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Part - I

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The National Anthem of Sri Lanka

Sri Lanka Matha
Apa Sri Lanka Namo Namo Namo Namo Matha
Sundara siri barinee, surendi athi sobamana Lanka
Dhanya dhanaya neka mal palaturu piri jaya bhoomiya ramya
Apa hata sepa siri setha sadana jeewanaye matha
Piliganu mena apa bhakthi pooja Namo Namo Matha
Apa Sri Lanka Namo Namo Namo Namo Matha
Oba we apa vidya
Obamaya apa sathya
Oba we apa shakthi
Apa hada thula bhakthi
Oba apa aloke
Apage anuprane
Oba apa jeevana we
Apa mukthiya oba we
Nava jeevana demine, nithina apa pubudukaran matha
Gnana veerya vadawamina regena yanu mana jaya bhoomi kara
Eka mavakage daru kela bevina
Yamu yamu vee nopama
Prema vada sema bheda durerada
Namo, Namo Matha
Apa Sri Lanka Namo Namo Namo Namo Matha

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ආනන්ද සමරකෝන්

ஒரு தாய் மக்கள் நாமாவோம்
ஒன்றே நாம் வாழும் இல்லம்
நன்றே உடலில் ஓடும்
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நலமே வாழ்தல் வேண்டுமன்றோ

யாவரும் அன்பு கருணையுடன்
ஒற்றுமை சிறக்க வாழ்ந்திடுதல்
பொன்னும் மணியும் முத்துமல்ல - அதுவே
யான்று மழியாச் செல்வமன்றோ.

ஆனந்த சமரக்கோன்
கவிதையின் பெயர்ப்பு.

Being innovative, changing with right knowledge,
Be a light to the country as well as to the world.

Message from the Hon. Minister of Education

The past two decades have been significant in the world history due to changes that took place in technology. The present students face a lot of new challenges along with the rapid development of Information Technology, communication and other related fields. The manner of career opportunities are liable to change specifically in the near future. In such an environment, with a new technological and intellectual society, thousands of innovative career opportunities would be created. To win those challenges, it is the responsibility of the Sri Lankan Government and myself, as the Minister of Education, to empower you all.

This book is a product of free education. Your aim must be to use this book properly and acquire the necessary knowledge out of it. The government in turn is able to provide free textbooks to you, as a result of the commitment and labour of your parents and elders.

Since we have understood that the education is crucial in deciding the future of a country, the government has taken steps to change curriculum to suit the rapid changes of the technological world. Hence, you have to dedicate yourselves to become productive citizens. I believe that the knowledge this book provides will suffice your aim.

It is your duty to give a proper value to the money spent by the government on your education. Also you should understand that education determines your future Make sure that you reach the optimum social stratum through education.

I congratulate you to enjoy the benefits of free education and bloom as an honoured citizen who takes the name of Sri Lanka to the world.

Akila Viraj Kariyawasam
Minister of Education

Foreword

The educational objectives of the contemporary world are becoming more complex along with the economic, social, cultural and technological development. The learning and teaching process too is changing in relation to human experiences, technological differences, research and new indices. Therefore, it is required to produce the textbook by including subject related information according to the objectives in the syllabus in order to maintain the teaching process by organizing learning experiences that suit to the learner needs. The textbook is not merely a learning tool for the learner. It is a blessing that contributes to obtain a higher education along with a development of conduct and attitudes, to develop values and to obtain learning experiences.

The government in its realization of the concept of free education has offered you all the textbooks from grades 1-11. I would like to remind you that you should make the maximum use of these textbooks and protect them well. I sincerely hope that this textbook would assist you to obtain the expertise to become a virtuous citizen with a complete personality who would be a valuable asset to the country.

I would like to bestow my sincere thanks on the members of the editorial and writer boards as well as on the staff of the Educational Publications Department who have strived to offer this textbook to you.

W. M. Jayantha Wickramanayaka,
Commissioner General of Educational Publications,
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2019.04.10

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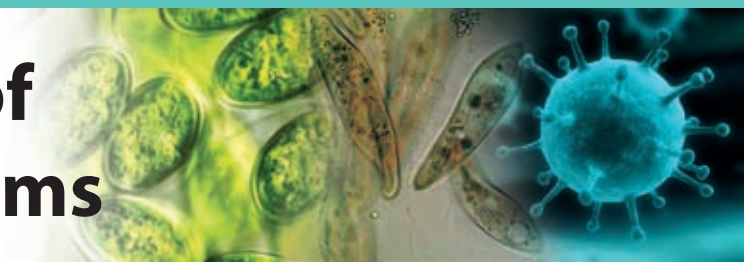
1 Importance of Microorganisms



1.1 Microorganisms

There are living organisms which are visible and also invisible to the naked eye in our environment. Let us do Activity 1.1 to observe the invisible living organisms.

Activity 1.1

You will need: - A sample of coconut water, a glass slide, a cover slip, light microscope

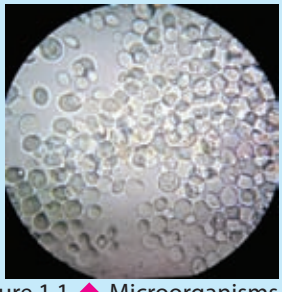


Figure 1.1 ▲ Microorganisms in a sample of aged coconut water

Method: -

- Put the coconut water into a clean container and keep it for three days.
- Then put a drop of coconut water on to the glass slide and cover it with a cover slip.
- Observe the prepared slide through the light microscope under low power. (Get the help of your teacher)
- Present your observations through diagrams.

It is obvious that the unicellular fungal variety called 'yeast' can be observed mainly in the above sample. This organism cannot be examined to the naked eye in isolation, but can be observed through a microscope. Therefore, yeast is a microorganism.

The uni-cellular (single celled) or multi cellular organisms which cannot be observed clearly by naked eye are called microorganisms.

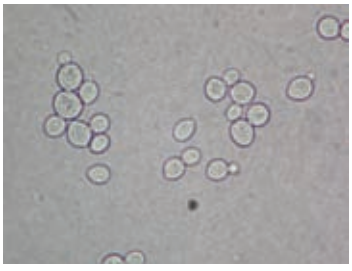
These microorganisms can be observed clearly through microscopes.

Microorganisms are found in every habitat on the earth. They live and thrive in all environments such as atmosphere, water, soil, in and on living organisms including hostile environments (glaciers, deserts, hot springs, deep sea and saline environments). There is a tremendous biological diversity among microorganisms. They differ in their morphological characters as well as in their physiological mechanisms.

e.g.:- bacteria, some algae, some fungal species, protozoans like *Amoeba* and *Paramecium*

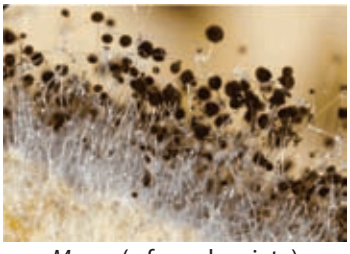
You can observe some permanent slides of microorganisms in your laboratory.

Bacteria



Yeast

Chlamydomonas (Algae species)



Mucor (a fungal variety)

Amoeba

Paramecium

Figure - 1.2 ▲ Microscopic appearance of some microorganisms

Use Figure 1.2 to identify different species of microorganisms.

For extra knowledge

Viruses show living features as well as non-living features. Although viruses are discussed under microorganisms, there is no conclusion yet as to whether they are living or non-living. Viruses can be observed through electron microscope.

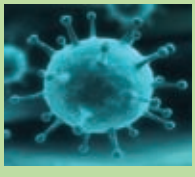


Figure 1.3 ▲ Antonie van Leeuwenhoek

The Dutch scientist Antonie van Leeuwenhoek observed microorganisms for the very first time in 1674, using a simple microscope that he invented. Exploration of microorganisms was possible with further developments in microscopy.

1.2 Effects of microorganisms on food

The growth of some microorganisms on foods make them not suitable for human consumption.

Do Assignment 1.1 and Activity 1.2 to observe the effects of microorganisms on food.

Assignment 1.1

- Get some food samples of bread, vegetables, fruits, milk, meat/fish, rice, butter in fresh condition.
- Observe their nature carefully.
- Again observe the nature of these samples after 24 hours, 48 hours and 72 hours.
- Tabulate your observations.

Table 1.1- Effect of microorganisms on food

Food item		Fresh food	After 24 hours	After 48 hours	After 72 hours
1. Bread	colour				
	texture				
	odour				
	appearance				
2.					

The microbial activities change the colour, texture, odour and appearance of food. The taste and the nutritional value of food also change. Food become unfavourable for consumption due to the changes of properties. This is known as spoilage of food. The main reason for food spoilage is the growth of microorganisms on food.

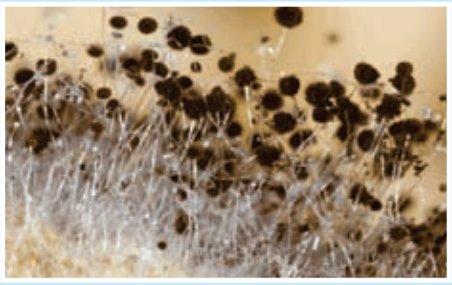
Activity 1.2

You will need: - A slice of bread, some water, a glass slide, a cover slip, microscope

Method: -

- Spray some water on the slice of bread and keep it for three days.
- Take some of the substance grown on the slice of bread and place on the glass slide. Put a drop of water on it.
- Cover the slide with a cover slip.
- Observe the slide through the microscope under the low power.
- Draw what you observed.

Slice of bread with fungi



Microscopic view of fungi

Figure 1.4

You will observe that there are some fibres and black structures on bread. They are a kind of fungi which spoils bread.

So, you can observe that microbial growth causes food spoilage.

The main reason for food spoilage is the growth of microorganisms on food and release of their byproducts.

Let us do Activity 1.3 to study microbial activity.

Activity 1.3

You will need: - Sugar, yeast, a balloon, warm water (40 °C), a bottle (500 ml), a beaker/suitable container

Method: -

- Dissolve two teaspoons of sugar in 200 ml of warm water.
- Add one teaspoon of yeast into the above sugar solution.
- Leave it for about 20 minutes and observe (Figure 1.5 a).

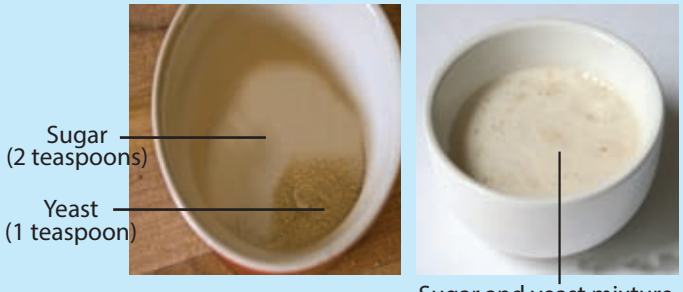


Figure 1.5 (a)

- Next pour a newly prepared solution into the bottle.
- Then fix a balloon to the mouth of the bottle.
- Record your observations after about 20 minutes. (Figure 1.5 b).

Figure 1.5 (b)

When sugar and yeast are mixed in a solution, it will bubble and become warm (Figure 1.5a/1.5b). You will smell the odour of alcohol. It is because ethyl alcohol is produced due to the activity of yeast in sugar solution.

As shown in Figure 1.5 b you will see that the balloon has been inflated. This is because a gas is produced due to the activity of yeast in sugar solution. The gas produced here is carbon dioxide.

Yeast is a key ingredient in bakery products. The activity of yeast forms carbon dioxide and makes the dough rise. Ethyl alcohol evaporates during the process of baking.


Figure 1.6 Rising of bread due to the activity of yeast

When food is exposed to air, microbes act on it very easily. This is because the environment provides suitable moisture and temperature for their growth.

Microorganisms start to grow rapidly when a moist food item is exposed to an environment with favourable temperature.

But if the food is refrigerated the microbial activity is minimized because the amount of moisture and temperature are controlled in a refrigerator.

Moisture and **temperature** are the main factors that contribute to microbial activity. Food spoils rapidly at room temperature (25°C - 30°C). This is because room temperature is favourable for microbial growth. The enzymes produced by these microbes change the taste, odour, colour, texture and the nutritional value of the food.

Microbial activities depend on the type of food.

- **Fermentation** :- Microbial activity on food high in sugars leads to fermentation.
- **Putrefaction** :- Microbial activity on food high in protein leads to putrefaction.
- **Rancidity** : - Microbial activity on food high in fats leads to rancidity.

A substrate, suitable temperatures and pH ranges are the factors for the growth of different microbes. Therefore, microbial activity can be controlled by controlling these factors.

1.3 Impact of microorganisms on humans and their activities

Some microorganisms are beneficial to humans while some are harmful.

Let us do Assignment 1.2 to understand the importance of microorganisms.

Assignment 1.2

- Collect information about beneficial and harmful effects of microorganisms and present them to the class.

Beneficial effects of microorganisms

Beneficial effects of microorganisms are of several types. Some of the advantages are, usage of microorganisms in different industries, microbial decomposition of dead plant and animal matter, biological pest control.

- Since ancient times man has been using microorganisms in different industries. Some examples are given in Figure 1.7.


producing curd


producing yoghurt


producing cheese


bakery products


producing antibiotics


producing vaccines


producing vinegar & alcohol


food (mushrooms)


making compost


producing bio gas


coir industry

Figure - 1.7 ▲ Applications of microorganisms in different industries

- Microorganisms decompose dead plant and animal matter. If not these matter get collected and it affects the balance of environment. Therefore, microorganisms contribute to the well-being of the environment.
- Microorganisms are also used to control pests. This is one of the biological control methods of pests.

Next let us consider harmful effects caused by microorganisms.

Harmful effects of microorganisms

Harmful effects of microorganisms are of several types. Food spoilage, causing infectious diseases for man, animals and crops, cause economical damage to clothes and wooden furniture are some of them.

- **Microbial activity causes food spoilage (This was discussed in section 1.2).**

growth of microorganisms on vegetables

growth of microorganisms on bread

growth of microorganisms on fruits

Figure - 1.8

- **Microorganisms cause various infectious diseases for man, animals and crops.**

Infectious diseases caused to man

Virus - common cold, dengue, AIDS (Acquired Immuno Deficiency Syndrome)

Bacteria - tuberculosis, leprosy, typhoid fever

Protozoa - malaria, leishmaniasis, amoebisis

Fungi - pityriasis, sore

dengue haemorrhogic patient

deformity due to leprosy

fungi on skin (Pityriasis)

Figure - 1.9

Infectious diseases caused to animals

Animals get infectious diseases due to microorganisms. Figure 1.10 shows some of the examples for such diseases.

a dog suffering from Rabies

a bull suffering from foot and mouth disease

a cow suffering from mastitis

Figure 1.10

Infectious diseases caused to plants

Plants get infectious diseases due to microorganisms. Figure 1.11 shows some of the examples for such diseases.

a potato plant with blight

papaw leaves with mosaic disease

chillie plant with leaf curled disease

Figure 1.11

- **Damage caused due to the growth of microorganisms, on surfaces of objects.**

Growth of microorganisms on clothes, walls of buildings and wood has been caused adverse effects on the economy. These effects are mostly caused by fungi.

fungi on clothes

fungi on walls

fungi on wooden surfaces

Figure - 1.12 Growth of microorganisms on different surfaces

Summary

- The organisms which cannot be observed by naked eye are called microorganisms.
- Microorganisms cause beneficial effects as well as harmful effects.
- Usage in various industries, decomposition of dead plant and animal matter and pest control are beneficial effects.
- Food spoilage, cause infectious diseases for man, animals and crops and damage to economically important surfaces are harmful influences caused by microorganisms.
- Nutrients, moisture, favourable temperature and favourable pH values are necessary for microbial growth.
- Food can be preserved by implementing necessary methods to control microbial activities.

Exercise

1) State whether the following statements are true (√) **or** false (×)

i) Bacteria belong to the category of microorganisms. ( )

ii) A virus causes Tuberculosis. ( )

iii) Refrigerating food helps to control the temperature suitable for microorganisms. ( )

iv) Moisture and warmth are necessary factors for the growth of fungi. ( )

v) The scientist Antonie van Leeuwenhoek observed microorganisms for the first time. ( )

2) Select the correct answer

I. A disease **not** caused by a virus is

1) AIDS 2) Measles 3) Leprosy 4) Rabies

II. The food type that undergoes fermentation in the presence of microorganisms is

1) Food with proteins 3) Food with sugars
2) Food with lipids 4) All three types

III. Environmental conditions, suitable for microbial growth are given below.

a)Temperature b) Moisture c) pH

which of the above conditions are controlled by refregerating food?

1) a and b 2) a and c 3) b and c 4) a, b and c

IV. The microbial activity on lipid food such as 'dodol'/'dothal' and 'kavum'/ 'paniyaram' is known as,

1) Fermentation 2) Putrefaction 3) Rancidity 4) All the above

V. A favourable impact for humans by microorganisms,

1) Decomposition of dead plant and animal matter

2) Cause diseases to humans, animals and crops

3) Make food unsuitable for consumption

4) Cause economical impact by growing on non living surfaces

3) Give short answers.

I. Write four examples for microorganisms
II. Mention two factors required for microbial activity
III. Name three products in which microorganisms are used.
IV. What factor needed for microbial growth is controlled when food is stored in sugar/honey ?
V. Mention two microbial applications in the field of medicine

Technical Terms

Microorganisms	-	ක්ෂුද්‍ර ජීවීන්	-	நுண்ணங்கிகள்
Microscopic	-	අණ්වීක්ෂීය	-	நுணுக்குக்காட்டி
Food spoilage	-	ආහාර නරක් වීම	-	உணவு பழுதடைதல்
Microbial degradation	-	ක්ෂුද්‍ර ජීවී හායනය	-	நுண்ணங்கிப் பிரிகையாக்கம்
Application of microbes	-	ක්ෂුද්‍ර ජීවී භාවිත	-	நுண்ணங்கிகளின் பிரயோகம்
Infectious diseases	-	බෝවන රෝග	-	தொற்று நோய்கள்

2 Animal Classification

There is a vast diversity among animals that live in our environment.

It is easy to study about them by classifying organisms, based on different criteria. **Grouping of animals in a systematic way by considering their common features is known as animal classification.**

Animals can be classified on different criteria.

In grade 7 you learnt how to classify animals based on presence or absence of a vertebral column (backbone).

Let us do Activity 2.1 from the knowledge and facts you learnt in grade 7.

Activity 2. 1

Method:-

- Observe given pictures of the animals living in your surroundings.
- Divide and tabulate them into two groups using the feature, presence or absence of a vertebral column.

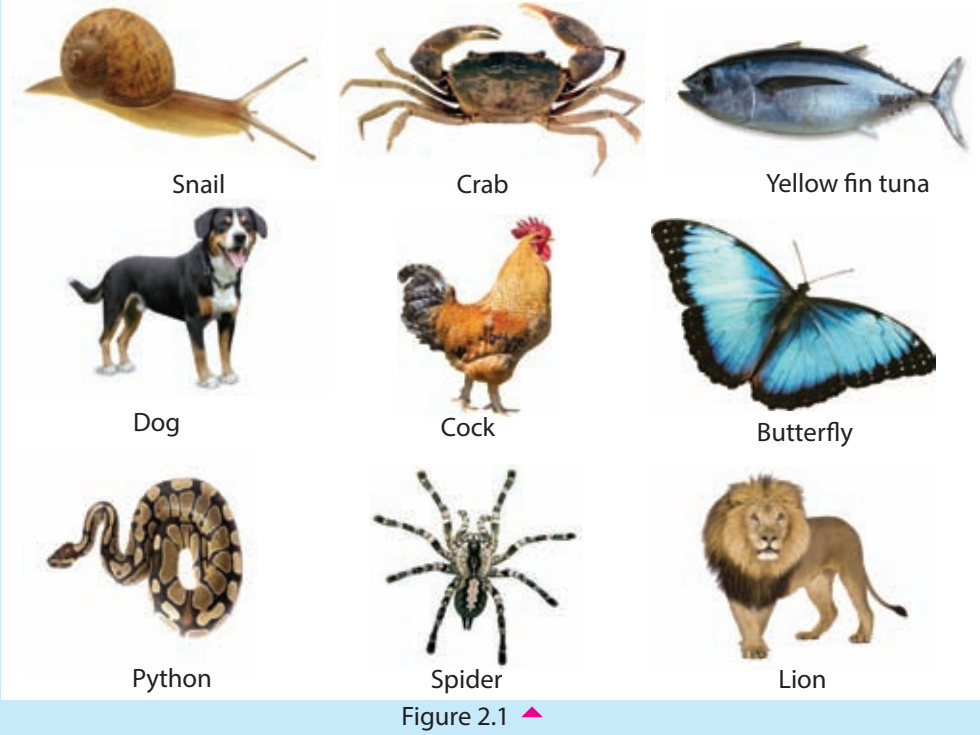


Figure 2.1

Among those animals, yellow fin tuna, dog, cock, python and lion have a backbone. Snail, crab, butterfly and spider do not have a backbone.

The animals without a backbone / vertebral column are known as **invertebrates** while the animals with a backbone / vertebral column are known as **vertebrates** Therefore, animals can be classified into two groups;

- Invertebrates
- Vertebrates

2.1 Main invertebrate groups

Engage in Assignment 2.1 to study about invertebrates.

Assignment 2.1

- Observe given diagrams of the invertebrate animal species.
- Classify them based on different criteria.

Figure 2.2

You have already classified the animals based on different criteria.

Invertebrates are scientifically classified by using their common features.
Some of the groups are given below.

1. Cnidaria
2. Annelida
3. Mollusca
4. Arthropoda

Let us consider the features of each of the above groups.

Cnidaria

The animals belong to Cnidaria are predators and they live in water. Hydra, sea anemone, jellyfish are some examples for the group of Cnidaria.


Hydra


Sea anemone


Jellyfish

Figure 2.3 ▲ Some Cnidarians

The features of Cnidaria are given below.

- Cnidarians have radially symmetrical body (If the body of an animal can be divided into two equal halves along several axes we call it a radially symmetrical animal).
- There are two forms as Polyps and Medusa. (Polyps are fixed to the substrate and lead a sedentary life while Medusa are free floating organisms)
- They cripple small creatures with their special tentacles having cnidocytes and use them as food.

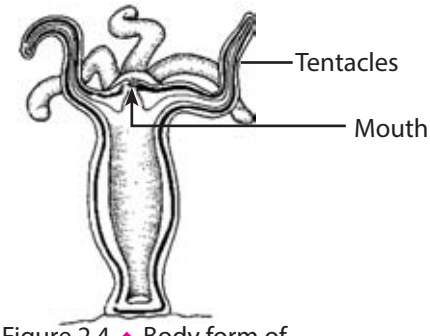


Figure 2.4 ▲ Body form of Cnidarian (Hydra)

For extra knowledge

The coral polyps belong to the Cnidaria group build up coral reefs.

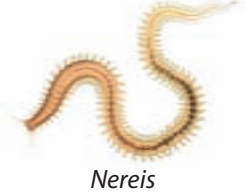
Annelida

Annelids live in both marine and fresh water environments as well as in wet terrestial environments.

Earthworm, leech, *Nereis* are some examples for Annelids.

Earthworm

Leech



Nereis

Figure 2.5 ▲ Some Annelids

Common features of Annelids are given below.

- Body is bilaterally symmetrical (If the body of an animal can be divided into two equal halves along one axis we call it a bilaterally symmetrial animal).
- They are vermiform (worm-like body shape).
- Body is divided into segments. Therefore, known as **segmented worms**.

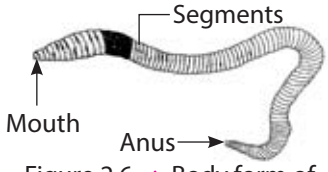


Figure 2.6 ▲ Body form of an Annelid (earthworm)

Mollusca

Molluscs live in terrestial, marine and fresh water environment. Snail, bivalve, chiton, slug, cuttle fish, octopus are some examples for Molluscs.

Snail

Bivalve

Octopus

Figure 2.7 ▲Some Molluscs

The features of Molluscs are given below.

- They are bilaterally symmetrical.
- Soft bodied animals.
- Possess a muscular foot.
- Possess a skin moistened with mucus.
- Some Molluscs bear shells.

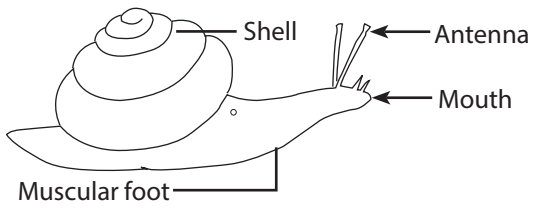


Figure 2.8 ▲ Body form of a molluscs (Snail)

Arthropoda

Arthropods live in terrestial as well as in aquatic environments. Arthropoda is the group to which the highest number of animals belongs. Insects, spiders, scorpions, millipedes, centipedes, prawns, crabs are some organisms that belong to the group Arthropoda.

Butterfly Scorpion Centipede Prawn

Figure 2.9 ▲ Some Arthropods

Features of Arthropods are given below.

- Arthropods are bilaterally symmetrical.
- Their body possesses an external skeleton/ exoskeleton.
- Some species possess wings.
- Arthropods have externally segmented body.
- All Arthropods have jointed appendages.

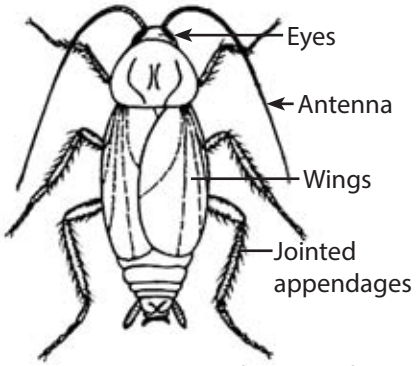


Figure 2.10 ▲ Body features of an Arthropoda (Insects)

Assignment 2.2

- Collect the bodies of dead insects.
- Get a box (wood, metal or card board) and fix a piece of styrofoam to the bottom of the box.
- Fix the bodies on the styrofoam using long pins.
- Paste a name tag for each insect. (Discuss with your teacher how to keep the bodies of insects without decaying)

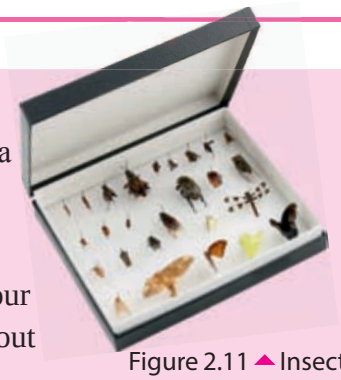


Figure 2.11 ▲ Insect box

2.2 Main vertebrate groups

Engage in Assignment 2.3 to study about vertebrates.

Assignment 2.3

- Observe the given pictures of different vertebrate animal species.
- Classify them using different criteria.

Blue fin tuna

Turtle

Crocodile

Common commorant

Toad

Hawk

Bat

Chimpanzee

Salamander

Figure 2.12 ▲

Now you can classify vertebrates based on different criteria.
Vertebrates can be scientifically classified depending on their common features.
Let us discuss the features of each of these groups.

1. Pisces
2. Amphibia
3. Reptilia
4. Aves
5. Mammalia

Pisces

Fish, the group of animals well adapted to live in water belong to Pisces. Tilapia, skate, shark, blue fin tuna, sear, gold stripped sardine, sprat are some fish that belong to Pisces.

Tilapia Skate Shark Blue fin tuna

Figure 2.13 ▲ Some Pisces

Features of Pisces are given below.

- Body is invariably streamlined. This feature helps them to swim through water.
- The body is covered with scales.
- Has fins to swim through water and to balance while swimming.
- Respiration through gills
- Possess eyes without eye lids.

Amphibia

Amphibians spend part of their life cycle in water. Frogs, toads, salamanders, *Ichthyophis* are some animals that belong to the group Amphibians.

Frog Toad Salamander *Ichthyophis*

Figure 2.14 ▲ Some Amphibians

Features of Amphibians are given below.

- Undergo metamorphosis.
- Skin is thin, moist and glandular. No scales in the skin.
- Some species use limbs for locomotion.
- Respiration is carried out by lungs, through wet skin or mouth.

Reptilia

Reptiles belong to this group. They are well-adapted for the terrestrial environment. Tortoise, turtle, cobra, python, viper, krait, lizard, monitor, iguana, crocodile belong to this group.

Tortoise Crocodile Cobra Viper

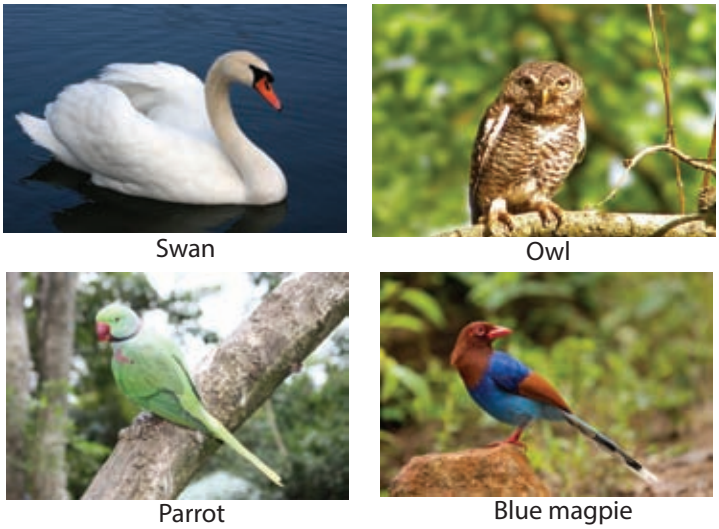
Figure 2.15 ▲ Some Reptiles

Features of Reptilia are given below.

- Possess a dry skin with scales. No glands are present in the skin.
- Use limbs for locomotion. But some reptiles are limbless. They are adapted for crawling
- Respiration through lungs

Aves

Birds belong to the group Aves. They are well-adapted for flying. Blue magpie, swan, owl, parrot are some examples for Aves.



Swan Owl

Parrot Blue magpie

Figure 2.16 ▲ Some Aves

Features of Aves are given below.

- Streamlined body is designed for flying.
- Body is covered with feathers.
- Possess limbs for locomotion. Forelimbs are adapted as wings.
- They do not have teeth but the beak is adapted for feeding.
- Breathe using lungs.

For extra knowledge

There are some birds that cannot fly. Some examples are given below.

Ostrich

Cassowary

Emu

Rhea

Penguin

Kiwi

Mammalia

These animals feed on mother's milk. Man, rat, loris, orangutan, gorilla, chimpanzee, bat, whale, dolphin, stag, deer are some examples for mammals.

Gorilla

Dolphin

Deer

Loris

Figure 2.17 ▲ Some Mammals

Features of Mammalia are given below.

- Has mammary glands.
- Skin has sweat glands, sebaceous glands and hair.
- Possess an external ear with ear lobe.
- Mammals have lungs to breathe.

Assignment 2.4

- Collect some pictures of mammals.
- Collect information about them.
- Prepare a booklet allocating one page for each animal. (Consider about the cover page, foreword, contents, acknowledgement etc.)

By studying this lesson, you have identified that there is a wide diversity among animals. You can further study about them by visiting zoological gardens and wildlife parks. All animals contribute immensely to maintain the balance of the environment.

Summary

- There is a vast diversity among animals in the environment.
- Animals with a backbone / vertebral column are known as Vertebrates and animals without a backbone / vertebral column are known as Invertebrates.
- Considering the common features, invertebrates can be classified into different groups. Cnidaria, Annelida, Mollusca and Arthropoda are some groups of Invertebrates.
- Considering the common features, vertebrates can be classified into different groups as Pisces, Amphibia, Reptilia, Aves and Mammalia.

Exercise

1. Select the most suitable answer.

i. The group of animals, **not** belonging to invertebrate is,

1. Annelida
2. Cnidaria
3. Amphibia
4. Arthropoda

ii. The group with highest number of animals is,

1. Aves
2. Athropoda
3. Mollusca
4. Mammalia

iii. An animal belonging to Reptilia group is,

1. shark
2. salamander
3. whale
4. turtle

2. Fill in the blanks.

i. Sea anemone belongs to ..... group.

ii. Possessing segmented appendages is a feature of ..... group.

iii …….. breathe using lungs, wet skin and the mouth.

