GENERAL SCIENCE

5

PUNJAB CURRICULUM AND
TEXTBOOK BOARD, LAHORE

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UNIT

1

CLASSIFICATION OF LIVING THINGS

In this unit, we will learn:

- Classification of living things
- Introduction of the Main Kingdoms (Bacteria, Algae, Fungi, Animals, Plants)
- Classification and Characteristics of Animals (Vertebrates and Invertebrates)
- Classification and Characteristics of Plants (Flowering and Non-flowering Plants)
- Classification of Flowering Plants (Monocot and Dicot Plants)
- Characteristics of Monocot and Dicot Plants

Classification means sorting out things into groups on the basis of similarities and differences among them. Figure 1.1 shows three groups of objects. In each group, things are put together on the basis of some similarities among them. For example, all the things of group (a) are made of metals. The things of group (b) are books and those of group (c) are fruits.

(a) Cutlery

(b) Books

(c) Fruits

Figure 1.1 Grouping of items on the basis of similarities and differences

In this unit, we will study different groups of living things and compare their characteristics.

1.1 Classification of Living Things

There are millions of living organisms in our world. Scientists have grouped them on the basis of similarities in their characteristics. Grouping of living organisms on the basis of similarities and differences in their characteristics is called classification of living things.

Classification of living things is essential for making their study easier. During classification, scientists examine the characteristics of an unfamiliar organism and find its proper group. They also suggest name for the organism for its identification.

You Need To Know

- The bodies of all the living things are made up of very small units called cells.
- The organisms whose bodies consist of single cell are called unicellular organisms.
- The organisms whose bodies are made up of more than one cells are called multicellular organisms.

1.2 The Five Kingdom System of Classification

Now-a-days, scientists classify living things into five main groups called kingdoms. These kingdoms are named as monera, protista, fungi, animalia and plantae. Examples of living things that belong to these kingdoms are as under:

Kingdom		Example
Monera	.....	Bacteria
Protista	.....	Algae
Fungi	.....	Yeast, mushrooms, etc.
Animalia	.....	Animals
Plantae	.....	Plants

Bacteria

Bacteria are unicellular organisms (Figure 1.2). They are found everywhere on the Earth. Some bacteria can make their food but others live in and get food from the bodies of other organisms or dead bodies. Most bacteria cause diseases in animals and plants.

Figure 1.2 Bacteria

Algae

Algae are unicellular, colonial and multicellular organisms. They are found in ponds, lakes, sea, etc. They have chlorophyll and make their own food by photosynthesis. *Chlamydomonas*, *Volvox* and *Spirogyra* are the examples of algae (Figure 1.3).

Chlamydomonas

Volvox

Spirogyra

Figure 1.3 Some algae

Fungi

Fungi are found as unicellular, multicellular or filamentous forms. All fungi lack chlorophyll and cannot prepare their own food. They absorb food

Yeast

Rhizopus

Mushroom

Figure 1.4 Some fungi

from their surroundings. Yeasts, Rhizopus and Mushrooms, etc., are included in kingdom Fungi (Figure 1.4). Yeasts are microscopic fungi. Rhizopus (black bread mould) grow on moist bread and fruits. Mushrooms (umbrella like fungi) appear on dumps of debris and heaps of dung.

Animals

Animals are a major group of multicellular organisms. They cannot prepare their own food. They depend on plants and other animals for their food.

Plants

Plants are photosynthetic, multicellular organisms. We will learn about their further classification under section 1.4.

1.3 Classification and Characteristics of Animals

Animals are classified into two main groups, i.e., vertebrates and invertebrates.

Vertebrates

Vertebrates are animals which have a backbone (Figure 1.5).

Activity 1.1

- Feel the back of your body with your fingers.
- Do you have a backbone?
- Are you a vertebrate or an invertebrate?

Figure 1.5 Some vertebrates

There are about 47,000 different kinds of vertebrates on the Earth. Vertebrates are further divided into five classes (groups), i.e., fishes, amphibians, reptiles, birds and mammals.

Mammals

Human beings, cows, goats, horses, tigers, cats, rabbits, etc., belong to a group of vertebrates called mammals (Figure 1.6). Mammals have hair or fur on their bodies. Babies of the mammals are fed on the mother's milk. The young ones in mammals generally develop inside the mother's body.


Cow


Goat


Horse


Tiger


Rabbit


Cat

Figure 1.6 Mammals

For Your Information

- The quantity of hair or fur on the bodies of mammals depends upon the climate of their environment. Polar bear lives in very cold climate; hence, it has a thick coat of fur. Elephant lives in hot climate, so it does not need a thick covering of hair or fur.
- Whale and dolphin are mammals. Blue whale is the world's largest animal. It is about 35 metres long and nearly 120 tonnes in weight. Indus blind dolphin or 'susu' is a river dolphin of Pakistan not found anywhere else in the world.
- Human, monkey, gorilla and chimpanzee are intelligent mammals. They have highly developed brain. Bat is a flying mammal.


Polar bear


Elephant


Dolphin


Whale


Monkey


Bat

Birds

Sparrows, crows, parrots, doves, robins, hens and pigeons, etc., belong to the group of vertebrates called birds (Figure 1.7). Birds have feathers, wings and beaks. They have hollow bones and air sacs, which make their bodies very light. Some birds like kiwi and ostrich cannot fly and are known as running birds. Birds lay eggs with shells. Eggs hatch into baby birds.

Activity 1.2

- Make a list of birds that you see in your surroundings.
- Examine their beaks.
- Why different birds have beaks of different shapes?

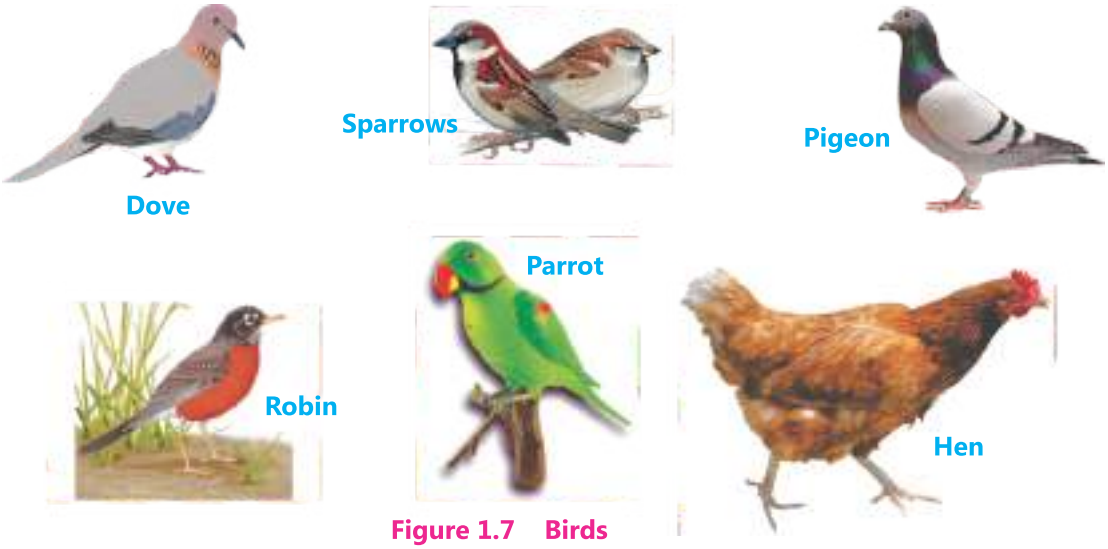


Figure 1.7 Birds

For Your Information

- Owl is a bird with big eyes. Kiwi and ostrich are running birds. Duck is a swimming bird. Penguin is a bird that lives on ice. Woodpecker is a bird that makes holes in trees.
- Hummingbird is the smallest bird in the world. Eagle lives in tall trees or on cliffs. It often builds nest near lake or river, so that it can dive down to catch fish for its food. Hawk is a bird of prey.

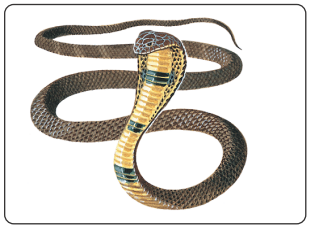
Reptiles

Lizards, snakes, tortoises, crocodiles, alligators, etc., belong to a group of vertebrates called reptiles (Figure 1.8). Reptiles have dry, thick and scaly skin which covers and protects their bodies. They reproduce by laying eggs on land. Their eggs have thick leathery shells which prevent them from getting dry. Most reptiles have four limbs but snakes lack limbs.

Do You Know?

Dinosaurs were the biggest reptiles in ancient times. They do not exist anymore.

Tortoise



Snake

Lizard

Crocodile

Alligator

Figure 1.8 Some reptiles

Amphibians

Toad, frog, salamander, etc., belong to a group of vertebrates called amphibians (Figure 1.9). They have four limbs. Amphibians can live in water as well as on land. They breathe through lungs or skin. They usually have loose and wet skin. Most of them spend their adult life on land and return to water to lay eggs. Amphibian eggs look like beads in jelly. These are soft and do not have hard shells.

Do You Know?

In winter, amphibians bury themselves in the mud and sleep for a long time to keep themselves safe from cold climate.

Toad

Frog

Salamander

Figure 1.9 Some amphibians

Fishes

There are over 25,000 different kinds of fishes found all over the world (Figure 1.10). They live in water. They have streamlined bodies well suited to swim fast in water. Fishes have fins and tail which help them to swim. They have stiff scales on their skin for protection. They have gills to breathe in water. Most of the fishes reproduce by laying eggs.

Rohu

Sea Trout

Rainbow Trout

Gold Fish

Shark

Butterfly Fish

Figure 1.10 Some fishes

Activity 1.3

Mark (L) for the animals which breathe through a pair of lungs and (G) for the animals which breathe through gills.

☐ Sheep ☐ Sparrow ☐ Shark ☐ Lizard

Invertebrates

Animals which do not have backbone are called invertebrates. There are different kinds of invertebrates found on the Earth. Insects, snails, starfish and worms are the examples of invertebrates.

Insects

Insects are well known invertebrates with jointed legs. They have segmented bodies. Ant, butterfly, bee, cockroach, etc., are the examples of insects (Figure 1.11). Every insect has three parts of its body: head, thorax and abdomen. Insects have six legs (three pairs). They have hard skeleton on the outside of their body. Outer skeleton provides support to their bodies.

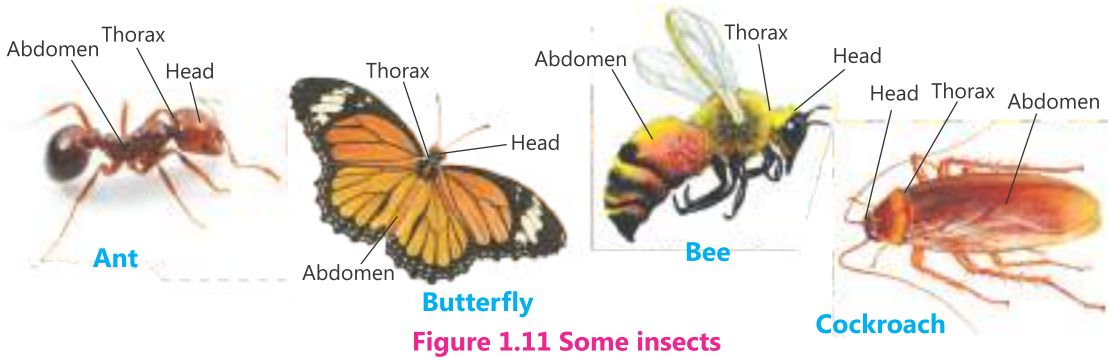


Figure 1.11 Some insects

Worms

Worms are invertebrates with soft bodies having no limbs. Most of them have elongated, snake-like bodies.

Do You Know?

Some worms live in the bodies of higher animals for getting food.

Earthworm and tapeworm are the worms whose bodies are divided into many segments (Figure 1.12). Flatworm and roundworm are the worms without segmented bodies.

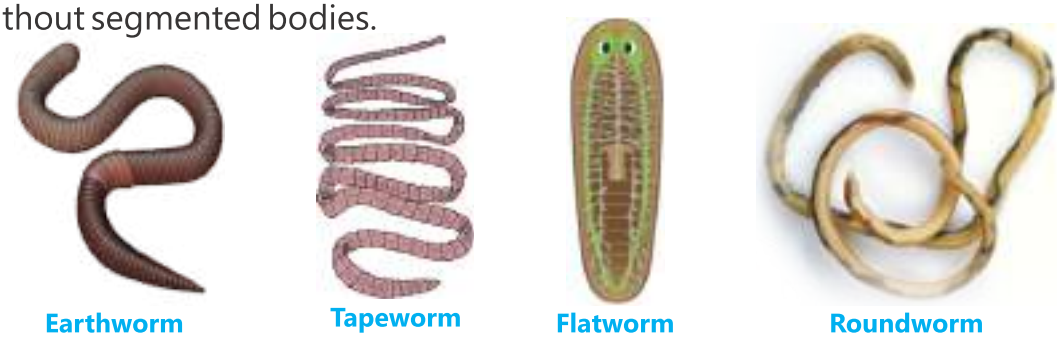


Figure 1.12 Some worms

FOR YOU INFORMATION

Starfish and sea anemone are the examples of marine invertebrates.

Activity 1.4

The word search below contains the name of animals which have no backbone. These animals are called **INVERTEBRATES**. There are eight invertebrates hidden and one is highlighted. Highlight the others.

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

Can you think of more invertebrates? Write down their names.

_____ _____ _____

_____ _____ _____

1.4 Classification and Characteristics of Plants

Plants are mainly classified as flowering plants and non-flowering plants.

Flowering Plants

The plants that bear flowers are called flowering plants (Figure 1.13). Flowers are their reproductive organs. The leaves in their flowers are called floral leaves. The outer green coloured floral leaves of a flower are called sepals. Inside the sepals, there are colourful leaves which are called petals. Flowering plants develop seeds in their fruits.

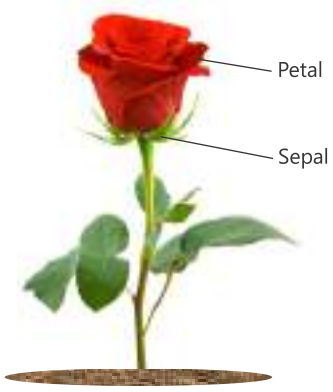


Figure 1.13 A branch of a Rose plant

Do You Know?

There is a young plant in every seed of flowering plants called embryo. Embryo bears one or two seed leaves called cotyledons. Cotyledons often store food which is used by the young embryo. Seeds of grasses have only one cotyledon.

(i) Monocot Plants

Flowering plants whose seeds have only one cotyledon are called monocot plants. Examples are oat, wheat, rice, etc. (Figure 1.14). Their leaves have veins which run parallel to each other. Floral leaves are usually three or multiples of three.

Oat Wheat Rice

Figure 1.14 Some monocot plants

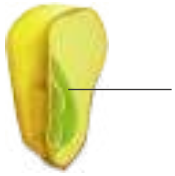
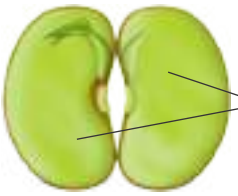
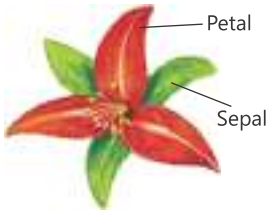
(ii) Dicot Plants

Flowering plants like rose, pea, bean, etc., have two cotyledons in their seeds. They are called dicot plants. Their leaf veins are in the form of a network. Floral leaves are usually four or five or their multiple.

Rose Pea Bean

Figure 1.15 Some dicot plants

Comparison of Monocot and Dicot Plants

Part of plant	Monocot plant	Dicot plant
Seed	 One cotyledon	 Two cotyledons
Leaf	 Veins run parallel to each other.	 Veins form a network.
Flower	 Floral leaves are three or multiple of three	 Floral leaves are four or five or their multiple

Activity 1.5

- Soak some pea seeds in water for one day.
- Remove their outer covering and observe the cotyledons inside.
- How many cotyledons are there?

Activity 1.6

You have studied the differences between monocot and dicot plants. Considering the characteristics of plants, tick the relevant box.

