is the longest bone in our body.

<input type="checkbox"/>

4. Select the correct option.

(10×1 marks)

- Which of the following is a function of food?
 - growth
 - repair
 - energy
 - all of these
- Meat, peas, milk, and eggs are rich sources of
 - carbohydrates
 - proteins
 - fats
 - vitamins
- Inter-looping of one or more sets of yarns is called
 - knitting
 - weaving
 - spinning
 - ginning
- Which of the following materials floats on water?
 - stone
 - cork
 - coin
 - golf ball

- e) The appropriate process to separate a mixture of sand and iron fillings is called
- | | |
|------------------------|-----------------|
| i) magnetic separation | ii) winnowing |
| iii) threshing | iv) decantation |
- f) Which of the following is an example of an irreversible change?
- a tomato ripens when left in the open
 - chocolate melts when left outside in the summer
 - peas turn hard when put in the freezer
 - jelly cubes melt when heated
- g) The loss of water in the form of vapour from the surface of the leaves is called
- | | |
|------------------|--------------------|
| i) transpiration | ii) photosynthesis |
| iii) pollination | iv) none of these |
- h) Which tissue attaches muscle to the bone?
- | | |
|-------------|---------------------|
| i) ligament | ii) cartilage |
| iii) tendon | iv) both i) and ii) |
- i) Stems carry out the process of photosynthesis in plants found in
- | | |
|--------------|----------------|
| i) mountains | ii) forests |
| iii) deserts | iv) grasslands |
- j) Birds are able to fly high in the sky because they have
- | | |
|-------------------------|-------------------------|
| i) hollow bones | ii) wings with feathers |
| iii) a streamlined body | iv) none of these |

5. Answer the following questions.

(10×2 marks)

- What is food? List the functions performed by food in our body.
- How is the presence of starch tested in a food item?
- How is cotton fibre extracted from the plant?
- What are conductors? Why are electric wires coated with plastic cover?
- Define winnowing. How is it done?
- Why do engineers have to be careful while designing large metal structures like bridges?
- Explain with diagrams the two types of venations in leaves.
- What adaptations are present in animals growing in deserts?
- With the help of a well-labelled diagram, describe the structure of a flower. Give the function of each part.
- Explain with examples the main movable joints present in our body.



Summative Assessment 2

(Maximum Marks: 50)

1. Fill in the blanks.

(5×1 marks)

- a) A swing is an example of _____ motion.
- b) The SI unit of time is _____.
- c) Moon is an example of a _____ object.
- d) Solar eclipse is an example of _____ in nature.
- e) Iron is a _____ material.

2. Match the columns.

(5×1 marks)

- | | |
|---|----------------------|
| a) SI unit of length | i) cell |
| b) the motion of the needle of a sewing machine | ii) electric current |
| c) bouncing back of light from a surface | iii) metre |
| d) flow of charge | iv) periodic motion |
| e) source of electricity | v) reflection |

3. State the following as true or false.

(10×1 marks)

- a) The standard known quantity for the measurement of a physical quantity is called a unit.
- b) Non-luminous objects emit light of their own.
- c) Light does not bend round the corners of an object.
- d) Glass is an opaque object.
- e) The poles of a magnet can be separated.
- f) Magnetic property of a magnet is lost if it is heated strongly.
- g) There will be no flow of circuit through an open circuit.
- h) A solar cell converts electrical energy into solar energy.
- i) Air occupies space.
- j) Microorganisms can break down even non-biodegradable waste.

<input type="checkbox"/>

4. Select the correct option.

(10×1 marks)

- a) Identify the unicellular organisms.
 - i) amoeba
 - ii) man
 - iii) tree
 - iv) all the above
- b) The motion of a fan is an example of
 - i) rectilinear motion
 - ii) curvilinear motion
 - iii) periodic motion
 - iv) none of the above
- c) An object that allows light to pass through it is
 - i) opaque
 - ii) transparent
 - iii) translucent
 - iv) none of the above
- d) Which of the following material is magnetic?
 - i) iron
 - ii) wood
 - iii) talcum powder
 - iv) all the above



- e) Which of the following will not conduct electricity?
i) copper
ii) aluminium
iii) wood
iv) all the above
- f) The change of water vapours into water on cooling is called
i) evaporation
ii) condensation
iii) transpiration
iv) none of the above
- g) The atmospheric layer where the various weather phenomena occur is
i) thermosphere
ii) stratosphere
iii) troposphere
iv) mesosphere
- h) Which of the following element is not a component of air?
i) carbon
ii) oxygen
iii) nitrogen
iv) iron
- i) Living organisms need oxygen for
i) photosynthesis
ii) combustion
iii) respiration
iv) none of the above
- j) Which are natural ways of increasing soil fertility?
i) composting
ii) vermicomposting
iii) adding fertilizers
iv) all the above

5. Answer the following questions.

(10×2 marks)

- a) Why is nutrition an important characteristic of a living organism?
- b) What are SI units of measurement and why are they needed?
- c) Write the steps for correctly measuring the length of a piece of cloth.
- d) What is a shadow? Discuss the characteristics of a shadow.
- e) What do you mean by reflection of light?
- f) Differentiate between magnetic and non-magnetic materials. Give examples.
- g) What is an electric circuit? Explain with an example.
- h) Discuss various methods by which we can conserve water.
- i) Explain the process by which the amount of oxygen in the atmosphere is balanced.
- j) What is composting and how is it useful?