3. Name the invertebrate group that bears each of the features given below.

   i. Muscular foot - .....

   ii. Worm-like segmented body - .....

   iii. Jointed appendages - .....

   iv. Radial symmetry - .....

4. Write down the answers.

i. Name two forms of Cnidaria with an example for each form.

ii. Name four Arthropods that can fly.

iii. Give three basic features of Mammalia.

iv. Give three basic features of Aves.

Technical Terms

Classification	-	වර්ගීකරණය	-	பாகுபாடு
Radial symmetry	-	අරීය සමමිතිය	-	ஆரைச் சமச்சீர்
Bilateral symmetry	-	ද්විපාර්ශ්වික සමමිතිය	-	இருபக்கச் சமச்சீர்
Morphological features	-	රූපීය ලක්ෂණ	-	உருவவியல் இயல்புகள்
Invertebrates	-	අපෘෂ්ඨවංශීන්	-	முள்ளந்தண்டிலிகள்
Vertebrates	-	පෘෂ්ඨවංශීන්	-	முள்ளந்தண்டுளிகள்
Cnidaria	-	නිඩාරියාවන්	-	நிடாரியா / குழிக்குடலிகள்
Annelida	-	ඇනෙලිඩා	-	அனலிடா / துண்டப் புழுக்கள்
Mollusca	-	මොලුස්කා	-	மொலஸ்கா / மென்னுடலிகள்
Arthropoda	-	ආත්‍රොපෝඩා	-	ஆத்திரப்போடா / மூட்டுக்காலிகள்
Pisces	-	පිස්කේස්	-	பிஸ்ஸஸ் / மீன்கள்
Amphibia	-	ඇම්ෆිබියා	-	அம்பியா / ஈருடகவாழிகள்
Reptilia	-	රෙප්ටීලියා	-	ரெப்ரீலியா / ஊர்வன
Aves	-	ආවේස්	-	ஆவேஸ் / பறவைகள்
Mammalia	-	මැමේලියා	-	மமேலியா / பாலூட்டிகள்

3 Diversity and Functions of Plant Parts

Plants in our environment show an enormous diversity as animals. Observe the diversity of plants in the forest shown in Figure 3.1.

Figure 3.1▲ A rain forest

The major reason for the beauty and the wonder of a forest is the diversity of plants. Plants differ each other in its size and morphological features. The reason for this vast diversity is the adaptations of plants to survive in different environments.

You have already learnt the parts of a plant in grade 7.

Recall what you have learnt and engage in Activity 3.1 to study further about the parts of a plant.

Activity 3.1

You will need : - 'Kuppameniya'/'kuppaimani' or a 'monarakudumbiya'/ 'seethaviyar selugkaluner' plant.

Method : -

- Uproot the plant from the soil without damaging the root system, and wash properly.
- Observe the plant and identify its parts.
- Draw a diagram and name the parts.

Figure 3.2 shows the main parts of a plant.

Compare your diagram with the given figure.

Every flowering plant consists of fruits, leaves, stem and roots. But they do not appear same in every plant. They have an extensive diversity. Let us have a review about the diversity and the functions of leaves, stem and roots of a plant.

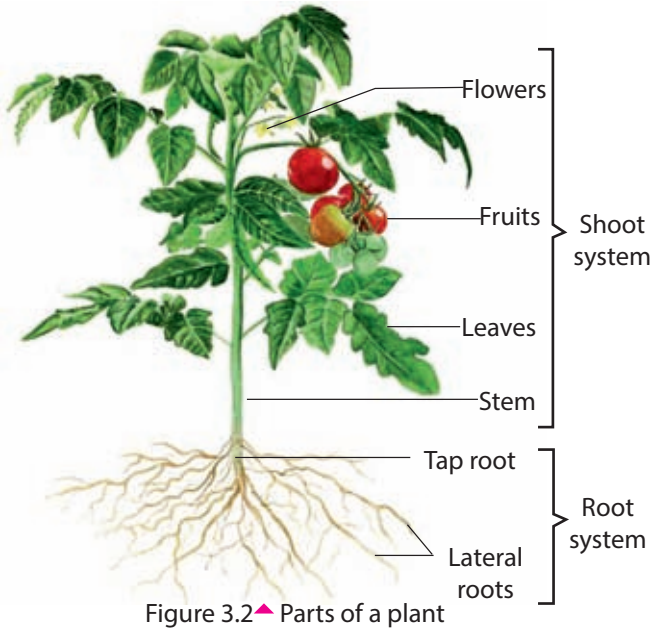


Figure 3.2 Parts of a plant

3.1 Diversity and functions of plant leaves

Leaves are considered as the most significant part of a plant. Most of the leaves are green in colour. The main function of a leaf is **photosynthesis**. Food is produced in plants having chlorophyll by using carbon dioxide, water and light energy. This process is known as photosynthesis.

Plant leaves are well adapted for efficient photosynthesis. Let us do Activity 3.2 to study about this.

Activity 3.2

You will need : - Some leaves of jak, mango, temple flower and manioc

Method : -

- Observe the leaves well.
- Compare the thickness of the leaves.
- Draw the area of the leaves on a square ruled sheet and compare them.

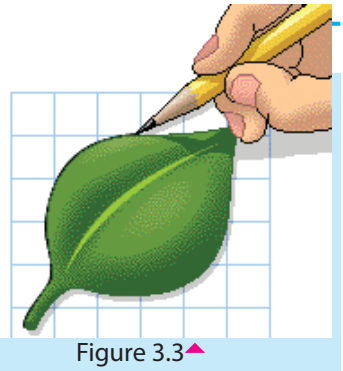


Figure 3.3

For the purpose of photosynthesis a leaf is typically flat and thin to expose to light over a broad area and allow light to penetrate fully into the tissues.

Thick and fleshy leaves can also be seen as an adaptation to adverse (arid) environmental conditions.

e.g:- Aloe, temple flower, yellow oleander (kaneru)

Figure 3.4 shows the parts of a leaf.

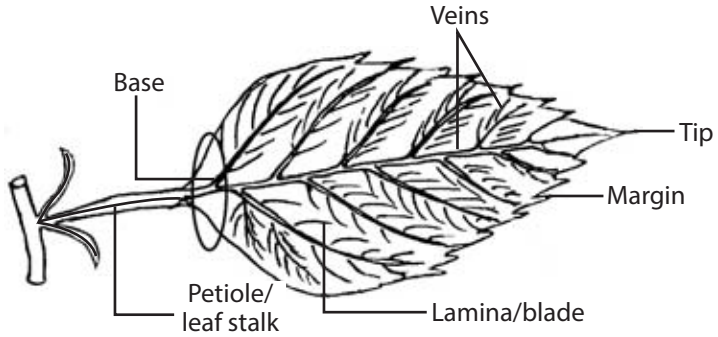


Figure 3.4 Parts of a leaf

Does every leaf have the same shape of petiole, margin, base and tip? Do Activity 3.3 to study about it.

Activity 3.3

You will need : - Some leaves that can be found in your environment (e.g: mango, papaw, rose, temple tress, 'Bo leaf'/'arasa illai')

Method: -

- Obtain leaves from different plants in your environment.
- Observe the leaves and draw pictures having different blades, bases, margins and tips.

When you observe the blades of these leaves you will understand that they have different shapes (Figure 3.5).

Figure 3.5 Diversity of leaf blades

You would have observed that there is a wide variation in leaf structure. That is due to their adaptations for the main function as well as various other functions.

Study the following diagrams and identify further the diversity of leaves. If you observe the tips of those leaves you will notice that the tips are different as sharp, curved, pointed, divided etc (Figure 3.6).

Figure 3.6 ▲ Diversity among leaf tips

The margins can be serrate or smooth. (Figure 3.7)

Figure 3.7 ▲ Diversity among leaf margins

The bases and the petiole of leaves too have different forms (Figure 3.8).

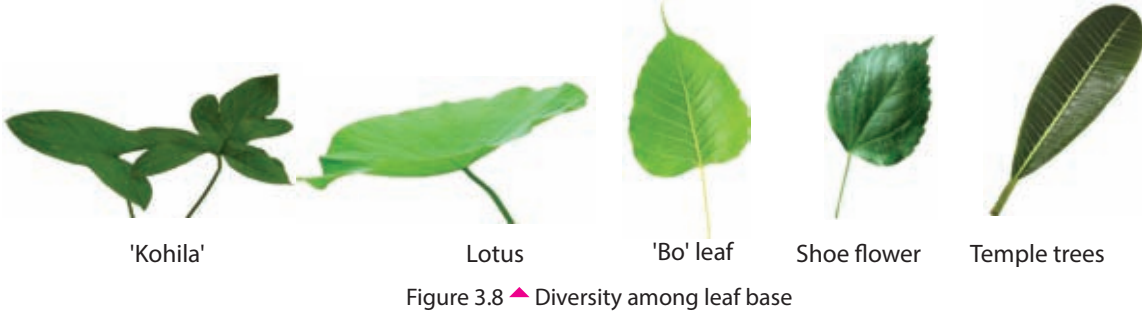


Figure 3.8 ▲ Diversity among leaf base

When you observe the environment you will be able to study more about other adaptations of leaves.

Leaf arrangement

The leaves are fixed to the stem in a way to expose all the leaves to the sun light. The pattern of fixing the leaf to the stem of a plant is known as **leaf arrangement**. Leaf arrangment supports efficient photosynthesis. Some leaf arrangements are given below.

- Leaves are on alternate sides of the stem.

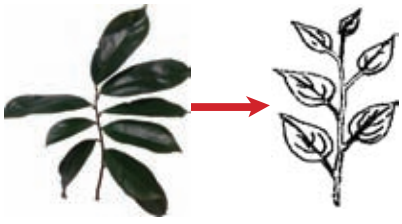


Figure 3.9 'Anona' ('Katu Anoda')/ 'Annamunna'

- Leaf attachments paired at nodes and in opposite directions.

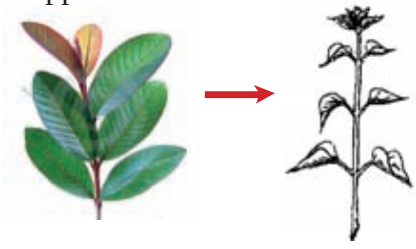


Figure 3.10 Guava

- Three or more leaves attach at each node on the stem in a whirl.

Figure 3.11 'Rukkaththana'/ 'Earlilaippalai'

- Leaves are attached in a spiral manner around the stem.

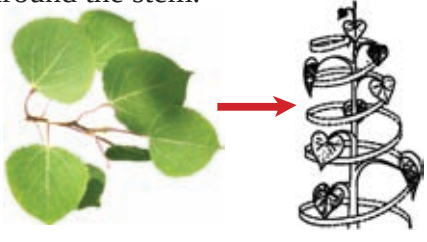


Figure 3.12 'Kanda'/'Vattakkanni'

Assignment 3.1

- Observe the environment and identify the leaf arrangements as much as possible.
- Complete the given table using your observations.

Table 3.1

Leaf arrangement	Examples of trees
Leaves are on alternate sides of the stem.	.....
Leaf attachments paired at nodes and leaves in opposite directions.	.....
Three or more leaves attach at each node on the stem in a whirl.	.....
Leaves are attached in a spiral manner around the stem.	.....

Let us now consider the other functions of leaves.

- Transpiration is the process of evaporation of water from plants (Figure 3.13). It mainly takes place through stomata in leaves. Transpiration helps to transport water to the upper parts of the plant.

Figure 3.13 ▲ Internal structure of a leaf

The leaves of plants in arid environments, are adapted to minimize transpiration.

Some adaptations are given below.

- Thick, waxy cuticle — e.g. - temple trees, oleander
- Leaves reduced to spines — e.g. - cactus
- Thin leaves — e.g. - 'kasa' / 'savukku'
- Reduced number of leaves — e.g. - 'navahandi' / 'kally', 'heerassa'/'pirattai'

Temple trees

Cactus

'Kasa'

Figure 3.14 ▲ Adaptations to minimize transpiration

- Some leaves are adapted to store water. They have become fleshy because they have specialized tissues to conserve water (Figure 3.15).

'Akkapana'

Aloe

Figure 3.15 ▲ Plants with water storage leaves

- Some leaves produce new plants through asexual reproduction.
  e.g. :- 'Akkapana', 'begonia'

Let us do Activity 3.4 to study how some plant leaves produce new plants.

Activity 3.4

You will need : - some leaves of plants such as akkapana, begonia, peparomia
Method : -

- Make a small cut at the veins of the above mentioned leaves and cover the place with soil.
- Keep them watering for several days.
- After 3-4 days observe the roots near the veins of the leaves.
- Find other ways of getting plants from leaves.


'Akkapana'


Begonia


Peparomia

Figure 3.16

3.2 Diversity and functions of plant stems

The basic functions of a stem are supporting and bearing leaves, buds, flowers, fruits, seeds of the plant and keeping the plant upright. Also the stem transports water and minerals throughout the plant. Most stems are found above the ground. Some stems grow underground and are known as **underground stems**.

In addition to the basic functions, stems have adapted to fulfill other functions. Let us study the diversity of stems based on their adaptations.

- Most stems produce new living tissues allowing plants to grow and reproduce. **These stems are known as propagative stems.** Given below are some examples for propagative stems (Figure 3.17, 3.18).


'Gotukola'


'Undupiyaliya'/ 'Sirupulladi'


'Ambul ambiliya'/ 'Puliyarai'

Figure 3.17 Some plants reproduced by runners/ stolon

Banana

'Kalanduru'/ 'Paalargu'

Paddy

Figure 3.18 ▲ Some plant species re-produced by Suckers

- Some plants store food in aerial stems (Figure 3.19).

Sugarcane

'Kithul'

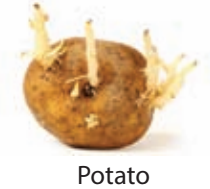
Figure 3.19 ▲ Some plants with storage stems

- Some underground stems serve the functions of storage of food perennation and sexual propagation. During the adverse seasons the aerial parts get destroyed but the underground stem survives. During favourable seasons new sprouts come out from the underground stem using stored food (Figure 3.20).

Turmeric

Ginger

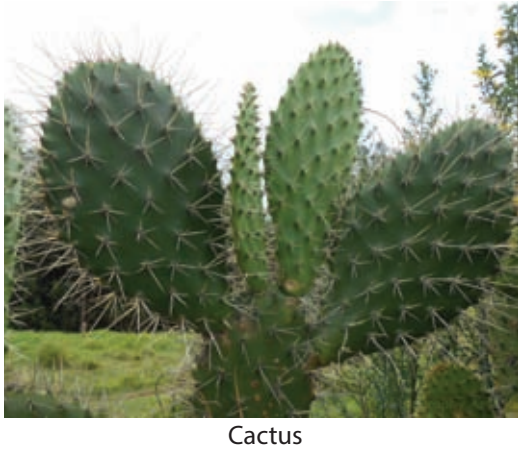
Onion



Potato

Figure 3.20 ▲ Some plants reproduced by underground stem

- Some stems are green and photosynthetic. Such stems are called **photosynthetic stems** (Figure 3.21).



Cactus

'Daluk' / 'Sathurakkalli'

Figure 3.21 ▲ Some photosynthetic stems

- Some plants fix to a support to climb up and absorb sunlight efficiently. Such stems are called **climbing stems** (Figure 3.22).

'Venival/ Maramanjal'

Beans

Figure 3.22 ▲ Some plants with climbing stems

Assignment 3.2

- Complete Table 3.2 using examples for each type of stems which have adapted to carry out the functions given below.

Table 3.2

Propagative stems	Aerial stems with food storage	Underground stems	Photosynthetic stems

3.3 Diversity and functions of plant roots

The basic function of root is to anchor the plant in the soil, absorb water and minerals. There are some roots adapted to satisfy other functions.

Other than the tap root and its branches, there are roots which arise from other parts of the plants. These roots are known as adventitious roots.

There are roots that adapted to fulfill many other functions. They are given various names.

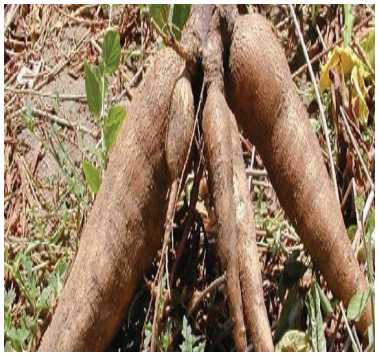
- **Tuberous roots** - The roots that are swollen due to storage of food are known as tuberous roots. Some tuberous roots allow the plant to survive in unfavourable seasons. Food can be stored either in the tap root or in adventitious roots.

  - Storage of food in tap root

Carrot Radish Beet

Figure 3.23 ▲ Some plants that store food in tap root

- Storage of food in adventitious roots


Manioc


Sweet potato


Dahlia

Figure 3.24 ▲ Some plants that store food in adventitious roots

- **Prop roots -** Adventitious roots that arise from branches. They penetrate the soil and helps to support branches.


Banyan Tree


'Rath kadol '/ 'Sen kandal'

Figure 3.25 ▲ Some plants with prop roots

- **Stilt roots -** Adventitious roots arise from the stem, grow below the ground and support the stem.


'Vetakeyya'/'Thalai'


'Rampa'


'Maha kadol'/'Perung kandal'

Figure 3.26 ▲ Some plants with stilt roots

- **Climbing /Clasping roots -** Roots that help the climbing stem/ creepers to fix to a surface/support.

Betel Pepper

Figure 3.27 ▲ Some plants with climbing roots

- **Aerial roots -** These roots absorb moisture from the atmosphere and supply the plant. These specialized roots can be found mostly in epiphytes.

Orchid Vanilla

Figure 3.28 ▲ Some plant with aerial roots

- **Respiratory roots -** These roots absorb air from the atmosphere and supply to the plant. They are specialized roots which can be found mostly in mangroves.

Sonneratia 'Maha kadol'

Figure 3.29 ▲ Some plants with respiratory roots

- **Propagative roots -** These roots produce new plants.

Curry leaves | Guava | 'Beli/Vilvam'

Figure 3.30 ▲ Some plants with propagative roots

Assignment 3.3

Collect some root specimens and study them. Consider the necessary steps that should be taken to conserve these roots.

Assignment 3.4

Plan a field visit to observe the nature and the diversity of plants. Study the adaptations of plants and relate them to their functions.

Plants play a vital role in the environment. Therefore, it is your duty to explore and collect specimens with minimum damage to the environment.

Summary

- The major parts of a plant are roots, stem, leaves, fruits and flowers.
- There is vast diversity among parts of the plants. Adaptation of plant parts to their functions is the reason for this vast diversity. There are some plant parts that exhibit special adaptations.
- The basic function of a leaf is photosynthesis. Some leaves are adapted to store food and water and also for propagation.
- The basic function of a stem is to hold leaves, flowers, fruits and transport water and minerals throughout the plant.
- Some stems are adapted for photosynthesis, to climb up, propagation and to store food.
- The basic function of roots is to anchor the plant in the soil, absorb water and minerals.
- Tuberous roots, prop roots, stilt roots, climbing roots, aerial roots and respiratory roots are adapted for special functions.
- The reason for vast diversity among plants is their functions and adaptations to survive in different environments.

Exercise

1) Write the main function of the given plant parts.

a) Plant leaves .....

b) Stem .....

c) Roots .....

2) Write the special adaptations of the following plant roots/stems/leaves.

i. Cactus
ii. Carrot
iii. Banyan
iv. Aloe
v. Sweet potato
vi. Pepper
vii. Begonia
viii. 'Navahandi'
ix. 'Niyangala'
x. Orchid
xi. Guava
xii. 'Rampa'

3) Fill in the blanks.

i) The pattern in which leaves grow on the stem is known as ……..

ii) Sugarcane, palmyrah are examples for ……. stems.

iii) The leaves of the cactus tree reduced to spines is an adaptation to minimize …….

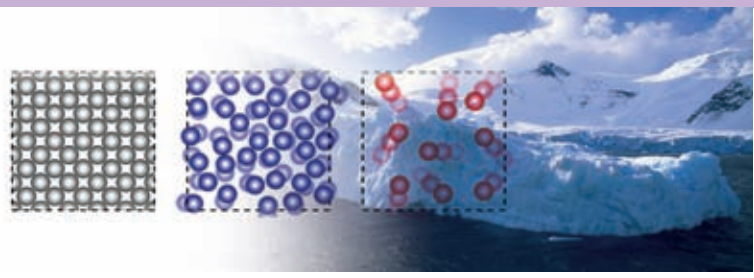
iv) Curry Leaves, beli, bread fruit trees often use the ……. for propagation.

v) Respiratory roots are specialized roots that can be seen in ……..…… plants.

Technical Terms

Diversity of leaves	-	පත්‍රවල විවිධත්වය	-	இலைகளின் பல்வகைமை
Diversity of stems	-	කඳන්වල විවිධත්වය	-	தண்டுகளின் பல்வகைமை
Diverstiy of roots	-	මුල්වල විවිධත්වය	-	வேர்களின் பல்வகைமை
Photosynthetic stems	-	ප්‍රභාසංශ්ලේෂක කඳන්	-	இலைத்தொழில் தண்டுகள்
Climbing stems	-	ආරෝහක කඳන්	-	ஏறும் தண்டுகள்
Propagative stems	-	ප්‍රචාරණ කඳන්	-	இனம்பெருக்கும் தண்டுகள்
Underground stems	-	භූගත කඳන්	-	நிலக்கீழ்த் தண்டுகள்
Tuberous stems	-	ආකන්දී කඳන්	-	முகிழுருவான தண்டுகள்
Tuberous roots	-	ආකන්දී මුල්	-	முகிழுருவானவேர்கள்
Prop roots	-	කරු මුල්	-	தாங்கும்வேர்கள்
Stilt roots	-	කයිරු මුල්	-	மிண்டிவேர்கள்
Aerial roots	-	වායව මුල්	-	காற்றிற்குரிய வேர்கள்
Respiratory roots	-	ශ්වසන මුල්	-	மூச்சுவேர்கள்
Storage roots	-	සංචිත මුල්	-	சேமிப்பு வேர்கள்
Propagation	-	ප්‍රචාරණය	-	இனப்பெருக்கம்

4 Properties of Matter



4.1 Discontinous nature of matter

The environment around us is composed of matter and energy. Recall the facts you learnt in grade 6 about matter and energy. To validate that knowledge further, do Assignment 4.1.

Assignment 4.1

Classify and tabulate following items as matter and energy.

Air, water, ball, light, bulb, sound, table, chair, electricity, heat, magnet

Table 4.1

Matter	Energy
air	light

Of the above, air, water, ball, bulb, table, chair and the magnet require space and have a mass. Such things are known as **matter**. When considering light, sound, heat and electricity, they do not occupy space and have no mass. They are considered **energy**. Components of the environment such as soil, water and rocks and the man made structures and various equipments are examples for matter.

Evidence for discontinuous nature of matter

An acceptable notion about the nature of matter was first put forward by the Greek philosopher Democritus who lived in the era 460-370 B.C. According to him, matter is made of very small particles. Later, the Greek philosopher Aristotle (384-270 B.C.) stated that matter is not composed of particles. It is said that in Athens of Greece, a public debate was held between the proponents of Aristotle and Democritus. The idea that "matter is particulate in nature" became victorious at that debate and later modern scientists confirmed experimentally the fact that matter is made up of particles. **The status matter exists as a collection of particles with spaces among them is known as discontinuous nature or particulate nature of matter.**

Matter can be classified as **solid**, **liquid** and **gas** according to its physical nature.

Various activities can be done to confirm the discontinuous nature of solid, liquid and gaseous matter.

Discontinuous nature of solid matter

Take a piece of chalk and break it into two pieces. Break one of those pieces again into two pieces. Likewise, break the pieces you get successively till you obtain the smallest possible particle.

When the initial piece was broken into two, you would have got two smaller pieces. When the chalk is broken again and again we get more and more smaller pieces. The smallest piece of chalk that we obtain like this without changing the properties of chalk is called a chalk particle. Accordingly, you would be able to imagine that a piece of chalk is formed by the union of a large number of chalk particles. The piece of chalk which is a collection of small particles has a particulate nature. There are spaces among those particles.

Let us do Activity 4.1 to investigate the discontinuity of solid matter.

Activity 4.1

You will need:- A container of water, a watch glass, blue or red ink, a few crystals of potassium permanganate, a piece of white chalk

Method:-

- Add a small amount of blue/red ink or a potassium permanganate solution to a watch glass. Take a piece of chalk and place one end of it on ink or the solution. Record your observations.

ink chalk chalk on ink

Figure 4.1

When the piece of chalk is placed on the blue/red ink or the potassium permanganate solution in the watch glass, you can see the colour soaking up through the piece of chalk. The ink is able to move up because the piece of chalk is discontinuous. It is because the piece of chalk consists of a large number of very small particles, each with the properties of chalk, and a large number of spaces through which the coloured particles can move. This activity confirms that solid matter is discontinuous.

Have you heard what happens when mercury comes into contact with items made of gold? In such an event, we will be able to observe mercury particles in the item of gold. The reason for this is the movement of mercury particles through the gold particles because gold is discountinuous. Because of this, when gold objects come into contact with mercury they get damaged.

Figure 4.2 ▲ A gold ring that came into contact with mercury

Assignment 4.2

- Plan and implement simple activities to show that solid matter is particulate in nature.

Let us next consider about the discontinuous nature of liquid matter.

Discontinuous nature of liquid matter

Take a small volume of water and divide into two portions. Divide one of them again into two portions. Likewise, divide one half again and again until you get the smallest possible volume.

Even though the small volume of water was divided into two, both volumes contain water. Even at the moment when the volume becomes extremely small after repeated divisions, water is the substance which occupies that volume. In such a way, the smallest volume of water that can be obtained while retaining the properties of water can be called a water particle. Hence, water is formed by the assembling of a large number of water particles with one another.

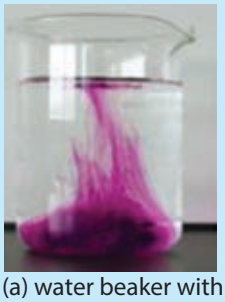
Let us engage ourselves in Activity 4.2 to look into the discontinous nature of liquid matter.

Activity 4.2

You will need:- A watch glass, a beaker with water, potassium permanganate/ coloured ink

Method:-

- Fill a beaker in half with water and put a crystal of potassium permanganate into it. Record the observations after about five minutes. Then, shake the water in the beaker gently. State the observations.
- Add a drop of coloured ink to a beaker containing water. Record the observations.



(a) water beaker with potassium permanganate

(b) water beaker with coloured ink

Figure 4.3 ▲

It can be observed that the colour of the potassium permanganate crystal placed in the beaker of water gradually spreads in water. It happens because the potassium permanganate particles move into spaces among the water particles. When a drop of ink is added to a beaker of water, the water gradually becomes coloured due to the movement of ink particles among water particles. Hence, it is clear that liquid matter also has a particulate nature.

Assignment 4.3

Plan and implement some simple activities to demonstrate that liquid matter is particulate in nature.

Discontinuous nature of gaseous matter

Let us conduct Activity 4.3 to verify that gases are discontinuous.

Activity 4.3

You will need:- Two gas jars, nitrogen dioxide gas, joss stick, a few drops of perfume

Method:-

- Fill a gas jar with brown-coloured nitrogen dioxide gas and close it with another gas jar. Record your observation after two minutes. (Do this as a teacher demonstration.)
- Light a joss stick.
- Place some perfume in a watch glass and leave for some time.
- Record observations.

When a gas jar is filled with brown nitrogen dioxide gas and an inverted gas jar containing air is placed over it, mixing of the two gases can be observed.

The reason for this movement of the nitrogen dioxide particles is the existence of spaces among the air particles.

The scent of the lighted joss stick spreads throughout the classroom. While the smell of perfume diffuses across the classroom, you would be able to see that the perfume had got removed from the watch glasses. We get its smell because its particles have moved through air and entered our nose during the spread of particles.

This leads to the explanation that gaseous matter too is particulate in nature.

Figure 4.4 ▲ Spread of nitrogen dioxide gas in gas jars

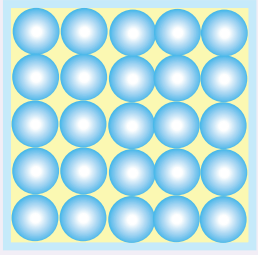
Assignment 4.4

Plan and implement with your teacher simple activities to support the fact that gaseous matter has a particulate nature.

Based on the above, we can conclude that all matter (solid, liquid or gas) is composed of particles and there are spaces among those particles. Thus, we can conclude that matter is discontinous.

4.1.1 Physical properties of matter in relation to its particulate nature

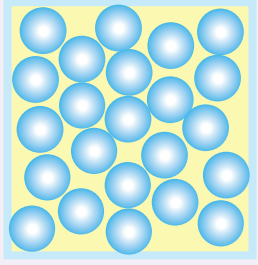
It is the difference in the organisation of particles that leads to the variation of the specific characteristics of the three states in which matter exists. This can be illustrated as follows.



Organisation of particles in a solid

Solid

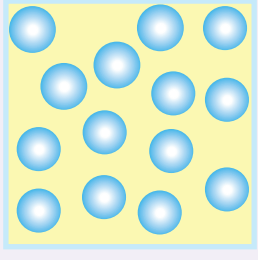
- Particles are orderly arranged.
- Particles are strongly bound to each another.
- Particles do not move relative to one another, but can vibrate in the same positions.
- Space among particles is less.



Organisation of particles in a liquid

Liquid

- Particles are not orderly arranged.
- Though, the particles are close to one another, the binding forces are not as strong as in a solid.
- The particles can move within the liquid.
- Space among particles is less, but higher than that of a solid.



Organisation of particles in a gas

Gas

- Particles are not orderly arranged.
- Binding forces among the particles are very weak.
- Particles move freely and randomly.
- Much space is left among the particles.

The reason for the variety of physical properties of solid, liquid and gaseous matter is the diversity of their prticular arrangement. Let us have a look at Table 4.2 which presents these differences.

Table 4.2

Property	Solid	Liquid	Gas
Shape	Has a definite shape	No definite shape. (Takes the shape of the occupied part in the container)	No definite shape. (Takes the shape of the occupied part in the container)
Volume	Has a fixed volume	Has a fixed volume.(Does not spread throughout the entire volume of the container)	No fixed volume. (Spreads throughout the entire volume of the container)
Compressibility	Connot be compressed easily.	Cannot be compressed easily.	Can be compressed easily.
Density	Has a high density	Has a high density	Density is low

A solid has a definite shape because the particles forming it are organised in a regular pattern and are strongly bonded. Liquids and gases lack a definite shape because their particles are not arranged orderly.

Solids and liquids have a definite volume, but gases do not have a definite volume. This is because the gas particles spread freely and occupy the entire volume of the container as the binding forces among gaseous particles are very weak.

Compression means the decrease in volume of matter by increasing pressure. Solid and liquid matter cannot be compressed easily. However, gaseous matter can be compressed easily. In order to compare the compressibility of liquids and gases let us do Activity 4.4.

Activity 4.4

You will need:- Two identical syringes, water, nitrogen dioxide gas

Method:-

- Draw water into one syringe until half of it is filled with water.
- Take an equal volume of nitrogen dioxide gas to the other syringe. (Do this as a teacher demonstration.)
- In both syringes close the open end and push the piston forward.
- In both cases compare the ability to move the piston forward.

You will note that the piston in the syringe with water cannot be pushed forward whereas the piston in the syringe with air can be pushed forward. This shows that it is difficult to compress water but air can be compressed easily. Let us find out the reason for this.

Water is a liquid. As the particles of a liquid are closely packed they cannot be brought closer by applying a force. Therefore, they are relatively difficult to compress. In a gas there are wider spaces among the particles, therefore, by applying a force the particles come closer. That is why the gases can be compressed easily.