Monocot ☐ Dicot ☐

Monocot ☐ Dicot ☐

Monocot ☐ Dicot ☐

Monocot ☐ Dicot ☐

Monocot ☐ Dicot ☐

Monocot ☐ Dicot ☐

Monocot ☐ Dicot ☐

Monocot ☐ Dicot ☐

Non-Flowering Plants

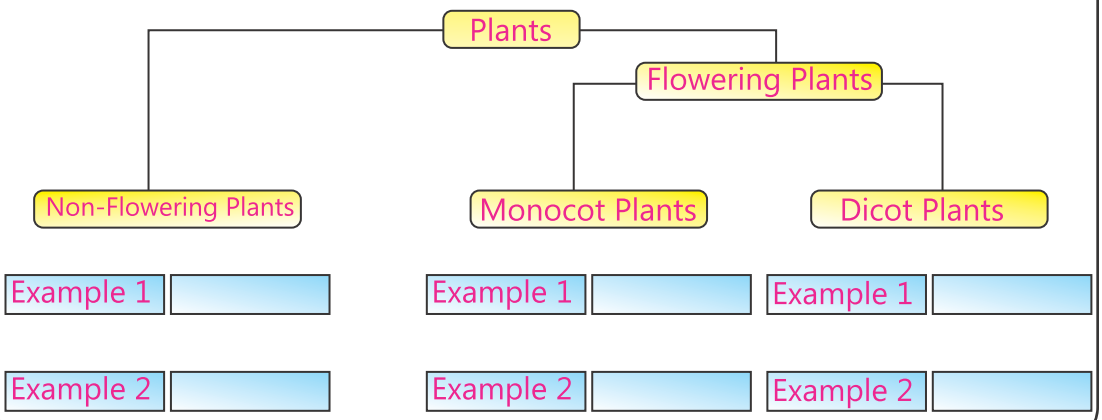
The plants which do not bear flowers are called non-flowering plants. Conifers, ferns, mosses and liverworts, etc., are the examples of non-flowering plants (Figure 1.16). Conifers have needle-like leaves. They reproduce by seeds developed in their cones. Leaves of ferns are divided into leaflets. Ferns reproduce by spores developed on the underside of their leaves. Mosses and liverworts have simple stem and tiny leaves. They reproduce by spores developed in their capsules.

Conifer Fern Moss Liverwort

Figure 1.16 Some non-flowering plants

Activity 1.7

Complete the following chart by giving examples of the groups of plants.



Activity 1.8

- Observe the leaf venation of five different flowering plants from your school garden and identify them whether they are monocot or dicot plants

Science, Technology, Society and Environment

Conifers found in the Northern areas of Pakistan are very important for us. We use their wood for making furniture, building materials, decorative crafts, etc. It is also an important source of pulp for paper and cellulose fibres such as rayon. The seeds of some conifers are used as dry fruit, e.g. pine seed (chulghoza).

KEY POINTS

- The process of sorting out living things into different groups on the basis of similarities and differences in their characteristics is called classification.
- Now-a-days, scientists classify living things into five main groups called kingdoms. These kingdoms are named as Monera, Protista, Fungi, Animalia and Plantae.
- Bacteria are the example of kingdom Monera, Algae are the examples of kingdom Protista, and yeast, Rhizopus, mushrooms are the examples of kingdom Fungi.
- All the animals are included in kingdom Animalia. All the plants are examples of kingdom Plantae.
- Two main divisions of animals are vertebrates and invertebrates. Vertebrates are further divided into five classes, i.e., mammals, birds, reptiles, amphibians and fish. Invertebrates include worms, insects and many other animals.
- Plants are mainly divided into two groups, i.e., flowering plants and non-flowering plants. Flowering plants are further classified as monocot plants and dicot plants. Non-flowering plants include conifers, ferns, mosses and liverworts.

QUESTIONS

1.1 Encircle the correct option.

i. Lizard belongs to which of the following groups of animals:

a. amphibians b. reptiles

c. birds d. mammals

ii. An animal with jointed legs:

a. earthworm b. cockroach
c. snake d. starfish

iii. Fish breathe through:

a. lungs b. skin
c. gills d. mouth

iv. What is true about vertebrates?

a. all have lungs b. all have gills
c. all have backbone d. all have jointed legs

v. Number of cotyledons in pea seed is:

a. one c. two
b. three d. four

vi. Ferns reproduce by:

a. seeds developed in fruit.
b. seeds developed in cones.
c. spores developed in capsules.
d. spores developed on the underside of leaves.

1.2 Give short answers.

i. Define classification of living things.
ii. Describe the need and importance of classification.
iii. What are mammals?
iv. What are insects?
v. What are cotyledons?

1.3 Give key characteristics of the following:

Birds, reptiles, amphibians, fish, worms, algae, fungi, bacteria

1.4 Differentiate between the following:

i. Vertebrates and invertebrates
ii. Flowering and non-flowering plants
iii. Monocots and dicots

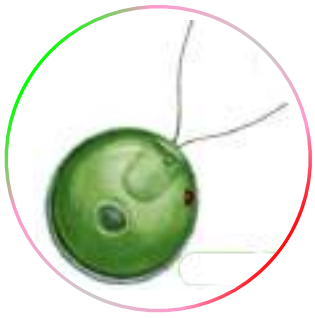
1.5 What do you know about dinosaurs, whale and dolphin?

1.6 Match the pictures with the words given below:

Monocot, dicot, algae, fungi, insect, worm.








Think-Tank

- What is common in animals and fungi?
- An animal has legs, skeleton and segmented body but lacks backbone and gills. To which group of animals does it belong?
- An organism lives in water and can make its food. It is not unicellular. To which group of organisms does it belong?

UNIT
2

MICROORGANISMS

In this unit, we will learn:

- Virus, bacteria and fungi
- Usefulness and harmfulness of microorganisms

We see living things all around us. Animals and plants are the well known examples of living things. However, there are some groups of living things that we cannot see with our naked eyes. These are the microorganisms. The word "microorganism" is the combination of two words, 'micro' means very small and 'organism' means living thing. In this unit, we shall discuss the microorganisms.

2.1 Microorganisms

Microorganisms are the living things that we cannot see with naked eye (Figure 2.1). They can only be seen with the help of a microscope. Microscope is a special type of instrument used for producing a much larger view of very small objects so that they can be seen clearly.

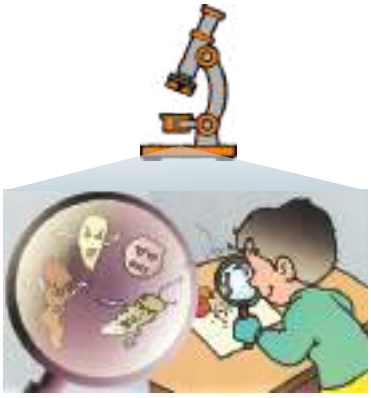


Figure 2.1

Microorganisms may be single-celled or may have more than one cell. They are widely distributed in the environment and are found in the air, soil, dust, foods, etc.

Ineresting information

- Microorganisms or microbes are the oldest form of life on the Earth. Some types have existed for billions of years.

2.2 Main Groups of Microorganisms

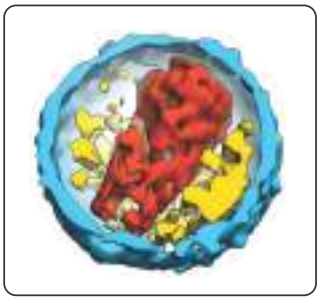
(Virus, Bacteria and Fungi)

There are many different kinds of microorganisms. They are classified on the basis of shape, structure, feeding habit, etc. Main groups of microorganisms are viruses, bacteria and fungi.

Viruses

Viruses are the smallest of all microorganisms (Figure 2.2). The word virus means poison. They are always harmful for living things as they cause diseases in humans, animals, plants and other organisms.

Polio caused by virus



Shape of virus

Flu caused by virus

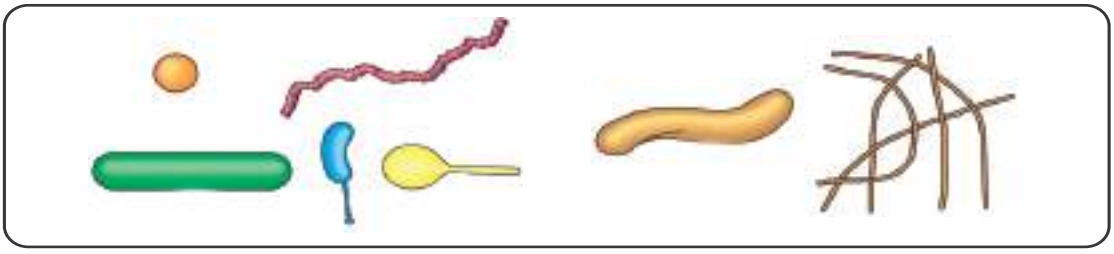
Figure 2.2 Some viruses

Bacteria

Bacteria are single-celled microorganisms that are present all around us. They are found in the air, water and soil. They are of different shapes (Figure 2.4). Some of them are harmful by causing different diseases such as Food Poisoning, Pneumonia, Tuberculosis, etc. (Figure 2.3). However, many of them are beneficial for us.

Food poisoning caused by bacteria

Figure 2.3



Different forms of bacteria

Figure 2.4

Activity 2.1

Do you know other shapes of bacteria? Draw them.

Fungi (Moulds and Yeasts)

Fungi cannot make their own food. They absorb food from the source they are growing on. Some fungi grow and feed on dead material while others feed on living plants and animals. Most fungi are harmless but some cause diseases in plants and humans. Moulds and yeasts are common examples of microscopic fungi (Figure 2.5).

Mould on bread

Yeast

Figure 2.5 Some fungi

Interesting Information

- There are more than 5,000 known kinds of bacteria.
- A cup of yogurt has billions of bacteria.

Activity 2.2

Conduct a discussion about microorganisms, their classification, what they do, and where they are found in the natural environment.

2.3 Advantages and Disadvantages of Microorganisms

Most of the microorganisms do not cause diseases and are beneficial. Some advantages and disadvantages of microorganisms are mentioned below:

Advantages of Microorganisms

(i) Making foods

Some microorganisms such as bacteria and yeast are used in the manufacture of different foods for example, yeast help in making of bread and cheese while bacteria help in yogurt making(Figure 2.6) .

Figure 2.6 Food products (bread, cheese, yogurt) manufactured with the help of microorganisms

(ii) Help in digestion

Many bacteria live in human intestine and help in digestion of food.

(iii) Making medicines

Some fungi are used to obtain antibiotics (Figure 2.7). Antibiotics are the compounds that are used to kill and control the growth of bacteria which cause diseases in humans and animals.

Figure 2.7 Antibiotics derived from fungi

Now-a-days, many types of antibiotics are used against the bacterial diseases. The first antibiotic called "**Penicillin"** was obtained from a fungus, "Penicillium".

(iv) Microorganisms as decomposers

Some microorganisms such as bacteria and fungi break down the dead bodies into simpler substances. These simpler substances are mixed in the soil for reuse by the plants and other organisms. Such microorganisms which break down the dead bodies by natural process are called decomposers. In this way, microorganisms recycle the materials between living and non-living environment.

Disadvantages of microorganisms

(i) Diseases

Many of the microorganisms cause diseases in humans, animals and plants. Some viral diseases are common cold, influenza, measles, chicken pox, polio, hepatitis and AIDS.

Athlete's foot | Ringworm | Smut on corn | Rust on leaf

Figure 2.8

Certain bacteria cause cholera, typhoid and food poisoning in humans. Some fungi also cause diseases in animals and plants. Athlete's foot, ringworm in humans and rust, smut in wheat, corn, rice and sugarcane are fungal diseases (Figure 2.8).

(ii) Spoilage of food

Some microorganisms spoil food by growing in it and make it unfit for human use (Figure 2.9). Examples are souring of milk by

Figure 2.9 Spoilage of fruit by microorganisms

bacteria, the growth of mould on bread, and the rotting of fruits and vegetables by bacteria and fungi both.

Information

Microorganisms which cause diseases are called pathogens.

Activity 2.3

- Place a wet slice of bread in a cabinet.
- Leave it for a few days and then observe.
- Record your observations and discuss them with your teacher and classmates.

Investigate

Food gets spoiled if not stored properly. Investigate a few ways of storing food to keep it safe and fresh.

2.4 Infection

The attack of disease-causing microorganisms in the body of an animal or plant is called infection (Figure 2.10). Infectious diseases quickly spread from one individual to another.

Figure 2.10 Infection

Some common infectious diseases

Viral diseases	Bacterial diseases	Fungal diseases
• Influenza	• Food poisoning	• Athlete's foot
• Common cold	• Pneumonia	• Ringworm
• Chicken pox	• Typhoid	• Rust
• Polio	• Cholera	• Smut
• Hepatitis	• Tuberculosis	
• AIDS		

Activity 2.4

Colour the box green if the infection is caused by bacteria, yellow for viruses, and pink for fungi.

Infection	Bacteria	Virus	Fungi
Polio			
Typhoid			
Athlete's foot			
Measles			
Cholera			
Flu			

How do microorganisms enter human body?

Microorganisms can enter the human body by the following ways (Figure 2.11):

Through air

When a person sick with flu sneezes, germs are spread in the air. These germs can enter the lungs of another person who breathes in such an air.

Through water

Some harmful microorganisms are transferred in the human body by drinking water containing microorganisms.

Caution!

We should drink boiled water to avoid water borne diseases.

Through contaminated food

Contaminated food contains harmful microorganisms. These microorganisms enter the body of a person who eats the contaminated food.

Through animals

Animals like mosquitoes transfer the harmful microorganisms into the body of a person during blood sucking. .

Through cuts on the skin

Scratches or cuts on the skin also provide entry points for germs. Bacteria causing tetanus enter the body through cuts or injuries on the skin.

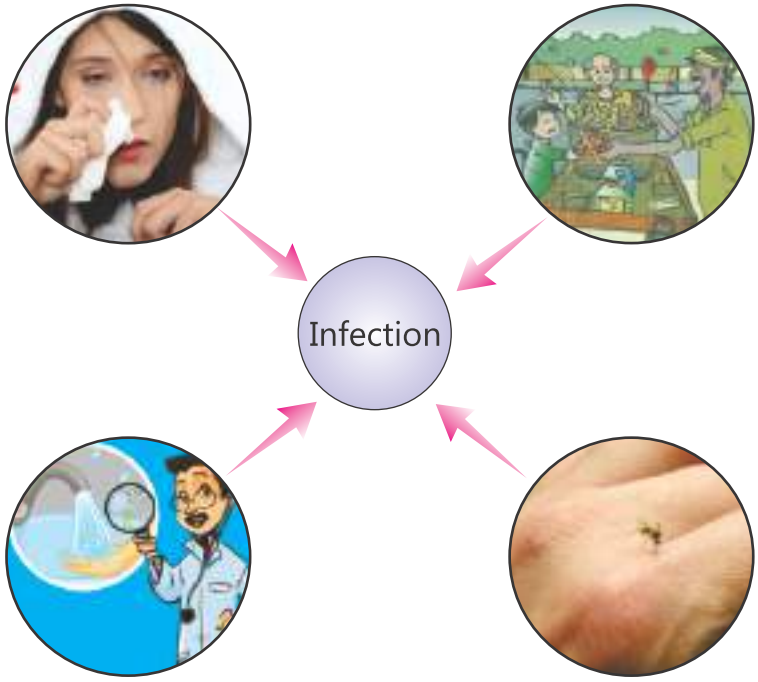


Figure 2.11 Microorganism enter human body through air, contaminated food, water, insect bite, and cause infection

Ways to avoid infections

Here are some simple ways to prevent infections (Figure 2.12):

- Dirty hands are the major source of germs. Wash your hands frequently especially before eating and after using toilet.
- Always eat healthy and fresh food. Wash fruits before eating them. Always cover the food.
- Brush your teeth regularly after meal, before going to bed and early in the morning.

- Keep your homes, schools and surroundings clean.
- Take a bath at least once a day.
- In case of injury or cut on the skin, clean it and cover it with a bandage and consult a doctor.
- Cut your nails regularly.

Figure 2.12 Ways to avoid infections

Activity 2.5

- Make a poster showing a few ways to avoid infections.
- Display the poster in your classroom.

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- Antibiotics are produced from the microorganisms (fungi) grown in large containers having a liquid.
- Antibiotics are extracted, purified and packed for use. Antibiotics are the medicines used to kill and control the growth of bacteria which cause diseases in humans and animals.
- Viral infections are prevented by vaccinations. If we get vaccinated against a disease, it makes our body safe from that disease.

KEY POINTS

- Microorganisms are the living things which can only be seen with the help of a microscope.
- Viruses are the smallest of all microorganisms. They are not visible under the simple microscope. They can be seen with the help of an electron microscope.
- Bacteria are microscopic single-celled organisms that exist all around us. They are important because of both their harmful and beneficial effects.
- Moulds and yeasts are the examples of microscopic fungi.
- An infection is an attack of disease causing microorganisms in the body of an animal or plant.
- The most frequent viral infections are common cold, chicken pox, dengue fever, hepatitis, the Acquired Immune Deficiency Syndrome (AIDS), etc.
- Common bacterial infections include pneumonia, typhoid, cholera, food poisoning, etc.
- Ringworm, athlete's foot, rust and smut, etc. are the common fungal

diseases.