When comparing the densities of solids, liquids and gases it is seen that solid and liquid matter have a high density but gases have a low density. Density will be studied further in a future lesson.

Solids, liquids and gases are used for various purposes depending on their properties. Some examples for the instances in which they are used are given below.

- Solids - parts of machinery, parts of vehicles, building materials, weapons
- Liquids - mercury thermometer, hydraulic jack, as a medium of transport
- Gases - inflating tyres, in pressure cookers, in hydrogen balloons, in liquid petroleum gas (LP gas) cylinders

Assignment 4.5

Make models to demonstrate the particulate nature (discontinuity) of the three states of matter.

4.2 Utilizing physical properties of matter

4.2.1 Pure substances and non pure substances

Consider a cylinder containing nitrogen gas and a cylinder containing ordinary air. The cylinder of nitrogen gas contains only nitrogen gas. The cylinder of air contains several gases such as nitrogen, oxygen, argon and carbon dioxide. On the otherhand potable water contains gases and various salts dissolved in it. But, pure water contains only water.

Let us do Assignment 4.6 to explore this further.

Assignment 4.6

- Pay your attention to the substances given in Table 4.3.
- Find out about the components in those substances and complete the table.

Table 4.3

Substance	Components	Contains one component only	Contains more than one component
air	hyrogen, oxygen, argon, carbon dioxide		✓
pure water	water	✓	
drinking water	water, various gases, dissolved in water, salts		
sugar	sugar		
salt solution	salt, water		
a piece of copper	copper		
tea	tea, water, sugar		
aluminium			
iron			
silver			

Of the substances given in the table, if you focus your attention to sugar, silver, pure water, aluminium, iron and copper, it is clear that they are composed of only one component. You may also be able to identify that the salt solution, tea and potable water contain more than one component.

Thus, on the basis of the components contained, matter can be divided into two main categories as follows.

- Pure substances - Matter that contains only one component.
- Non pure substances - Matter that contains two or more components.

Pure substances

Substances having a constant composition, that is, substances containing only one component with definite properties, are called pure substances.

Hence, sugar, copper, pure water, aluminium, silver and iron given in Table 4.3 are pure substances.

Based on the nature of the pure substances, they can be classified into two groups, **elements** and **compounds**.

Elements

Let us consider copper, aluminium, silver and iron classified under pure substances. These cannot be divided further into simpler substances.

Pure substances with definite properties which cannot be further divided by physical or chemical methods into substances are known as elements.

As at now, scientists have identified nearly 120 elements. Each of these elements has unique properties of its own.

Iron, aluminium, sulphur, carbon, oxygen, nitrogen, mercury, copper, gold, silver, lead, hydrogen and chlorine are a few examples for elements.


Sulphur


A bottle filled with chlorine gas


Iron


Copper


Carbon


Mercury


Aluminium


Zinc

Figure 4.5 ▲ Some commonly used elements

Compounds

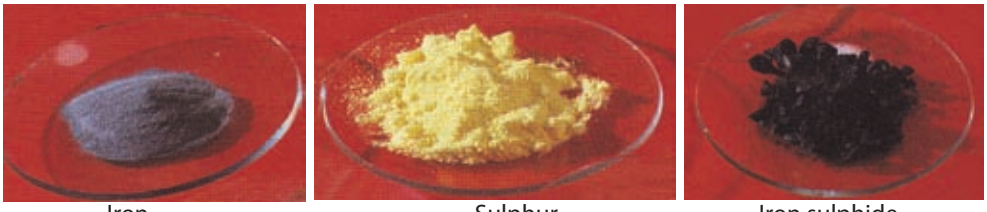
Let us consider about sugar and pure water you classified under the pure substances above. They are formed by the combination of two or more elements.

Compounds are homogeneous, pure substances in which two or more elements are chemically combined in a fixed ratio. The properties of a compound are different from the properties of the elements that contributed to form that compound.

Although, there are only 120 elements, there are millions of compounds in existence. The reason for this the possibility of combining elements in a vast multitude of ways with one another.

Let us inquire into the formation of compounds by the combination of elements chemically through the following example.

- Iron powder is a greyish black solid substance.
- Sulphur powder is a yellow coloured solid.
- When these two are mixed and heated till the solid mass melts, a black solid is formed.



Iron | Sulphur | Iron sulphide

Figure 4.6

It can be observed that the substance formed finally is different in properties from the substances that were used initially.

Now, it may be clear to you that here, the element iron has combined chemically with the element sulphur to form the black coloured compound, iron sulphide.

Given below are some compounds used in everyday life.

A fire extinguisher filled with carbon dioxide | Copper sulphate | Sodium chloride | Calcium carbonate | Sodium hydroxide | Glucose

Figure 4.7

Oxygen, nitrogen and argon present in ordinary air are elements. Nevertheless, carbon dioxide is a compound. The compound carbon dioxide is formed by the combination of the elements carbon and oxygen chemically.

Table 4.4 shows the elements contained in some compounds.

Table 4.4

Compond	Elements present
copper sulphate	copper, sulphur, oxygen
sodium chloride	sodium, chlorine
sodium hydroxide	sodium, hydrogen, oxygen
calcium carbonate	calcium, carbon, oxygen
carbon dioxide	carbon, oxygen
water	hydrogen, oxygen

You will study about non pure substances/ mixtures in a higher grade.

4.2.2 Various physical properties of matter

Different substances have different physical properties. There are a number of physical properties in matter that help to identify and distinguish them. Some of these are presented in Table 4.5

Table 4.5

Physical property	Simple introduction to the physical property
Lustre	Shiny suface due to reflection of light falling on it.
Hardness	Resistance of the material to wear and tear and scratching
Brittleness	Being subject to breaking / crushing into pieces when a force is applied
Thermal conductivity	Ability to conduct heat through the substance
Electrical conductivity	Ability to conduct electricity through the substance
Sonority	Emitting a lasting sound when struck with an object
Colour	The visual quality of the substance
Elasticity	Ability to stretch upon pulling and returning to the initial state when the force is released
Density	Mass of a unit volume
Malleability	Ability to be hammered into sheets without breaking into pieces
Ductility	Ability to be drawn into a wire without breaking
Smell	Sensation caused in the nose due to the volatility of the substance
Expansivity	Increase in volume without an increase in the mass upon increasing temperature
Texture	The rough or smooth nature felt to the touch
Melting point/ temperature	The temperature at which a substance turns from the solid state to the liquid state
Boiling point/ temperature	The temperature at which a substance turns from the liquid state to the gaseous state

Some of the physical properties of a substance can be used to examine its purity.

e.g.:- Density, melting point, boiling point

Density

What can you observe if you put a piece of iron, a cork stopper and a candle to water ? The piece of iron sinks while the cork and the candle float. The reason for this is the fact that the density of iron is greater than that of water wheres the density of cork and candle wax is less than that of water. Density is a property unique for a particular substance. **Density is the mass of a unit volume of a given substance.**

Let us do Activity 4.5 to find out whether the density of water has a constant value.

Activity 4.5

You will need:- Density bottle, distilled water, triple beam balance, fresh water, brackish water, hard water

Method:-

- Fill the density bottle (specific gravity bottle) with water, blot it and weigh using the triple beam balance.

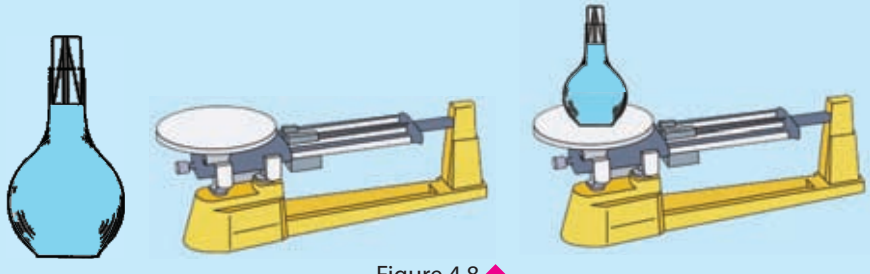


Figure 4.8

- Remove the water, refill the density bottle with distilled water, blot it and weigh.
- Compare the masses obtained.
- Repeat same experiment using the same density bottle but filling it with samples of water obtained from different environments such as fresh water, brackish water, brine and tank water and compare the masses.

Even if the masses are taken by repeating weighing several times, you will be able to see that the mass of an equal volume of distilled water takes a constant value. But the masses of equal volumes of fresh water, brine and brackish water will not be equal.

Distilled water is the water free from dissolved solids. Since, the density of pure water always takes the same value, pure water can be identified by measuring the density.

Similarly, for other pure substances, the density is a fixed value. Therefore, the purity of solids, liquids and gases can be determined by finding their densities.

Table 4.6 gives densities of some pure substances.

Table 4.6

Substance	Density/kg m^{-3}
Gold	19300
Mercury	13600
Lead	11300
Copper	8900
Iron	7700
Aluminium	2700
Water	1000

Melting point

There is a fixed temperature at which a solid turns into a liquid. This temperature is known as its melting point. Pure substances have a fixed melting point.

Let us conduct the following experiment to find out whether the melting point of pure substances has a constant value.

Activity 4.6

You will need:- A boiling tube, a beaker, some ice chips, water, a thermometer, a burner, a stand, a stirer

Method:-

- Fill about one fourth of a boiling tube with ice chips.
- Arrange the apperatus as in Figure 4.9.
- Heat till the ice melts.
- Stir the water well, using a stirer.
- Tabulate temperature against time.

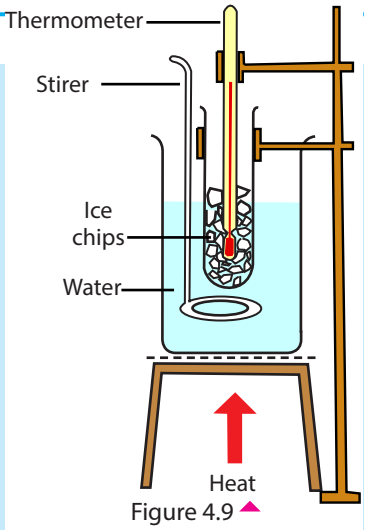


Figure 4.9

Table 4.7

Time	Temperature

You would have observed that the temperature remains constant until all the ice melts.

When heat is supplied, matter turns from the solid state to liquid state without changing its temperature. The specific temperature at which this change in state occurs is called the melting point.

In the above experiment the temperature remained at 0 °C until all the ice turned into liquid water. So, the melting point of pure water at normal atmospheric pressure is 0 °C.

Table 4.8 indicates melting points (at standard atmospheric pressure) of some pure substances.

Table 4.8

Substance	Melting point/ (°C)
Ice	0
Sulphur	132
Lead	317
Aluminium	660
Copper	1083
Iron	1539

The melting point of pure substances is a constant. Therefore, the purity of a substance can be determined by measuring its melting point.

Boiling point

There is a definite temperature at which a liquid turns into a gaseous state. That temperature is known as its boiling point. Pure substances have a constant boiling point.

In order to find out whether there is a constant value for the boiling point of pure substances let us conduct Activity 4.7.

Activity 4.7

You will need:- A boiling tube, water, a thermometer, a stand, a burner

Method:-

- Add water to a boiling tube and fix a thermometer as shown in Figure 4.10.
- Heat the water with the burner.
- Tabulate the change in temperature with time.

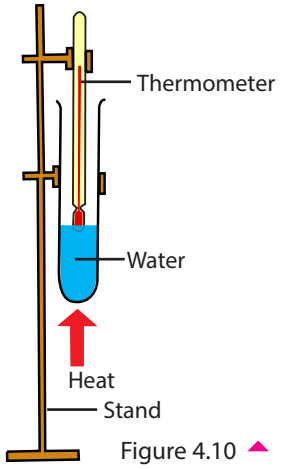


Figure 4.10

Table 4.9

Time	Temperature

When water is heated temperature rises gradually. At a certain moment, the rise in temperature stops and water turns into the vapour state from the liquid state. That temperature remains unchanged till all the water is vapourised. That temperature is called the **boiling point** of water. The boiling point of pure water at standard atmospheric pressure is 100 ^{o}C (The boiling point of a liquid depends on the surrouding pressure. If the surrounding pressure falls, the boiling point falls. The boiling point of water on a high mountain is lower than 100 ^{o}C).

If water is not pure due to the dissolving of foreign substances the boiling point (100 ^{o}C) may be elevated or lowered. From this it is clear that the boiling point is also a physical characteristic that can be used to probe the purity of a compound.

Table 4.10 shows boiling points of some substances under normal atmospheric pressure.

Table 4.10

Substance	Boiling point (^{o}C)
Ethyl alcohol	77
Water	100
Sulphur	444
Lead	1744
Iron	2900

Now let us see whether we can classify the elements that we identified as pure substances based on their physical properties.

Activity 4.8

You will need:- Iron, copper, sulphur, carbon (graphite), magnesium, aluminium, lead, zinc

Method:-

- Identify observations or simple activites appropriate to examine the properties such as metallic lustre, sonority, thermal conductivity, electrical conductivity, malleability and brittleness. You can have an understanding about this by reading the paragraph coming after this activity.
- Do the relevant activities and record the observations using a table such as Table 4.11. Place a tick (√) when the element has the relevant property and a cross (×) if it does not.

Table 4.11

Substance	Lustre	Sonority	Thermal conductivity	Electrical conductivity	Malleability	Brittleness
Iron	√	√	√	√	√	×
Copper						
Sulphur						
Graphite						
Magnesium						
Aluminium						
Lead						
Zinc						

Some methods which you can adopt to examine each physical property are described below. To investigate the physical properties you can use either those methods or other methods after discussing with your teacher.

To examine the **lustre**, you can scratch the surface of the substance with a knife or clean it with a sand paper.

The material used to examine **sonority** should be at least one millimetre thick. It can be done by striking with a metal rod or dropping on the cement floor from a suitable height.

To inquire into the **thermal conductivity** a change that can be observed during the transmission of heat has to be used. For example, drops of candle wax can be placed on rods made of different materials and melting of the wax during conduction of heat can be done.

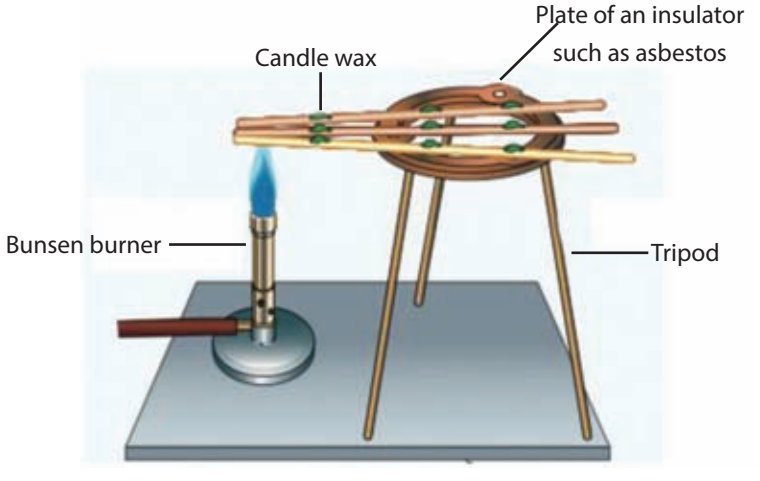


Figure 4.11 ▲ Examine thermal conductivity

In order to examine **electrical conductivity** a simple circuit should be constructed. It could be constructed on a circuit board or made by connecting the pieces of equipment using crocodile clips.

If the substance to be tested placed between A and B, conduct electricity, the bulb will light. If the substance does not conduct electricity the bulb will not light.

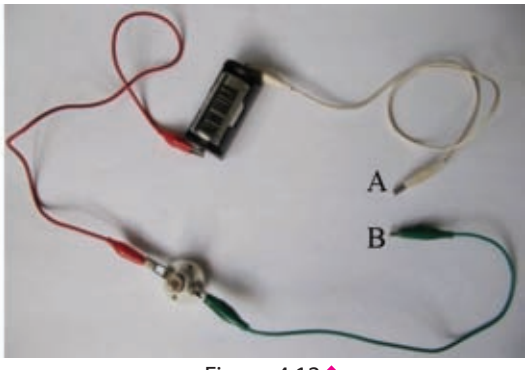


Figure 4.12

To observe malleability and brittleness a piece of the relevant substance can be struck lightly with a hammer after placing it on a fairly thick surface. If it turns into a sheet on hammering, it shows malleablilty. If it crumbles, it is a brittle substance.

Based on the results of the above experiment and other characteristics, elements can be divided into two classes, metals and non metals. The diversity of the physical properties of metals and non metals can be illustrated as follows.

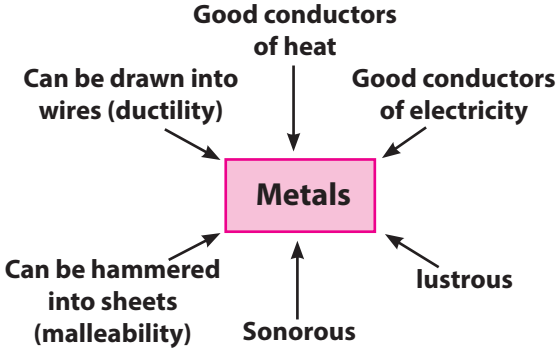


Figure 4.13

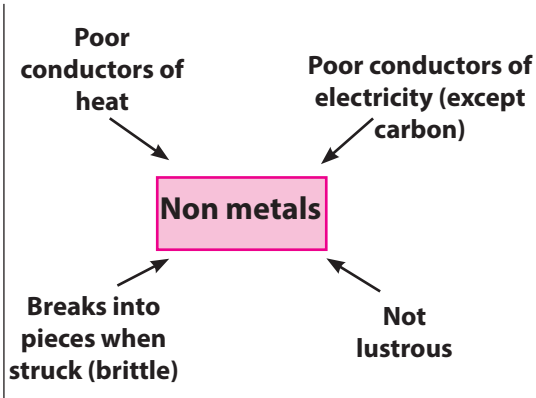


Figure 4.14

Assignment 4.7

Classify the substances given in Table 4.11 in Activity 4.8 as metals and non metals.

Based on their physical properties, elements can be classified as metals and non metals. Moreover, based on the physical state of matter they can be classified as solid, liquid and gas. Study Table 4.12 well and get to know the diversity of elements.

Table 4.12

Element	Metallic/Non metallic nature	Physical state (solid, liquid, gas)
Sodium	Metal	Solid
Aluminium	Metal	Solid
Calcium	Metal	Solid
Iron	Metal	Solid
Copper	Metal	Solid
Magnesium	Metal	Solid
Zinc	Metal	Solid
Lead	Metal	Solid
Mercury	Metal	Liquid
Carbon	Non metal	Solid
Silicon	Non metal	Solid
Phosphorus	Non metal	Solid
Sulphur	Non metal	Solid
Iodine	Non metal	Solid
Hydrogen	Non metal	Gas
Nitrogen	Non metal	Gas
Oxygen	Non metal	Gas
Chlorine	Non metal	Gas
Argon	Non metal	Gas
Bromine	Non metal	Liquid

4.2.3 Day-to-day applications of various physical properties of matter

The physical properties of matter can be usefully applied in various ways in our everyday life. Table 4.13 presents a few such instances.

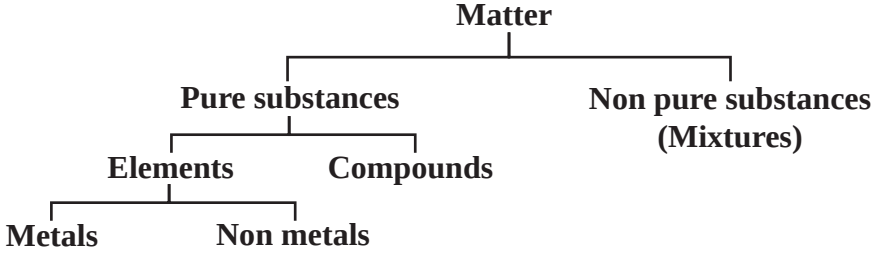
Table 4.13

Physical property of matter	Instances of application	Substance
Metallic lustre	making jewellery	gold, silver
Hardness	withstanding weight	steel rails
	cutting glass	diamonds stylets
Compressibility	storing gases in cylinders	oxygen, LP gas
Odour	detecting gas leakages	LP gas
	spreading the scent	perfumes, sweet smelling smoke
Thermal conductivity	cooking pans	aluminium
	soldering	lead
Electrical conductivity	conducting electricity	copper, aluminium cables
Elasticity	Tyres and tubes	rubber
Expansivity	measuring temperature	mercury/ alchol theremometers
	automatic electrostats	electrical appliances with a bimetallic strip
Brittleness	breaking larger pieces into smaller pieces	chemical compounds, cereals, granite, egg shells
Texture (smooth)	applying talcum powder chalk	talc (a mineral)
Texture (rough)	smoothening the surface of wood, walls etc	sand paper

Assignment 4.8

Explore information relating to the instances where the properties of matter are exploited in real life and present the information in a creative manner.

At the end of the chapter, a schematic diagram such as one given below can be constructed.



Summary

- The things that have a mass and that occupy space are known as matter.
- The making of matter from particles and the existence of spaces among them is referred to as the discontinous nature of matter.
- All three states, solid, liquid, and gas are discontinuous.
- The reason for the specific features of matter in solid, liquid and gaseous state is the diversity of the arrangement of particles in them.
- The different properties of solids, liquids and gases make them applicable for different purposes.
- Based on composition, matter can be classified as pure substances and non pure substances.
- Pure substances can further be classified into two catergories; elements and compounds.
- Pure substances with definite properties and indivisible by physical or chemical methods into substances with different properties are called elements.
- The pure substances formed by the chemical combination of two or more elements in a constant ratio are known as compounds.
- Sonority, thermal conductivity, electrical conductivity, malleability, ductility, density, melting point, boiling point, hardness, elasticity, expansivity, lustre, etc are physical properties of matter.
- In pure substances the physical properties such as density, boiling point and melting point have a constant value.
- Based on the physical properties, elements can be classified as metals and non metals.
- Various physical properties of substances are used for daily activities in life.

Exercise

01) For the following questions, select the correct answer or the most suitable answer from the responses given

01. Which of the following response contains only matter?
    1. Air, water and light
    2. Water, heat and a brick
    3. Electricity, a brick and ink
    4. A brick, ink and air

02. A property only common to solids and liquids is,
    1. having a definite shape
    2. having a definite volume
    3. the ability to compress
    4. the free movement of particles

03. When a drop of ink is added to a vessel of water, the colour of ink spreads throughout water. Which of the following response explains this observation best ?

1. Water is discontinuous
2. Ink is discontinuous
3. Water and ink are discontinuous
4. Ink is discontinous and water is continuous

04. Which of the following is a pure substance?

1. Bottled water
2. Fizzy drinks
3. Colourless toothpaste
4. Crystals of sodium hydroxide

05. The property of crumbling upon the application of a small force is called the,

1. Hardness
2. Brittleness
3. Elasticity
4. Ductility

06. Given below are three ideas expressed by three students about the masses of equal volumes of water and kerosene.

A) Their masses are equal

B) Mass of kerosene is less

C) Mass of water is greater

The correct response of these is /are

1.only A 2. only B 3. only C 4. only B and C

07. Which of the following substance is an electrical conductor?

1. Iron 2. Wood 3. Sand 4. Wax

08. What is the boiling point of pure water at standard atmospheric pressure?.

1. 0 ^{0}C 2. 30 ^{0}C 3. 100 ^{0}C 4. Between 30 ^{0}C - 100 ^{0}C

09. What is the liquid metal that conducts electricity?

1. Water 2. Mercury 3. Alcohol 4. Wine spirit

10. Some ideas expressed by students about the boiling point of a liquid are as follows.

A) It is the temperature at which a change in state occurs

B) It is the temperature at which a solid turns into a liquid without changing temperature upon heating

C) It is the temperature at which a liquid turns into a gas without changing temperature on heating.

The correct statements of the above are;

1. only A 2. only B 3. only C 4. only A and C

11. Which of the following is correct about the density of a metal?

1. It always takes a high value
2. Mostly it takes a low value
3. It takes a definite value
3. Densities of all the metals are equal

02) Place the mark √ if each of the following statements is correct and mark × if it is wrong.

01. Air does not belong to the category of matter. ( )
02. All matter has a particulate arrangement. ( )
03. Gas particles move freely. ( )
04. Sun contains only energy. ( )
05. Solids, liquids and gases can be compressed easily. ( )
06. A liquid has a fixed shape as well as a fixed volume. ( )
07. Copper is a brittle metal. ( )
08. Sulphur is an electric conductor and a non metal. ( )
09. Sonority is a property seen in most of the metals. ( )
10. All metals have malleable and ductile properties. ( )

Technical Terms

Energy	-	ශක්තිය	-	சக்தி
Matter	-	පදාර්ථය	-	சடம்
Discontinous nature	-	අසන්තත ස්වභාවය	-	தொடர்ச்சியற்ற தன்மை
Shape	-	හැඩය	-	வடிவம்
Volume	-	පරිමාව	-	கனவளவு
Compressibility	-	සම්පීඩනය	-	நெருக்கற்றகவு
Density	-	ඝනත්වය	-	அடர்த்தி
Pure substances	-	සංශුද්ධ ද්‍රව්‍ය	-	தூய பதார்த்தம்
Elements	-	මූලද්‍රව්‍ය	-	மூலகம்
Compounds	-	සංයෝග	-	சேர்வைகள்
Metals	-	ලෝහ	-	உலோகங்கள்
Non metals	-	අලෝහ	-	அல்லுலோகங்கள்
Mixtures	-	මිශ්‍රණ	-	கலவைகள்
Lustre	-	දිස්නය	-	பளபளப்பு
Hardness	-	දෘඪතාව	-	வன்மை
Brittleness	-	භංගුර බව	-	நொருங்குமியல்பு
Thermal conductivity	-	තාප සන්නායකතාව	-	வெப்பக்கடத்துத் திறன்

Electrical conductivity	-	විද්‍යුත් සන්නායකතාව	-	மின்கடத்து திறன்
Sonority	-	රැව් දෙන හඬ	-	கணிர்ஒலி
Colour	-	වර්ණය	-	நிறம்
Elasticity	-	ප්‍රත්‍යස්ථතාව	-	மீள்தன்மை
Malleability	-	ආහන්‍යතාව	-	வாட்டத்தகுமியல்பு
Ductility	-	තන්‍යතාව	-	நீட்டற்றகுமியல்பு
Smell	-	ගන්ධය	-	மணம்
Expansivity	-	ප්‍රසාරණතාව	-	விரிவு
Texture	-	වයනය	-	இழையமைப்பு
Melting point	-	ද්‍රවාංකය	-	உருகுநிலை
Boiling point	-	තාපාංකය	-	கொதிநிலை

5 Sound

Sound, we hear constantly in the environment is produced by vibrating various things. Instruments, that produce sound are called **sources of sound.**

It can be concluded that various musical instruments produce sound in various ways.

Sources of sound can be divided into three categories according to the part that vibrates when producing sound.

Figure 5.1

Some of the sounds we hear in the environment occur naturally while some others occur artificially.

Birds call

Cats mew

Figure 5.2 ▲ Several natural sounds

Sound of machines in factories

Sound of vehicles

Figure 5.3 ▲ Several artificial sounds

Artificial sounds, as well as natural sounds are produced by vibrating strings/ bars, membranes or air columns.

Assignment 5.1

- List out separately some naturally produced sounds and artificially produced sounds in the environment.
- Identify and name the part that vibrates when those sounds are produced.

Humming of bees comes from fast motion of their wings. Grass hoppers and cicadas generate their characteristic sound by rubbing the bristles on their legs

Assignment 5.2

- Make a list of some animals that generate sounds.
- Investigate the methods that they generate sounds and make a report.

Frequency of vibrations

Let us do Activity 5.1 to study further, the nature of sounds.

Activity 5.1

You will need:- An organ, a piano or a xylophone

Method:-

- Play two keys of the organ, the piano or xylophone, which are apart from each other.
- Listen to the sound and you will realise that the two sounds are different to each other.
- Now play the seven relevent keys to seven notes, which are cosecutive one at a time.
- Listen to the sound and you will realise that there is a slight difference between each note.
- Discuss the reason for that difference, you observed.

The difference in the sound you realised in the above activity is due to a quantity called frequency of vibration.

The number of vibrations of an object per unit time is referred to as the frequency of that object.

If an object vibrates 50 times a second, then it is said that, the frequency of that object is 50 Hz.

Frequency of vibrations is measured by the international (SI) unit Hertz (Hz).

Let us do Activity 5.2 to study further, the frequency of vibrations.

Activity 5.2

You will need:- Two tuning forks of long arms and short arms

Method:-

- Vibrate the tuning fork of long arms and listen to the sound carefully.
- Then vibrate the tuning fork of short arms and listen to that sound carefully (Both tuning forks should be vibrated in the same manner. Get the support of your teacher for this purpose.)
- Repeat vibrating the tuning forks several times and identify the difference of sounds.
- Record your observations.

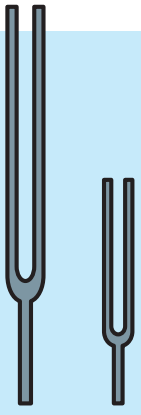


Figure 5.4
Tuning forks

Now it is clear to you that, the sound generated by a tuning fork differs according to its arm length. It is the frequency of sound that changes here.

Observe the tuning forks of different length. The frequency differ according to the length of them. The longest tuning fork has the minimum frequency. Frequency increases gradually with decreasing length. There are mechanisms in every musical instrument to change the frequency. The seven notes in music are produced by changing the frequency of vibration.

5.1 Musical instruments that produce sound by vibrating membranes

Let us construct a simple instrument that produce sound by vibrating membranes.

Activity 5.3

You will need :- A large balloon, a small plastic cup, rubber bands

Method :-

- Cut the neck of the balloon as shown in the Figure 5.5.
- Insert the plastic cup into the balloon and make it like a drum as shown in the figure. Use rubber bands where necessary to tighten the balloon membrane. Strengthen the upper edge of the cup also with a rubber band.
- Tap the drum, thus made and listen to the sound produced.
- Tighten the balloon membrane by pulling the balloon down. Tap again and listen to the sound. (Tapping should be done in the same manner at each instance.)
- Listen to the sound produced by increasing the tightness of the balloon membrane.

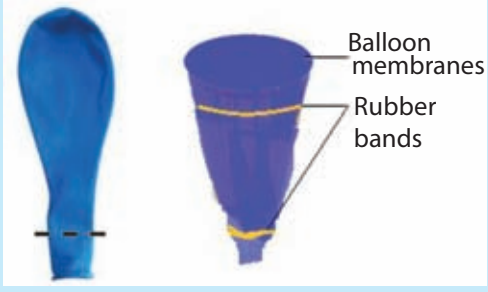


Figure 5.5

It is clear that the sound is sharp and high when the tightness of the balloon membrane is increased. The frequency of the sound produced has increased when the membrane is stretched more.

Assignment 5.3

- Make an instrument that produces sound by vibrating a membrane.
- Design a suitable way to adjust its sound and present it to the classroom.

Let us find out how the sound of a membrane vibrating instrument can be adjusted.

Activity 5.4

You will need :- A thabla

Method :-

Figure 5.6

- Play the thabla that you are provided with.
- Listen to the sound of it carefully.
- Tighten the thabla strap well by tapping gently to the pieces of wood fitted for that purpose. This will stretch the membrane to the thabla. (Get the music teacher's assistance for this)
- Play the thabla again and listen to the sound well.
- Notice the difference between the sounds in two instances.
- Identify the change of sound by playing the thabla several times, while changing the tension of its membrane.
- Record your observations.

Stretching of the membrane of thabla can be adjusted by tightning or loosening its strap. You may understand that the sound produced by the thabla is different when its skin is stretched and not stretched. It is the frequency of the sound that changes here. When the membrane is stretched, the frequency of the sound produced is high.

Assignment 5.4

- Find another instruments which produce sound when a membrane is vibrated.
- Plan and present a method to adjust their sound.
- Adjust membranes of the instruments and hear the sound well.
- Identify the difference between them and record them.