- Microorganisms enter the human body through air, water, food, animal bite or injuries.
- We can avoid infection by:
  - i. taking a bath regularly and washing our hands before eating and after using toilet.
  - ii. using boiled water and fresh food.
  - iii. keeping our surroundings clean.
  - iv. using bandage over the injuries.
  - v. making no contact with people suffering from flu, common cold, chicken pox, etc.

QUESTIONS

2.1. Choose the best answer:

i. Which one of the following diseases is caused by virus:

a. AIDS b. diarrhoea
c. cholera d. ringworm

ii. Viruses can be seen with the help of:

a. naked eye b. magnifying glass
c. light microscope d. electron microscope

iii. Tuberculosis is caused by:

a. fungi b. virus
c. bacteria d. protozoa

iv. Fungi are the organisms which:

a. absorb food from surrounding.
b. ingest food.
c. depend on viruses for food.
d. can prepare their own food.

v. The first antibiotic was prepared from:

a. bacteria b. yeast

c. Pencillium d. mushroom

vi. Antibiotics are used to control the growth of:

a. bacteria b. insects

c. plants d. algae

2.2 Fill in the blanks with suitable word:

i. Polio is caused by ----------.

ii. Cholera and typhoid in humans are caused by ----------.

iii. Rust and smut are caused by ----------.

iv. Bacteria causing tetanus enter the body through ---------- in skin.

v. We can find ---------- all around us, in food, air and in our bodies.

2.3 Give short answers:

i. What is a microorganism?

ii. Write names of two products which are made with the help of bacteria.

iii. Where can microorganisms be found?

iv. What are the major groups of microorganisms?

v. Can microorganisms be helpful? If yes, give examples.

vi. What is infection?

vii. Name two diseases which are caused by viruses.

2.4 By which ways microorganisms can enter the human body? Discuss briefly.

2.5 How can we avoid infections?

2.6 Describe disadvantages of microorganisms.

2.7 Write brief notes on:

i. Decomposers ii. Antibiotics

Project

Read the statements in column A; identify the microorganisms in column B. Mention whether it is helpful or harmful in column C.

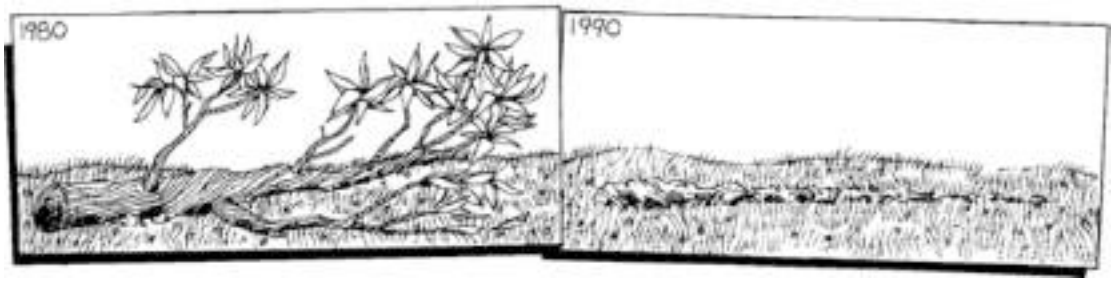
Column A	Column B	Column C
 Making of yogurt	Bacteria Fungi Virus	Helpful Harmful
 Decomposition of dead leaves	Bacteria Fungi Virus	Helpful Harmful
 Making of bread	Bacteria Fungi Virus	Helpful Harmful
 Rotten apple	Bacteria Fungi Virus	Helpful Harmful

Column A	Column B	Column C
 Cause of chicken pox	Bacteria Fungi Virus	Helpful Harmful
 Making of cheese	Bacteria Fungi Virus	Helpful Harmful

Think-Tank

Viral infections are prevented by vaccinations. If we get vaccinated against a disease, it makes our body safe from that disease. Discuss with your teacher:

- What are vaccines?
- How they make our body safe from diseases?



1. In the illustration above, a change has taken place over time. What kind of microorganism has caused the change?

.....

2. Is this change helpful or harmful for the environment?

.....

UNIT
3

ENVIRONMENTAL POLLUTION

In this unit, we will learn:

- Pollution
- Kinds of pollution (Water, Air and Land)
- Effects of pollution
- Measures to reduce pollution
- Biodegradable and non-biodegradable materials

Things around us make our environment. Living things get food, oxygen, water and other necessities of life from their environment. Environmental pollution is a big challenge to life. We should make serious efforts to reduce pollution in the environment. In this unit, we shall discuss kinds and sources of pollution. Effects of pollution and measures to reduce pollution also be discussed.

3.1 Pollution and Pollutants

Environment is not always as clean as it should be. The human activities are mixing harmful substances in it. These harmful substances can be animal wastes, industrial wastes, ash, dust and smoke, etc. The addition of unwanted materials to the environment that make it unfit for life is called environmental pollution. The materials which pollute the environment are called pollutants.

Kinds of Pollution

Air, water and land are the parts of environment. Hence, pollution can be divided into following kinds:

1. Air pollution 2. Water pollution 3. Land pollution

Air Pollution

Air environment is being polluted by toxic materials present in traffic smoke and industrial smoke. These toxic materials are the major air pollutants. Road dust and burning of fuels in homes and furnaces are also polluting the air (Figure 3.1).

Traffic smoke

Industrial smoke

Burning of fuel

Figure 3.1 Air Pollution

Activity 3.1

- Hang a clean white tissue paper in open space.
- Observe it after a day or two using a magnifying glass.
- Can you see any materials attached with the tissue paper?
- Where did these materials come from?

Water Pollution

We are adding sewage and industrial waste into rivers, canals, streams and oceans. In this way, we are polluting the water. Highly toxic materials present in industrial waste are the major cause of water pollution (Figure 3.2). The germs present in the sewage from hospitals and gutters are also water pollutants.

Sewage discharge

Polluted water

Figure 3.2

Land Pollution

We throw our domestic trash at open places on the land. This trash includes tin cans, plastic bags, rubbish and other solid wastes which pollute the land. Agricultural wastes, fertilizers, chemicals sprayed on crops and solid waste from factories are the main causes of land pollution (Figure 3.3).

Rubbish

Chemical spray on crops

Figure 3.3

3.2 Effects of Pollution

i. Air pollution causes diseases of throat, skin and eyes. Toxic air pollutants enter the human body with inhaled air and cause breathing difficulties, bronchitis and serious diseases like lungs cancer (Figure 3.4).

ii. In plants, air pollution slows down the process of photosynthesis. It also reduces growth in plants.

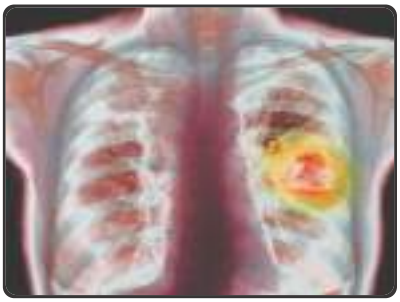


Figure 3.4 Lungs cancer

iii. Air pollutants released from industries dissolve in rain water and make it acidic (Figure 3.5). Acid rain damages trees, buildings and life in ponds and lakes, etc. (Figure 3.6).

iv. Polluted water affects the animals, plants and people who use it. Germs present in polluted water cause diseases like cholera, diarrhoea, typhoid, dysentery, etc.

v. Toxic matters like mercury, lead, chromium, arsenic etc. are present in industrial wastes which pollute the water and land environments. They cause serious diseases like cancer and brain damage.

vi. Toxic chemicals and bacteria from the rubbish and other solid wastes when washed into rivers and oceans pollute water and harm the life in water (Figure 3.7).

vii. Bacteria growing on raw sewage use much of the oxygen from water. Due to this reason, the fish and other aquatic life do not get enough oxygen and thus die (Figure 3.7).

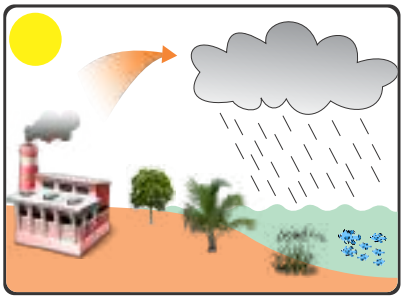


Figure 3.5 Acid rain water

Figure 3.6 Effect of acid rain

Figure 3.7
Effect of water pollution

viii. Oil from the tankers of a shipwreck spreads over the surface of the sea water and damages the sea animals (Figure 3.8).

Figure 3.8 Oil spill and its effects

Do you know?

Running the engine of a motor vehicle in a closed garage can make a person unconscious or even cause death due to carbon monoxide released in the smoke.

3.3 Measures to Reduce Pollution

Following steps can be taken to reduce pollution:

- Factories and industries should be shifted away from the cities;
- Industrial wastes should be treated and made ineffective before releasing into the atmosphere (Figure 3.9);
- Industrial waste and sewage should not be added into the fresh water of rivers or other water bodies (Figure 3.10);
- Domestic rubbish and other solid wastes should not be thrown into the streets or open places. They must be disposed off properly (Figure 3.11);
- Measures should be taken to:

Figure 3.9
Exhaust treatment plant

Figure 3.10
Sewage treatment plant

(a) reduce the number of vehicles on roads;

b) recycle the plastic wastes (cans, bottles and shopping bags);

c) reduce cutting of trees and forests as they absorb carbon dioxide and other air pollutants and reduce air pollution and

Figure 3.11
Disposal of rubbish

Figure 3.12
CFC-free products

d) Chloroflurocarbons (CFCs) used in air conditioners, refrigerators or freezers if accidently released in the air will damage the protective ozone layer beyond the atmosphere on the Earth. This can lead to very serious consequences on human health. It is

therefore important that alternate to CFC should be used to avoid damage to our Earth's natural system (Figure 3.12).

3.4 Biodegradable and Non-Biodegradable Materials

Waste material or pollutants can be classified as biodegradable and non-biodegradable. The materials which are naturally decomposed into simpler substances by natural process and mix in the soil for reuse by plants and animals are called biodegradable materials.

Fig. 3.13 Biodegradable substances

Kitchen waste, tree leaves, grass, wood, paper, cotton, leather, feathers, fruits, vegetables and dead organisms, etc. are the examples of biodegradable materials (Figure 3.13).

Non-biodegradable materials cannot be decomposed into simpler forms by natural process. Glass, ceramics, heavy metals, detergents, toxic chemicals, styrofoam, plastic bags and other plastic things are the examples of non-biodegradable materials (Figure 3.14).

Figure 3.14 Non-Biodegradable substances

Impact of Non-Biodegradable Materials on the Environment

Non-biodegradable wastes never decompose and remain as pollutants. Non-biodegradable pesticides and other toxic chemicals may cause diseases in animals and plants. Non-biodegradable materials cannot be recycled in the environment by natural process.

Activity 3.2

Tick (✓) biodegradable and cross (×) non-biodegradable material from the pictures given below.








Ways to Reduce the Impact of Non-Biodegradable Materials

The three "3R" strategy (Reduce, Reuse and Recycle) is an easy way to control pollution due to non-biodegradable wastes (Figure 3.15).

1. Reduce

We must reduce the use of natural resources to produce plastic items and other non-biodegradable materials. We should stop using plastic bags for grocery, snacks and sandwiches, etc.

Figure 3.15
3Rs strategy

2. Reuse

The things which are made of non-biodegradable materials should be used again and again for various purposes instead of throwing them to increase pollution.

3. Recycle

The used plastic goods, broken glass bottles, and tin cans can be recycled easily. We should recycle them instead of throwing them as waste.

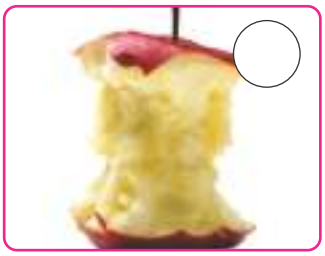
Environmental pollution is a serious threat to life and we must share our responsibility to make our environment pollution free. You have learnt many ways to reduce pollution. However, you can conduct the following activities under the guidance of your teacher.

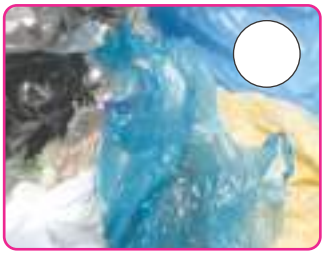
Activities 3.3

- Create awareness in your community about environmental pollution, effects of pollution and minimising pollution through seminars, banners and mutual discussions.
- Develop an approach in your community to reduce using plastic bags, and plastic bottled drinks.
- Plant trees especially along roadsides.
- Educate people not to throw their domestic rubbish and other solid wastes into the streets, open places or drainage systems.

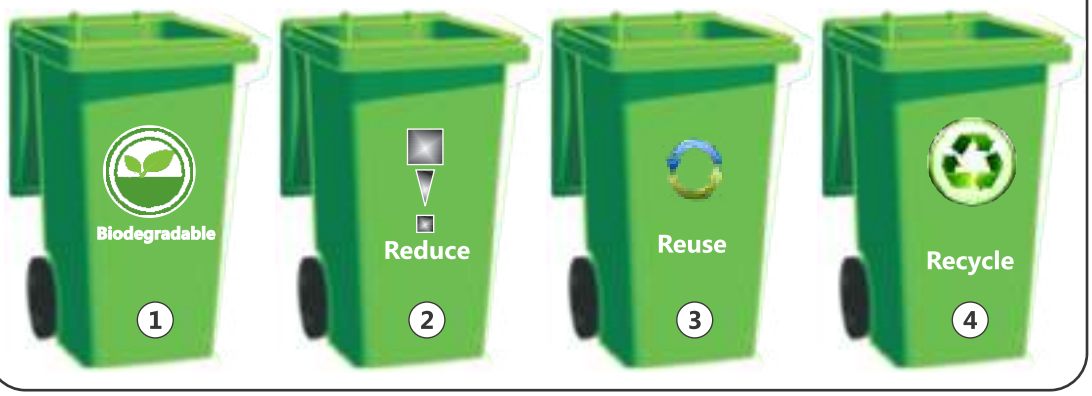
Activity 3.4

Look at the pictures and write on them the number (s) (1, 2, 3 or 4) of their relevant bins shown below.





Science, Technology, Society and Environment

- Governments and non-government organizations have become active to create public awareness about environmental pollution and developing emphasis on adopting measures to reduce it.
- Many technologies have been introduced to control the addition of pollutants in the air, water and land environments .

KEY POINTS

- The addition of unwanted materials to the environment that make it unfit for life is called environmental pollution.
- The materials which pollute the environment are called pollutants.
- Three kinds of pollution are air pollution, water pollution, and land pollution.
- Toxic materials present in traffic and industrial smoke are major air pollutants.
- Highly toxic materials present in industrial waste and sewage from hospitals and gutters are water pollutants.
- Domestic trash, plastic bags, agricultural wastes, fertilizers, chemical sprays and other solid wastes are major land pollutants.
- Smoke, sewage water, industrial wastes, solid wastes and oil spills are the sources of pollution.
- Control on pollution is highly desirable. The public and the government must share responsibilities to control pollution.
- The materials which are decomposed into simpler substances by natural process and mix in the soil for reuse by the plants and animals are called biodegradable materials.
- The materials which cannot be decomposed into simpler substances by natural process are called non-biodegradable materials.

QUESTIONS

3.1 Fill in the blanks.

i. _____ is the addition of harmful materials in the

environment.

ii. Those harmful waste materials which are added into air, soil and water are called as _____.

iii. Solid wastes which will be degraded by themselves are known as _____.

iv. The three Rs are _____, _____ and _____.

v. The substances which cause pollution are called _____ .

vi. Smoke is a source of _____ pollution.

vii. Bacteria growing on raw sewage use much of _____ from water.

3.2 Encircle the correct option.

i. Which of the following diseases can be caused by air pollution?

a. lungs cancer b. diarrhoea
c. cholera d. dysentery

ii. Toxic matters like mercury, lead, chromium, arsenic, etc. are found in:

a. freshwater pond b. sewage water
c. rain water d. industrial waste

iii. Typhoid can be caused by the germs present in:

a. fertilizers b. pesticides
c. sewage water d. industrial waste

iv. Which of the following is non-biodegradable:

a. grass clippings b. feather
c. styrofoam d. paper

v. The cause of polluted rain water is:

a. road dust b. industrial smoke
c. water vapours in the air d. oil spills

3.3 Give short answers.

i. What is environmental pollution?

ii. Name any three sources of pollution.

iii. Name any three land pollutants.

iv. What is 3R strategy to control pollution?