5.2 Musical instruments that produce sound by vibrating air columns

Let us do Activity 5.5 to study about the instruments that produce sound by vibrating an air column.

Activity 5.5

You will need :- Three pen tubes in different length with a close end

Method :-

- First blow the shortest pen - tube (A) and listen to the sound carefully.
- Then, blow the longer one (B) and listen. Finally, blow the longest one (C). Listen and identify the difference of sounds.
- Repeat this activity several times to identify the difference of sounds well.

Figure 5.7

You may hear that the sound produced by pen tubes of different lengths are different. Thus, it is clear that the frequency of the sound produced differs according to the length of air column vibrated.

Assignment 5.5

- Make a whistle using six one end closed pen tubes as shown in Figure 5.8.
- Blow the whistle you made rhythmically.

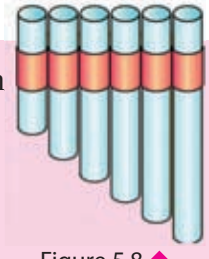


Figure 5.8

Activity 5.6

You will need :- Six tall glass tumblers of the same size, a metal spoon, water

Method :-

- Fill the six glass tumblers with water to varing heights as shown in the figure.
- Tap the edge of each tumbler with a spoon gradually, starting from the one with less water.
- Listen to the sound carefully.

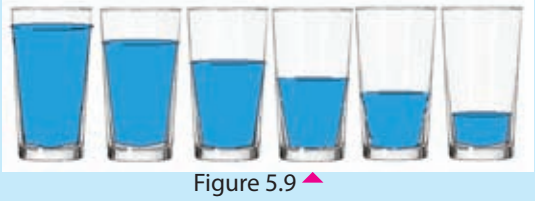


Figure 5.9

Assignment 5.6

- Make a whistle using a tender coconut leaf. Blow it while changing the length of its reeds and listen to the sound carefully.
- Record the change of sound according to change of length of the reed.

Let us find some more facts about the instruments that produce sound by vibrating a column of air.

Activity 5.7

You will need :- A flute

Method :-

- Close all the holes of the flute provided to you and play it.
- Listen to the sound carefully.
- Then, open the holes B,C,D,E,F and G gradually one at a time and blow the flute.
- Listen carefully to find whether there is a change in the sound when each hole is opened and closed.
- Record your observations

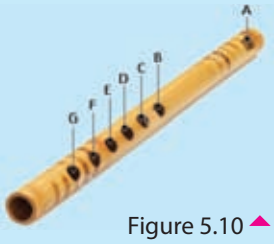


Figure 5.10

When the holes B,C,D,E,F and G are opened gradually one at a time, the length of the vibrating air column increases.

Thus, flute is a musical instrument that changes the sound with the change of the length of air column vibrated. It is played with the blow of air that vibrates the air colomn in the flute. The air pores are closed and opened with the fingers to produce different sounds in music.

Assignment 5.7

- Make a flute using a piece of PVC pipe or a piece of bamboo. Use a cork stopper to close the end of the flute.
- Try to play it rhythmically by opening and closing the holes.

5.3 Musical instruments that produce sound by vibrating strings/rods

Let us construct a musical instrument that produces sound by vibrating strings.

Activity 5.8

You will need :- A piece of plank which is about 2 feet long and 6 inches wide, empty fish can, 4 iron nails, 4 bolts, a small thin plastic sheet, 4 pieces of wire of the same metal which are 45 cm long and have different diameters.

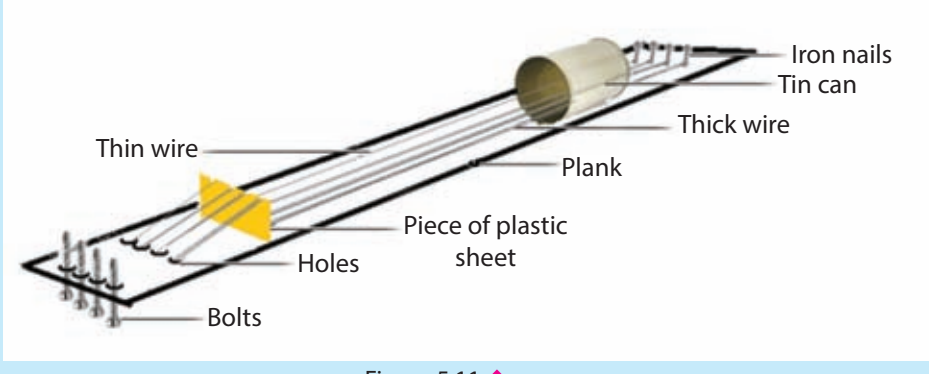


Figure 5.11

Method:-

- Fix the iron nails to the plank as shown in Figure 5.6 and tie the wires to them. Take the other ends of the wires through the holes of the tin can, fixed to the plank.
- Pass the wires through the slots made on the plastic sheet, which is placed on the plank. Send the wires through the holes, made on the plank.
- Wind the wires around the bolts which are fixed to the plank. (Ask the assistance of your teacher for this)
- Make sure that the lengths of the vibrating part of the wires and their tension can be adjusted.
- Play the instrument, you made adjusting wires and identify the change of sound.
- Record your observations.

Let us do Activity 5.9 to investigate the methods of changing the sound produced by the musical instruments with strings.

Activity 5.9

You will need :- A guitar

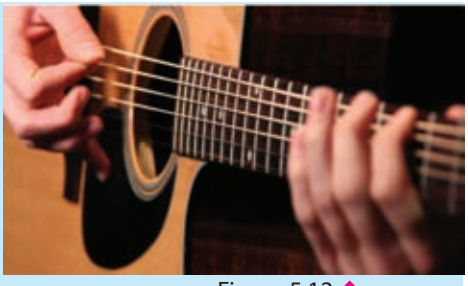


Figure 5.12

Method :- (Get the assistance of your teacher for the activity)

- Observe well, the way that wires are fixed in a guitar and the thickness of those wires.
- Then, vibrate the wires one by one starting from the thick wire.
- Listen carefully to the sound produced, when each wire is vibrated.
- Listen to the sound produced, when length and the tension of wires are gradually changed. Identify the differences.
- Repeat this procedure several times.
- Record your observations.

A sharp (high) sound is produced when short, tight, thin wires are vibrated. Sound produced by the vibration of long, loose and thick wire is not that sharp. When a guitar or a violin is being tuned, the length and the tension of the wires are changed. Sound may also be changed by the way and the speed of vibrating the strings.

Assignment 5.8

- Plan to construct a musical instrument that produces sound by vibrating strings.
- Construct the instrument planned, and play it.

Assignment 5.9

- Investigate the methods of tuning some other musical instruments that produce sound by vibrating strings.
- Tune those instruments, identify the change of sound and record the methods of tuning.

Xylophone is a musical instrument with vibrating bars. Let us study more about the sound produced by a xylphone.

Activity 5.10

You will need :- Xylophone

Method :-

- Tap gradually, one by one on the plates of the xylophone, you are provided with, (starting from the longer plate to the shorter one). Listen to the sound carefully.
- Repeat playing the xylophone by tapping the plates.
- Record your observations.

Figure 5.13

Xylophone produces sound because of the vibration of plates. Here, tapping to the shorter plates, gives higher (intense) sound than tapping to the longer plates. It is clear that the sound produced by tapping shorter plates is different to the sound produced by tapping longer plates. The frequency is changed by the change of the length of plates. As in the set of tuning forks, in the xylophone also, the frequency is highest in shortest plate and it is lowest in the longest plate.

Assignment 5.10

- Try to construct a xylophone and play it.
- Prepare a list of musical instruments that produce sound by vibrating bars or plates.
- Find and record how the sound is produced in them.

Figure 5.14

Assignment 5.11

- Construct various musical instruments with your class mates.
- Adjust the sound of those musical instruments well.
- Present a group display, using those musical instruments in your science or literary society.

Musical tones and noises

Figure 5.15 ▲ Instances where noises are produced

It is joyful to listen to playing guitar or violin or to listen to a song. Such sounds are pleasant to our ears. But the sounds coming from factories and vehicles are not pleasant. Such sounds are a nuisance to our ears.

Rhythmical sounds which are pleasant to our ears are musical tones. Such sounds are produced by methodical or formal vibrations of objects. Sounds which are unpleasant to our ears are called noises. They are produced by non formal vibrations of objects.

Even a musical tone may be unbearable to our ears, when the sound of which is very high. It depends on the relevant person.

High and noisy sounds may be harmful to ears. They disturb our day-to-day activities. It is our duty to use instruments that produce sounds without disturbing others.

Assignment 5.12

- List out some instances, where noises are produced.
- Mention the source of noise, infront of the instances you identified.
- Investigate and record the part of the source which vibrate to produce the noise.

Ancient, traditional and modern musical instruments

It is said that musical instruments had been used for the services in religious places in ancient Sri Lanka. Large drum ('daula'), double drum ('tammattama'), and trumpet are prominent among those instruments. From the ancient times, till today, those instruments are in use for the life activities of common folk, like devil dancing, chanting good will and religious worships.

Figure 5.16 ▲ Several ancient musical instruments

Low country drum, up country drum 'udekkiya', large drum ('daula'), double drum ('tammettama'), trumpet and "geta beraya" are main items in traditional musical instruments. These are used in cultural festivals.

Figure 5.17 ▲ Several traditinal musical instruments

Guitar is a very popular musical instrument among younger generation. It is used in local popular music as well as in North Indian "Ragadari " music.

There are instances in the modern world where ancient and traditional musical instruments are used along with instruments like electric organ, guitar and thabla.

Figure 5.18 ▲ Several modern musical instruments

Special importance of modern musical instruments is that a single person can fulfil the necessity of a full orchestra or a number of instruments by using a computer and a keyboard. Octopad is commonly used for rhythm playing and organ is used as a permanent keyboard instrument.

Assignment 5.13

- Collect information on ancient traditional and modern musical instruments and prepare a booklet.

Musical therapy

Music can be used to improve the quality of life. Music has an ability to heal the mental stress and give spiritual happiness to the people spending busy life. Thus, the treatment given using music is known as musical therapy.

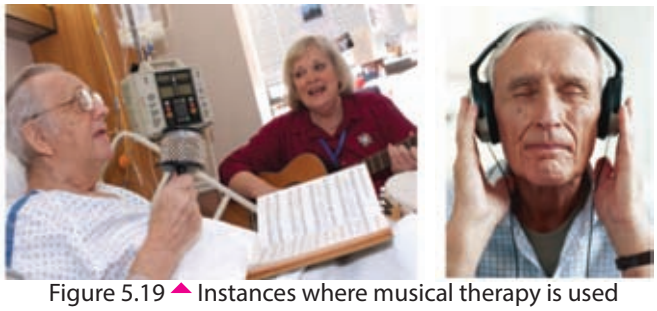


Figure 5.19 ▲ Instances where musical therapy is used

Musical therapy can be used as a method of treatment to improve physical fitness and mental integrity. It is discovered that diseases and disorders of brain and nervous system, heart failures, mental depression so on, can be cured by using this therapy.

So, training a person from his childhood to enjoy music will be helpful to develop a healthy mind.

For extra knowledge

Nowadays musical therapy is used in many countries of the world to coordinate muscle movements in sport activities like running and cycling to prepare patients for surgeries and as a healing method after surgeries.

Assignment 5.14

- Prepare a letter to a wall paper on musical therapy which can be used to develop the quality of life.

Limits of hearing

Can we hear a vibration of any frequency?

Let us do Activity 5.11 to find out about this.

Activity 5.11

You will need :- A long hacksaw blade, a G-clamp

Method :-

- Clamp the hacksaw blade to the table. Keep the free end of the blade longer. (Figure 5.20)
- Vibrate the blade and listen.
- Then reclamp the blade making its free end shorter.(Figure 5.21)
- Vibrate it again and listen.
- Discuss your observations with the teacher.

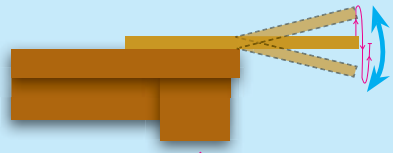


Figure 5.20

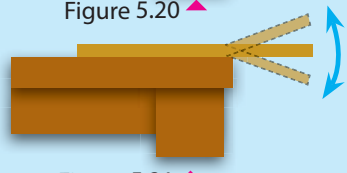


Figure 5.21

You may have experienced that no sound is heard though the longer blade is vibrating. The reason is that the human ear is not sensitive to the sound produced by the vibration of that blade.

We cannot hear the sound of any frequency. We can hear only the sound of a certain range of vibrations. That range we can hear is known as the **limits of hearing**.

The limits of hearing or the range of frequency of sound that human ear can hear is 20 Hz to 20 000 Hz. Man cannot hear the sounds of frequency which is less than 20 Hz or more than 20 000 Hz.

Dog can hear the sounds of the frequency which is less than 20 Hz or more than 20000Hz. Bat can hear the sounds of higher frequencies up to 70 000 Hz.

Summary

- Instruments that produce sound are called sources of sound.
- All natural and artificial sounds are produced by vibrations of strings/rods, membranes, bars or air columns.
- Number of vibrations of a sound source, produced in unit time is called the frequency.
- International (SI) unit of frequency is Hertz.

- Man cannot hear the sound of any frequency. There is a limited range of frequency of sound that man can hear.
- The limits of hearing of human is 20 Hz - 20 000 Hz.
- There are three categories of musical instruments, according to the part that vibrates when producing sound.
- Sound produced can be changed by adjusting the vibrating parts of musical instruments.
- Sound can be used to improve the quality of life.

Exercise

1. Select the appropriate words from those given in the brackets to fill in the blanks.

   II. Sound of high frequency can be obtained, when the wires of a violin are ..... (longer/ shorter).

   III. Sound of high frequency can be obtained, when the membrane of a drum is ..... (thinner/ thicker).

   IV. Human ear is ..... (sensitive/ not sensitive) to any range of sound.

   V. Vibrations of an object are ..... (regular/ irregular) when musical tones are produced.

2. Categorize the musical instruments given below, into three groups according to the way they produce sound.

   Double drum ('Tammattama'), 'Udekkiya', 'Horanewa', 'Sitar', 'Trumpet', 'Conch shell' ('Hak gediya'), 'Violin', 'Cello', 'Mandolin', 'Large drum' ('Daula')

3. If the statements given below are correct, put a (√) and if they are wrong put a (×) in the brackets.

IV. When the wires of a violin are tightly stretched, it gives a low tone. ( )

V. When the length of the vibrating air column is less, it gives a sound of low frequency. ( )

VI. Xylophone is an instrument that produces sound by vibrating bars. ( )

VII. Some mental depressions/conditions of patients can be cured by musical therapy. ( )

Technical Terms

Sources of sound	-	ධ්වනි ප්‍රභව	-	ஒலி முதல்
Vibration	-	කම්පනය	-	அதிர்வு
Artificial sounds	-	කෘත්‍රිම ශබ්ද	-	செயற்கை ஒலி
Natural sounds	-	ස්වාභාවික ශබ්ද	-	இயற்கை ஒலி
Adjusting	-	සීරුමාරු කිරීම	-	சுரத்தை மாற்றுதல்
Limitation of hearing	-	ශ්‍රව්‍යතා සීමාව	-	கேள்தகு எல்லை
Tuning fork	-	සරසුල	-	இசைக்கவை
Musical sounds	-	සංගීත නාද	-	சங்கீத ஒலி
Noises	-	ඝෝෂා	-	இரைச்சல்
Musical therapy	-	සංගීත චිකිත්සාව	-	இசைச் சிகிச்சை

6 Magnets

There are instances where magnets are used in our day-to-day life. Recalling what we have learnt about magnets in grade 6, let us do Activity 6.1 to identify materials that show magnetic properties.

Activity 6.1

You will need:- A permanent magnet, a piece of thread, a stand, various types of coins, an iron nail, a brass nail, a pebble, a plastic ruler, several other things that you like to test for magnetic properties.

Figure 6.1

Method:-

- Hang the magnet on the stand using the piece of thread as shown in Figure 6.1
- Bring each substance, one at a time, close to the magnet, when the magnet remains still. Enter the observations in Table 6.1

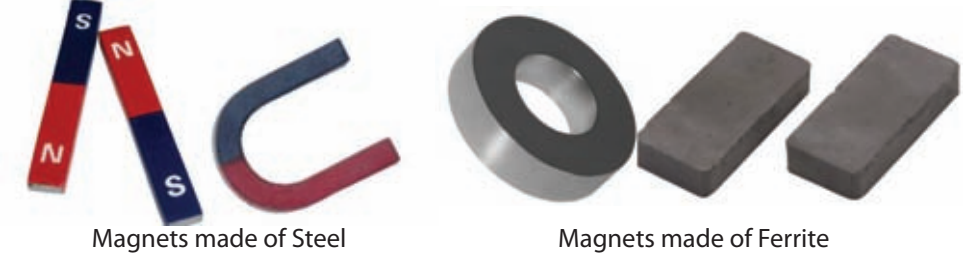
Table 6.1

Material	Attract / does not attract to the magnet
1. Plastic ruler	Does not attract.

It will be clear to you that only certain materials attract towards magnets. **Materials which attract towards magnets are known as magnetic materials.**

Metals such as iron, nickel, chromium and alloys like steel and ferrite are magnetic materials.

Alloy ferrite is used to make more powerful magnets.



Magnets made of Steel Magnets made of Ferrite

Figure 6.2 Magnets made of various materials

Magnetic property or magnetism is a property of some materials.

6.1 Poles of a magnet

Let us do Activity 6.2 to study further how magnetic power exists around a magnet.

Activity 6.2

You will need :- A bar magnet, iron filings, a thin polythene sheet or a polythene bag, a sheet of paper

Method:-

- Cover the bar magnet completely with the polythene bag.
- Heap iron filings on the sheet of paper.
- Dip the magnet on the heap of iron filings.
- Take the magnet out of the heap of iron filings and observe the pattern of iron filings attracted to the magnet.

Regions where iron filings are thickly attracted can be easily identified. Magnetic power is concentrated in these regions.

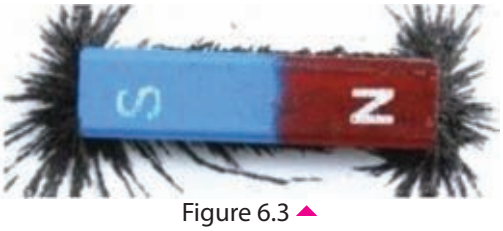


Figure 6.3

Regions of a magnet, where magnetic power is concentrated are called magnetic poles. There are two of them.

- North pole (N)
- South pole (S)

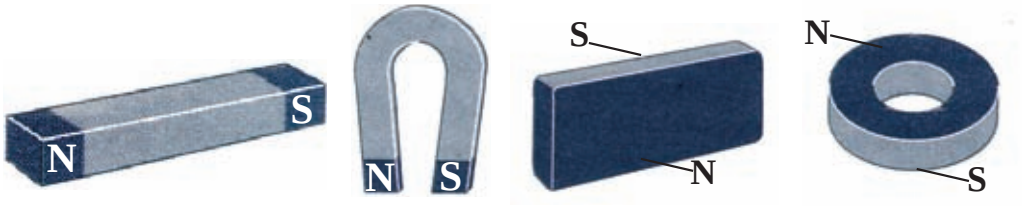


Figure 6.4 How poles are located in different types of magnets

Identifying magnetic poles

We have learnt earlier that north and south poles are marked in most of the magnets. Now, let us consider how the poles of a magnet can be identified when they are not marked.

Figure 6.5 ▲ Magnets with poles marked

Figure 6.6 ▲ A magnet on which poles are not marked

Let us do Activity 6.3 to study the methods of identifying the poles of a magnet.

Activity 6.3

You will need : - A magnet on which poles are not marked, a magnet on which poles are marked, a compass, a piece of thread, a stand, a piece of cork or a piece of styrofoam, a basin of water, two watch glasses

Method : -

- Let us find out various methods to identify the poles of a magnet using given materials. Following methods can be tried out for this.

Figure 6.7 ▲ Using a compass

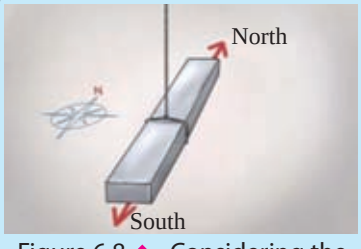


Figure 6.8 ▲ Considering the direction that a magnet turns, when it is hung by a thread.

Figure 6.9 ▲ Considering the direction, that magnet turns, when it is floated on water using a piece of cork or styrofoam.

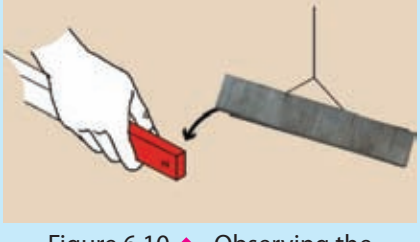


Figure 6.10 ▲ Observing the attraction or repulsion when a magnet with known poles is brought closer

Figure 6.11 ▲ Observing the direction that the magnet turns when it is kept on a watch glass and moved freely on another watch glass

Investigate whether there are methods, other than those mentioned, to identify the poles of a magnet.

6.2 Magnetic field of a magnet

Let us do Activity 6.4 to find out about the area that magnetic power is distributed around a magnet.

Activity 6.4

You will need : - A bar magnet, iron filings, a piece of cardboard

Method : -

- Spread a thin layer of iron filings on the sheet of cardboard.
- Gently place the sheet of cardboard on the bar magnet.
- Tap on the sheet of cardboard gently.
- Observe the pattern in which iron filings are arranged.
- Can you suggest the reason for the arrangement of iron filings on the sheet of cardboard, according to a pattern?

Let us do Activity 6.5 to study the magnetic field around a bar magnet.

Activity 6.5

You will need : - A bar magnet, iron filings, A test tube of the size to insert the magnet, a beaker of tall form, glycerine or coconut oil

Method : -

- Fill the beaker with glycerine or coconut oil mixed with iron filings.
- Insert the bar magnet into the test tube and dip it slowly in the beaker.
- Observe the pattern of iron filings arranged around the magnet.

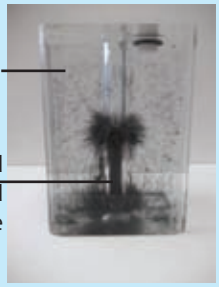


Figure 6.12 ▲ A bar magnet dipped in glycerine mixed with iron filings

It can be observed that iron filings are arranged in a pattern, within a certain area around the magnet.

Area that the magnetic power is spread around a magnet is called the magnetic field of that magnet.

Imaginary lines used to denote the magnetic power around a magnet are known as magnetic field lines.

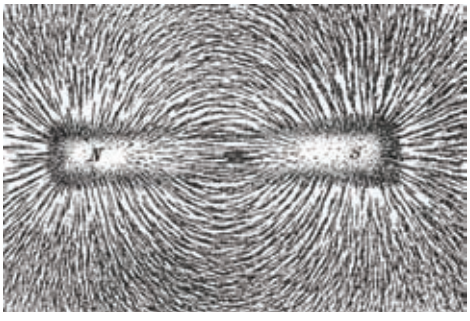


Figure 6.13 ▲ How iron filings are arranged around a bar magnet

Let us do Activity 6.6 to demonstrate the magnetic fields between magnetic poles.

Activity 6.6

You will need : - Two short bar magnets, a styrofoam board of A4 size, 4 pieces of cardboard of A4 size, binder gum, iron filings

Method : - • Carve two grooves in the styrofoam board.

- Insert two short bar magnets into the grooves, so that like poles are directed against each other, as shown in Figure 6.14.

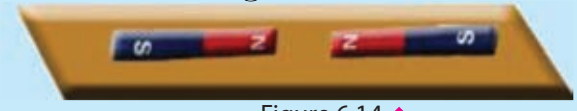


Figure 6.14 ▲

- Place one piece of cardboard on the styrofoam board.
- Spread a thin layer of iron filings on the cardboard.
- Tap gently to a corner of the cardboard sheet.
- Observe the pattern in which iron filings are arranged.
- Apply a layer of binder gum on another cardboard sheet and allow it to dry.
- Place the side of the cardboard applied with gum, on the pattern of iron filings and press gently.
- Take away the cardboard sheet applied with gum and observe. The pattern of magnetic field lines are imprinted on it.
- Now change the poles of one magnet so that the set-up is changed to demonstrate the magnetic field between unlike magnetic poles. (Figure 6.15)

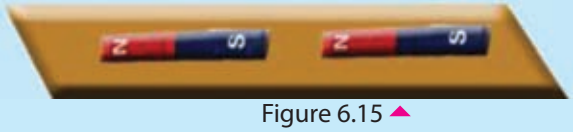
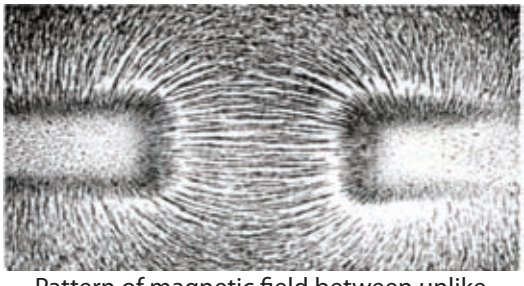


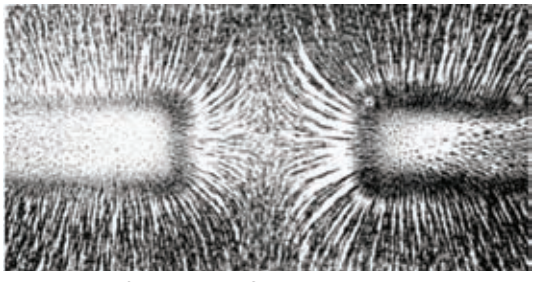
Figure 6.15 ▲

- Repeat the above steps and obtain the pattern of iron filings corresponding to the magnetic field between two unlike poles.
- Exhibit your creations in the classroom.

It may be clear to you that iron filings are arranged around a magnet along the patterns of magnetic field lines.



Pattern of magnetic field between unlike poles.



Pattern of magnetic field between like poles.

Figure 6.16 ▲ Pattern of magnetic field lines between magnetic poles

6.3 Compass

You may have heard that an instrument called compass is used to find the direction. Compass was invented by Chinese about thousand years ago. Today various types of compasses are in use. A compass is made from a magnetic needle (this is like a small magnet) which can freely float on a liquid or turn round on a pivoted point.

Figure 6.17 ▲ Types of compasses

Let us do Activity 6.7 to make a simple compass.

Activity 6.7

You will need : - A large needle, a cork bung, a small knife, a bar magnet, a plastic basin full of water, red paint.

Method : -

- Magnetize the needle by contact method using the bar magnet.
- Cut a thin slice of the cork bung and fix the needle on it. (Figure 6.17)
- Float the slice of cork, with the needle on the basin of water.
- Test whether the floating needle is always turned in the same direction.
- Colour the end of the needle, which always turns to the geographical north with red paint.
- What you have constructed is a simple compass.
- Modify your compass to make it more attractive.

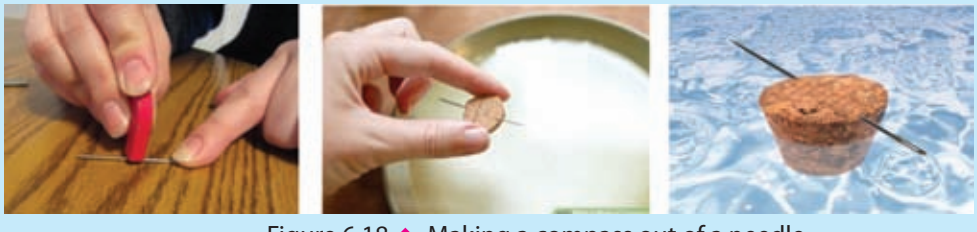


Figure 6.18 ▲ Making a compass out of a needle.

Figure 6.19 ▲ Several compasses constructed in various ways

When a compass is kept near a magnet, the needle turns along the direction of the magnetic field. Therefore, the magnetic field of a magnet can be identified, using a compass.

Let us do Activity 6.8 to identify the direction of magnatic field using a compass.

Activity 6.8

You will need : - A bar magnet, a compass, a sheet of white paper

Method : -

- Place the bar magnet on the sheet of white paper.
- Draw the outline of the magnet on the paper, using a pencil.
- Label the north and south poles of the magnet on the paper.
- Place the compass on the paper as shown in Figure 6.20 and mark the positions of the compass needle.
- If you are unable to find several compasses, you can use the same compass for each location.
- Try to build up the pattern of the magnetic field by connecting the positions of the compass needle.

Figure 6.20 ▲ Positions of a compass needle around a bar magnet at various locations

Magnetic field lines of a permanent magnet direct from North pole to South pole.

Hence, **the direction of magnetic field is from North pole to South pole.**

The Figure 6.21 illustrate the arrangement of magnetic field lines around a bar magnet.

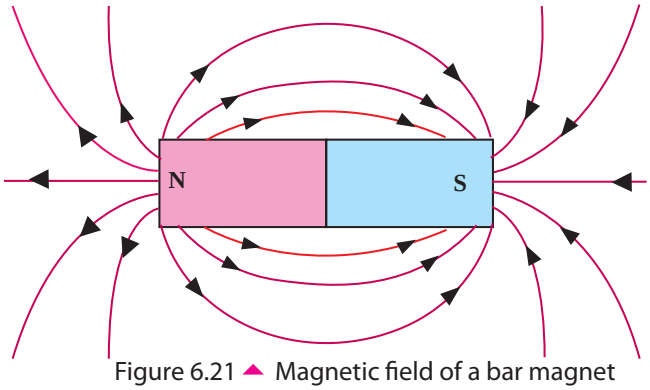


Figure 6.21 ▲ Magnetic field of a bar magnet

6.4 Geomagnetism

You know that north - south directions of the earth can be identified using a compass. When a compass is kept horizontally near the surface of the earth, its needle turns along the north-south direction.

Let us do Activity 6.9 to find the direction of the magnetic field of the earth.

Activity 6.9

You will need : - Two compasses, a bar magnet, a piece of thread, a stand

Method : -

- Hang one bar magnet horizontally on the stand, using the piece of thread.
- Keep the bar magnet, hung on the stand, and two compasses about two meters apart from each other.
- Take another bar magnet and bring one of its poles closer to each compass and to the magnet hung on the stand.
- Record your observations.
- Take away the bar magnet and observe the directions of the poles of compass needles and the bar magnet which is hung.
- Repeat the activity, changing the locations of compasses.
- Discuss the reasons for the observations in the classroom.

Figure 6.22 ▲

The compasses and the magnet which is hung turned when another magnet is brought closer to them. Thus it is clear that magnets and compasses turn, when they are under the influence of a magnetic field.

When bar magnets and compasses are free from the influence of other magnets, their north poles always turn to one direction and south poles to the opposite direction.

Though the position of bar magnets and compasses are changed, their poles turn to the same directions. The reason for this is the existence of a large magnetic field around the earth through north and south poles.

This magnetic field existing near the earth is known as geomagnetism.

Liquified metal currents circulate around the axis of the earth, because of the high temperature at the core of the earth. The magnetic field of the earth is the result of the electric currents thus generated.

When a compass or a magnet is kept freely near the earth, its north and south poles are directed along the magnetic field of the earth.

The direction that the north pole of a magnet or a compass, kept in that manner is known as the magnetic north of the earth.

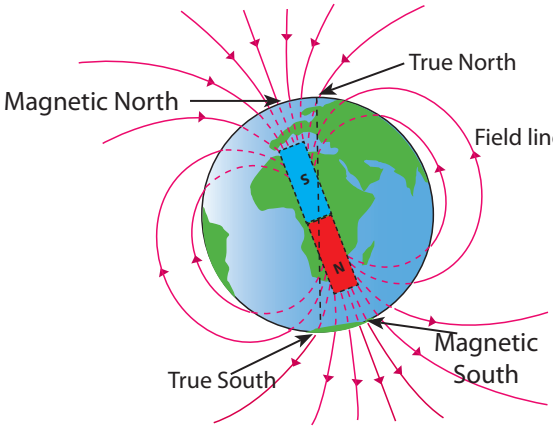


Figure 6.23 ▲ How earth's magnetic field is located

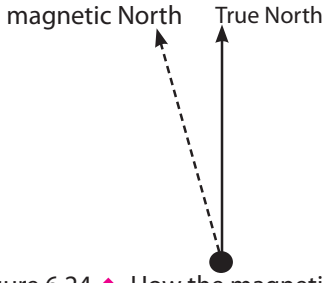


Figure 6.24 ▲ How the magnetic North and real North are denoted on a map

There is a little difference between the real north and the magnetic north of the earth. The magnetic north lies a few degrees north west from the real north.

6.5 Temporary magnets and permanent magnets

Two types of magnets can be identified when considering the uses of magnets.

- Permanent magnets
- Temporary magnets

Let us do Activity 6.10 to understand more about permanent magnents and temporary magnets.

Activity 6.10

You will need : - Iron nail or iron rod of about 2 inch length, two meters of insulated copper wire of 32 SWG, two dry cells, cellotape, a bar magnet, few file clips or pins, a switch

Method : -

- Wind the insulated copper wire of 32 SWG, around the iron nail or iron rod, to make a coil.
- Scrape both ends of the coil and connect it to the dry cells.
- Bring the coil close to the file clips while supplying electrcity and see what happens.
- Disconnect the electrical supply and bring the coil close to the clips, again
- Bring the bar magnet close to the clips and see what happens.
- Discuss your observations in the classroom.

Figure 6.25 ▲ File clips are attracted when electricity is supplied

Figure 6.26 ▲ File clips fall off (do not attract) when electrical supply is disconnected

Figure 6.27 ▲ File clips are attracted to a permanent magnet

A set-up that becomes a magnet, only when electricity is supplied is known as an **electromagnet.**

In an electromagnet, magnetic power remains only when electricity is supplied. Therefore, they are called **temporary magnets.**

Magnetic power remains for a long time in bar magnets. Therefore, they are called **permanent magnets.**

Making a permanent magnet

Magnets of various shapes and sizes are used for various purposes. Let us consider how these magnets are constructed.

Materials that show magnetic properties are used to make magnets. Steel, ferrite and soft iron are some magnetic materials which are used to make magnets. Various materials are used to produce various types of magnets.

Magnetic power is not retained in soft iron for a long time. Therefore, soft iron is used to make electromagnets and other temporary magnets.

Magnets, in which magnetic power is retained for a long time, are known as permanent magnets. Steel or ferrite is used to make permanent magnets. Ferrite is used to make more powerful permanent magnets.

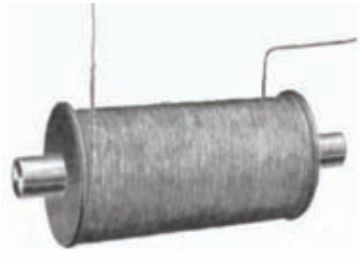


Figure 6.28 ▲ An electromagnet

Figure 6.29 ▲ Permanent magnets made of steel

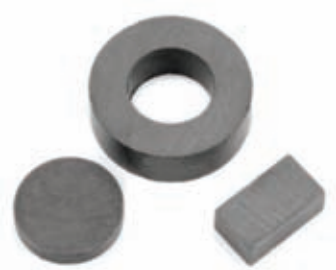


Figure 6.30 ▲ Permanent magnets made of ferrite

Construction of permanent magnets using magnetic materials can be done in two ways.

1. Electrical method
2. Contact method

Let us do Activities 6.11 and 6.12 to make magnets using electrical method and contact method.

Activity 6.11

You will need :- Iron nail or iron hacksaw blade of 2 inches, two meters of insulated copper wire of 32 SWG (Standard Wire Gauge), two dry cells, cellotape, a piece of cardboard, few file clips

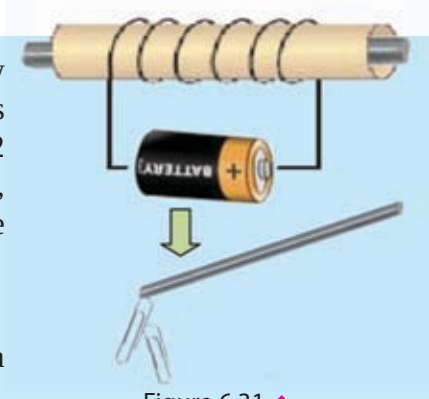


Figure 6.31 ▲

Method : -

- Make a 5 cm long tube (about the size of a pencil) using the piece of cardboard.
- Wind the copper wire of 32 SWG, around that tube to make a coil.
- Bring the iron nail close to the file clips to check whether it has magnetic power.
- Then insert the iron nail into the cardboard tube.
- Scrape both ends of the coil and connect it to the dry cell and supply the current several times to the circuit.
- Take the iron nail/ iron hacksaw blade away and observe while bringing it close to the file clips.
- Discuss your observations in the classroom.

The electric current should be supplied several times to the circuit for a long time until permanent magnetism is observed.

Activity 6.12

You will need : - A steel needle or steel hacksaw blade of two inches, a few file clips, a bar magnet

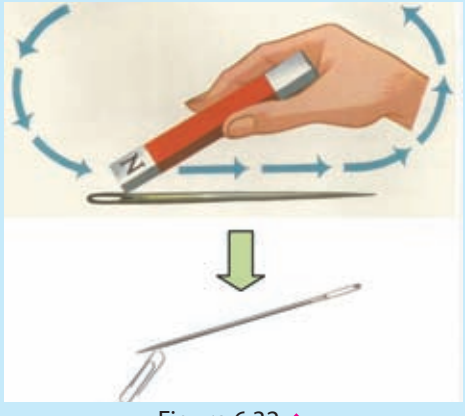


Figure 6.32

Method : -

- Bring the needle/hacksaw blade close to the file clips to check whether it has magnetic power.
- Now, place the needle horizontally on a table.
- Place one end of the bar magnet on the needle and drag it along the same direction as shown in Figure 6.32.
- Repeat this process several times.
- Now bring the needle/hacksaw blade close to the file clips and see what happens.
- Discuss your observations in the classroom.

It will be clear to you that a permanent magnet can be made using electrical method and contact method according to Activities 6.11 and 6.12.

Does the magnetic power of permanent magnets retain forever ? The answer is 'No'. The magnetic power of permanent magnets are lost due to various reasons. Some of the reasons are given below.

- Ageing
- Being subjected to high temperatures
- Being subjected to strong magnetic fields
- Being subjected to vibrations

Let us do Activity 6.13 to test how magnetic power is lost.

Rubbing should be continued for a longtime until permanent magnetism is observed.

Activity 6.13

You will need : - Three identical iron nails magnetized by a permanent magnet, a few pins, a bunsen burner, a hammer, a pair of crucible tongs, a strong permanent magnet

Method : -

- Bring the pins close to each magnetized iron nail, separately, and note down the maximum number of pins attracted to each nail.
- Subject each nail to each of the following treatments.
  - (a) Vibrate by hammering.
  - (b) Heat to a high temperature.
  - (c) Move to and from close to the strong magnet.
- Bring the pins close to each nail again and count the number of pins attracted to each nail. Fill Table 6.2.

Figure 6.33 ▲ Heating strongly

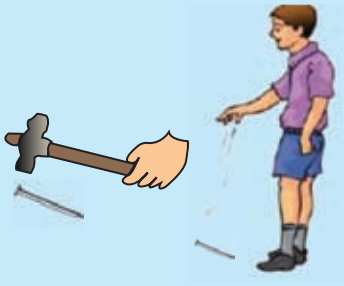


Figure 6.34 ▲ Subjected to vibrations

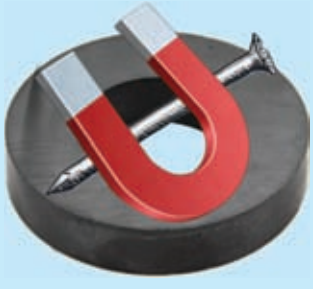


Figure 6.35 ▲ Subjected to strong magnetic fields

Table 6.2

Action done	Number of pins attracted before action	Number of pins attracted after action
Hammering		
Heating		
Subjecting to strong magnetic fields		

It may be clear to you that magnetic power fades off because of vibrations, temperature and being subjected to strong magnetic fields. Magnetic power also fades due to ageing. Magnets should be stored in an orderly manner without being subjected to vibrations, temperature and strong magnetic fields to maintain magnetic power for a long time.

Storage of permanent magnets

Magnetic power of a permanent magnet can be protected for a long time, if it is stored in such a way that its magnetic field does not scatter.

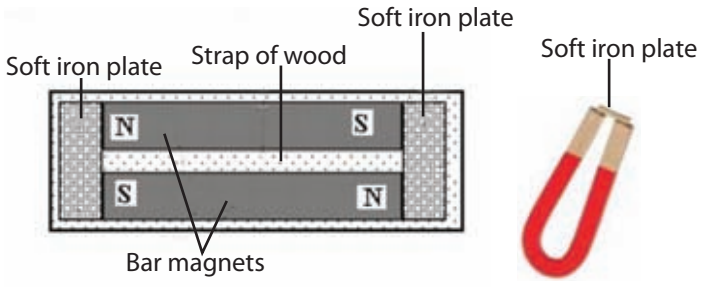


Figure 6.36 ▲ How magnets are stored

Use of permanent magnets

There are various equipments found in day-to-day life, where permanent magnets are used.

Assignment 6.1

List out instances where permanent magnets are used.

Check whether permanent magnets are used in the following instances.

In loud speakers and speakers

In small electric motors

In some door locks

Bags

In some toys

In compasses

In pencil boxes

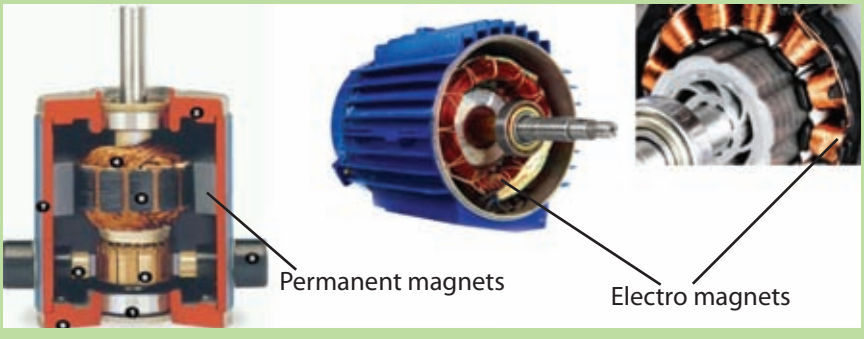
Stickers on refrigerators

Phone covers

Figure 6.37 ▲ Some applications of permanent magnets

For extra knowledge

There are permanent magnets as well as electro-magnets found in most of the small electric motors. But there are some motors only with electro-magnets.



Summary

- Magnetism is a property of some materials.
- Materials which attract to magnets are magnetic materials.
- Iron, nickel, chromium, steel and ferrite are some examples for magnetic materials.
- The area that the magnetic force exists around a magnet is called the magnetic field.
- Imaginary lines used to denote the influence of magnetic field are known as magnetic field lines.
- The direction of magnetic field is from the north pole to the south pole.
- A compass is important to detect magnetic fields.

- Terminals of a magnet, where magnetic force is concentrated are called magnetic poles.
- There is a magnetic field on the earth. It is known as geomagnetism. When a compass is placed near the earth the direction that its pointer indicates is the direction of earth's magnetic field.
- The direction indicated by the compass is the magnetic north. It lies a little north-western to the real north.
- Permanent magnets are made of steel and ferrite, and temporary magnets are made of soft iron.
- Contact method and electrical method are used to make permanent magnets.
- Power of a magnet may wear off with time, because of high temperature, strong vibrations and the influence of strong magnetic fields.
- Power of a magnet can be retained for a long time by proper storage.
- Permanent magnets and electromagnets are widely used in day-to-day life.

Exercise

1. Select the appropriate words from the brackets and fill in the blanks of the paragraph given below.

(Soft iron, magnetic materials, magnetic poles, magnetic field lines, ferrite, magnetic field).

Materials that show magnetic properties are called ..... . The best material to make permanent magnets is ..... . To make temporary magnets, ... is commonly used. The area in which magnetic forces exist is called ..... . Influence of a magnetic field can be observed using ..... . The area on a magnet, where the magnetic forces are concentrated is known as the ..... .

2. Given below is a rough sketch of a pencil box that closes with the help of a magnet. Suggest a method to test whether the magnet is fixed on the box or on the lid.

3. A student who checked some magnets in the school laboratory found out that their magnetic force is worn out. Give three reasons for that.

4. Explain scientific reasons for the following.

(a) North pole of a bar magnet, hung freely by a thread is directed towards north.

(b) A piece of iron is attracted towards a magnet, but a piece of copper is not.

5. An iron rod, placed on a table was contacted several times with a bar magnet. Then, it was observed that pins and small pieces of wire are attracted to the iron rod.

(a) Give reasons for the above incident.

(b) What is the term used for the above process?

(c) Suggest another method to get the same result without using a permanent magnet.

Technical Terms

Magnet	-	චුම්බක	-	காந்தம்
Permanent magnet	-	ස්ථිර චුම්බක	-	நிலையான காந்தம்
Magnetic field	-	චුම්බක ක්ෂේත්‍රය	-	காந்தப்புலம்
Geomagnetism	-	භූ චුම්බකත්වය	-	புவிக்காந்தவியல்
Compass	-	මාලිමාව	-	திசைகாட்டி
Electromagnet	-	විද්‍යුත් චුම්බක	-	மின்காந்தம்
Magnetic pole	-	චුම්බක ධ්‍රැව	-	காந்தமுனைவு
Magnetic materials	-	චුම්බක ද්‍රව්‍ය	-	காந்தத்திரவியம்
Steel	-	වානේ	-	உருக்கு
Ferrite	-	ෆෙරයිට්	-	பெரைற்று
Soft iron	-	මෘදු යකඩ	-	மென்னிரும்பு
North pole	-	උත්තර ධ්‍රැවය	-	வடமுனைவு
South pole	-	දක්ෂිණ ධ්‍රැවය	-	தென்முனைவு

7 Measurements Associated with Electricity

Electricity is one of the main sources of energy used in day-to-day life. Recalling what we have studied about electricity in lower grades let us do Activity 7.1.

Activity 7.1

You will need:- Two dry cells, a torch bulb, a switch, a bulb holder, connecting wires

Method:-

- Prepare a circuit to light the torch bulb using the given items.
- Switch on your set-up and observe what happens.
- Draw the set-up you prepared using circuit symbols.
- Mention the positive and negative terminals of the cells correctly on the diagram you draw.

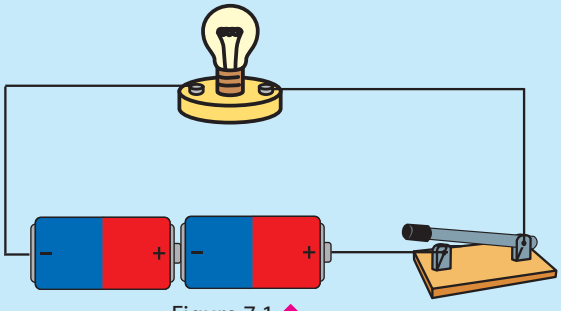


Figure 7.1

- Discuss the reason for the illumination of bulb.

The electric current produced in the cells when the switch is closed flows through the conductors of the circuit. The bulb is illuminated because current flows through it.

Flow of electrical charges through a closed circuit is known as an electric current.

7.1 Electric current

Let us do Activity 7.2 to study the flow of electric current through a conductor.

Activity 7.2

You will need:- Two dry cells, a switch, a small motor, connecting wires

Method:-

- Prepare the circuit as shown in Figure 7.2
- Connect the parts as indicated in Table 7.1 and switch on the circuit.
- Record your observations.

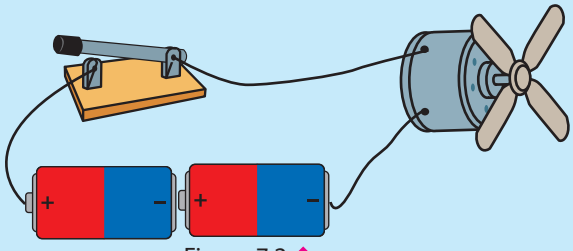


Figure 7.2

Table 7.1

Step	Observations	Observations after changing the terminals of cells
1. Connect the electric motor	It rotates to one direction	.....

- What happens when terminals of cells are changed ?
- What can be concluded according to your observations ?

The direction of the current flow, changes when the terminals of the cells are changed. The reason for the change of rotational direction of the motor is the change of the direction of current.

- There is a definite direction for the flow of electric current.
- Conventionally, it is considered that current flows from the positive terminal to the negative terminal.

A center-zero galvanometer or a center-zero ammeter/ milliammeter can be used to identify the direction of an electric current.

Figure 7.3 A galvanometer

Figure 7.4 A milliammeter

Let us do Activity 7.3 to study further about the direction of current.

Activity 7.3

You will need:- An ammeter or center-zero milliammeter, an electric motor, a dry cell, a switch

Method:-

- Prepare the circuit as in Figure 7.5.
- Operate the circuit and observe what happens.
- Interchange the terminals of the cell and observe again.
- Draw diagrams for each instance and mark the direction of the current flow.
- Discuss the reason for your observations.

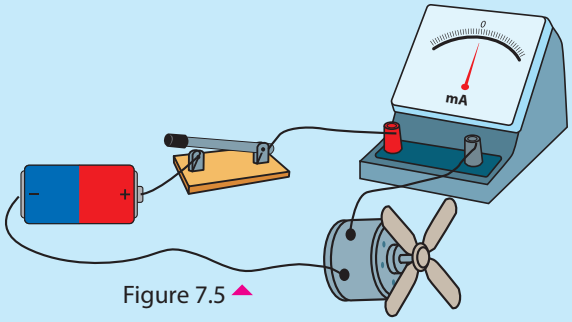


Figure 7.5

It is clear that, when changing the connecting terminals to the battery, the direction of motion of ammeter-indicator and the rotational direction of the motor are changed. The reason for this is the change of the direction of current.

Measuring the electric current

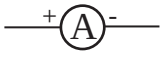
Physical quantities are measured in various instances. For this purpose various measuring equipment and various units are used. Electric current is also a physical quantity. Let us investigate how electric current is measured.

Symbol for electric current - I
International unit (SI) for electric current - Ampere
Symbol - A

Sub units are used to measure small currents. Two such sub units are given below.

- Milliampere - mA
- Microampere - μA

1000 mA - 1 A
1000 μA - 1 mA

Equipment used to measure current - Ammeter
Symbol - 

Milliammeter or microammeter can be used to measure small electric currents.

There are two terminals, positive and negative, in ammeter and milliammeter. Usually the positive terminal is red and negative terminal is black.

- When an ammeter is used in a circuit the terminals should be connected correctly.
- To measure the current, ammeter or milliammeter is connected **in series** to the circuit.

Figure 7.6 ▲ Ammeter

Figure 7.7 ▲ Milliammeter

Let us do Activity 7.4 to measure the current flowing through a circuit.

Activity 7.4

You will need:- Two dry cells, six torch bulbs, bulb holders, connecting wires, switches, an ammeter, a milliammeter

Method:-

- Prepare the circuit as in Figure 7.8.
- Connect the milliammeter to the circuit.
- Measure the current flowing through the bulb while it is illuminating.
- Draw the circuit, to which the milliammeter is connected, using symbols.
- Connect the ammeter instead of the milliammeter and take the readings again.
- Connection of which instrument makes it easier to take the readings ? Is it ammeter or milliammeter ?
- Discuss the reason for your answer in the classroom.

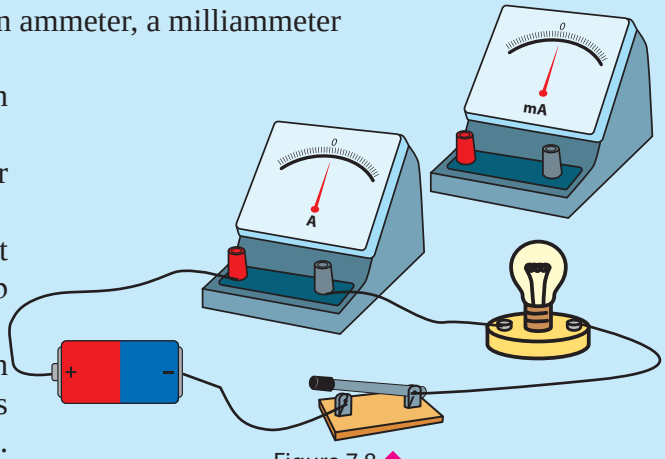


Figure 7.8 ▲

The electric current flow through the above circuit is lesser than one amphere (1A). Therefore, it is suitable to use miliammeter to measure small currents. Ammeter is suitable to measure large currents, while milliammeter is suitable to measure small currents.

Let us consider another factor, essential for flowing of electric current through a conductor.

7.2 Potential difference

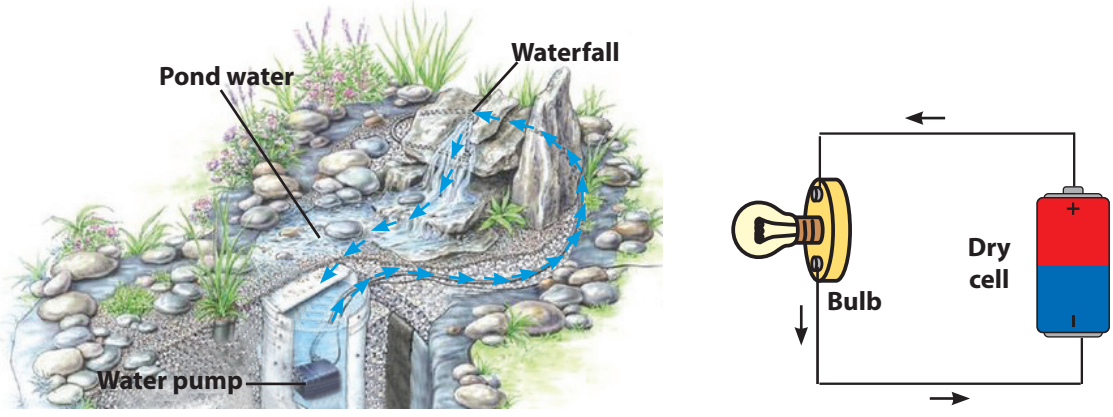


Figure 7.9

You may have seen ponds and waterfalls designed in modern houses, which function with the help of water pump. Pond water has less potential energy. But when water is pumped up to the waterfall more potential energy is stored.

The process of electric circuit takes place in the same manner. Dry cell provides electric potential energy to electric chargers. Positive (+) terminal has higher potential than the negative (-) terminal.

This difference of electric potential energy between the two terminals of the cell is called voltage or potential difference.

Electic current flows from a higher electric potential to a lower electric potential.

The voltage between positive terminal and negative terminal of electric cells and batteries is marked on them.

Assignment 7.1

- Collect as many as possible electric cells and batteries used commonly.
- Observe how the positive and negative terminals and the voltage values are marked on them.
- Prepare a table of the cells you collected and their voltages.

Figure 7.10 ▲ How voltage is marked on some cells

Measuring the potential difference

Symbol for potential difference	-	V
International unit (SI) for potential difference	-	Volt
Symbol	-	V
Equipment used to measure potential difference	-	Voltmeter
Symbol of voltmeter	-	+V-

There are positive and negative terminals in voltmeter as well as in ammeter. Usually, positive terminal is red and negative terminal is black.

Voltmeter is connected parallelly to the circuit to measure the potential difference between two points.

Figure 7.11 ▲ Voltmeter

Let us do Activity 7.5 to identify the voltages of some cells and batteries which are commonly used.

Activity 7.5

You will need:- Several dry cells, a button cell, a voltmeter, connecting wires

Method:-

- Observe how the voltages are marked on the cells and batteries you collected.
- Connect the cells or batteries to the circuit you made as shown in Figure 7.12
- Measure the voltage between the terminals of the cells or batteries using the voltmeter.
- Compare the values obtained by measuring and the values mentioned.
- Tabulate your observations.

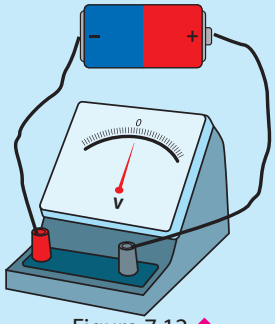


Figure 7.12

Table 7.2

Cell/ Battery	Voltage (V)
Dry cell	
Lead acid accumulator	
Button cell	

The voltage of a normal dry cell is 1.5 V. The voltage between the terminals of a car battery containing six cells is 12 V.

Let us do Activity 7.6 to measure the potential difference between two points of a circuit, using a voltmeter.

Activity 7.6

You will need:- Two dry cells, a torch bulb, a bulb holder, a small electrical motor, a voltmeter, connecting wires, a switch

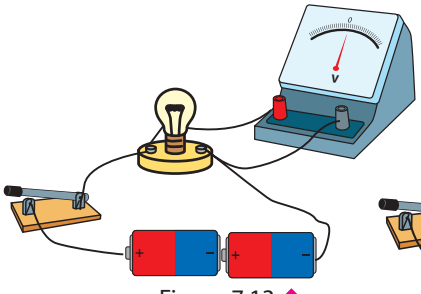


Figure 7.13

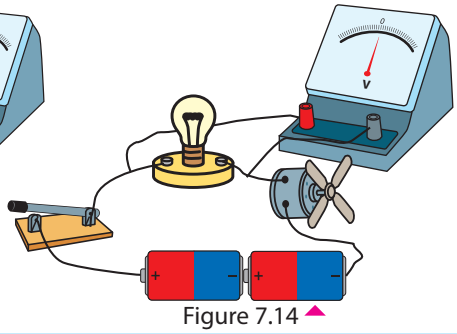


Figure 7.14

Method:-

(A)

- Build a circuit to light the bulb, using the bulb, two dry cells, and a switch.
- Connect the voltmeter correctly to measure the potential difference between the two ends of the bulb.
- Measure and record the potential difference between two ends of the bulb
- Draw the diagram of the circuit you built using symbols.

(B)

- Remove the bulb and connect the electrical motor to the circuit.
- Switch on the circuit and measure the potential difference between the terminals of the motor.

(C)

- Connect both, the bulb and the motor to the circuit as shown in Figure 7.14
- Measure separately the potential difference between the terminals of the bulb and the motor, using the voltmeter.

Now you have the ability of measuring the potential difference between two points of a given electrical circuit.

There are instances, in day-to-day life where accurate measurements of current and voltage have to be taken. Some such instances are given below.

1. To make sure, voltages, supplied to houses and factories are of the accurate voltage.
2. To detect defects of electrical appliances by measuring the current they consume.
3. To take measurements associated with electricity in power houses and electrical generators.
4. To identify whether the parts of electrical appliances are functioning properly when repairing.

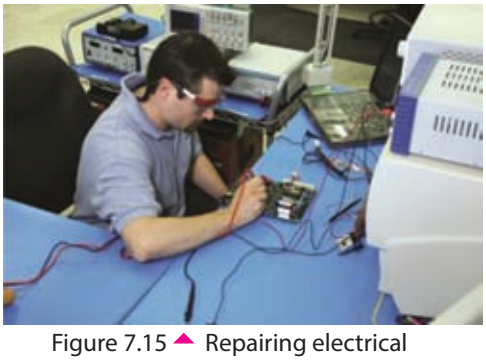


Figure 7.15 ▲ Repairing electrical appliances

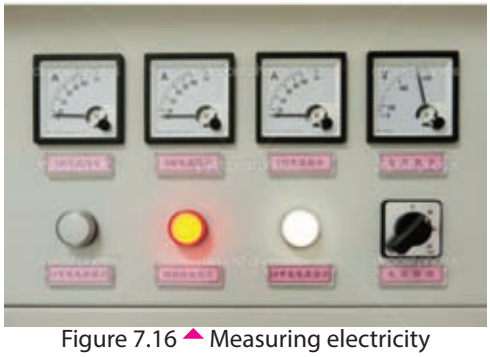


Figure 7.16 ▲ Measuring electricity in power houses and electrical generators

For extra knowledge

Very sensitive voltmeters and ammeters, assembled using digital technology, are in use currently. They are very high in sensitivity. Reading has been given on the board digitally. Therefore it is easy to use.

Modern voltmeters and ammeters assembled using digital technology

7.3 Resistance of a conductor

We have already observed that a current flows when a potential difference is applied to the ends of a conductor. Let us find out further, whether there are any other factors affecting the flow of current through a conductor.

Activity 7.7

You will need:- Two dry cells, an ammeter, a torch bulb, a bulb holder, a switch, three wires of iron, nichrome and copper of the same length (about 50 cm) and same diameter

Method:-

- Prepare a circuit as shown in the figure.
- Connect each piece of wire, separately to A and B terminals and switch on the circuit.
- Record the observations in Table 7.3
- Discuss the reasons for your observations in the classroom.

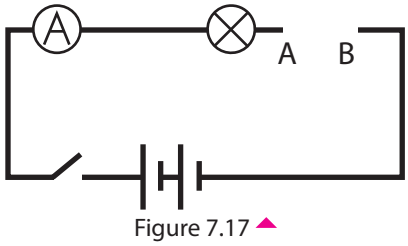


Figure 7.17

Table 7.3

Type of wire	Nature of illumination of the bulb	Ammeter reading (Ampere)
1. Copper	Illuminate brightly	.....
2. Iron	.....	.....
3. Nichrome	.....	.....

The reason for the difference in illumination of the bulb is because of the current flowing through the circuit changes depending on the type of conductor used.

- Electric current flowing through a conductor depends on the material that it is made of.
- The reason is that the obstacle for flowing of electric current is different from conductor to conductor.

The obstacle caused by a conductor to the flowing of current through it is called the resistance of that conductor.

Symbol used to denote resistance - R

Unit of measuring resistance - Ohm (Ω)

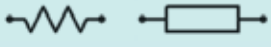
When the resistance of a conductor increases the current flowing through it decreases.

For your attention

- Resistance is a very useful factor to control the current flowing through a conductor.
- Current flowing through a conductor can be controlled by changing its resistance.
- Components called resistors, produced to various values of resistance are connected to circuits to control the current flow.
- Mostly the value of a conductor is mentioned on it according to a colour code system.

Electrical parts that possess the property called resistance are known as resistors. Some of those components are given in Figure 7.18.

Figure 7.18 ▲ Various types of resistors

Symbols for resistors 

Now you may understand that the current flowing through a circuit can be reduced by connecting resistors to increase resistance of the circuit.

Summary

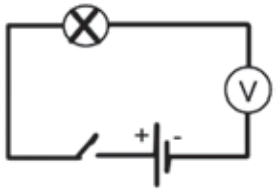
- The flow of electrical charges through a conductor is known as an electric current.
- Unit of measuring current is Ampere. The equipment used for that is ammeter.
- Ammeter should be connected in series to the circuit. The terminals also should be connected correctly.
- There should be a potential difference between two points of a circuits, for the flow of current.
- Potential difference between the two terminals of an electric source is known as its voltage.
- Unit of measuring potential difference is Volt and the equipment used is voltmeter.
- To measure the potential difference across a part of a circuit the voltmeter should be connected in parallel to it.
- Obstruction of electric current flow through a conductor is known as its resistance.
- Unit of measuring resistance is Ohm.
- Resistors of various values can be used to change the current flowing through a circuit.

Exercise

1) Complete the following paragraph using suitable terms for the blanks.

Electric current is a flow of ..... through a closed circuit. Always electric current flows from a high ..... to a ..... electric potential. ..... terminal is the place of a cell, where electric potential is high and ..... terminal is the place where it is low.

2) Figure below shows a set-up prepared by a student to measure the potential difference between two ends of a bulb.



1. Is the circuit suitable for the purpose?
2. Give reasons for your answer.
3. If there is any defect, correct it and draw the circuit again.
4. Mention two facts, that should be considered when connecting a voltmeter to a circuit.