3.4 Match the words of column A with the pictures of column B.

A	B
Biodegradable	
Non-biodegradable	
Water pollution	
Air pollution	

3.5 Differentiate between biodegradable and non-biodegradable substances.

3.6 Describe the effects of:

i. air pollution ii. water pollution

iii. land pollution

3.7 Briefly describe the ways to reduce:

i. air pollution ii. water pollution

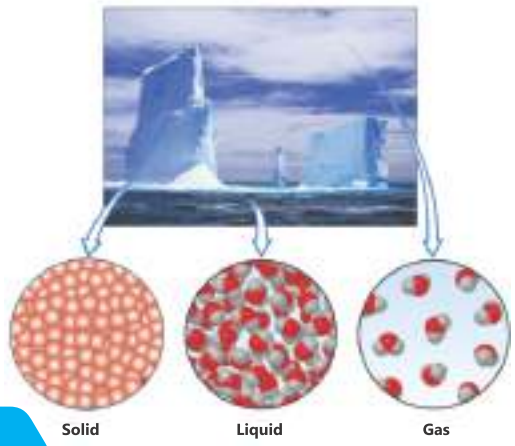
iii. land pollution

3.8 What is the impact of non-biodegradable materials on the environment?

UNIT

4

MATTER AND CHANGES IN ITS STATES



In this unit, we will learn:

- Matter
- Arrangement of particles in solids, liquids and gases
- Effects of heat on arrangement of particles
- Processes involving change in states (Melting, Freezing, Boiling, Evaporation and Condensation)
- Application of condensation and evaporation in nature (Water Cycle)

Things all around us are made up of matter. Matter has mass and occupies space. Different substances are made up of different kinds of matter. The food we eat, the water we drink and the air we breathe in, all are examples of matter. In this unit we shall study properties of different states of matter. The arrangement of particles in different states of matter, the effect of heat on matter, and processes involved in changing the states of matter will also be discussed.

Activity 4.1

Hold up your hand close to your mouth and breathe out through your mouth. The warm air you feel on your hand is matter. Touch the tip of your finger to your tongue. Your fingertip becomes wet from the saliva. Saliva is matter. Touch your hair, a fingernail, your nose and teeth. These parts of your body are all composed of matter.

4.1 Physical States of Matter

Matter exists in three states, namely, solid, liquid and gas. Table, stone, pen and bag are the examples of solids. Water, milk, oil, blood, etc. are the examples of liquid. Oxygen, carbon dioxide and water vapours are examples of gases. Other examples of solids, liquids and gases are shown in the pictures below (Figure 4.1).

Figure 4.1

We can see and feel many solid, liquid and gaseous things around us. The question is why solids, liquids and gases are different from each other? This is due to the arrangement of particles present in them.

Arrangement of particles in solids, liquids and gases

Every kind of matter is composed of small particles which are in constant random motion. Let us discuss the arrangement of these particles in three states of matter, i.e., solids, liquids and gases (Figure 4.2).

Solids

The particles of solid substances are tightly packed with each other. These are arranged in an order. There are strong attractive forces between them. The particles vibrate only at their mean positions. They cannot be compressed easily. That is why solids have fixed shape and fixed volume.

Liquids

The particles of liquid substances are very close to each other, but are not arranged in an order. The attractive forces between them are strong but weaker than solids. Liquids cannot be compressed easily because their particles are quite close to each other. Their particles can move away and

towards each other and thus liquids can flow. Liquids have fixed volume but their shape is not fixed. The liquids take the shape of the vessel in which they are kept.

Gases

The forces of attraction between the particles of gases are very small. The distances between the gas particles are much greater than those of solids and liquids. Gas particles move freely in all directions. They occupy all available space. They constantly collide with each other and with the walls of the container. In this way, they exert pressure. Gases have no fixed shape and no fixed volume.

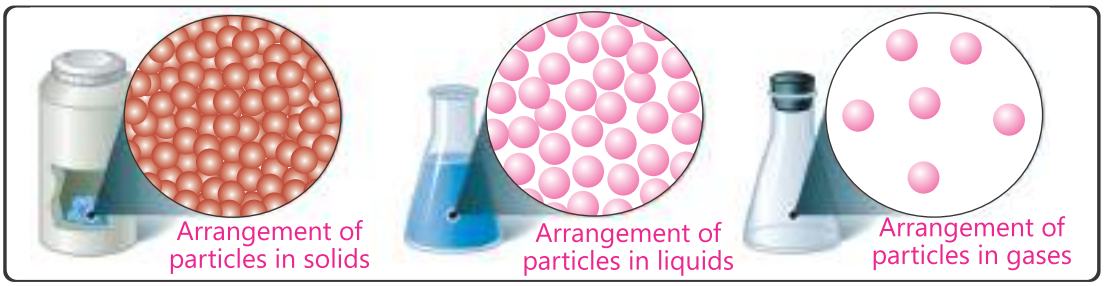


Figure 4.2

Activity 4.2

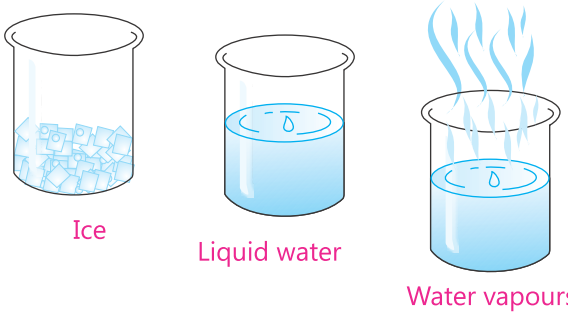
- Take three cardboard pieces and cover them with white paper using transparent insulation tape.
- Take beads of different colours and use them to present as particles of matter.
- Taking help from the diagram above, paste the beads of one colour on one of the boards and make a model showing arrangement of particles in solids.
- Make the models of liquid and gaseous states of matter in the same way on the other boards.

Interesting information

The human body is an interesting example of states of matter. Our bodies have solids (skin, muscles and bones), liquids (blood, saliva, acids, etc.), and gases (oxygen and carbon dioxide in the lungs, etc.).

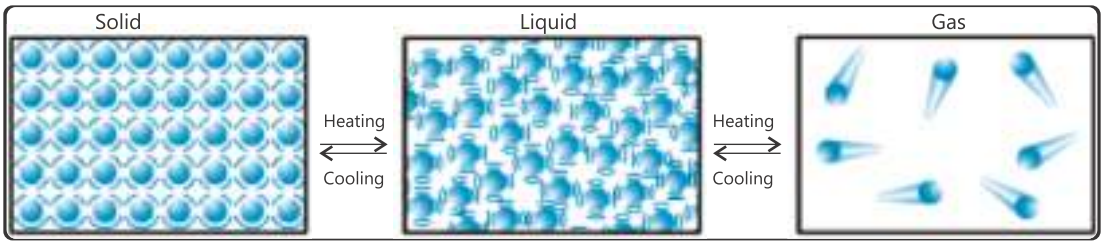
Do you know?

Most of the materials are commonly found in just one or two physical states. Water exists naturally on the Earth in all the three states. It depends on temperature and other conditions such as humidity and air pressure. Water often changes from one state to another.



4.2 Effect of Heat on the Arrangement of Particles

Properties of matter change with a change in temperature (Figure 4.3). When heated, the particles gain energy, move faster and move away from each other. That is why things expand on heating.



Effect of heat on arrangement of particles in solids, liquids and gases
Figure 4.3

On cooling, the particles lose energy, their motion becomes slower and distances between them are decreased. That is why things contract on cooling.

4.3 Processes Involving Change in States of Matter

Physical state of matter can be converted from one form to another on heating or cooling. Melting, freezing, boiling, evaporation and condensation are the processes involved in changing the states of matter.

Mini Exercise

1. Mercury in the bulb of a thermometer expands when placed under a person's arm pit or tongue. Why?
2. An inflated balloon placed in the Sun bursts after sometime. Why?

Melting

The change of solid state of matter into its liquid state due to heat is called melting. When ice cubes melt, they change their state. Solid ice becomes liquid water. This is due to the heat energy absorbed by the ice cubes from surroundings.

When a solid is heated, its particles start vibrating faster. Spaces between them increase. On continuous heating, particles of the solid substance vibrate faster and faster. The forces of attraction between them become weaker and they begin to move away from each other. Hence, liquid state is attained by the solid.

Mini Exercise

What happens to ice cream when it is kept out of the freezer?

Freezing

The change of liquid state of matter into solid state on cooling is called freezing. When liquid water is kept in the freezer, it freezes. Its state is changed. Liquid water becomes solid ice. In this process, heat energy is lost from liquid water to surroundings. As a result, movement of particles in liquid becomes slower and they come closer to each other. The spaces between the particles are decreased. Finally, the liquid contracts and gets solidified.

Activity 4.3

- Take a candle and light it.
- Observe and discuss what is happening.
- Some of the wax melts into its liquid state (process of melting).
- The molten wax moves away from the flame and solidifies back into its original solid state (process of freezing).
- The wax melts due to the heat of the burning wick and on cooling, it hardens again.

Boiling

If we heat a liquid continuously, the movement of its particles becomes faster and faster. Spaces between particles are increased and attractive

forces between them become weaker. Finally, the liquid begins to change into bubbles of vapours or gas. Heating changes the liquid state of matters into its gaseous state, in the form of vapours. This process is called boiling (Figure 4.4).

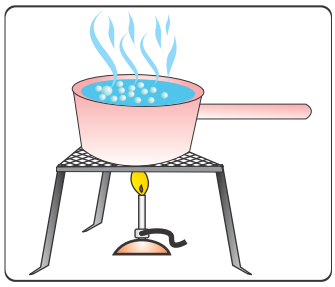
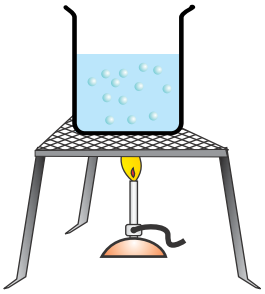


Figure 4.4 Boiling of water

Activity 4.4 (Demonstration by the teacher)

- Take a beaker and pour some water in it.
- Place wire gauze over a tripod stand and then place the beaker over it as shown in the figure.
- Heat the water and observe what happens to it?
- After a few minutes, you would observe that water starts boiling.

Cautions: (i) Never play with the burner and matches.
(ii) Do not touch boiling water.



Evaporation

The change of liquid state of matter into its gaseous state without boiling is called evaporation (Figure 4.5). Wet clothes are dried due to evaporation.

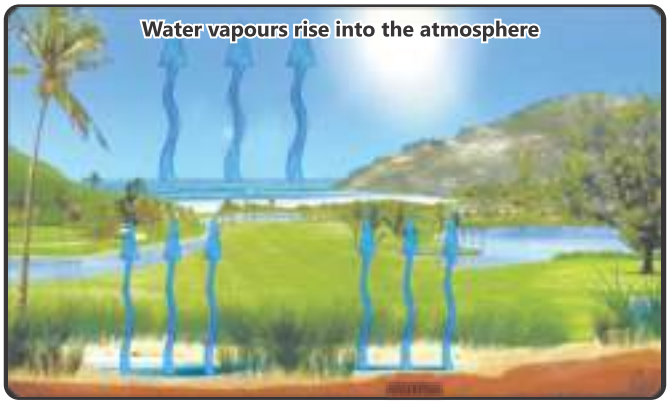


Figure 4.5 Evaporation from a lake

When liquid water evaporates, it changes its state. Liquid water goes into the surrounding air as water vapours. Water can evaporate at any temperature. Evaporation of water takes place from the surfaces of sea, rivers, canals, lakes, etc. It also takes place from the leaves of the plants and from the surface of snow.

Do you know?

Boiling of a liquid requires high temperature. Evaporation can take place at any temperature. However, it is rapid at higher temperatures.

Activity 4.5

- Take two shirts of the same stuff. Wash them with water.
- Hang one in the room and the other in the sunny place.
- Note the time of hanging of the shirts.
- Check them after every 10 minutes.
- Note the time of drying of each shirt.
- Which shirt dried faster and why?

Condensation

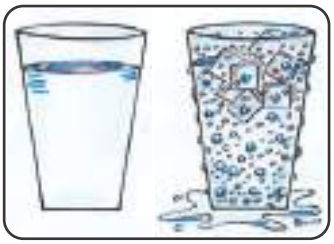
Information

Water vapours in the air condense when they meet a colder solid surface. You may see water condensed on the glass of windows on a cold day.

The change of gaseous state of matter into its liquid state is called condensation. When a gas is cooled, its particles lose heat. As a result, their movement slows down. They come closer to each other and attractive forces between them become stronger. Finally the gas changes into liquid. During condensation, heat is given out to the surroundings.

Activity 4.6

- Take a glass which is dry from its outside.
- Fill it with ice cold water and place it on the table.
- Look at the outer surface of the glass.
- You would see tiny water droplets over the outer surface of the glass.
- Where have they come from?
- Did water leak out from the glass?
- Is this the condensation of water present in the air in the form of vapours?



4.4 Role of Evaporation and Condensation in the Water Cycle

Sea, river, lake, canal, pond, etc. are called water bodies. The transfer of water from water bodies to the atmosphere and its return back is called water cycle (Figure 4.6). The sun shines on water bodies, makes the water evaporate into the atmosphere in the form of vapours. Evaporation also takes place from plants (transpiration) and surface of snow on the

mountains. As these vapours rise up, they lose energy and condense into water droplets. At a certain height, these water droplets gather in the air and form clouds. The water droplets in the clouds get heavier and heavier and the air cannot hold them anymore.

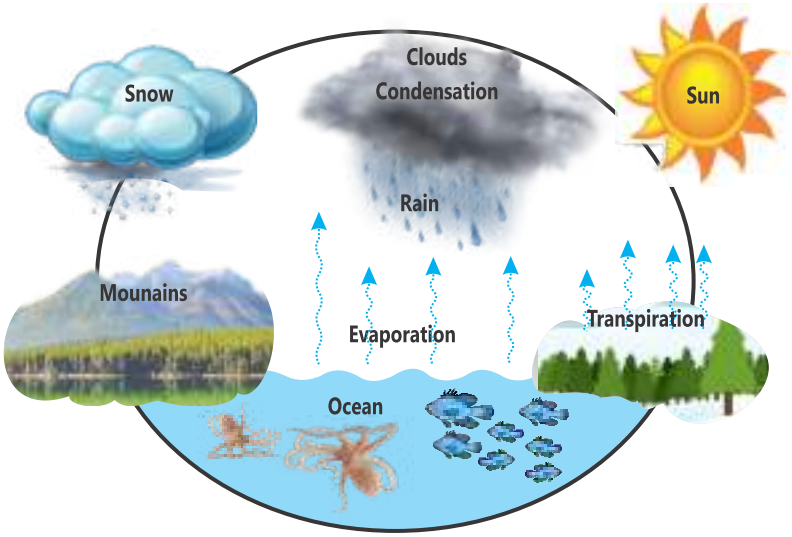


Figure 4.6 Water Cycle

The water then falls down in the form of rain and snow. The rain water again flows to the rivers, streams, lakes, canals and sea. In this way, water is always moving in a cycle. The processes of evaporation and condensation are involved in the water cycle. Water goes through its three phases (liquid, solid, gas) as it cycles in the Earth system. It evaporates from plants as well as land and water surfaces into the atmosphere and after condensing in clouds, returns to the Earth as rain and snow.

4.5 Forms of Moisture in the Environment

- Water is always present in the air in the form of water vapours. When there is smoke and dust in the cold climate, these water vapours appear as fog (Figure 4.7).

Figure 4.7 Fog

- Early in the morning, when the temperature falls down, the water vapours present in the air get together to form tiny droplets. These droplets can be seen on leaves and flowers as dew (Figure 4.8).

Figure 4.8 Dew drops

- Water vapours in the air are the gaseous state of water. At certain height, water vapours in the air condense to form water droplets (liquid state) due to cold. The presence of water droplets in the air forms clouds (Figure 4.9).

Figure 4.9 Clouds

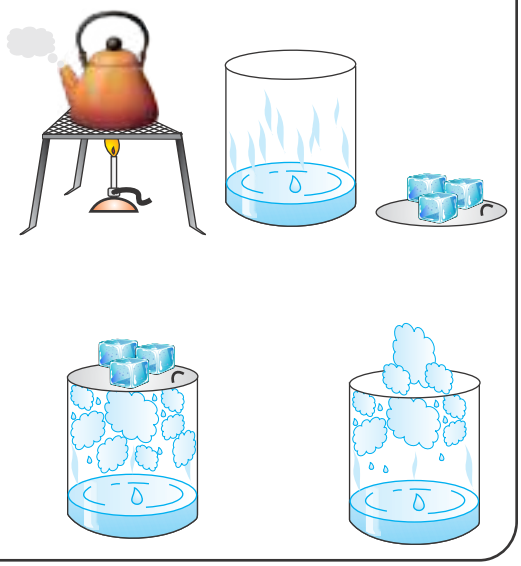
- In severe winter, the water present in the atmosphere freezes to form snow on the mountains and a layer of frost on the surface of ponds and lakes (Figures 4.10 and 4.11).