3) Given below is a circuit prepared by a student to rotate a cardboard disc using an electric motor.
To decrease the rotational speed of this motor;

1. What property of the circuit should be increased?
2. Suggest a method to do it.

4) List out three instances in day-to-day life where measuring voltage and current is important.

Technical Terms

Electric current	-	විද්‍යුත් ධාරාව	-	மின்னோட்டம்
Electricity	-	විද්‍යුතය	-	மின்சாரம்
Electric potential	-	විද්‍යුත් විභවය	-	மின் அழுத்தம்
Voltage	-	වෝල්ටීයතාවය	-	வோல்ற்றளவு
Resistance	-	ප්‍රතිරෝධය	-	தடை
Resistor	-	ප්‍රතිරෝධක	-	தடையி
Circuit	-	පරිපථය	-	சுற்று
Conductor	-	සන්නායකය	-	கடத்தி
Voltmeter	-	වෝල්ට්මීටරය	-	வோல்ற்றுமானி
Switch	-	ස්විචය	-	ஆளி

8 Changes in Matter

8.1 Physical changes and chemical changes

Tear a paper into small pieces. Burn another piece of paper.

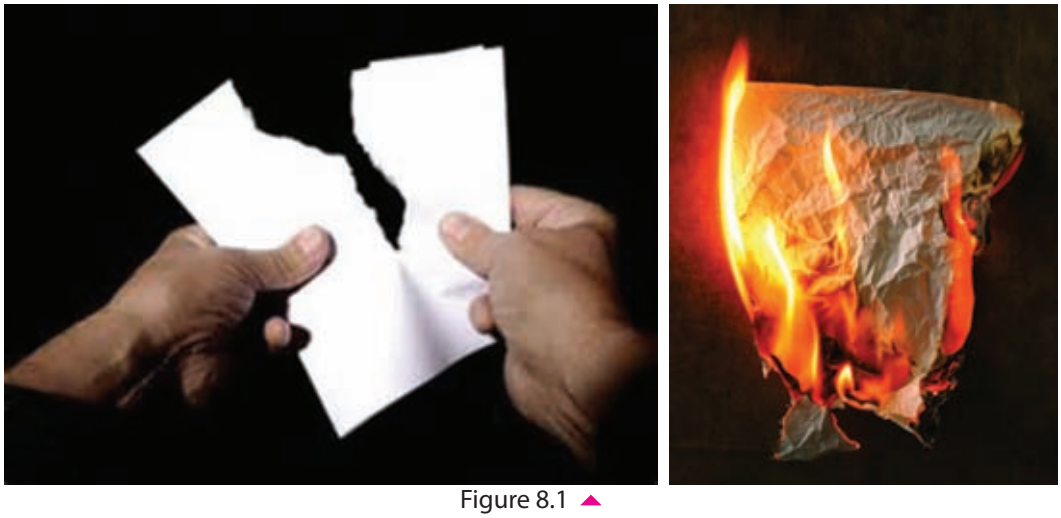


Figure 8.1

Can you explain the difference between these two changes?

Though the paper is torn into pieces, it is still a paper. So, when tearing a paper its composition is not subjected to any change. Something which is not a paper cannot be formed by tearing the **paper**. Therefore, such changes are known as **physical changes**.

Changes in which the composition of matter does not change, even though its nature of existence changes, are called physical changes.

However, when the paper is burnt, ash and smoke are formed. There the composition of the paper changed and new substances are formed. Such changes are known as **chemical changes**.

Changes in which the composition of matter forming new substances are known as chemical changes.

Let us engage in Activity 8.1 to study the nature of physical changes.

Activity 8.1

You will need:- A beaker, water, salt, tripod, spirit lamp/ bunsen burner

Method:-

- Take 250 ml beaker and add about 50 ml of water into it.
- Add about one teaspoon of powdered salt into it and dissolve thoroughly.
- Keep a wire gauge on a tripod and place the beaker on it.
- Heat the beaker using the spirit lamp/bunsun burner until water is completely vapourised.
- Record your observations.

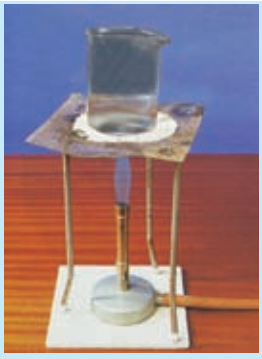


Figure 8.2

A residue can be seen at the bottom of the beaker. That residue is the salt that was previously dissolved in water. From this it is clear that the change happening during the dissolving of salt in water is a physical change.

Let us do Activity 8.2 to investigate the nature of chemical changes.

Activity 8.2

You will need:- A magnesium ribbon, a candle or a spirit lamp

Method:-

- Take a magnesium ribbon and clean it well.
- Burn it by holding to the flame.
- Record your observations.

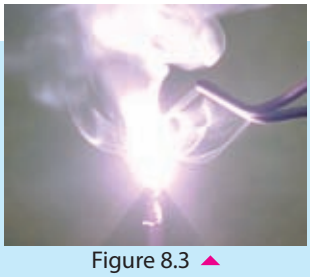


Figure 8.3

Before burning, the magnesium ribbon had a metallic lustre.
When held to the flame, it burnt with a bright flame leaving a white powder. Here, the composition of magnesium has changed and a new substance has formed. Therefore, burning of the magnesium ribbon is a chemical change.

Like this, the changes we experience in our day-to-day life can be divided into two types, physical changes and chemical changes. Engage in Assignment 8.1 to reinforce your knowledge in this regard.

Assignment 8.1

Classify the following changes as physical changes and chemical changes.

- Melting of solid wax
- Vapourisation of water
- Rusting of iron
- Melting of ice
- Breaking granite into pieces
- Burning camphor
- Burning firewood
- Lighting a cracker

8.2 Changes of state as physical changes

Let us do Activity 8.3 to gain an understanding about the changes of state.

Activity 8.3

You will need:- A beaker, a tin lid, a bunsen burner, a glass plate, a tripod, a wire gauge, a crucible, a glass funnel, boiling tubes, surgical spirit, water, a piece of wax, naphthalene, iodine

Method:-

Do the activities as indicated in Table 8.1 and record relevant observations.

Table 8.1

Activity	Observation
1. Place the piece of wax in a boiling tube and heat. Observe. Allow to cool and observe again.	
2. Put some pieces of ice into a beaker and heat. Observe. Continue heating even after the piece of ice completely turns into water. Make your observations. Hold the plate of glass over the beaker when water boils. (Do as a teacher demonstration)	
3. Put a few pieces of iodine into a crucible and heat. Hold an inverted funnel a little above the crucible.	

You would have observed that the wax melted when it was heated in a boiling tube. You would have also observed that liquid wax turns into solid when it is allowed to cool. When a solid substance is heated, it turns into the liquid state at a certain temperature. The transition of a substance from the solid state to the liquid is called **melting** or **fusion**. Transition of a substance from the liquid state to solid state is called **freezing**.

You would have observed that ice turns into water. Ice is a substance that exists in the solid state. Water is a liquid. The conversion of a substance from the solid state to liquid state is also a change of state and it is known as fusion. When that water is heated further water vapourises. The change of a liquid into a gas is known as **vapourisation**. When water boils, formation of droplets of water on the glass plate can be observed. These droplets were formed by the cooling of steam. The conversion of a substance that exists in the gaseous state into liquid state is called **condensation**.

When crystals of iodine were heated in a crucible, you would have seen that iodine turned directly into a gas. When that iodine gas was brought into contact with a glass surface, crystals of iodine can be seen on the surface from this, it is clear that

when iodine vapour cools it directly turns into solid iodine without becoming a liquid. The turning of a solid into vapour without passing through the liquid state is also a change of state. It is known as **sublimation**.

During a change of state no new substances are formed by changing the composition. Therefore, the changes of state are physical changes.

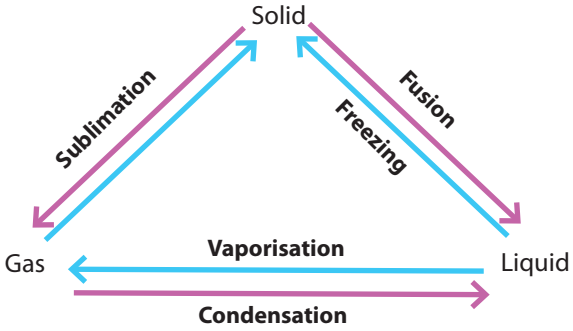


Figure 8.4

8.3 Chemical changes

So far we have discussed about the nature of physical changes. When a physical change occurs, a change in the composition of the substances does not occur.

But when chemical changes occur, new substances are formed.

Let us do Activity 8.4, 8.5, 8.6 and 8.7 to study the nature of chemical changes further.

Activity 8.4

You will need:- Lead nitrate, a boiling tube, a bunsen burner

Method:-

- Take about 1g of lead nitrate to a boiling tube.
- Heat the boiling tube using the bunsen burner.
- Record your observations.

When white lead nitrate is heated a brown coloured gas is evolved leaving a red coloured powder in the boiling tube. Since, the composition of lead nitrate has changed this is a chemical change.

Activity 8.5

You will need:- Copper sulphate, an iron nail, a boiling tube, a thermometer

Method:-

- Add water and copper sulphate crystals to the boiling tube and prepare a light blue solution.
- Put the cleaned iron nail into it.
- Record your observations.

When a cleaned iron nail is placed in a copper sulphate solution you would observe that the blue colour of the solution decreases, a reddish brown subtance deposits on the nail and at the bottom while the temperature rises.

Activity 8.6

You will need:- A solution of copper sulphate, a solution of sodium hydroxide, two test tubes

Method:-

- Mix the copper sulphate solution with the sodium hydroxide solution.
- Record your observations

When the copper sulphate solution is added to the sodium hydroxide solution, a formation of a light blue solid can be observed. Such solids are called precipitates.

Activity 8.7

You will need:- Dilute hydrochloric acid, a zinc granule, a boiling tube

Method:-

- Add a little dilute hydrochloric acid to the boiling tube.
- Add the piece of zinc into it.
- Record your observations.

When a granule of zinc is added into hydrochloric acid, we see that zinc dissolves and a gas is liberated.

Pay your attention to the above activities. In all of them new substances are formed. You already know that in chemical changes new substances are formed. In the above activities, identify the observations which testify the formation of new substances and complete Table 8.2.

Table 8.2

Reaction	Observations in support of the formation of new substances
1. Heating lead nitrate	Formation of a red powder Evolution of a brown coloured gas
2. Putting an iron nail into a copper sulphate solution	
3. Adding copper sulphate solution to sodium hydroxide solution	
4. Adding a zinc granule to hydrochloric acid	

Based on the observations made with regard to the chemical reactions stated in this chapter before, some of the following can be given as evidences in support of the fact that a chemical reaction has taken place in the above activities.

- Evolution of gases
- Change in colour
- Change in temperature (exchange of heat)
- Formation of precipitates
- Production of sound/light
- Production of an odour

The formation of a new substance having a different composition or several new substances by one or more substances undergoing change is known as a chemical change or a chemical reaction.

Recall the burning of magnesium again. Magnesium is a metal with a silvery lustre. Upon heating, it combines with oxygen in the air and forms a white powder. That powder is known as magnesium oxide.

The substances that get subjected to change during a chemical reaction are called reactants.

Hence, the reactants of the above reaction are magnesium and oxygen.

The new substances formed by a chemical reactions are referred to as products.

The product of this reaction is magnesium oxide. This reaction can be shown in the form of a word equation as follows.

Magnesium + Oxygen ⟶ Magnesium oxide

Hence, in a chemical reaction, reactants turn into products.

Rusting of iron, tarnishing of metals, combustion of materials, decay of organic matter, ripening of fruits, blast of a cracker and digestion of food by enzymes are some chemical reactions taking place every day.

Law of conservation of mass

What kind of a change do you think will happen to the total mass of the substances that are subjected to the chemical changes or chemical reactions you have identified? To inquire into this let us do following activities.

Activity 8.8

You will need:- Iron wool, two identical iron wires, a horizontal rod

Method:-

- Take two equal masses of iron wool and lump them loosely
- Using the two iron wires tie them to the horizontal rod as shown in Figure 8.5.
- Suspend the rod on a support to balance it horizontally. Light one lump of iron wool.
- Record your observations.

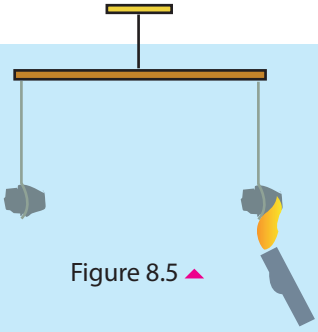


Figure 8.5

Iron wool burns giving reddish sparks. At the same time the side with burnt wool moves down. From this we can infer that when iron wool turns into the products of combustion, the mass increases.

Activity 8.9

You will need:- A few heads of matches, a boiling tube

Method:-

- Put a few heads of matches to a boiling tube. Weigh the boiling tube with them.
- Heat the boiling tube strongly with an open flame until the match heads catch fire.
- After cooling, weigh the boiling tube with its contents.
- Record your observations.

Here, you will be able to observe that the mass after the reaction is lower than the mass before the reaction.

Here, you may have the problem why there was an increase in the mass when iron wool was burnt in Activity 8.8 while a decrease in mass was shown when the match heads were burnt in Activity 8.9. In the above experiments, the substances were burnt in open environments. Therefore, when those substances react there is a chance to combine with some substances in the environment and also to release the products of combustion to the environment. An increase in mass occured due to addition of some substances. A decrease in mass was noticed due to the loss of some substances to the environment.

- **Open systems** - The systems in which the substances can exchange between the system and the surroundings are referred to as open systems.
- **Closed systems**- The systems in which the substances cannot exchange between the system and the environment are called closed systems.

Therefore, to find out whether a change occurs in the total mass of substances taking part in a chemical reaction, the experiment should be conducted in a closed system in which substances are neither gained from nor lost to the surrounding. Let us engage in Activity 8.10 and Activity 8.11 which have been designed after taking these facts into consideration.

Activity 8.10

You will need:- A few matches, a boiling tube, a rubber balloon

Method:-

- Let us now conduct Acitvity 8.9 in a closed system.
- As shown in Figure 8.6, close the mouth of the boiling tube containing matches with a balloon. Measure its mass.
- Apply heat close to the bottom of the tube until the matches light up.
- Allow the boiling tube to cool and weigh again.

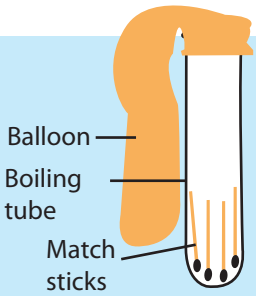


Figure 8.6

When the matches burn, the balloon get inflated gradually.

During the reaction the products are not lost. Also it is seen that there is no change in the total mass before and after the reaction.

Activity 8.11

You will need:- A conical flask, lead nitrate 1 g, water 20 ml, sodium chloride 1 g, a boiling tube

Method:-

- Take about 1g of lead nitrate to a conical flask and dissolve in about 20 ml of water.
- Take about 1g of sodium chloride to a test tube, dissolve it in about 5ml of water and transfer this solution to an ignition tube.
- Tie the ignition tube with sodium chloride solution with a string and suspend it inside the conical flask containing the lead nitrate solution with the help of a stopper as shown in Figure 8.7.

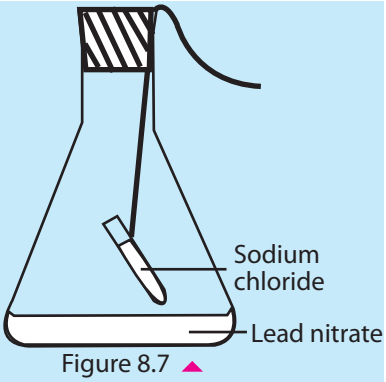


Figure 8.7

- Seal the conical flask by applying vaseline around the stopper. Weigh the flask with its contents.
- Slant the apparatus slowly and let the two solutions mix. Record your observations.
- Weigh the apparatus again and note the mass.

Formation of a white precipitate on mixing the two solutions indicates the occurrence of a chemical reaction in the apparatus. The result of the experiments also shows that there is no change in the total mass before and after the reaction.

The french scientist Antoine Lavoisier (1743 - 1794) who conducted many experiments such as the above in relation to various chemical reactions showed for the first time that the total mass of the substances taking part in a chemical reaction (reactants) is equal to the total mass of the products obtained after the reaction. Later this finding came to be known as the **Law of conservation of mass**.

Law of conservation of mass

During chemical reactions the total mass does not change. That means the mass is conserved.

8.4 Combustion

When magnesium burns in air, magnesium reacts with oxygen in the air forming magnesium oxide.

Oxygen gas in air is essential for combustion. Oxygen is the gas in air that supports combustion. There are substances which can be burnt and which cannot be burnt. The substances that can be burnt are known as combustible substances. The substances that cannot be burnt are non-combustible substances.

- **combustible** substances: e.g. :- camphor, wax, sulphur, sugur, lacquer, paper, tar, flour, petrol, kerosene
- **non-combustible** substances: e.g. :- asbestos, glass, sand, rock

Combustion is the reaction of a combustible substance with a gas which acts as a supporter of combustion. **The special feature of the reaction of combustion is that it is a chemical change which takes place releasing thermal energy and light energy.**

A combustible substance has to be heated to a certain temperature for combustion (to start to reacting with oxygen gas). This temperature changes from substance to substance. **The temperature at which a combustible substance begins combustion in the air is called its ignition temperature (ignition point).**

Let us do Activity 8.12 to compare the ignition temperatures of several combustible substances.

Activity 8.12

You will need:- A tin lid, a stand, a match, a piece of paper, cotton wool, magnesium ribbon, sugar, a piece of sulphur

Method:-

- Fix the tin lid to the stand.
- Place the above substances on the tin lid.
- Keep the Bunsen burner underneath the tin lid and heat.
- Observe the sequence in which the combustible substances placed on the tin lid ignite and note it down.

The substances which ignite early have low ignition temperature.

A combustible substance starts to burn after it gets heated to its ignition point.

Thus, three main factor essential for combustion can be identified. They are;

- Presence of a combustible substance
- Having access to a supporter of combustion (Oxygen).
- Heating the combustible substance to its ignition temperature.

Fire triangle

Pay your attention to a fire broken out by accident. The fire should be extinguished to prevent damage. If a fire is to be extinguished the factors causing fire should be removed from the fire. The following figure which shows the relationship among the factors required to create a fire is known as the fire triangle. Examine it well.

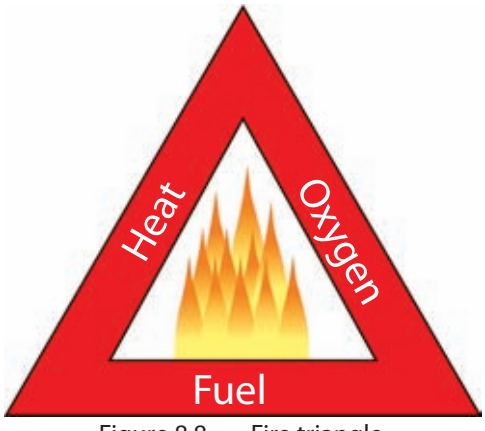


Figure 8.8 ▲ Fire triangle

To extinguish a fire it is required to prevent the access of the supporter of combustion to the fire, prevent reaching the ignition temperature (i.e.prevent receiving heat) and remove the combustible substance.

The method we use to extinguish a fire mostly is throwing water over the burning material. In addition to this covering the burning substance with sand and wet gunnies is also done.

- When water is sprayed over the fire it is extinguished. This is because when water vaporises absorbing heat from the burning material, temperature of under falls below the ignition temperature.
- When somebodys, clothes catch fire, the most suitable method to extinguish it is to roll on the ground. This helps break the connection between air, the supporter of combustion, and the material that has caught fire. When the clothes are on fire you should never run. During running more and more oxygen is supplied to the fire, so it spreads faster.

The same method cannot be used to extinguish all fires. The nature of the fire should be identified and then the appropriate method should be selected.

Fuels

Fuels are substances used to generate heat energy and light energy by combustion.

- Examples for solid fuels :- Firewood, coconut husks, coconut shells, wax
- Examples for liquid fuels :- Kerosine, petrol, diesel, coconut oil
- Examples for gaseous fuels :- Liquid petrolium gas (LP gas), coal gas, methane (bio gas)

Almost every fuel contains the elements carbon and hydrogen.

Let us carry out Activity 8.13 to identify the products formed during the combustion of fuels.

Activity 8.13

You will need:- A candle, a boiling tube, a bottle, a funnel, lime water, copper sulphate

Method:-

- Arrange the apparatus as shown in Figure 8.9. Connect the boiling tube/bottle with lime water to the aspirator. Light the candle and operate the aspirator. When the aspirator works an air current is drawn through the apparatus from the funnel to the boiling tube.

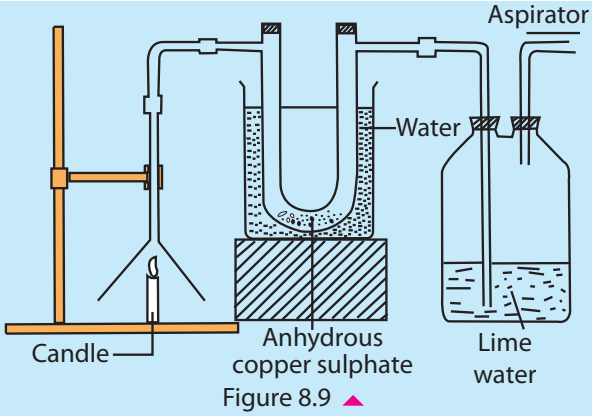


Figure 8.9

U tube contains anhydrous copper sulphate (white). The boiling tube/bottle contains colourless lime water. When the candle is lit and the aspirator is set to work you will observe that white anhydrous copper sulphate turns blue. Also, it can be seen that the lime water turns milky.

White anhydrous copper sulphate turns blue because of the water (water vapour) drawn into the U tube. Lime water turns milky due to carbon dioxide gas.

This activity indicates that when a candle burns, water and carbon dioxide gas are produced. Thus, in the combustion of fuels water and carbon dioxide gas are produced as the products.

Complete combustion and incomplete combustion of fuels

Complete combustion occurs when an adequate oxygen gas (supporter of combustion) is supplied for combustion. You know that fuels contain the elements carbon and hydrogen. On complete combustion carbon gives carbon dioxide and hydrogen gives water. More heat is produced by complete combustion.

The combustion occurring in an inadequate supply of oxygen is called incomplete combustion. In this carbon monoxide and unburnt carbon particles are also produced in addition to carbon dioxide and water. In incomplete combustion, the quantity of heat produced by the flame is relatively low.

Candle flame

When a candle is lit, solid wax turns into liquid wax. Liquid wax moves up through the wick and vapourises. This wax vapour, reacts with oxygen and produces heat and light giving rise to the flame of the candle.

Observe the candle flame well. It has three clearly visible zones.

The inner zone is the non-luminous zone. It contains wax vapour. Its temperature is low relatively to that of the other zones. Outer to the non-luminous zone is the luminous zone. The unburnt carbon particles present in that zone becomes incandescent emitting a yellow light. The temperature in this zone is greater than that of the non-luminous zone. Outer to the luminous zone is another zone which appears in blue colour at the base of the flame but is hardly visible in other areas. This is known as the outer zone (invisible zone) and has the highest temperature.

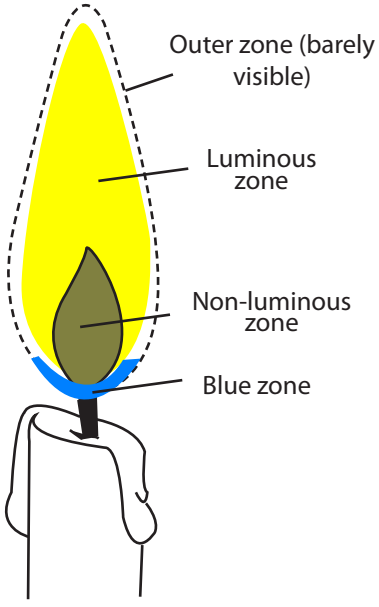


Figure 8.10 ▲ Candle flame

Bunsen flame

The colour of the bunsen flame changes with the amount of oxygen gas supplied for combustion. When the oxygen supply decreases the flame turns yellow and when the flame receives enough oxygen it turns blue. By observing the blue flame well, several zones of it can be identified.

At the centre of it is the non-luminous zone consisting of unburnt gas. Outer to the non-luminous zone lies a dark blue zone and a light blue zone respectively. The outerpart is the invisible zone. In the invisible zone complete combustion occurs.

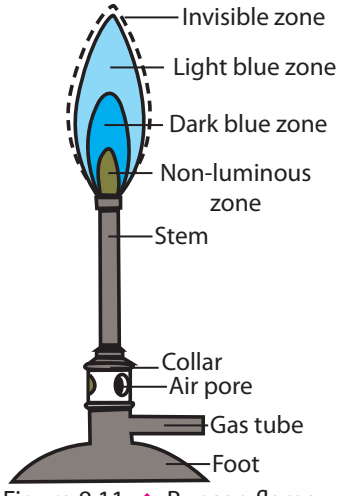


Figure 8.11 ▲ Bunsen flame

8.5 Tarnishing of metals

You have learnt that having a shiny surface is a property of metals. When metals are exposed to air for a long period, that lustre disappears. The change in surface of metals like this is called tarnishing. Almost every metal tarnishes.

A substance called rust is formed on the surface of iron due to tarnishing. This is reddish brown in colour and is called iron rust. This process is called rusting of iron. Due to tarnishing and rusting the surfaces of metals corrode. This is called corrosion of metals. Tarnishing of metals and rusting of iron are chemical changes.

Rusting of iron

Let us do Activity 8.14 and Activity 8.15 to investigate the factors essential for rusting of iron.

Activity 8.14

You will need:- Three test tubes, cleaned iron nails, coconut oil

Method:-

- Take some water into a test tube and heat to boiling. Put a cleaned iron nail into it and cover the water surface with a layer of oil (setup A). Oil layer is placed to prevent the dissolving of air when water cools.

- Take equal volumes of cold water to two other test tubes and put a cleaned iron nail into each. Put an oil layer to one of them (set-up B).
- Leave the other test tube as it is (set-up C).
- After a few days observe the setups.
- Record your observations.

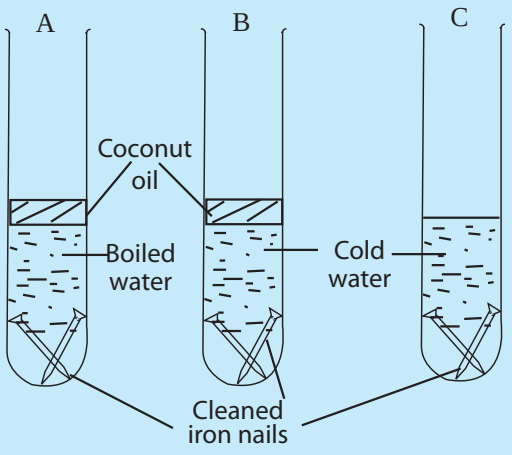


Figure 8.12

The nail in test tube A does not rust. As it contains boiled water all the air dissolved in it has been expelled. Putting a layer of coconut oil on water has prevented the dissolving of air when water cools.

Test tube B contains cold water. Therefore, its water contains air. Because there is air dissolved in water the nail in it rusts.

The nail in the test tube C is open to the outer environment. As it receives air from outside rusting occurs. Hence it can be concluded that air is essential for rusting.

Activity 8.15

You will need:- A boiling tube, two cleaned iron nails, cork stopper, calcium chloride crystals, wax, coconut oil

Method:-

- Clean the two iron nails with sand paper.
- Fix them to the cork stopper as shown in the Figure 8.13.
- Add calcium chloride crystals to the boiling tube and fix the stopper with the iron nails to it.
- Make the tube air tight with wax.
- Observe this setup for several days.
- Record your observations.

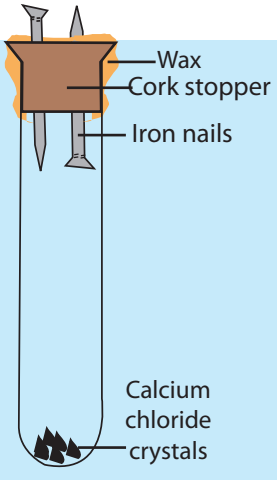


Figure 8.13

After a few days it can be seen that the parts of the nails outside the boiling tube have rusted while the parts inside the tube remain without rusting.

Calcium chloride crystals absorb moisture in the air in the boiling tube. Placing wax around the stopper makes the tube air tight and prevents the entry of moisture in air into the tube. As the air inside the tube is free from moisture, the parts of nails inside the tube do not rust.

What is expected by driving the two nails into the cork in opposite directions is to ensure that the pointed tip or the flat head of nails have no effect on rusting.

Activity 8.16

You will need:- A beaker, two test tubes, iron filings, cotton wool

Method:-

- Take two test tubes. In one of them (A) trap some moist cotton wool. In the other tube (B), trap a similar plug of moist cotton wool with some iron filings on it.
- Take some water into a beaker and dip the two inverted test tubes A and B in water as shown in Figure 8.14.
- Observe this setup a few days.
- Record the observations.

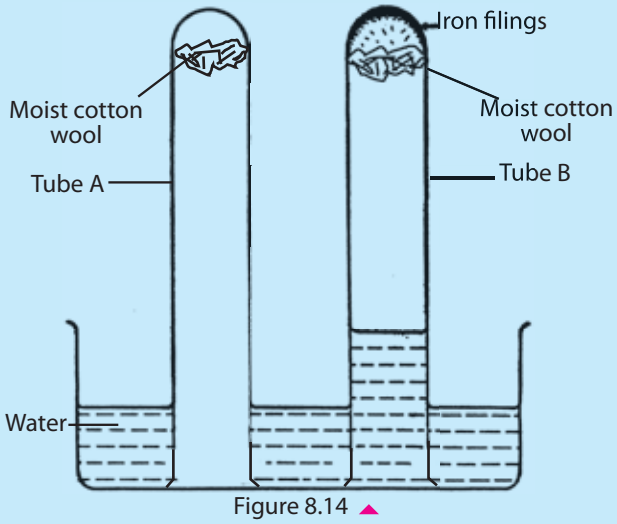


Figure 8.14

It can be seen that iron filings in tube B have undergone rusting while water has risen up to about one fifth of its height.

The percentage of oxygen in air by volume is 21%. That is, nearly 1/5 th of air in a given space is oxygen. If oxygen gas is used up for rusting, 1/5 th of the volume of air contained in space where rusting occurs should have been spent.

For the rusting of iron filings in tube B, oxygen gas in the air in that tube is used up. As 1/5 th of the volume of air is oxygen the water level rises to 1/5 th the height of the test tube. From this it is clear that oxygen gas is consumed during rusting.

These activities prove us that oxygen and water vapour/water in air are essential for the rusting of iron.

Protection of iron from rusting

Iron objects rust only when they are able to come in contact with air and water.

Figure 8.15 ▲ A galvanised bucket

Figure 8.16 ▲ A Painted gate

You would have seen that paints are applied on objects made of iron such as grills, gates and bridges. Application of paint is a frequently used method to prevent rusting of iron. It prevents iron from coming into contact with air and water. Grease is also applied in machinery made from iron to prevent rusting.

You have heard about the galvanized iron items. During galvanizing, zinc metal is applied on objects made of iron. Iron in galvanized items does not rust even if their zinc coat is scratched exposing some of their points to air. Therefore, galvanizing is a very good protective method. Items such as buckets, roofing sheets and iron nails are protected by galvanizing.

Application of tin metal is also another method used to protect iron from rusting. The containers of sealed food such as sardine and milk powder, though commonly called 'tins' are vessels made of iron. In them tin is present only as a coating. However, when scratched tin coated vessels rust very fast.

8.6 Neutralisation

Recall what you have learnt in grade 7 about acids, bases and neutral substances. Let us do Activity 8.17 to revise facts about them.