Figure 4.10
Snow on mountain

Figure 4.11 Frost

Activity 4.7 How to make a cloud? (Demonstration by the teacher)

1. Boil water in a kettle. Pour about 20mL of boiled water into the jar. Shake the hot water in the jar so that the sides of the jar are heated up.
2. Put a few ice cubes on the lid and put it on the jar.
3. Take the lid off and quickly spray some black colour. Now put the lid along with the ice cubes on the top of the jar. Watch the cloud forming inside the jar. When clouds are fully formed, take the lid off and watch the escape of cloud .



Science, Technology, Society and Environment

Evaporation produces cooling. This principle is used in the technology of making refrigerators and air conditioners, etc. The compressors in the AC and refrigerators etc., compress the gases to change them into their liquid state. These liquified gases when allowed to evaporate, absorb energy from the surroundings and produce cooling.

KEY POINTS

- All around us are substances that are made of matter.
- Matter has mass and occupies space.
- Matter exists in three states, namely, solid, liquid and gas.
- All matter is composed of small particles.
- The arrangement of the particles determines the state of matter.
- Matter can change its state when the temperature is changed.
- In solid, particles are arranged in an orderly manner and close to one another. Particles vibrate at fixed positions. Solids have a fixed

shape and volume.

- Particles are not arranged in an orderly manner in a liquid. Particles move randomly and slowly in liquids. Liquids do not have a fixed shape.
- In a gas, the spaces between particles are large. The particles are far apart and are randomly arranged.
- Solids melt into liquid state on heating.
- Liquids boil on heating and change into gaseous state.
- Liquids freeze on cooling.
- Gases condense on cooling.
- Freezing is the reverse of melting.
- When liquid water evaporates, it changes its state. Liquid water goes into the surrounding air as water vapours. Water can evaporate at any temperature.
- Condensation is the process by which a gas or vapour changes to liquid state at a certain temperature when it is cooled. When a gas is cooled, the particles lose heat.

QUESTIONS

4.1 Choose the correct option:

i. Matter has:

a. no mass but occupies space
b. mass but occupies no space
c. mass and occupies space
d. no mass and occupies no space

ii. A solid has:

a. maximum spaces between the particles
b. definite shape but no definite volume
c. maximum force of attraction between particles
d. definite volume but no definite shape

iii. Conversion of gas to liquid is called:

a. condensation
b. evaporation
c. freezing
d. boiling

iv. The process by which wet clothes dry up is called:

a. condensation
b. evaporation
c. freezing
d. melting

v. Matter changes from one state to another with the change in:

a. temperature b. place
c. volume d. shape

vi. Water is always present in the air as:

a. fog b. clouds
c. frost d. vapours

vii. Which of the following is opposite to boiling?

a. evaporation b. freezing
c. melting d. condensation

4.2 Fill in the blanks with suitable words.

i. When a liquid changes to a gas, this is called _____.

ii. By adding or removing _____, we can change the state of matter.

iii. In a _____ state, the particles are loosely held and the matter takes the shape of the container.

iv. In a _____state, particles are held together, and the matter cannot easily change its shape.

v. ---------- is the term used to describe the process when a liquid changes into a solid.

4.3 Select the process from the list given below and write it against the phenomenon where it is involved during the change of state. The phenomena may involve more than one processes.

Melting Freezing Boiling Evaporation Condensation

Phenomenon	Process
Drying of clothes	**Evaporation**
Formation of dew	
Distillation	
Preparation of ice cream	
Burning of candle	
Rain	
Snowfall	
Cooking	
Air conditioning	

4.4 Answer the following questions:

i. What is matter? Mention the states of matter.

ii. Differentiate between boiling and evaporation of a liquid.

iii. When does matter change its state?

iv. How do solids differ from liquids with regard to particle arrangement?

v. Describe what happens when a solid is heated.

vi. Why does an ice cube melt at room temperature?

vii. How are the particles arranged in three states of matter?

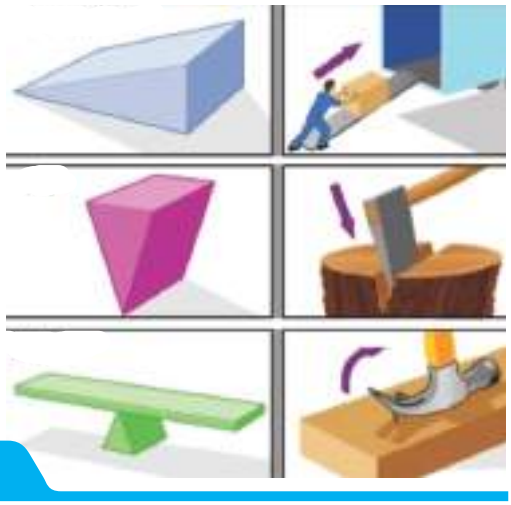
viii. Differentiate between evaporation and condensation.

ix. Differentiate between melting and freezing.

UNIT

5

FORCES AND MACHINES



In this unit, we will learn:

- Friction
- Advantages and disadvantages of friction
- Methods to reduce friction
- Gravitational force
- Simple machines
- Lever and kinds of lever

We use force when we do work. We use force when we write on a paper, open a door, pedal a bicycle or push an iron nail into the wood. We cannot see a force but we can see its effects.

5.1 Friction

What happens when we stop pedalling a bicycle? Why a rolling ball stops after moving some distance on the ground? There is a force which opposes the motion of the bicycle and the rolling ball (Figure 5.1).

Pedalling a bicycle

Kicking a ball

Figure 5.1

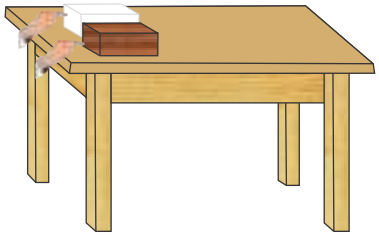
A force which slows down and stops the things from moving is called frictional force or friction.

Friction appears when a moving object is in contact with another. It is a

contact force. There is less friction when smooth surfaces such as glass and a marble slide over each other. There is more friction when rough surfaces such as sand paper and bricks slide over each other.

Activity 5.1

- Place equal sized wooden and ice blocks side by side on a table. Push them to slide over the surface of a table as shown in the figure.
- Which of the two blocks needs lesser force to slide over the table and why?



Roughness of the surfaces increases friction. No surface is perfectly smooth. A surface that appears smooth has roughness also when seen under a microscope (Figure 5.2).

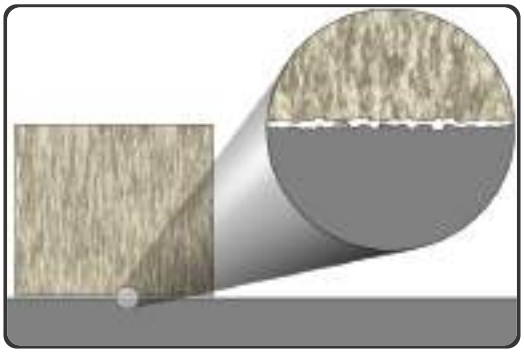


Figure 5.2: A magnified view of a smooth surface under a microscope

Some materials are deformed (deshaped) under pressure. Deformed materials also cause friction (Figure 5.3). So, roughness of surfaces and deformations are the causes to increase the friction.

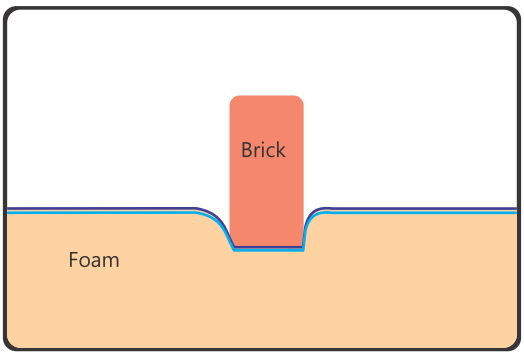


Figure 5.3: Deformation causes friction

Objects moving in liquids and gases also face friction. Water resistance is a force which slows the objects moving through water. Air resistance is a force which slows the objects moving through air.

Advantages of Friction

Many of our daily life activities such as walking, writing and stopping the fast moving vehicles by applying brakes are due to friction.

Figure 5.4

We cannot write if there is no friction between paper and the pencil (Figure 5.4). When we write and rub a pencil on the paper, friction is produced due to which carbon particles leave a mark on the paper. Friction between our shoes and the Earth enables us to walk or run on the ground. When the grooves on the sole of our shoes slide on rough surface of the floor, friction is produced. It gives our shoes the grip we need to walk (Figure 5.5). Similarly, friction between the tyres of the vehicles and the ground enables them to stop when brakes are applied. Birds cannot fly if there is no air resistance. The reaction of pushed air enables the birds to fly (Figure 5.5).

Figure 5.5

Disadvantages of Friction

Despite friction is very important to us, it has many disadvantages too. Friction offers resistance to a moving object at high speed and reduces the speed of moving objects.

We know that worn out tyres of the vehicles are replaced after some period. What is the cause of wear and tear of tyres? The answer is friction. Similarly, if we do not grease the chain of a bicycle, the chain and the pulley will wear out soon due to friction. The moving parts of engines and machines which rub against each other become very hot. This increases the wastage of energy. The sole of our shoes is worn out due to friction with the ground.

Methods to Reduce Friction

Friction can be reduced by the following methods:

1. Polishing of surfaces

Polishing of surfaces of the objects reduces the friction (Figure 5.6).

2. Using lubricants

Use of lubricant (oil or grease) between the moving parts of machines can reduce friction (Figure 5.6).

Polishing of surface

Using lubricants

Figure 5.6

3. Using rollers or wheels

Friction in rolling an object over another is much less as compared to sliding. Therefore, rollers or wheels are used to pull a cart or a TV trolley on the floor. They reduce friction and make our work easier.

4. Using ball bearings

Ball bearings change sliding friction into rolling friction. They are usually placed around an axle, so the rotation of the wheel becomes easier (Figure 5.7).

Use of wheels

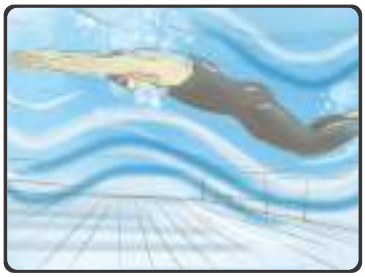
Ball bearing

Figure 5.7

5. Streamlining the bodies

Cyclists use very narrow and hard tyres in their bicycles to reduce friction with the road. They wear tight dress and bend their bodies to give themselves a streamline shape which moves through the air easily. This shape faces minimum air friction when moving. For example, sports cars are always streamlined so that they can move fast. Similarly, the swimmers also acquire streamlined shape to reduce the water friction. Aeroplanes, ships and boats have streamlined shapes and they face less friction to move (Figure 5.8).

Cyclist



Swimmer

Boat

Figure 5.8 Streamlining bodies

For your information

Skating is the movement on ice using ice skates. The metal blades at the bottom of the shoes glide with very little friction over the surface of ice. Edges of the blades dig into the ice and increase the friction which helps skaters to control their movements.

Parachutists use air friction to slow down their fall. During downward fall, their weight and air friction, which are opposite in direction, balance each other. This makes their landing safe.

5.2 Gravitational Force

We know that when a ball is thrown upward it comes back to the Earth. It is easy to go down stairs as compared to moving upstairs. A cricket ball thrown upward, comes downwards. Similarly, an apple or an orange from a tree always falls downward (Figure 5.9). Why does everything fall down? Actually, Earth attracts all the bodies towards itself. This force of attraction is called gravitational force (force of gravity).

Figure 5.9

Gravitational force not only exists between the Earth and other bodies but also exists between all the objects around us. It is a pulling force. It depends upon the mass of the objects and the distance between their centres. The greater the mass of an object, the greater will be gravitational force. The larger the distance between the centres of the objects, the smaller will be the gravitational force.

Do you know?

The gravitational force of the Earth is stronger at its poles than at the equator.

Gravitational force between small objects is too small to be noticed. It can

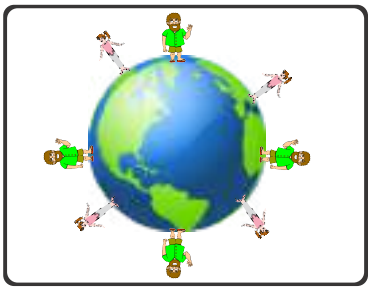
easily be observed with massive objects such as the Sun, the Earth and the other planets.

Gravitational force of the Sun pulls the Earth and other planets to orbit around it.

It is the gravitational force of the Earth that:

(i) holds us on the surface of the Earth and stops us floating away into the space (Figure 5.10).

(ii) keeps the moon revolving around the Earth (Figure 5.10).



Earth's gravitational force

Moon revolving around the Earth

Figure 5.10

(iii) makes rain fall on the Earth (Figure 5.11).

(iv) makes the rivers flow down stream (Figure 5.11).

Rainfall

River

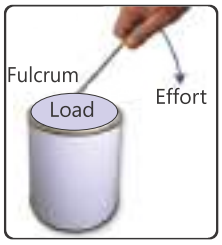
Figure 5.11

Do you know?

The Moon's gravitational force is about six times less than that of the Earth.

5.3 Lever

A lever is a simple machine which turns about a fixed point. When a force is applied at one end of the lever, it turns about the fixed point to lift the load at the other end (Figure 5.12).



Lid opener
Figure 5.12

The fixed point about which a lever turns is called its fulcrum (F). The force which is applied on the lever is called effort (E) and the weight which is lifted is called load (L). Scissors, pliers, claw hammer, door, and staplers, etc., are the examples of the levers.

There are three kinds of lever based on relative positions of the fulcrum (F), the effort (E) and the load (L).

First kind of lever

In the first kind of lever, the fulcrum is between the effort and the load (Figure 5.13). First kind of levers can produce large force from a small effort. In this case the effort arm which is the distance between effort and fulcrum, is long whereas the load arm, the distance between load and fulcrum is short. By a longer effort arm, greater force will be produced. Scissors, pliers, lid opener, and claw hammer, etc., are the examples of the first kind of lever (Figure 5.14).

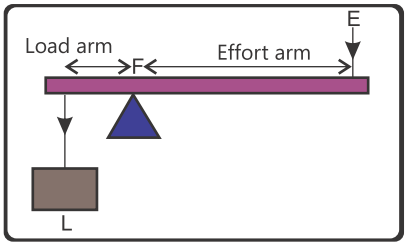


Figure 5.13 First kind of lever

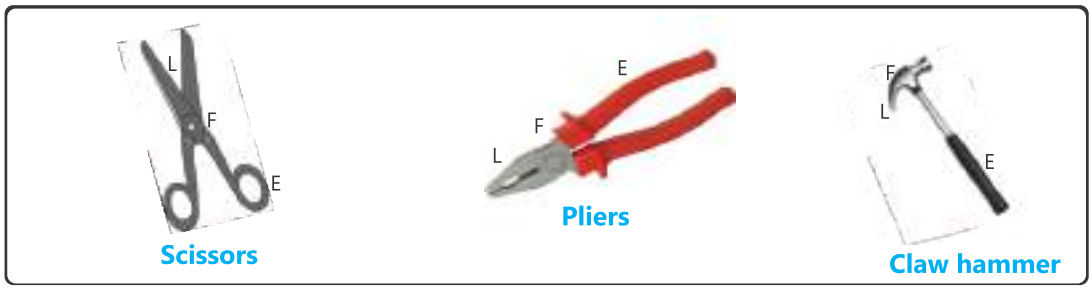


Figure 5.14

Second kind of lever

In the second kind of lever, the load is between the fulcrum and the effort (Figure 5.15).

Bottle opener, wheelbarrow, nut cracker, paper cutter and door, etc., are the examples of second kind of lever (Figure 5.16).

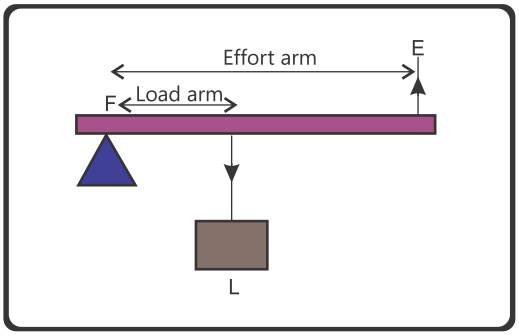


Figure 5.15: Second kind of lever

Bottle opener

Wheelbarrow

Nut cracker

Figure 5.16

Third kind of lever

In the third kind of lever, the effort is between the fulcrum and the load (Figure 5.17).

In this case the effort moves a short distance, whereas the load moves a long distance.