Activity 8.17

You will need:- Test tubes, red litmus, blue litmus, pH papers, hydrochloric acid, sodium hydroxide solution, sodium chloride (salt) solution, phenolphthalein

Method:-

- Take hydrochloric acid solution, sodium hydroxide solution and sodium chloride (salt) solution separately into three test tubes.
- Test these three solutions with red litmus papers.
- Test these three solutions with blue litmus papers.
- Test these three solutions with pH papers.
- Add two drops of phenolphthalein to these solutions.
- Record your observations.

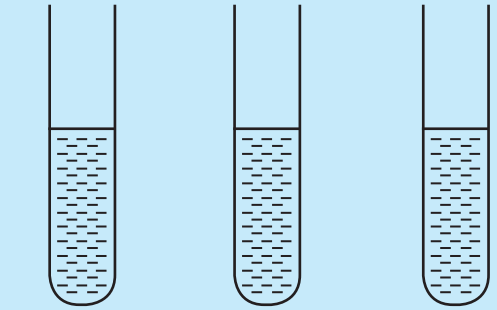


Figure 8.17

- A Solution A turns the blue litmus paper into red. Solution A does not change the colour of red litmus.When examined with a piece of pH paper, a value less than 7 is obtained. On addition of phenolphthalein it stays colourless.
- Solution B does not change the colour of blue litmus. It turns red litmus into blue. When tested by a pH paper the pH value is greater than 7. The solution gives a pink colour with phenolphthalein.
- Solution C does not change the colour of blue litmus or red litmus. The colour it gives with the pH paper corresponds to 7. It does not show a colour change with phenolphthalein.

From the above observations it can be identified that solution A is acidic, B is basic and C is neutral.

Investigating what type of a change occurs when an acid is added to a base

You might have heard that milk of magnesia liquid is given to relieve the acidity in stomach. Milk of magnesia is a basic substance. What is the reason for giving a basic substance like this to minimize the affect of an acidic substance? Let us conduct Activity 8.18 to look into this.

Activity 8.18

You will need:- A beaker, a dropping pipette, dilute sodium hydroxide solution, dilute hydrochloric acid, phenolphthalein

Method:-

- Pour dilute sodium hydroxide solution to a beaker. Add a few drops of phenolphthalein into it. Then add dilute hydrochloric acid dropwise into it using a dropping pipette and observe the colour change in the solution.
- When the acid is added the pink colour of the solution gradually decreases and at a certain moment the solution becomes colourless. This indicates that when an acid is added to a base, the basic property of the base gradually disappears.

a - Sodium hydroxide solution with a few drops of phenolphthalein

b - Nutralised to some extent due to the addition of acid

c - Totally neutralised solution

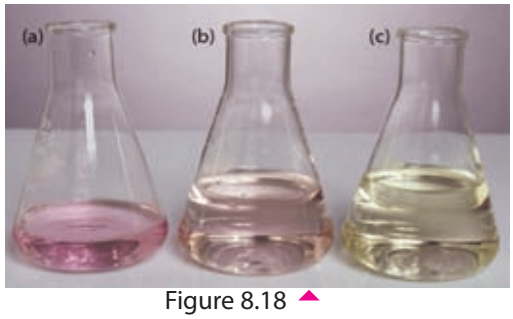


Figure 8.18

When an acid is added to a base or base is added to an acid, their acidic and basic properties decrease and at a certain point acidic and basic properties totally disappear. This process is called neutralisation. You know that sodium hydroxide is a base and hydrochloric acid is an acid. When these two react sodium chloride and water are formed which are neutral substances.

Sodium hydroxide + Hydrochloric acid ⟶ Sodium chloride + Water

This reaction between an acid and a base is a chemical reaction. It is referred to as a neutralisation reaction.

Let us now explore about some instances in which we happen to meet acid-base neutralisation in day-to-day life.

When acidity in the stomach increases milk of magnesia is administered. Milk of magnesia means the base magnesium hydroxide. This base neutralises the excess hydrochloric acid in the stomach.

The pain caused by bee stings disappear on application of lime. When bees sting, acidic substances are introduced into the skin. Lime is a base. It neutralises the acid. That is why the pain subsides.

The wasp sting is basic. Therefore, when an acidic substance such as vinegar or lemon juice is applied, the poison gets neutralised relieving the pain.

Lime is applied to acidic soils. Lime which is a base neutralises acids in the soil.

Figure 8.19

Summary

- The changes takes place in matter is of two types, physical changes and chemical changes.
- In the case of physical changes the existing nature of matter changes, though its composition remains unchanged.
- The changes in which the composition of matter changes giving rise to new substances are known as chemical changes.
- Rusting of iron, corrosion of metals, combustion nutralisation are examples for chemical changes.
- Changes of state such as fusion, vapourisation, sublimation, condensation and freezing are physical changes.
- Heat change, evolution of a gas, formation of a precipitate, colour change and change in temperature provide evidence for the occurrence of a chemical reaction.
- The substances take part in a reaction are reactants and the substances formed during a reaction are products.
- During chemical reactions, the total mass does not change. That means, the mass of the reactants that took part in the reaction is equal to the mass of the products formed after the reaction.
- The reaction of combustible substances with oxygen is called combustion.
- When many fuels are subjected to complete combustion, carbon dioxide and water are formed.
- During incomplete combustion unburnt carbon and carbon monoxide are also formed in addition to carbon dioxide and water.
- The quality of heat generated during complete combustion is relatively higher than that generated during incomplete combustion.

- Water/water vapour and oxygen are essential for the rusting of iron.
- Rusting can be prevented by methods such as applying paint, galvanizing and applying grease.
- When an acid reacts with a base, the acidic properties of the acid and the basic properties of the base disappear.
- The chemical reactions between acids and bases are called neutralisation reactions.

Exercises

01) Select the correct or best suitable answer for the following questions.

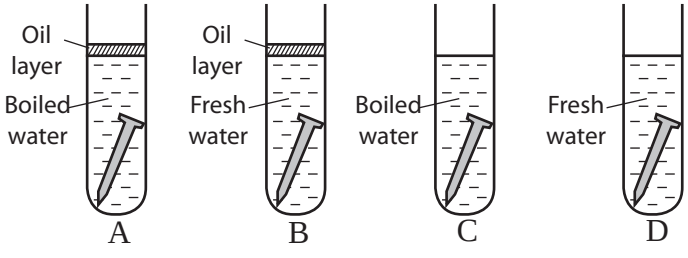
01. Which of the following is **not** a chemical change?

1. Condensation of steam
2. Burning of magnesium
3. Rusting of iron
4. Tarnishing of metals

02. Which of the following statement is **false**?

1. Combustion is a chemical reaction.
2. Oxygen is essential for the rusting of iron.
3. Complete combustion gives rise to a yellow flame.
4. It is necessary to heat something to its ignition temperature to burn.

03. The nail in which test tube does **not** rust after few days ?



04. Which of the following is **not** observed when a piece of zinc is placed in a copper sulphate solution?

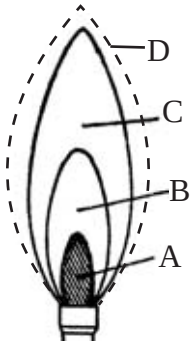
1. Gradual dissolution of the piece of zinc.
2. Deposition of a reddish brown substance around the piece of Zinc.
3. Slight heating of the solution.
4. Blue colour of the solution remain same.

05. Which of the following does **not** undergo a chemical change on heating?

A-Sulphur B-Magnesium C-Iron

1. Only A 2. Only A and B 3.Only B and C 4. A, B and C

02. The diagram shows a bunsen flame.



a. Name A, B, C and D zones.

b. In which zone complete burning occurs?

c. What is the fuel that burns in a bunsen burner?

03. Milk of magnesia is prescribed as a remedy for the discomfort caused by increasing acidity of stomach.

a. Is milk of magnesia acidic or basic?

b. How do you name the reaction between milk of magnesia and an acid?

04.Give short descriptions for the following phenomena.

1. Slaked lime is added to avoid acidic nature in soil.
2. Iron is protected from rusting by application of paint.
3. You should never run,when your clothes are on fire.

Technical Terms

Physical changes	-	භෞතික විපර්යාස	-	பௌதிக மாற்றங்கள்
Chemical changes	-	රසායනික විපර්යාස	-	இரசாயன மாற்றங்கள்
Tarnishing	-	මලින වීම	-	மங்குதல்
Melting	-	ද්‍රව වීම	-	உருகுதல்
Vapourisation	-	වාෂ්පීකරණය	-	ஆவியாதல்
Sublimation	-	ඌර්ධ්වපාතනය	-	பதங்கமாதல்
Condensation	-	ඝනීභවනය	-	ஒடுங்கல்
Freezing	-	හිමායනය	-	உறைதல்
Combustion	-	දහනය	-	தகனம்
Corossion	-	විඛාදනය	-	அரிப்பு
Rusting	-	මළකඩ කෑම	-	துருப்பிடித்தல்
Neutralisation	-	උදාසීනීකරණය	-	நடுநிலையாக்கம்
Open system	-	විවෘත පද්ධතිය	-	திறந்த தொகுதி
Closed system	-	සංවෘත පද්ධති	-	மூடிய தொகுதி
Reactants	-	ප්‍රතික්‍රියක	-	தாக்கிகள்
Products	-	ඵල	-	விளைவுகள்
Law of conservation of mass	-	ස්කන්ධ සංස්ථිති නියමය	-	திணிவு காப்புவிதி

SCIENCE

Part - II

Grade 8

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The National Anthem of Sri Lanka

Sri Lanka Matha
Apa Sri Lanka Namo Namo Namo Namo Matha
Sundara siri barinee, surendi athi sobamana Lanka
Dhanya dhanaya neka mal palaturu piri jaya bhoomiya ramya
Apa hata sepa siri setha sadana jeewanaye matha
Piliganu mena apa bhakthi pooja Namo Namo Matha
Apa Sri Lanka Namo Namo Namo Namo Matha
Oba we apa vidya
Obamaya apa sathya
Oba we apa shakthi
Apa hada thula bhakthi
Oba apa aloke
Apage anuprane
Oba apa jeevana we
Apa mukthiya oba we
Nava jeevana demine, nithina apa pubudukaran matha
Gnana veerya vadawamina regena yanu mana jaya bhoomi kara
Eka mavakage daru kela bevina
Yamu yamu vee nopama
Prema vada sema bheda durerada
Namo, Namo Matha
Apa Sri Lanka Namo Namo Namo Namo Matha

අපි වෙමු එක මවකගෙ දරුවෝ
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ආනන්ද සමරකෝන්

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Be a light to the country as well as to the world.

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Akila Viraj Kariyawasam
Minister of Education

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The educational objectives of the contemporary world are becoming more complex along with the economic, social, cultural and technological development. The learning and teaching process too is changing in relation to human experiences, technological differences, research and new indices. Therefore, it is required to produce the textbook by including subject related information according to the objectives in the syllabus in order to maintain the teaching process by organizing learning experiences that suit to the learner needs. The textbook is not merely a learning tool for the learner. It is a blessing that contributes to obtain a higher education along with a development of conduct and attitudes, to develop values and to obtain learning experiences.

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I would like to bestow my sincere thanks on the members of the editorial and writer boards as well as on the staff of the Educational Publications Department who have strived to offer this textbook to you.

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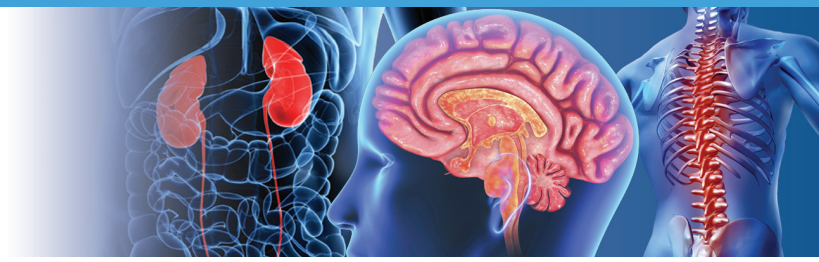
9 Human organ systems



9.1 Human excretory system and excretory products

The biological processes that take place within the cells, produce different products that are useful to the body as well as useless to the body.

As an example, let us consider the respiration reaction. In respiration glucose react with oxygen and produce energy, carbon dioxide and water.

Energy is used for the biological processes in the body. But carbon dioxide and water may become harmful to cells when there is an excess amount.

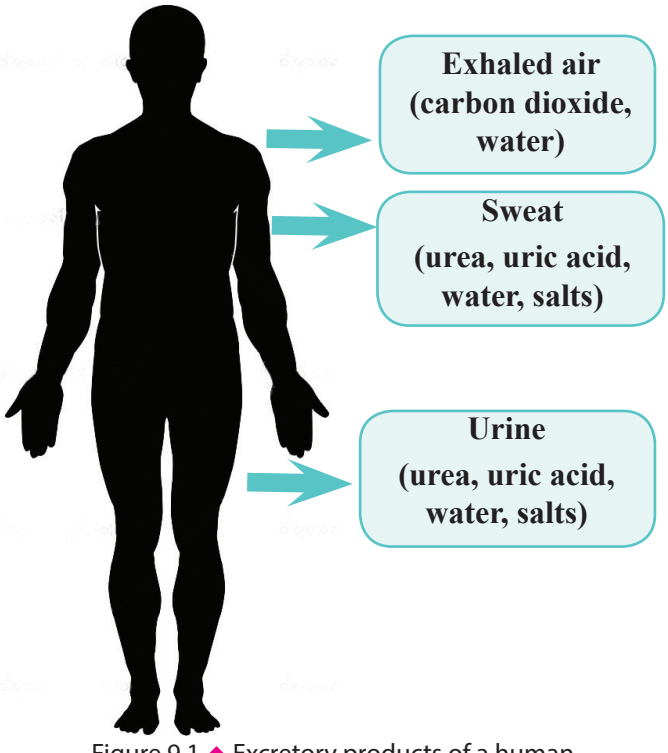


Figure 9.1 ▲ Excretory products of a human

The useless products that are produced during chemical reactions within the cells are known as **excretory products**. You can observe the Figure 9.1 to study about the excretory products in human body.

Excretory products can damage the cells when accumulated in excess amount. Some products may be toxic. Therefore, it is very important to remove the excretory products from the body. The process that remove the excretory products from the body is known as **excretion.**

Waste matter remaining after food has been digested is known as faeces. As it is not produced by chemical reactions within the cells in the digestive system, it is not considered as an excretory product.

There are organs and systems that are specialized to perform the function of excretion in human body.

Table 9.1 shows the excretory products, where they are produced and how they are excreted.

Table 9.1

Excretory organ	Excretory products	The form they are excreted
Lungs	Carbon dioxide, water	As exhaled air
Kidneys	Urea, uric acid, salts, water	As urine
Skin	Little amount of urea, uric acid, salts, water	As sweat

Human urinary system

During the chemical reactions which take place in human body cells, nitrogenous by-products are produced. These nitrogenous by-products are excreted from the body through kidneys as urine. Therefore, the urinary system is considered as the main nitrogenous excretory system of human body.

Let us do Activity 9.1 to identify the parts of the human urinary system.

Activity 9.1

You will need:- A model/ diagram of the human urinary system
Method: -

- Observe the parts of the urinary system.
- Draw a diagram and name the parts.

The labelled diagram of urinary system of human is shown in Figure 9.2.

Urinary system consists of four main parts.

- Kidneys
- Ureter
- Bladder
- Urethra

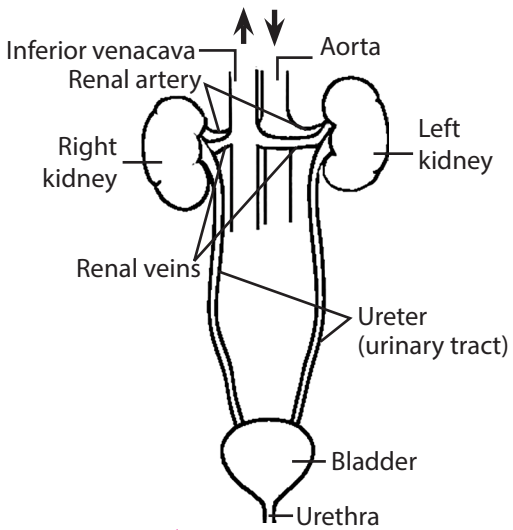


Figure 9.2 ▲ Human urinary system

Figure 9.3 ▲ The way to observe the location of kidneys externally

As shown in Figure 9.3 place your hands on your hips. Then the tips of your thumbs give an indication of the location of the lower end of kidneys.

Kidneys reside against the back muscle in the upper abdominal cavity. They sit opposite each other on either side of the spine. The right kidney is little bit lower than the left kidney to accommodate the liver.

In an adult each kidney is about 13 cm long and 6 cm wide. Kidneys are bean-shaped organs. Observe Figure 9.4 to get an idea about the external structure of a kidney.

The renal artery supplies blood to the kidney while the renal vein carries away the blood from kidneys.

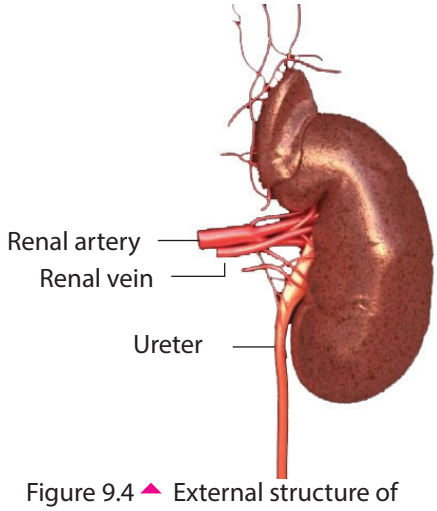


Figure 9.4 ▲ External structure of human kidney

Do Activity 9.2 to study about the internal structure of a kidney.

Activity 9.2

You will need:- A model/photograph of a kidney

Method: -

- Study the internal structure of a kidney using a model/ photograph of a kidney in your laboratory.
- Get the assistance of your teacher.

The labelled diagram of human kidney is shown in Figure 9.5.

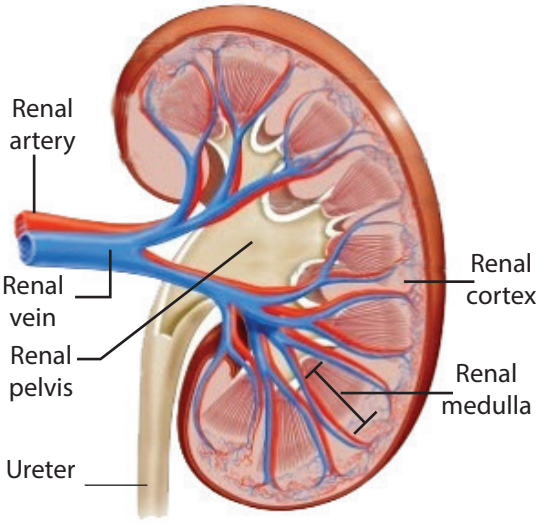


Figure 9.5 ▲ Longitudinal section of human kidney

A kidney consists of two major parts.

- Cortex
- Medulla

Renal cortex consists of lot of blood capillaries. Therefore, it is dark in colour. Within the renal medulla there are triangular shaped structures called renal pyramids. The tips of these renal pyramids are directed to the renal pelvis. The renal pelvis narrows and open into the upper end of the ureter.

Blood with excretory products transported by renal arteries is filtered in the kidneys. The filtered excretory products are carried by the ureter to the bladder and they are temporarily stored in the bladder. The fluid with excretory products is known as urine.

Components of urine

- Water
- Urea
- Salts (more sodium chloride)
- Uric acid

For extra knowledge

Components of urine of a healthy person is given below as percentages;

Water	- about	96%
Urea	- about	2%
Salts	- about	2%
Uric acid	- trace amounts	

Above mentioned values and colour of urine are important in diagnosing kidney diseases.

When the bladder is full, a person urinates through the urethra to eliminate the waste.

If the kidneys are damaged, the process of excretion does not happen the way they should. Some examples of kidney diseases and the reasons are given below.

- **Kidney stones**

Salts such as calcium oxalate deposit in kidneys and form crystalline structures. These structures are known as kidney stones (Figure 9.6). Kidney stones may occur, due to following reasons.

- Not drinking enough water
- Taking salty diets regularly
- Not passing urine at proper time (when wanted)

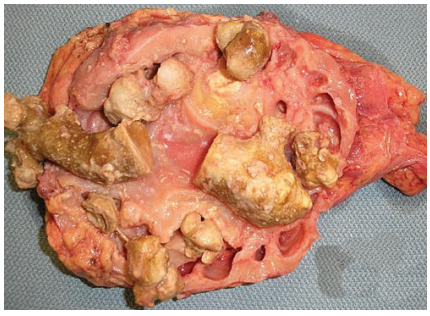


Figure 9.6 ▲ How kidney stones are formed

- **Kidney failure**

Functioning of kidneys get disordered and it is called kidney failure. Kidney failure may occur due to following reasons.

- Entering of heavy metals and toxic chemicals into the body
- Suffering from diabetes for a long time
- Using drugs for a long time period for certain diseases
- Smoking and consuming alcohol

- **Kidney infection**

The urethra can be infected by microorganisms and it may cause kidney damage.

Excretory process should be carried out efficiently in the body. For this purpose maintaining healthy kidneys is very important. Following are some tips that should be considered to maintain healthy kidneys.

- Drinking enough pure water daily
- Limit consuming too much salty and sour food (pickle, lime pickle, food with vinegar)
- Quit smoking and consuming alcohol

- There is a risk of kidney failure for the persons who are suffering from diabetes. Therefore, it is important to control the blood sugar levels.
- If a person takes medications regularly over a prolonged period, he should take them to the prescribed dosage by the physician and should have regular tests to check kidney functions.
- One should concern about the cleanliness of the surrounding area of the urethra because this area can be infected very easily.

9.2 Nervous system

Imagine how a cricketer hits a ball. We know that he coordinates many organs in the body/ body parts to hit the ball in the proper way. Mainly, he coordinates the eyes, hands, legs and neck to hit the ball properly. If these organs do not coordinate in the proper manner his hit will not be successful.

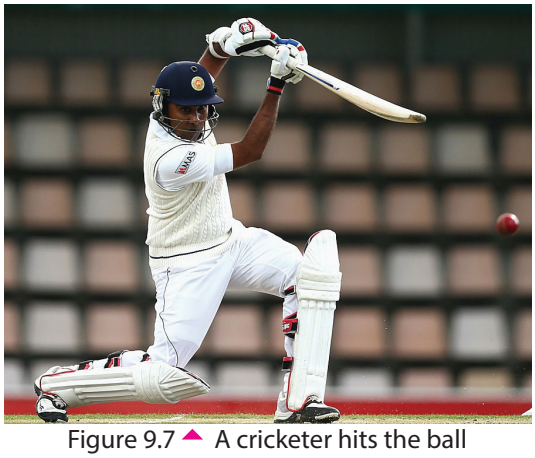
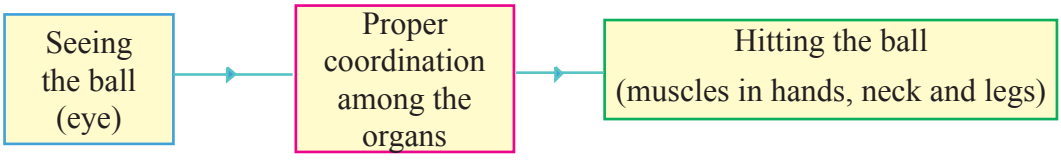


Figure 9.7 ▲ A cricketer hits the ball

Think about which body organs coordinate when you drive or put a thread to a needle.

Following flow chart shows the relevant process of hitting the ball.



According to the above, seeing the ball is a sense. It occurs through the sensory organ called the "eye". The eye is the receptor. Hitting the ball is the reaction. Muscles in the eye, neck, hands and legs are used for the reaction.

Let us focus on how the organs are coordinated in seeing and hitting the ball.

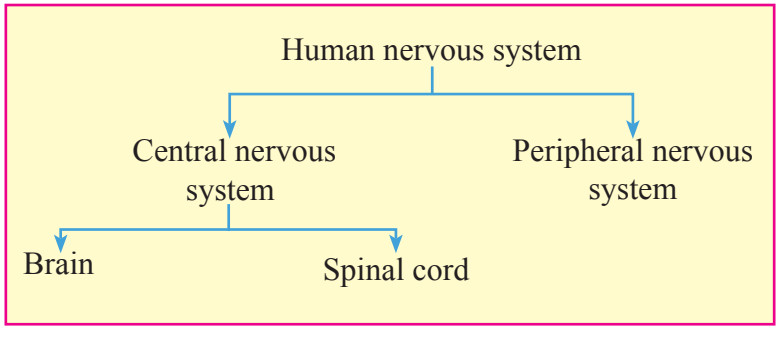
Many changes occur within the internal body of humans as well as in his surrounding environment. Body should react for these changes. To react, there should be a very good interaction between the receptors (eye, ear, nose, tongue, skin) and the effectors (muscles and glands). This process is known as **coordination**.

The nerves and hormones are very important in coordination. Coordinating and controlling the various functions of our body by the nervous system is known as **nervous coordination.** Coordinating the body organs through hormones is known as **chemical coordination.**

Nervous coordination

Let us study about the human nervous system.

Major parts of the human nervous system is given below.



Central nervous system

The two main organs of the central nervous system are the brain and the spinal cord. The central nervous system is better protected in the body. Its main line of defense is the bones. The bones around the brain is known as the skull and spinal cord is surrounded by the vertebral column. Both the skull and vertebral column create a hard physical barrier to injury.

Both the brain and the spinal cord are protected by layers of special connective tissues called the **meninges.**

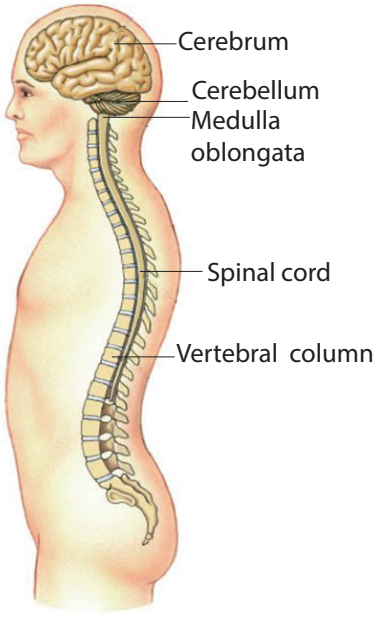
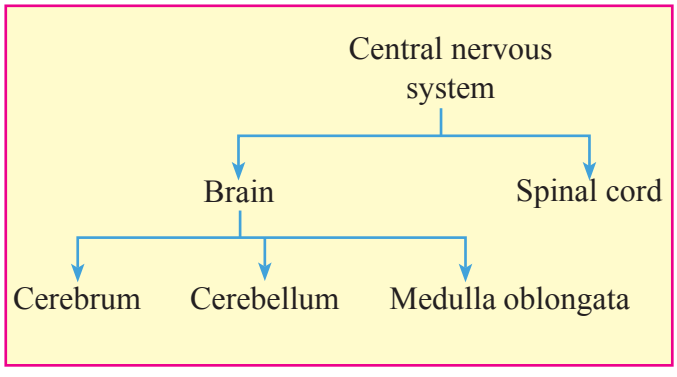


Figure 9.8 ▲ Central nervous system

The meninges are filled with a special fluid called **cerebrospinal fluid**. Some functions of cerebrospinal fluid are given below.

- Absorb shocks
- Supply nutrients
- Prevents the central nervous system from microbial infections



The functions of each part of the central nervous system differs.

- **Cerebrum/cortex** - Controls higher brain functions such as thought, intelligence
  Recognition of senses
  Controls the movements of muscles with the intent to perform a specific action (controlling the voluntary actions)
- **Cerebellum** - Regulation and coordination of body balance
- **Medulla Oblongata** - Controls the autonomic functions (non-voluntary functions) such as heart beat, breathing
- **Spinal cord** - Relays messages from the brain to different parts of the body

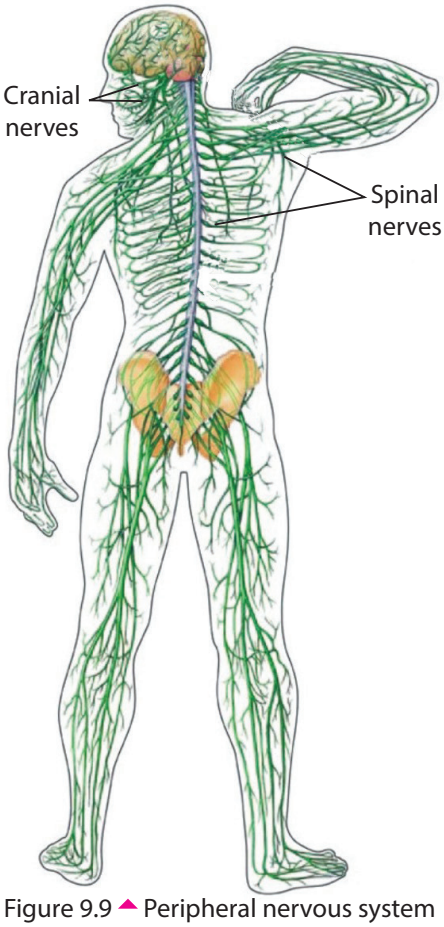


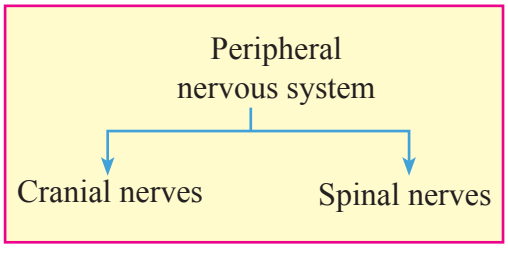
Figure 9.9 ▲ Peripheral nervous system

Peripheral nervous system

All the nerves that lie outside the spinal cord and brain are known as the peripheral nervous system.

The nerves that lead directly from the brain are called cranial nerves. There are 12 pairs of cranial nerves.

The nerves that arise from the spinal cord are called as spinal nerves. In humans there are 31 pairs of spinal nerves.



Functions of peripheral nervous system

- Transmitting impulses from receptors to the central nervous system
- Transmitting impulses from central nervous system to the effectors

An electrical signal that travels along a nerve is called an impulse.

Engage in Activity 9.3 to study the speed of impulses in human nerve.

Activity 9.3

You will need:- 30 cm ruler

Method:-

- As shown in Figure 9.10 take the 30 cm ruler to your hand vertically (the "0" of the ruler towards the ground)
- Free the ruler from the hand and ask your friend to catch it.
- Get the reading of the ruler where your friend touched with the hand.
- Repeat this activity with different students.

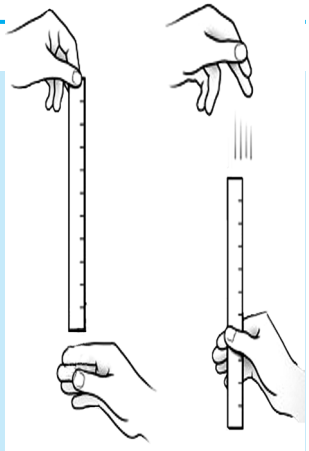


Figure 9.10

You will notice that each student gets different readings.

The dropping of the ruler is recepted from the eyes. The message is transmitted to the brain and is returned to the effector, the muscles of the right hand. Then, the right hand responses.

According to the results of Activity 9.3 the speed of impulses differ from person to person.The most important part of our body are the brain and spinal cord. So, it is very important to take necessary protective measures in day-to-day activities since the nervous system is very fragile.

Some protective measures are given below.