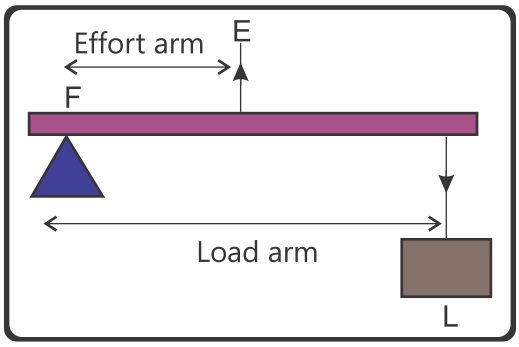
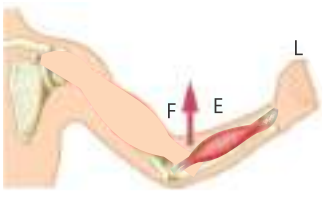


Figure 5.17: Third kind of lever

Pair of tongs

Broom



Arm

Figure 5.18

Pair of tongs or forceps, broom, and the human arm, etc., are the examples of third kind of lever (Figure 5.18).

Science, Technology, Society and Environment

Today is the age of machines. Wheel was the first invention which initiated a revolution in technology and man's life. Think about the tasks which we do using simple machines like wedge, bottle opener, scissors, pliers, stapler, fishing rod, etc. Can we do the same tasks easily and precisely without using machines?

KEY POINTS

- The force which slows down and stops the things from moving is called friction.
- The force of attraction between any two objects is called gravitational force.
- Lever is a simple machine which turns about a fixed point.
- There are three kinds of lever based on relative positions of load (L), effort (E), and fulcrum (F).
- Scissors, pliers and claw hammer etc., are the examples of first kind of lever.
- Bottle opener, nutcracker and wheelbarrow are the examples of second kind of lever.
- Broom, fishing rod and human arm are examples of third kind of lever.

QUESTIONS

5.1 Encircle the correct option.

i. Friction produces:

a. heat b. cooling
c. motion d. roughness

ii. Which of the following is not a way to reduce friction?

a. use of lubricant
b. smoothening the rubbing surfaces
c. increasing roughness of the surfaces
d. changing the sliding friction to rolling friction

iii. Which of the following is not a simple machine?

a. bicycle b. screw driver
c. wheel d. wedge

iv. Simple machine is a tool that:

a. gives energy to other machines
b. does only one job
c. makes the work easier
d. made of many small parts

v. The point about which a lever turns is called:

a. effort b. load
c. fulcrum d. weight

vi. Wheelbarrow is an example of the lever of:

a. first kind c. second kind
b. third kind d. both first and second kind

vii. Which of the following is an example of second kind of lever?

a. scissors b. bottle opener
c. fishing rod d. pliers

5.2 Classify the kind of lever.

Machine	Figure	Kind of lever
Fishing rod		
Human arm		
Fodder machine		
Bottle opener		
Stapler		

Machine	Figure	Kind of lever
Hand pump		
Claw hammar		
Shovel		

5.3 Define (i) friction (ii) lever.

5.4 What are the causes of friction?

5.5 State the advantages and disadvantages of friction.

5.6 Suggest some methods to reduce friction.

5.7 What do the cyclists and swimmers do to reduce friction?

5.8 Why does it become dangerous to walk on a wet or polished smooth floor?

5.9 Describe how lever makes work easier by giving examples of its uses from everyday life.

UNIT
6

PROPERTIES AND BEHAVIOUR OF LIGHT

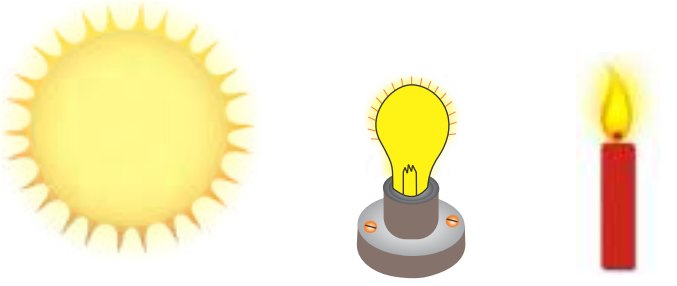
In this unit, we will learn:

- Luminous and non-luminous objects
- Transparent, opaque and translucent objects
- Light travels in straight line
- Shadow formation
- Eclipse formation

Light is a form of energy. The Sun is the biggest source of light. Light bulbs, flames of fire, candles, etc., are also the sources of light. Light travels in a straight line. It can travel through different media like air, glass, water, etc. It can also travel through vacuum. The speed of light in vacuum is 300,000,000 metre per second. Light takes about 8 minutes to reach the Earth from the Sun.

6.1 Luminous and Non-Luminous Objects

It is our daily observation that the objects like the Sun, the flame of a candle and the filament of a lighted bulb, etc., emit their own light (Figure 6.1). Those objects which emit their own light are called luminous objects.



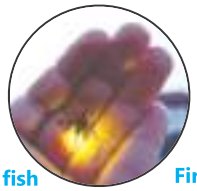
Sun Lighted bulb Candle

Figure 6.1

For your information

Living things like deep-sea fish, glow-worm, firefly, etc., emit light to make their bodies glow. Such a light is produced during some chemical reactions in the bodies of the organisms.

Deep-sea fish



Firefly

The objects that do not emit their own light are called non-luminous objects. The book in your hand, the table, the chair, the Moon, the Earth and other planets are the examples of non-luminous objects. We see the non-luminous objects only when the light of some other sources fall on them and they reflect light into our eyes.

Awareness beyond the classroom

Some non-luminous substances become luminous when they are heated at high temperature. For example, coal is non-luminous. It becomes luminous on heating. Such luminous objects are called incandescent objects.

6.2 Transparent, Opaque and Translucent Objects

Objects can be classified as transparent, opaque and translucent. The objects through which light can pass are called transparent objects. Glass, water and air are the examples of transparent objects. We can see through transparent objects, because light passes through them.

The objects through which light cannot pass are called opaque objects. Wood, metals, concrete, ceramics and fibres are opaque objects. We cannot see through opaque objects because light does not pass through them.

The objects which allow some of the light to pass through them are called translucent objects. Frosted glass, tissue paper, etc., are the examples of translucent objects. Things behind translucent objects cannot be seen clearly, they look blurred. This is because light cannot pass through them completely.

Activity

(a) Place a torch on the table in a dark room and light it. Place a glass plate in front of the torch and see it from the other side.

i. Does the glass plate allow light to pass through it?

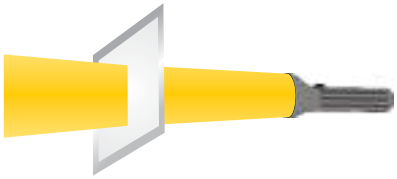
ii. What type of object is the glass plate?
(i) transparent (ii) translucent (iii) opaque.

(b) Place a tissue paper in front of the torch and see it from the other side.

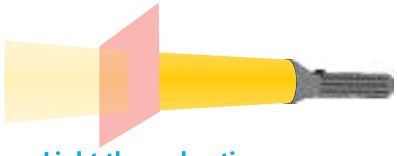
I. Does the tissue paper allows as much light as pass through it as the glass plate?

ii. What type of object is the tissue paper?
(i) transparent (ii) translucent (iii) opaque.

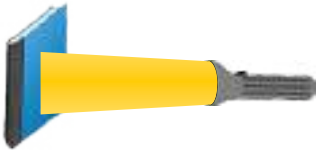
(c) Now place a book in front of the torch and see whether light is passing through the book or not. What type of object is the book?
(i) transparent (ii) translucent (iii) opaque.



Light through a glass



Light through a tissue paper



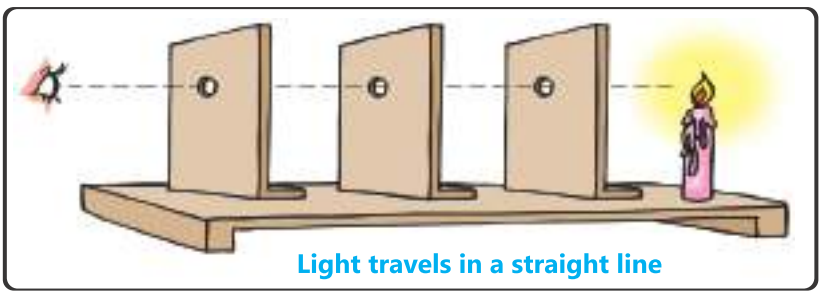
Light cannot pass through a book

6.3 Light Travels in a Straight Line

We can prove that light travels in a straight line. Let us perform an experiment as follows:

Experiment

Take three similar cardboards and make holes in them at the same height. Place them on a table in a straight line. Now light a candle and place it on one side of the cardboards in such a way that the flame is exactly in front of the holes in the cardboards as shown in Figure 6.2 given below.



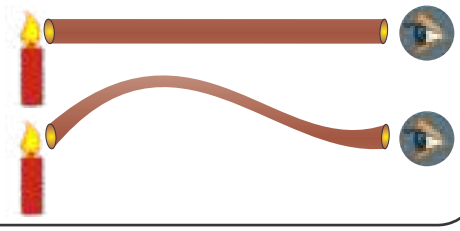
Light travels in a straight line

Figure 6.2

See through the hole in the cardboard placed opposite to the candle. Do you see the flame? Now move any one of the cardboards slightly so that the holes are not in line and again see the flame through the hole in the same cardboard. Do you still see the flame? You will notice that the eye will not be able to see the flame. What does it mean? It means that light travels in a straight line. It cannot pass through the holes which are not in line.

Activity

- Take a plastic tube and see the flame of a candle through it.
- Now slightly bend the tube and again see the flame through it.
- Can you see the flame through a bent tube? Why does it happen?

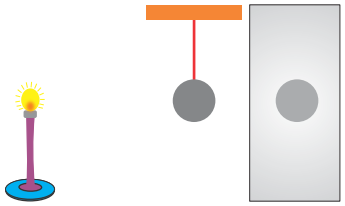


6.4 Shadow Formation

Light travels in a straight line. When an opaque object is placed in the path of the light, it cannot pass through the object. Hence, shadow is formed behind the opaque object. Shadow is a region of darkness behind an opaque object facing the source of light.

Activity

- Switch on a table lamp in a dark room. It will light up the walls of the room.
- Hang a small ball between the lamp and a wall. A dark circle (shadow) will appear on the wall.
- This is because the ball stops the light from reaching the wall in the region of the dark circle.



A shadow of a ball on the wall

Location, size and shape of shadow

The type of the shadow depends on the size of the light source, shape and size of the object and its position from the light source.

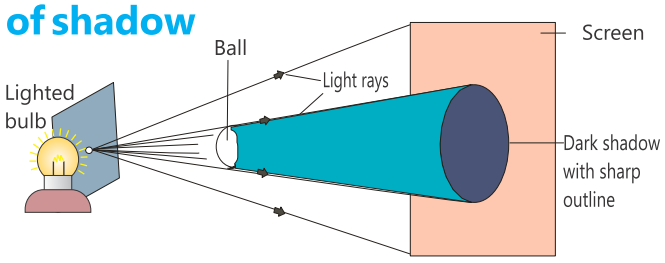
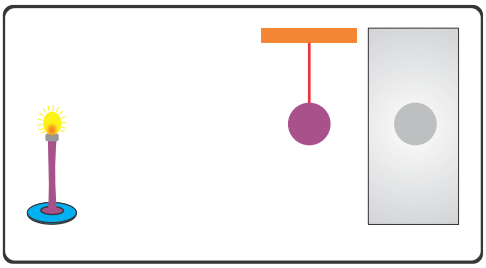


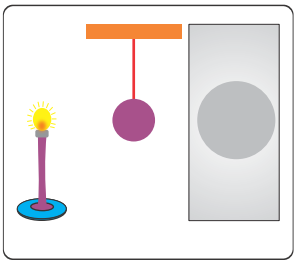
Figure 6.3 Shadow formed by a point source of light

The shadow formed by a point source (a very small source) of light is totally dark with sharp outline (Figure 6.3).

When a light source is away from the object, the shadow formed is smaller (Figure 6.4a). Moving the light source closer to the object makes the shadow much bigger than the object (Figure 6.4b). The shadow resembles the object in shape.



Shadow formation when light source is away from the object
Figure 6.4 (a)



Shadow formation when light source is close to the object
(b)

6.5 Eclipse

The Earth moves around the Sun and the Moon moves around the Earth. When the Moon, the Earth and the Sun come in a straight line, an eclipse takes place (Figure 6.5a, b).

Solar Eclipse

When the Moon comes between the Sun and the Earth, it throws its shadow on the Earth, which results into solar eclipse (Figure 6.5b).

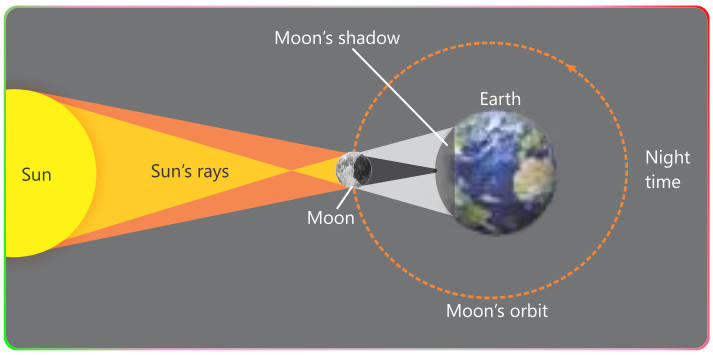


Figure 6.5 (a) Solar eclipse

A solar eclipse
Figure 6.5 (b)

Lunar Eclipse

When the Earth comes between the Sun and the Moon, it throws its shadow on the Moon, which results into lunar eclipse (Figure 6.6a).

Figure 6.6 (a) A lunar eclipse

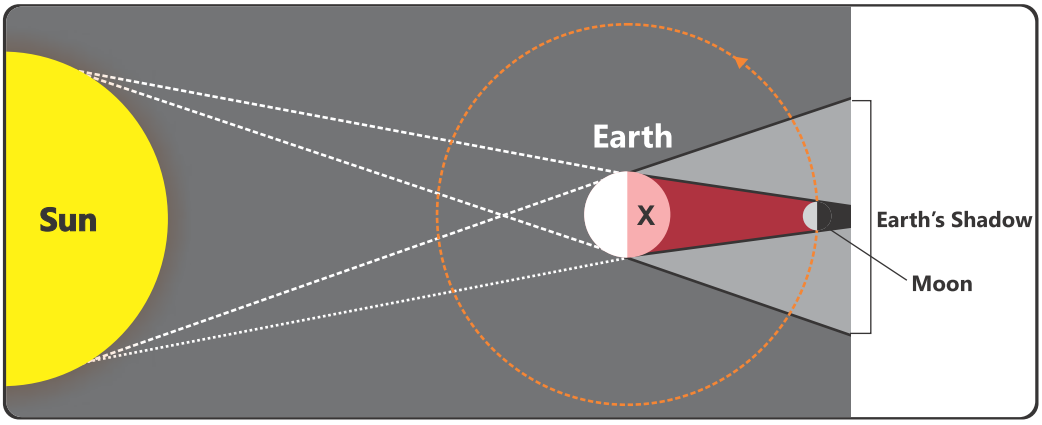


Figure 6.6 (b) A lunar eclipse

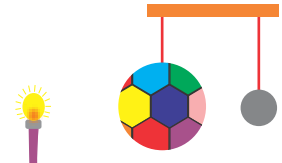
The shadow of the Earth on the Moon is so large that it covers the full Moon. When the Moon is in the dark region of the Earth's shadow, the people on the Earth at position X (as shown in the Figure 6.6(b) cannot see the Moon for sometime as no light falls from the Sun.

Warning

Never look directly at Solar eclipse, even through sunglasses. Special type of dark blue glasses should be used to see the Solar eclipse. Such glasses are used by the welders.

Activity

- Suspend a football and a small toy ball with the help of strings in front of a table lamp in the dark room as shown in the figure.
- Switch on the lamp and observe the shadow of the football on the toy ball. Has the shadow of the football covered the toy ball fully?



Consider the football as the Earth and toy ball as the Moon and explain the lunar eclipse from this model.

Science, Technology, Society and Environment

The property of light that it travels in a straight line and casts shadow of the objects has been used by the scientists in developing the vast field of photography. The concept of pinhole camera became the basis of the inventions of variety of instruments like lens, camera, microscope and telescope etc.

KEY POINTS

- The objects that give out their own light are called luminous objects.
- The objects that do not give out their own light are called non-luminous objects.
- The objects which allow almost all the light to pass through them are called transparent objects.
- The objects which do not allow light to pass through them are called opaque objects.
- The objects which allow some of the light to pass through them are called translucent objects. Frosted glass, tissue paper, etc., are the examples of translucent objects.
- Light travels in a straight line. When it is blocked by an object, shadow is formed.
- A shadow is a region of darkness behind an opaque object facing the source of light.
- Shadows are formed and eclipses occur because light travelling in a straight line is blocked.
- The shadow formed by a point source of light is totally dark with sharp outline.
- A solar eclipse occurs when the Sun, the Moon and the Earth are in a straight line and the Moon is between the Sun and the Earth.
- A lunar eclipse occurs when the Sun, the Moon and the Earth are in a straight line and the Earth is between the Sun and the Moon.

QUESTIONS

6.1 Encircle the correct option.

i. The light from the Sun reaches the Earth in about:

a. 5 minutes. b. 8 minutes.

c. 10 minutes. d. 15 miutes.

ii. Lunar eclipse occurs when:

a. the Moon comes between the Sun and the Earth.

b. the Earth comes between the Sun and the Moon.

c. the Sun comes between the Earth and the Moon.

d. the Mars comes between the Sun and the Moon.

iii. The objects which do not allow light to pass through them are:

a. transparent b. translucent

c. luminous d. opaque

iv. The objects which allow some of the light to pass through them are:

a. transparent b. translucent

c. luminous d. opaque

v. A shadow of an object is formed because the:

a. object is luminous b. object is opaque

c. object is too big d. object is transparent

vi. When light source is far away from the object, the shadow formed is:

a. equal in size to the object.

b. smaller in size than the object.

c. bigger in size than the object.

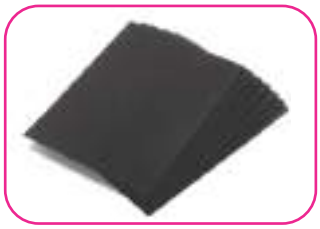
d. double in size than the object.

6.2 Identify transparent, translucent and opaque objects from the following:


Glasses


Door


Sun hat


Black card


Stain-glass window


Plane glass window


Net curtain


Magnifying glass


Brick wall


Tissue paper


Water


Sellotape

Transparent:	
Translucent:	
Opaque:	

6.3 Name three examples of:

i. luminous objects

ii. non-luminous objects

iii. transparent objects

iv. translucent objects

v. opaque objects.

6.4 The Moon is non-luminous. How do we see it?

6.5 What is shadow? Describe the location, size and shape of the shadow.

6.6 Why are the shadows of the objects in open place formed in different directions at different times of the day?

6.7 How can you prove that light travels in a straight line?

6.8 Explain with the help of diagrams:

a) Solar eclipse

b) Lunar eclipse

UNIT

7

ELECTRICITY AND MAGNETISM

In this unit, we will learn:

- Electric current
- Electrical circuit and its components
- Fuse and its importance
- Static electricity
- Electromagnets
- Earth's magnetism
- Magnetic compass

All the material objects are composed of extremely small particles called atoms. An atom consists of further smaller particles called electrons, protons, neutrons, etc. (Figure 7.1). Protons have positive charge on them and are located in the central part of an atom called nucleus. Electrons have negative charge on them and revolve around the nucleus in different paths called orbits.

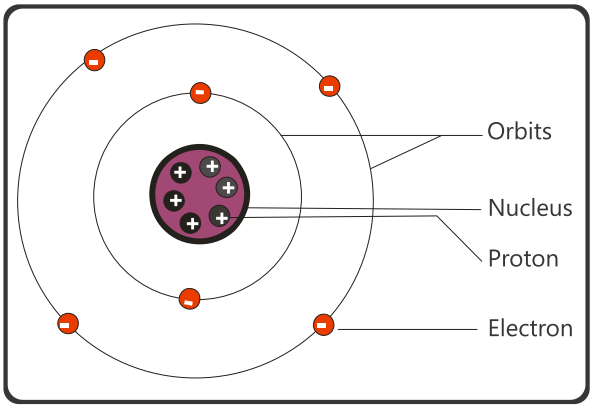


Figure 7.1 Structure of an atom

7.1 Electric Current

In some objects like copper, aluminium, silver, etc., electrons can move from one atom to another atom within the material. These electrons are called free electrons. They move freely in random directions in the material. To make these electrons flow in one direction, a force is needed, which is provided by the battery or a cell.

The flow of free electrons is called electric current.

Consider a cell as shown in Figure 7.2. If the two ends of the cell are connected by means of a metallic wire, an electric current will start flowing from positive end of the cell to its negative end through the wire. The electric current in the wire can be tested by connecting a bulb in its way. The bulb will glow due to the flow of electric current.

Electric current is measured by an instrument called ammeter (Figure 7.3).

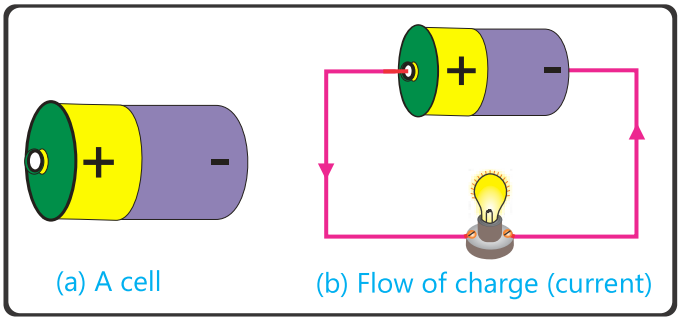


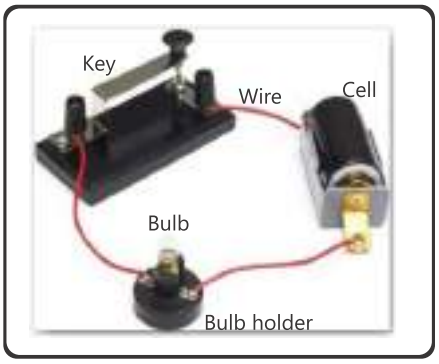
Figure 7.2

Figure 7.3

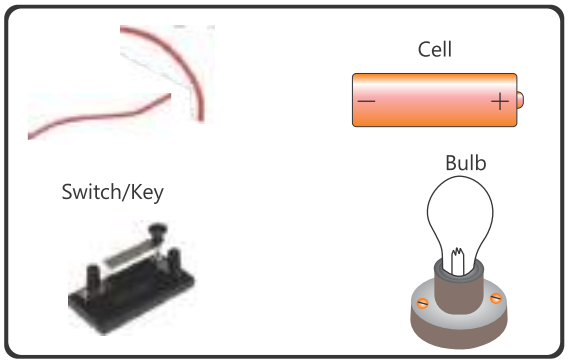
7.2 Electrical Circuit and its Components

The path along which electric current flows is called an electrical circuit (Figure 7.4). Figure 7.4 shows the flow of electric current from one end of the cell to the other end through a wire. Connecting wires, bulbs, keys or switches, battery/cell, etc., are the components of an electric circuit (Figure 7.5).

We observed that a complete or closed circuit is needed for electric current to flow. When the current passes through an electrical component such as bulb, it glows up. After passing through the bulb, the electric current enters the battery at its negative end.



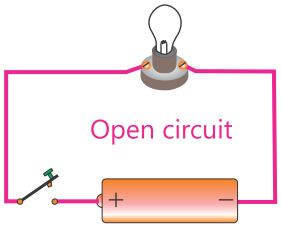
Electrical circuit
Figure 7.4

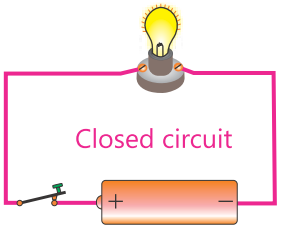


Components of an electric circuit
Figure 7.5

Activity 7.1

- Take a bulb holder and fix a bulb in it.
- Connect one end of a wire at negative terminal of the battery or cell with the help of a sticky tape.
- Connect the free end of this wire with the bulb through the bulb holder.
- Take another piece of wire and connect its one end with the second point of the bulb holder.
- Connect the free end of the other wire with positive terminal of the cell through a key.
- When the key is open, the bulb is OFF.
- Now close the key, the bulb will glow.
- When the key is open, the circuit is not complete and the bulb does not glow. Such a circuit is called open circuit.





- When the key is closed, the circuit is complete and the bulb will glow. Such a circuit is called closed circuit.

7.3 Fuse and its Uses

Fuse is a safety device connected in electrical circuits. It is a thin metal wire which allows a specific amount of current to flow through it. If the current exceeds the limit, the fuse wire melts and breaks the circuit and we say that the fuse has blown up. In this way, the fuse saves our electrical appliances from any damage.

The maximum current that a fuse allows to pass through is called its rating. Fuses of different ratings are used for different appliances. Now-a-days, circuit breakers are also used at the place of fuses. They have the same function as the fuses (Figure 7.6).

Different kinds of fuses and circuit breaker

Figure 7.6

7.4 Static Electricity

We have learnt about two types of charges, i.e., positive charge and negative charge. Positive charge appears on an object when it loses electrons. Negative charge appears on an object when it gains some extra electrons. By gaining or losing electrons, an object can be charged. This is called static electricity. The term static means at rest and electricity means charge. Static electricity thus means the charge at rest on an object. It is also interesting to know that the objects with like charges repel each other and those with unlike charges attract each other (Figure 7.7).

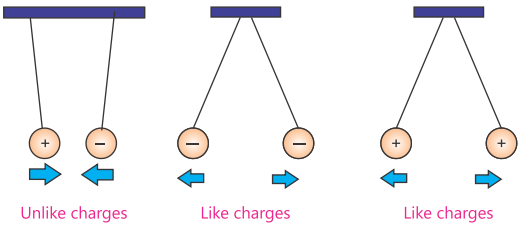


Figure 7.7

Warning!

Never touch wires or other metal parts connected to main electricity. Never touch electric switches bare footed or with wet hands.

How do static charges build up?

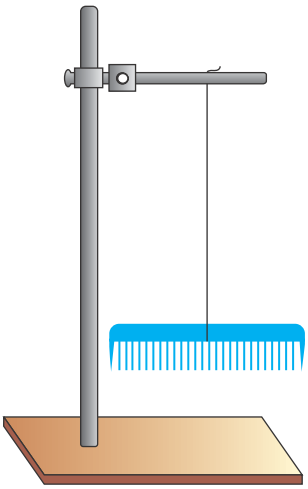
Rubbing of certain materials with one another creates imbalance of positive and negative charges on them. For example, when a plastic comb is rubbed through dry hair, electrons move from hair to the comb. Static charges are built up on the hair (positive charge) and the comb (negative charge). Hair having similar charges repel each other and stand erected separately.

When a charged object is brought close to a neutral object, it repels similar charges present on the object and attracts opposite charges on it. In this way, charges will be induced on the neutral object. Such distribution of

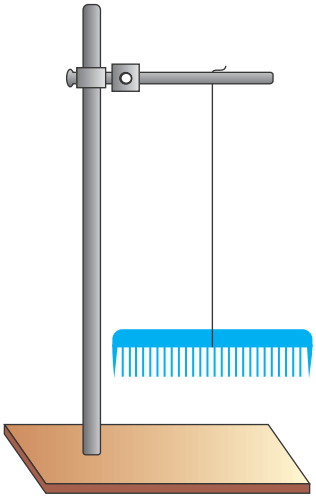
charges on the neutral object remains intact until we move the charged object away from it.

Activity 7.2

- For this activity you need the pieces of silk cloth and woolen cloth, a laboratory stand, a piece of nylon thread, two combs and one thin glass rod.
- Tie a comb with one end of the thread from its middle and hang it in such a way that it remains nearly horizontal. Rub this comb with the woolen cloth and let it hang freely. Now rub the second comb also with woolen cloth and bring it near the hanging comb. Observe what happens.



- Now take the glass rod and rub it with silk cloth. Bring it near the hanging comb and observe what happens.



From your observations, can you guess about the nature of charge on the comb and the glass rod?

Activity 7.3

- Take a balloon filled with air. Rub it against your hair (in one direction only) and bring it near the wall.
- Your hair will be raised up and the balloon will stick with the wall.
- Why does all this happen?

Lightning

Lightning is an example of static discharge. The patches of clouds during their movement rub against each other. As a result, huge amount of static charges appear on the cloud patches. Frequent rubbing of clouds increases the amount of static charges on them. When two highly oppositely charged clouds collide, a flash of light appears and a clicking sound is produced as clap of thunder (Figure 7.8).

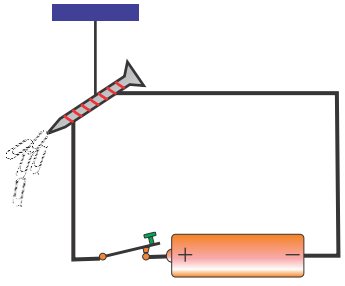
Figure 7.8 Lightning

7.5 Electromagnets

There is a close relationship between electric current and magnetism. Let us perform an activity to understand the relationship between electric current and magnetism.

Activity 7.4

- Take an iron nail and wind an insulated copper wire around it to make a coil.
- Connect the free ends of the coil to a cell or battery through a key.
- Keeping the key open, bring the iron clips near the iron nail. The iron nail will not attract the iron clips.



- Now close the key and observe what happens with the iron clips when brought near the iron nail?
- They will be attracted by the nail and cling to it as shown in the figure.
- Now open the key again and observe what happens with the iron clips?
- All the iron clips will fall from the nail. What do you conclude from this activity?

From the above activity, we observe that when an electric current passes through a wire wound around the nail, the nail starts to attract the iron clips. Thus we can conclude that:

An iron nail or a rod becomes a magnet when electric current passes through the coil wound around it . Such a magnet is called electromagnet.

An electromagnet is a temporary magnet. It remains magnet as long as the current passes through it but when the current is switched OFF it loses its magnetic effect.

Uses of Electromagnets

Electromagnets attract the objects made of iron, nickel and cobalt. They are used widely in our daily life. For example, they are used in magnetic locks, circuit breakers, and loud speakers, etc., Electromagnets are also used in magnetic cranes, electric bells, electric motors etc.

1. Electromagnetic Crane

Have you ever seen electromagnetic cranes working in a scrap yard? In electromagnetic cranes, powerful electromagnet is used for lifting heavy iron scrap (Figure 7.9). These cranes pick up metal scrap by switching the magnet ON. To release the scrap, the electromagnet is switched OFF.

Electromagnetic crane
Figure 7.9

2. Electric Bell

Electromagnet is used in the electric bell (Figure 7.10). When the switch is turned ON, a current starts flowing through the coil around an iron rod. It

becomes electromagnet and thus attracts the elastic iron strip (called armature) towards itself. The hammer which is attached to the armature strikes the gong of the bell and sound is produced. Now electric circuit breaks and the current stops flowing through the coil. The coil no longer remains electromagnet, the armature moves back and completes the circuit again.

The same action is repeated and the hammer continues to strike the gong as long as the switch is kept ON.

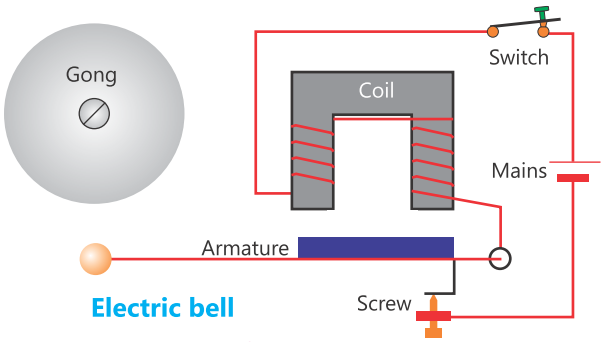


Figure 7.10

7.6 Magnetic Compass

We know that compass is an instrument containing a freely suspended magnetic needle which always points in North-South direction. It is a navigational instrument which is used for finding directions (Figure 7.11).

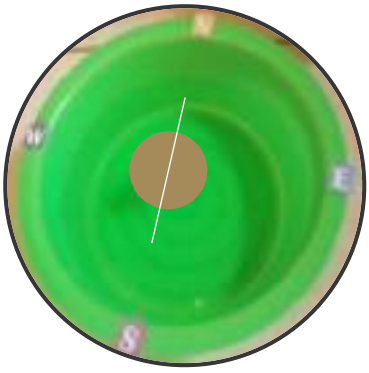
Figure 7.11 Magnetic compass

Compass is also used to locate the direction of Qibla.

Let us make a simple compass by the following activity.

Activity 7.5

- Magnetize a needle by rubbing it with North pole of a bar magnet several times in the same direction.
- Fix the needle on a cork using a sticky tape.
- Put the cork in a bowl containing water and let it float. You will see that the cork floats in water in such a way that one end of the needle points towards the north and the other towards the south.



- Change the position of the bowl in different directions and observe the movement of the needle. The needle always rotates and points in north-south direction.
- Explain what causes the magnetized needle to rotate.

Science, Technology, Society and Environment

There is a key role of electricity and magnetism in the development of modern technology and making the life comfortable. Can you imagine what would happen with technical and social activities if there was no electricity?

It is the electromagnetism on which most of our electrical appliances like fans, electric motors, etc. are based.

KEY POINTS

- Electricity is produced by the flow of electric charge within the materials.
- The path along which electric current flows is called electrical circuit.
- Fuse is a safety device connected in electric circuits. It stops the flow of excessive electric current to pass through an electric appliance and protects it from getting damaged.
- Presence of an electric charge on the surface of an object is known as static electricity.
- Static charges remain on the objects until they are neutralized or discharged.
- When the charged object is brought close to a neutral object, charges will be induced on the neutral object .
- An iron nail or a rod becomes a magnet when electric current passes through a coil around it . Such a magnet is called electromagnet.
- Our Earth itself acts as a huge magnet.

QUESTIONS

7.1 Fill in the blanks with suitable word from the word bank.

Word Bank

electrons bulb switch circuit magnet fuse charges

i. _____ can move in a metal wire.

ii. A _____ makes the current flow in a circuit.

iii. A _____ pulls iron pieces only.

iv. A _____ is used in the electric circuit for safety.

v. Thunder clouds have opposite _____ on them.

7.2 Encircle the correct option.

i. The opposite charges:

a. attract each other b. repel each other

c. heat up each other d. have no effect on each other

ii. Electric current is the flow of:

a. heat b. light

c. charges d. atoms

iii. To protect an appliance from damage we use:

a. switch b. fuse

c. bulb d. battery cell

iv. Which of the following is not an electromagnetic device?

a. Microphone b. Loudspeaker

c. Electric bell d. Magnetic compass

v. Which one is not an electrical component?

a. Microphone b. Telephone

c. Electric motor d. Magnet

vi. Which of the following is an example of static electricity?

a. Battery cell b. Lightning

c. Electromagnet d. Magnetic field

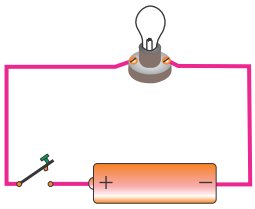
vii. The force needed for electric charge to flow in a circuit is provided by :

a. electric switch b. electric bulb

c. electric wire d. cell

viii. Which of the following is a correct figure for a closed circuit?

a.



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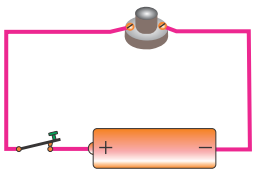
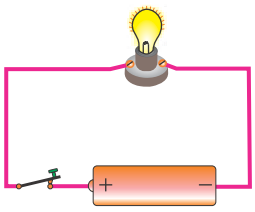
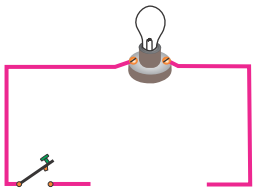


c.



d.



ix. Which of the following is used as a safety device in an electrical circuit?

a. Key b. Circuit breaker

c. Battery d. Ammeter

x. Which is the best material for making an electromagnet?

a. Rubber b. Glass

c. Iron d. Plastic

7.3 Name three examples of:

i. magnetic materials

ii. electromagnetic devices

7.4 Define the following:

Electric current, electrical circuit, static electricity, and electromagnet.

7.5 Explain with the help of diagram.

i. Closed circuit. ii. Open circuit.

7.6 What is a fuse? Describe its uses.

7.7 How do static charges build up?

7.8 You are given a small bulb. Name the other components you need to light it up.

7.9 When two clouds come closer to each other, lightning is produced. Why?

UNIT
8

SOLAR SYSTEM

In this unit, we will learn:

- Stars and Planets
- Solar system (Sun and Planets)
- Natural Satellites in solar system

The Sun and the planets are main parts of our solar system. The Sun has the central position in the solar system while the planets and many other objects are revolving around the Sun. The Earth is the only planet of the solar system on which life exists. In this unit we will get a brief introduction of the stars, planets and natural satellites.

8.1 Stars and Planets

We see several stars shining in the sky at night (Figure 8.1). The Sun is also a star. Have you ever thought what these stars are? These are huge spheres of burning gases which emit heat and light. In scientific terminology, a huge object which emits its own light is called a star.

Figure 8.1 Stars in the sky at night

In the universe, some stars are smaller while others are bigger than the Sun. Why cannot we see the stars during day time? This is because the Sun is closer to the Earth as compared to the other stars and in the presence of its bright sunlight, the light of distant stars becomes invisible.

Those objects which revolve around the Sun are called planets. Planets are not stars because they do not shine with their own light. There are eight planets that revolve around the Sun. Our Earth is also a planet.

8.2 Solar System (The Sun and Planets)

The Sun and other planets, satellites and comets which revolve around the Sun make our solar system.

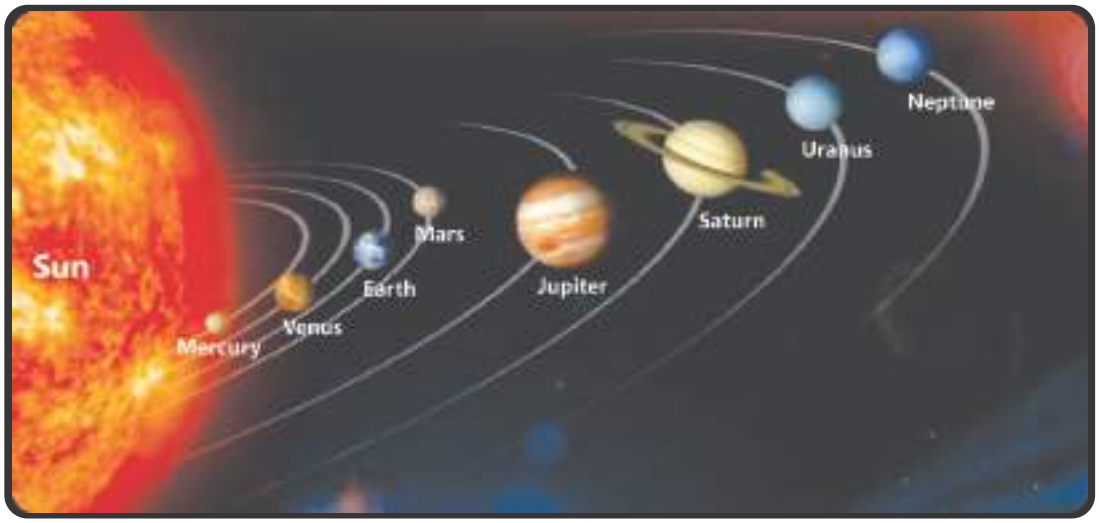


Figure 8.2 Solar System

The Sun

Our Sun is a medium sized star emitting heat and light continuously. It is very big as compared to the Earth. Its diameter is about 1.4 millions km, which is about 110 times bigger than that of the Earth. The temperature of the outer surface of the Sun is about 55,000°C, whereas the temperature of its central part (core) is about 15,000,000°C. The Sun is composed of about 75% hydrogen and 25% helium by mass. In the Sun's core, hydrogen is being converted into helium. This conversion produces heat, sunlight and other radiations.

The Planets

The eight planets which revolve around the Sun are named as Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune. The arrangement and position of the planets in solar system is shown in Figure 8.2. This figure shows that planets are at different distances from the Sun.

As the distance of each of the eight planets from the Sun is different, hence, each one completes its cycle around the Sun in different periods. Some information about eight planets of solar system is given in Table 8.1.

Table 8.1: Some information about eight planets

Name of the planet	Diameter (km)	Distance from the Sun (million km)		Revolution / orbit round the Sun
		Min.	Max.	
Mercury	4,880	46	69.8	87.97 Earth days
Venus	12,104	107.5	108.9	224.7 Earth days
Earth	12,756	147.1	152.1	365.25 days
Mars	6,794	206.6	249.2	686.98 Earth days
Jupiter	142,984	740.6	816	11.86 Earth years
Saturn	120,536	1350	1510	29.46 Earth years
Uranus	51,118	2730	3010	84.01 Earth years
Neptune	49,532	4460	4540	164.79 Earth years

Ref: Encyclopedia of space by DK. Edition 2009

Mercury

Mercury is a planet closest to the Sun having almost no atmosphere and no water. It is the smallest planet of the solar system. Its outer layer consists of rocks. Beneath the rocky layer, most of the planet comprises of iron.

Venus

Venus is similar to the Earth in size and mass. Its atmosphere primarily consists of carbon dioxide which traps heat (greenhouse effect) and makes it hotter than Mercury.

Do you know?

Venus is a planet, not a star. However, it is known as morning star and evening star. This is because the sunlight makes it shine brightly just before sunrise in the morning and after sunset in the evening.

Earth

Earth is the third planet from the Sun. Its atmosphere, distance from the Sun and many other factors have made it heaven for life. The central part of the Earth is solid iron core which creates magnetic field. It is surrounded by a thick layer of molten rocks called mantle. The surface of the Earth is made of water, air and solid ground. Its atmosphere consists of nitrogen, oxygen, carbon dioxide and other gases.

Mars

Mars is also called red planet due to its reddish colour. Its colour is due to a layer of iron-rich dust. The planet has a central core of iron, surrounded by a thick layer of rock. Its atmosphere is thinner than that of the Earth. Mars has water, but it is locked up as ice. Scientists think that many millions of years ago, there was Earth-like climate on Mars.

Jupiter

Jupiter is the largest planet in the solar system. It is a gas planet mainly composed of hydrogen and helium gases. It has no real surface. The gaseous clouds create a weather including storms.

Saturn

Saturn is the second largest planet in the solar system. Like Jupiter, it is made up of gases mainly hydrogen and helium. Saturn is encircled by thin rings consisting of billions of snowballs. These rings are over 302,000 km in diameter. Through a telescope the planet appears beautiful due to its rings.

Uranus

Uranus is also a gas planet, but its composition is different from other gas planets. It contains methane in addition to hydrogen and helium. Due to methane, it appears blue-green in colour.

Neptune

Neptune has a core of molten rock. Around the core, there is very cold water layer. The top layer is made of hydrogen, helium and small amount of methane. Methane gives it blue colour.

Interesting Information

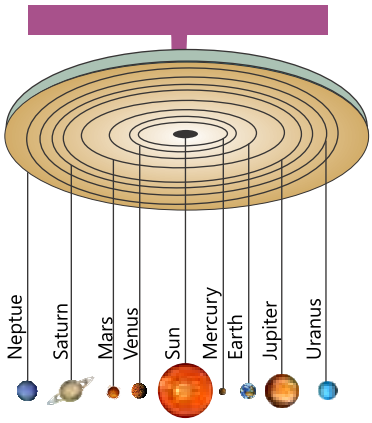
The Earth revolves anticlockwise around the Sun with the speed of about 107,244 km per hour.

Do you know?

Diameter of moon is 3476 km.

Activity 8.1

- Take a large ball, two small but different sized balls, six soft beads of different sizes, nine pieces of threads approximately equal in length, 18 small iron/steel hooks, one round cardboard sheet, one side of which is smooth and white.
- Paste white paper on the cardboard sheet.
- Draw eight circles of different diameter around one another on the white side of the cardboard.



- Hang the cardboard with some support in such a way that its white side should face the ground.
- Tie 18 hooks, one at each end of the nine pieces of threads.
- Join three balls and six beads separately with one end of each thread by fixing the hook into the ball or bead.
- Hang the large ball by fixing the hook tied at second end of its thread in the cardboard at the central point of the circles. It will represent the Sun in the model of the solar system.
- Follow the figure and hang the other beads and balls around the large ball (representing the Sun) in such a way that they should represent the size and position of the eight planets in the model of the solar system.

Do you know?

Venus, Mars, Jupiter and Saturn are the planets which can be seen without telescope. Other planets are so far that we cannot see them without telescope.

8.3 Natural Satellites in Solar System

A satellite is an object that orbits a bigger mass. The Moon is a

satellite of the Earth. Mars has two Moons. Similarly, most other planets have satellites that orbit around them. These are natural satellites. These natural satellites are usually termed as Moons.

Do you know?

Scientists have launched several artificial satellites into the space for space research. Artificial satellites are sent into space with the help of rockets. The first artificial satellite named as Sputnik-1 was launched into space by Russia on 4th October 1957. Since then thousands of satellites have been launched into space for different purposes.

Activity 8.2

Comparison of the size of Earth, Sun and Moon

Observe the picture that has been taken from space and answer the following questions:

1. Why does the Sun look smaller than the Earth?
2. How many times is the diameter of the Sun bigger than that of the Earth?
3. How many times is the diameter of the Sun bigger than that of the Moon?
4. How many times is the diameter of the Moon smaller than the Earth?

Science, Technology, Society and Environment

Geostationary satellites and polar satellites are used for studying the weather, navigation, and communication. Satellites in high polar elliptical orbits are used for communication to the people living close to the North Pole, as it is difficult for them to receive signals from geostationary satellites above the equator. Low Earth orbit satellites pass over the Earth's surface only a few hundred kilometres up. They can be used to photograph the surface of the Earth in detail.

KEY POINTS

- A huge object which emits its own light is called a star. The Sun is also a star.
- Eight large material objects in the space which are not stars but revolve around the Sun are called planets. These planets are named as Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.
- An object that orbits around a planet is called a satellite. The Moon is a satellite of the Earth.

QUESTIONS

8.1. Fill in the blanks.

I. The _____ is third planet from the Sun.

ii. The _____ is the largest planet in the solar system.

iii. Pluto is _____ a planet.

iv. The first artificial satellite named as _____ was launched into space in 1957.

v. Moon takes about _____ days to orbit around the Earth.

8.2 Encircle the correct option.

i. After which planet does the Neptune orbit?

a. Mars b. Uranus

c. Earth d. Mercury

ii. Before which planet does the Venus orbit?

a. Mercury b. Mars

c. Earth d. Saturn

iii. Which is the biggest planet amongst the following?

a. Venus b. Mars
c. Uranus d. Earth

iv. Which one of the following is the natural satellite of the Earth?

a. Mars b. Pluto
c. Moon d. Mercury

v. Which is the biggest planet of our solar system?

a. Earth b. Jupiter
c. Uranus d. Saturn

vi. The second largest planet in the solar system is:

a. Venus b. Uranus
c. Jupiter d. Saturn

vii. Diameter of the Earth is about:

a. 4900km b. 6800km
c. 12100km d. 12756km

viii. The cause of blue colour of Neptune is:

a. water b. hydrogen
c. helium d. methane

ix. Scientists think that many millions of years ago, there was Earth-like climate on:

a. Venus c. Mars
b. Uranus d. Moon

x. The Earth's Moon completes one revolution around the Earth in:

a. 27 days b. 28 days
c. 29 or 30 days d. 31 days

8.3 Short answer questions:

(i) Which is the self illuminated object in the solar system?

(ii) What is a satellite?

8.4 Differentiate between the stars and planets.

8.5 Explain why the Sun bears prime importance in the solar system?

8.6 Venus is very similar to the Earth in size. Why is it unlikely to support life?

8.7 Compare the sizes of the Earth, Sun and Moon.

8.8 Search the names of the planets given in box in the crossword.

Word Puzzle

MERCURY
VENUS
EARTH
MARS
JUPITER
SATURN
URANUS
NEPTUNE

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

GLOSSARY

Algae: The aquatic organisms with chlorophyll.

Antibiotics: Antibiotics are drugs designed to destroy bacteria.

Bacteria: Bacteria are microscopic, single-celled organisms widely distributed in the environment.

Biodegradable materials: Materials which are decomposed into simpler substances.

Boiling: Changing of the liquid state of water into its gaseous state on heating.

Condensation: The process by which a gas or vapour changes to liquid state at certain temperature upon cooling.

Decomposers: Organisms that eat the dead or decaying organic matter and break it down into simpler substances.

Dicots: Plants having two cotyledons in their seeds.

Eclipse: The blocking of the light of the Sun when the moon is between it and the Earth, or the Earth is between it and the moon.

Effort: Force applied on lever.

Freezing: The conversion of liquid to a solid.

Friction: A force which opposes the things from moving is called friction.

Fulcrum: A point about which some thing turns.

Fungi: The organisms which do not contain chlorophyll and are the most efficient decomposers .

Gravitational force: Attractive force between two masses.

Infection: An attack and multiplication of microorganisms in the body tissues.

Invertebrates: Animals without backbone.

Kingdom: A main group of living things.

Load: The weight lifted or force which is overcome by the effort

Lunar: Of the moon.

Mass: Amount of matter in an object.

Melting: The process of changing a solid to its liquid state.

Microorganisms: Living things which can only be seen with the aid of a microscope.

Monocots: Plants having one cotyledon in their seeds.

Non-biodegradable materials: Materials which cannot be decomposed into simpler substances by natural process.

Planets: Eight large objects in space orbiting the Sun.

Pollution: The contamination of environment.

Satellite: An object orbiting a bigger mass.

Shadow: A region of darkness behind an opaque object facing light in front of it.

Star: An object emitting its own heat and light.

Vertebrates: Animals with backbone

Weight: Gravitational pull acting on an object.

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