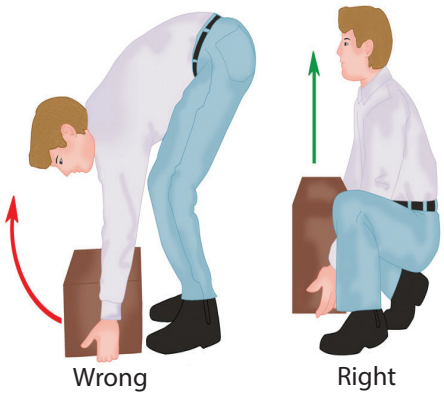


Figure 9.11

- Maintaining a balanced nutrition from childhood
- Prevent children facing accidents
- During pregnancy, mother should get proper nourishment, considering the baby's physical and mental development
- Be sure to get the correct posture during sports, exercises in daily life and lifting a burden to force
- Control mental stress
- Avoid excessive keeping awake sleepless
- Engage in intelligence development activities
- In an accident there is a possibility for spinal cord injuries. Never move anyone

who you think have a spinal injury unless it is very necessary. Keep the person absolutely still and safe. Do not allow the body to bend or twist. Keep the person on a wooden flat surface and rush to the nearest hospital.

9.3 Human skin

Skin is the largest organ of the body. It weighs about 4.5 kg and 1-2 mm thick in an adult. Skin mainly consists of two layers.

- Epidermis
- Dermis

Let us engage in Activity 9.4 to study about the structure of the human skin.

Activity 9.4

You will need:- A diagram/model of the human skin

Method:-

- Identify the main parts of the human skin.
- Draw a cross sketch of the human skin and name the parts.

Structure of the human skin is shown in Figure 9.12.

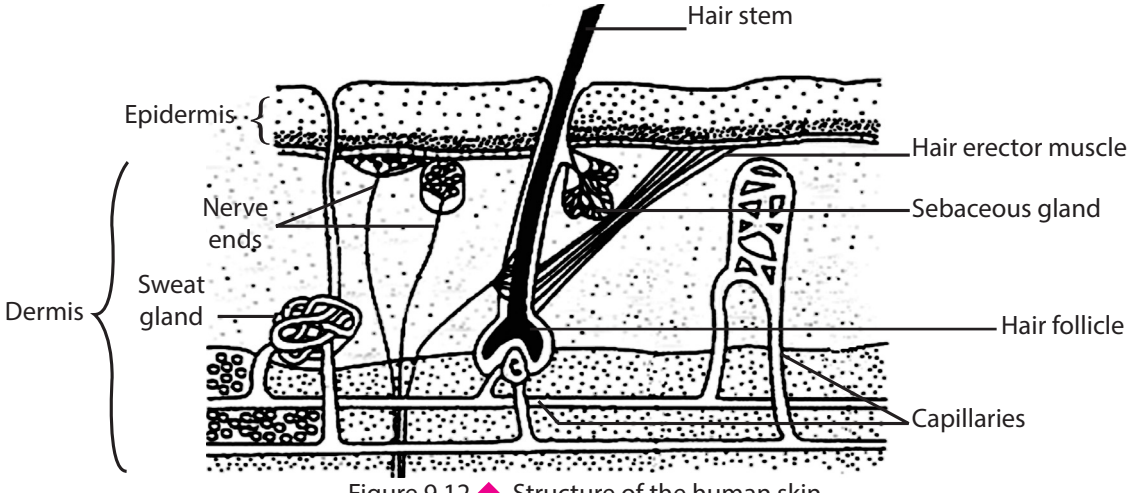


Figure 9.12 ▲ Structure of the human skin

Epidermis

The outer most layer of skin is epidermis. The epidermis is made up of several layers of cells. The epidermis is heeding thousands of dead cells and replenishing daily. Skin colour is due to melanin- a pigment produced in the epidermis to protect from the sun's ultraviolet rays.

Dermis

The dermis beneath the epidermis contains hair follicles, sweat glands, sebaceous glands, muscles, nerve endings and blood vessels (capillaries). The dermis is thicker than the epidermis.

Hypodermis lies beneath the dermis.

Functions of the human skin

- **Protective layer of the body**

  The layers of the epidermis minimize water loss from the body and prevent from dehydration.

  Melanin pigments in the cells of the skin protects the body from ultra violet rays.

  The secretion from sebaceous gland act as a barrier against microorganism infections. This is a natural defense mechanism.

- **Regulation of body temperature**

  When the temperature increases in the environment than the body temperature, the sweat glands secrete sweat to release heat.

  When the atmospheric temperature is lower than the body temperature, the blood supply to the surface of the skin is decreased and the body temperature is regulated. The secretion of sweat is minimized.

- **Acting as a sensory organ**

  In the dermis, there are nerve endings which detect the pressure, touch and temperature.

- **Synthesis of vitamin D**

  Using the energy of sunlight, vitamin D is synthesized in the cells of the skin.

- **Excretion**

  The sweat glands secrete sweat which consists of urea, uric acid, and ammonium salts. Therefore, skin can be considered as an excretory organ.

As the skin is exposed to the environment, there is a possibility to the skin to be infected by microorganisms and waste materials.

Wipe your face with a tissue paper. You will notice that your face becomes clean and there is dust in the tissue paper. Cleanliness and protection help to maintain a healthy skin.

Following are some tips that help to maintain a healthy skin.

- Have nutritive diet
  - Vitamin A and E are essential for a healthy skin. Consuming fresh fruits and vegetables helps to supply vitamin A and E to the skin.
  - Drink adequate amount of fresh water daily.

- Be gentle to your skin
  - Bath daily (if the person is not sick).
  - Use a mild soap which does not wipe the oil on your skin.
  - After wash or bath, gently blot the skin with a towel and do not rub against the skin.

- Protection from sun
  - If you are exposing to the sun for a long period of time wear clothes that covers your skin well.

- Avoid smoking and smokers
  - Smoking narrows the blood vessels in the skin and reduce the circulation of blood. The skin cells get less oxygen and nutrients. Therefore, the skin loses its strength and elasticity and develops wrinkles and looks older.

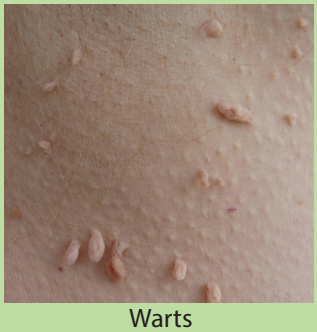
- Other factors
  - Wearing cotton dresses
  - Do not share your dresses with others
  - Get medical advices for skin disorders such as pimples and warts
  - Manage stress and always try to maintain a good mental health

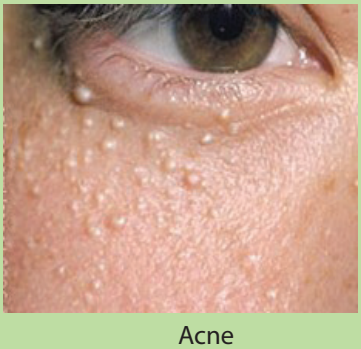
For extra knowledge

Dirty skin is easily infected by microorganisms. Also lack of nutrients lead for skin disorders. Following figures show some skin disorders.


Pityriasis


Removal of skin


Warts


Acne


Heel getting dry


Eczema

Assignment 9.1

Prepare a booklet on "The importance of taking protective measures for the excretory system, nervous system and skin in day-to-day life."

Summary

- Many biological processes take place in the human body.
- We should maintain proper functioning of the organs and the organ systems in order to maintain biological processes efficiently.
- The harmful products that are produced during the chemical reactions within the cells of living organisms, are known as excretory products.
- The process which pass the excretory products from the body is known as excretion.
- Kidneys, lungs and skin are the main excretory organs in the human body. The basic nitrogenous excretory organs are the kidneys.
- Other than the kidneys, the lungs and skin are also function as excretory organs.
- The urinary system is considered as the nitrogenous excretory system of the human body.
- Eye, ear, nose, tongue and skin are the sensory organs of the human body.
- The effectors of the body response for the senses detected from the sensory organs.
- The process of adjusting the body for the changes in the external and internal environment by inter connecting the receptors and effectors is known as coordination.
- Nerves and hormones are important in coordination.
- Coordination by nervous system is known as nervous coordination.
- The two major parts of the human nervous system are central nervous system and peripheral nervous system.
- Central nervous system consists of brain and spinal cord.
- All the nerves in the body outside the brain and spinal cord are known as peripheral nervous system.
- Central nervous system controls the higher brain functions such as muscle movements, carrying impulses etc.
- Skin is the largest organ in the human body. It consists of two layers called epidermis and dermis.
- It is important to lead a healthy life in order to maintain the proper functioning of the body organs.

Exercise

1. Give short answers.
   i) What do you mean by excretion?
   ii) What are the main excretory organs in the human body?
   iii) Why is faeces not considered as an excretory product?
   iv) What is the main component in urine?
   v) Write three instances that can damage the kidneys.

2. Underline the correct answer.
   i) The nerve endings are present in (epidermis/ dermis).
   ii) Inter-connection between the receptors and effectors is known as (homeostasis /coordination).
   iii) There are (meninges layers/pleura) for the protection of central nervous system.
   iv) The cerebrum/cortex (controls higher brain functions/regulates and coordinates of body balance).
   v) All the nerves in the body that lie outside the brain and spinal cord are called as (central nerves/ peripheral nerves).

3. Match the correct answer

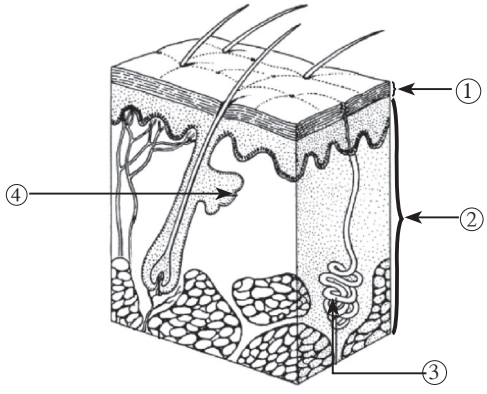
A	B
i) Cerebrum	Controlling the heart beat
ii) Cerebellum	Controlling the movements of muscles with the intent to perform a specific action
iii) Medulla oblongata	Transmitting messages between the body and brain
iv) Cerebrospinal fluid	Absorbing shocks
v) Spinal cord	Balancing the body

4. Fill in the blanks using suitable words.

Skin is the ……. organ in the human body. It consists of two layers called ……. and …… There are …….. cells in the epidermis. In some epidemic cells there is a special pigment called …… that determines the skin colour. It protects the skin from sun's ……. rays. There are …….. glands and …… glands within the dermis. When there is sunlight skin synthesizes vitamin …… In the skin there are …… that detect pressure, touch and temperature.

5. Write a list of protective measures that can be taken to maintain a healthy skin.

6. Name the parts 1-4 given in the cross section of the skin.



Technical Terms

Excretion	-	බහිස්ස්‍රාවය	-	கழிவகற்றல்
Excretory products	-	බහිස්ස්‍රාවිය ඵල	-	கழிவுப்பதார்த்தங்கள்
Urinary system	-	මෛත්‍ර පද්ධතිය	-	சிறுநீரகத்தொகுதி
Kidney	-	වෘක්කය	-	சிறுநீரகம்
Nervous system	-	ස්නායු පද්ධතිය	-	நரம்புத்தொகுதி
Nervous coordination	-	ස්නායු සමායෝජනය	-	நரம்பு இயைபாக்கம்
Central nervous system	-	මධ්‍ය ස්නායු පද්ධතිය	-	மைய நரம்புத்தொகுதி
Peripheral nervous system	-	පර්යන්ත ස්නායු පද්ධතිය	-	சுற்றயல் நரம்புத் தொகுதி
Brain	-	මොළය	-	மூளை
Spinal cord	-	සුෂුම්නාව	-	முண்ணான்
Impulse	-	ආවේගය	-	கணத்தாக்கம்
Dermis	-	චර්මය	-	மேற்தோல்
Epidermis	-	අපිචර්මය	-	உட்தோல்
Hypodermis	-	අධශ්චර්මය	-	அடித்தோல்
Sweat gland	-	ස්වේද ග්‍රන්ථිය	-	வியர்வைச் சுரப்பி
Sebaceous gland	-	ස්නේහස්‍රාවී ග්‍රන්ථිය	-	நெய்ச்சுரப்பி
Hair follicles	-	රෝම සුෂුනිකාව	-	மயிர்ப்புடைப்பு

10 Electricity

You may have used an electric torch when you are going out at night. You can get more light when using an electric torch with more cells.

You can use a line of bulbs to illuminate the environment in ceremonial occasions. In such occasions, colour bulbs can be used to increase the attraction. The bulbs illuminate because an electric source sends a flow of electric charges through them. Such a flow of electric charges is known as an **electric current.** The path of an electric current is called an **electric circuit.** A voltage should be supplied to a circuit for the flow of current. Voltage is supplied by an electric source.

Electric current flows only when an electrical source is connected in a closed circuit with conductors. A switch can be used to open or close a circuit when necessary.

Let us find out about making circuits using various electric components and how they work.

10.1 Various methods of connecting cells and bulbs

- **Series cell systems**

Let us find out methods of lighting a bulb, using several 1.5 V dry cells.

Activity 10.1

You will need :- Three identical filament bulbs (6.0 V), six dry cells (1.5 V), a switch, connecting wires, a voltmeter

Method :-

- First connect one dry cell with the bulb and the switch as shown in Figure 10.1. Connect the voltmeter to measure the voltage across the bulb.

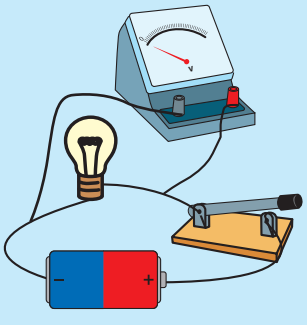


Figure 10.1

- Then connect two dry cells with another bulb and the switch as shown in Figure 10.2.

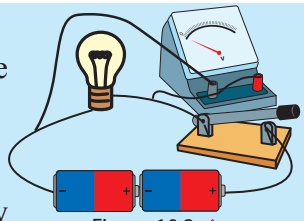


Figure 10.2

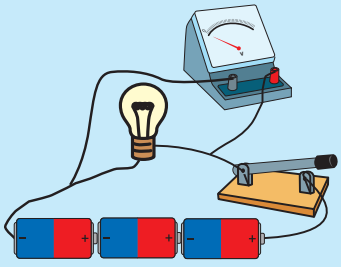


Figure 10.3

- After that connect three dry cells with the third bulb and the switch as shown in Figure 10.3.
- Now close the switches of all three circuits at the same time.
- Compare the brightness of the bulbs and record the voltmeter reading.
- Fill Table 10.1 according to your observation above.

Table 10.1

Occasion	Number of cells connected	Voltmeter reading	Brightness (comparatively)
Circuit in Figure 10.1			
Circuit in Figure 10.2			
Circuit in Figure 10.3			

It can be observed that the brightness of a bulb increases when more cells are connected as in Figure 10.1, 10.2 and 10.3 respectively. When the number of cells are increased, the voltage increases, and the current also increases accordingly.

When the required voltage for an electrical equipment cannot be supplied by a single cell, several cells are connected as in Figure 10.4.

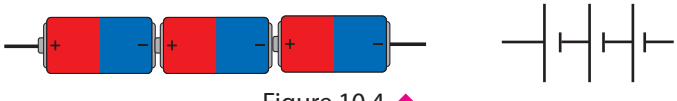


Figure 10.4

In this connection the negative terminal of one cell is connected to the positive terminal of the next one. The negative terminal of the second cell is connected to the positive terminal of the third one and so on.

When two or more cells are connected one after the other as described above it is called a series connection.

Therefore, such a cell system is known as series cell system. A combination of multiple cells is known as a battery. Two and three cell combinations shown in figure 10.5 are examples for batteries.

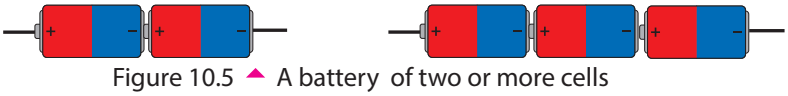


Figure 10.5 A battery of two or more cells

• Parallel cell systems

Another method of connecting the cells in a cell system (battery) is shown in Figure 10.6 (a) and 10.6 (b).

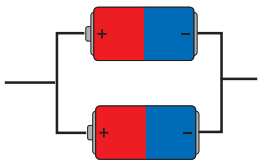


Figure 10.6 (a)

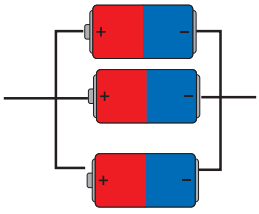


Figure 10.6 (b)

In this connection, positive terminals of all the cells are connected to one point and the negative terminals of them are connected to an another point. A connection like this is called a parallel connection. Such a cell system is known as a **parallel cell system.**

Let us do Activity 10.2 to study about parallel cell systems.

Activity 10.2

You will need:- Six dry cells (1.5 V), three identical filament bulbs (2.5 V), three switches, connecting wires

Method:-

- First, connect one dry cell with a bulb and a switch as shown in Figure 10.7.
- Close the switch and observe the brightness of the bulb.

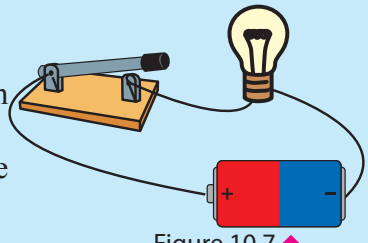


Figure 10.7

- Then, connect other cells to bulbs and switches as shown in Figure 10.8 and 10.9. Close the switches in each instance and observe the brightness of the bulbs.

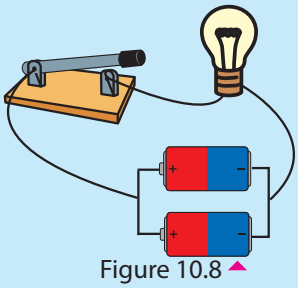


Figure 10.8

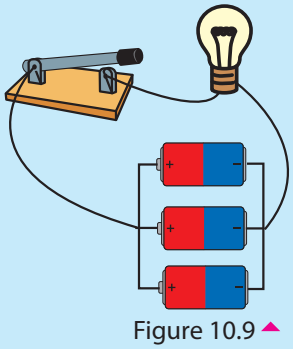


Figure 10.9

- Close the switches of the circuits as shown in Figure 10.7, 10.8 and 10.9 .
- Compare the brightness of the bulbs.

The bulbs will light with, more or less the same brightness in all the three instances mentioned above. Thus the current flowing through the bulbs should be equal. When cells are connected in this manner, each cell supplies less current. But, the collection of current supplied by cells is equal to current supplied by one cell. Therefore, when cells are connected parallely bulb can light for a longer time thus cells can last a longer time.

When current should be supplied for a long time to an electrical equipment parallel cell systems are used.

Systems of bulbs

Two simple methods of connecting several bulbs to a circuit are given in Figure 10.10 (a and b) below.

When bulbs are connected as in Figure 10.10 (a) it is called a **series** connection. When the connection is as in Figure 10.10 (b) it is a **parallel** connection.

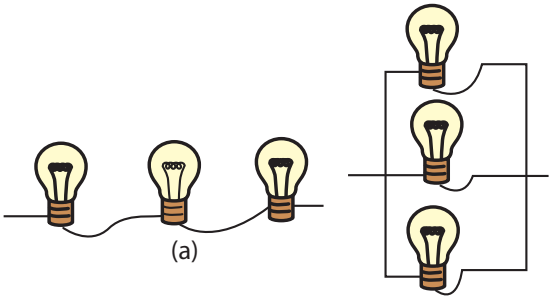


Figure 10.10

Series bulb system

Let us do Activity 10.3 to study about series bulb systems.

Activity 10.3

You will need:- Five filament bulbs (2.5 V), four dry cells, three switches, connecting wires

Method:-

- Connect one bulb with a switch and a cell as shown in Figure 10.11.

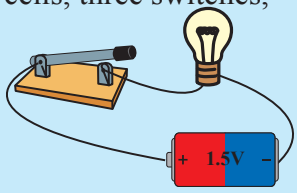


Figure 10.11

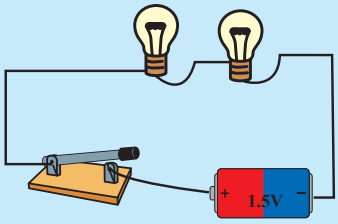


Figure 10.12

- Connect two bulbs with a switch and a cell as shown in Figure 10.12.
- Connect two bulbs, joined in series to a switch and two cells as shown in Figure 10.13.

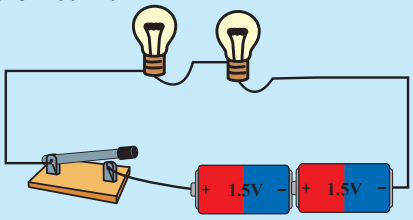


Figure 10.13

- Switch on all the three circuits at the same time and observe the brightness of the bulbs.
- Discuss with the teacher about the conclusion that you can come to, according to the observations.

According to Activity 10.3 it is clear that the brightness of the bulbs decreases, with the increase of bulbs connected in series across a voltage supply. But the initial brightness can be obtained by increasing the number of cells. Thus, several low voltage bulbs can be lit from a high voltage supply, when they are connected in series.

Parallel bulb system

Let us do Activity 10.4 to study about parallel bulb systems.

Activity 10.4

You will need:- Six filament bulbs (2.5 V), three dry cells (1.5 V), three switches, connecting wires

Method:-

- First, connect one bulb to a cell and a switch as shown in Figure 10.14.

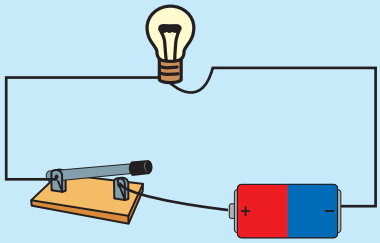


Figure 10.14

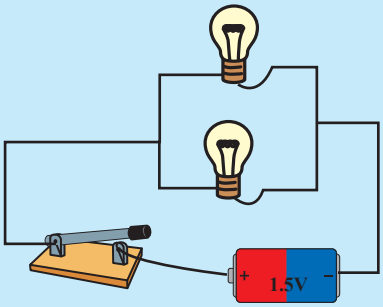


Figure 10.15

- Connect two parallelly connected bulbs to a switch and a cell as shown in Figure 10.15.
- Connect three parallelly connected bulbs to a switch and a cell as shown in Figure 10.16.

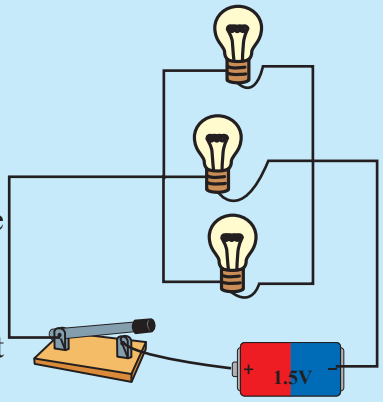


Figure 10.16

- Now switch on all the three circuits at the same time.
- Observe the brightness of the bulbs.
- Discuss with your teacher, the conclusions that you can make according to the observations.

The brightness will not significantly change even though the number of bulbs, connected in parallel are increased. They all will light with almost the same brightness.

10.2 Simple electric circuits

• Electric torch

Electric torch is an essential equipment when we are going in dark at night and when we are in search of something in dark.

There are electric torches with only one dry cell or with several dry cells connected in series. The Figure 10.17 shows such an electric torch.

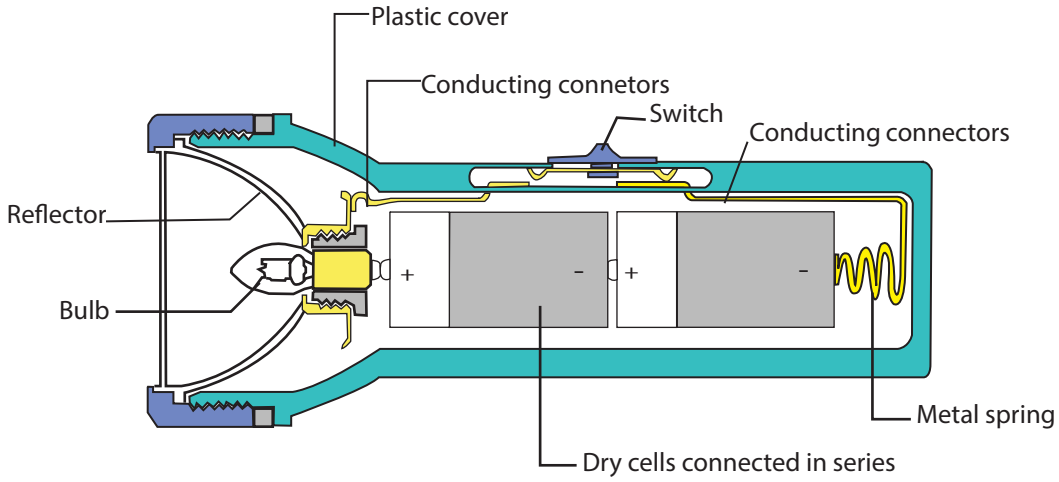


Figure 10.17 ▲ Electric torch

As shown in Figure 10.17, dry cells, bulb, metal spring and conducting connectors of this torch are connected with each other. But the circuit is open because of the switch. Therefore, the bulb does not light. When the switch is pushed forward, the gap between the conducting connectors is closed and the bulb is lit.

Assignment 10.1

- Using the circuit symbols for bulb, electric cell, switch and connecting wires, draw the circuit diagram for electric torch in Figure 10.17.
- Explain the advantages of using a reflector in an electric torch.

• Light decoration

You may have seen that light decorations are used to decorate various ceremonial occasions.

Let us do Activity 10.5 to make a light decorating circuit.

Activity 10.5

You will need:- Power supply (6 V) or four dry cells, six colour LEDs (two red, two blue and two green), connecting wires, copper strips

Method:-

- Draw a diagram for the circuit shown in Figure 10.18. Indicate where the switches should be connected to light blue LEDs, only red LEDs, only green LEDs, and both blue and green LEDs at the same time.
- Make the circuit on a board. Take all switches to one place of the board. Supply power to the circuit.
- By opening and closing the switches, try to build a simple pandol.

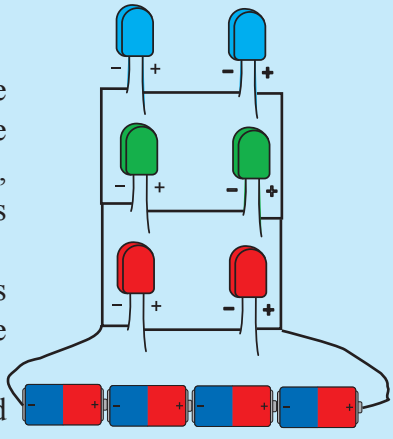


Figure 10.18

Assignment 10.2

- Make some light decorating circuits using dry cells, LEDs, switches and connecting wires. Get the assistance of your teacher for this.

10.3 Current controlling components

On various occasions it is necessary to control the amount of current flowing through an electric circuit. There are several components that can be used for this purpose. We can use those components according to the situation. Let us consider, how some of such components can be used.

Switches / Keys

Switches or keys are used to turn on or turn off an electric current flow through a circuit when necessary. There are various types of keys. Some simple keys are mentioned below.

Tap key

Diagram of a Tap key is shown in Figure 10.19 (a). P and Q are the terminals connected to the circuit. When the B end of the metal strip is pressed with your finger, X and Y ends contact each other. Then, the circuit between P and Q is completed. When the finger is released B end of the AB metal strip lifts up as a spring. Hence, circuit is disconnected.

This is called one way tap key because it is used to let the current to flow one direction.

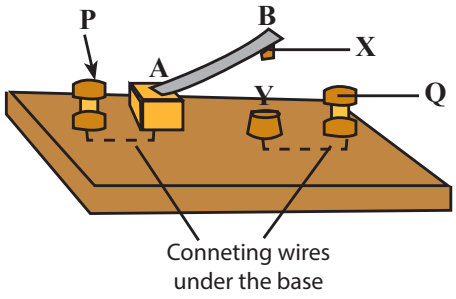


Figure 10.19 (a) ▲ Tap key

Plug key

Diagram of a Plug key is shown in Figure 10.19 (b). P and Q are the terminals connected to the circuit. There is a gap between the metal blocks made of brass. When the plug rod is inserted into the hole between the gap, the circuit is closed. When the plug rod is removed, circuit is disconnected.

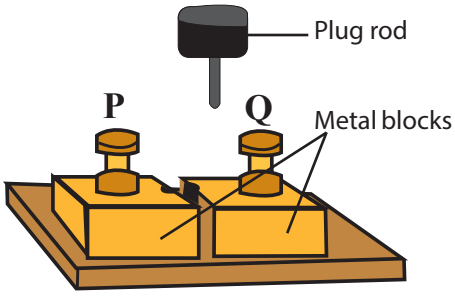


Figure 10.19 (b) ▲ Plug key

Permanent resistors

Obstacle to flow an electric current through a conductor is called the **resistance**. Components that have the property of resistance are known as **resistors**.

Copper wires are used to connect circuits because their resistance is very low. Resistance of wires made of nichrome and manganin is very high. Therefore, wires made of metals like nichrome and manganin are used to make resistors.

There are resistors made to certain fixed values in the laboratory. They are known as **fixed resistors**.

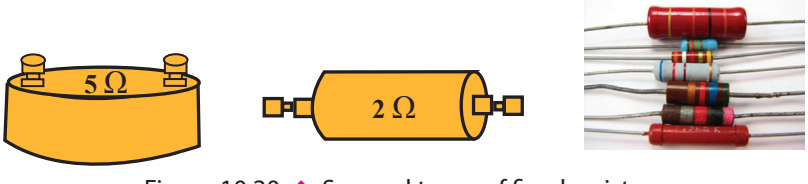


Figure 10.20 ▲ Serveral types of fixed resistors

Every electric component has an exact resistance value. Therefore, they also can be considered as permanent resistors.

Activity 10.6

You will need :- A permanent resistor of 2 Ω, a permanent resistor of 5 Ω, a Filament bulb of 2.5 V, two dry cells, an ammeter or milliammeter, a switch, connecting wires

Method:-

- Connect the bulb, the switch, the ammeter or milliammeter and dry cells as shown in Figure 10.21.
- Close the switch and record the ammeter reading. Observe the brightness of the bulb also.
- Then, connect the extra fixed resistor of 2 Ω to this circuit as shown in Figure 10.22.

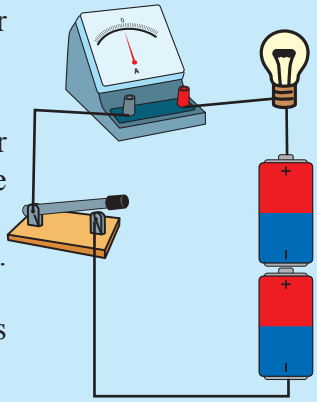


Figure 10.21

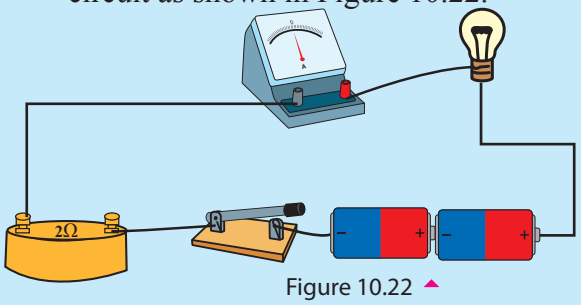


Figure 10.22

- Close the switch, observe the brightness of the bulb and record the ammeter reading.
- Open the switch of the circuit shown in Figure 10.22 and replace the fixed resistor of 5 Ω instead of 2 Ω resistor
- Close the switch again. Then, observe the brightness of the bulb and record the ammeter reading.
- Complete Table 10.2 according to the observations you made

Table 10.2

Instance	Brightness of the bulb	Ammeter reading
Without permanent resistor		
With permanent resistor of 2 Ω		
With permanent resistor of 5 Ω		

- What is the conclusion that you can reach according to your observations?

When an extra resistor is connected to an electric circuit, electric current flowing through the circuit is reduced. When the resistance of the circuit increased further current flowing decreases. Therefore, it is clear that the current flowing through a circuit can be reduced by connecting fixed resistors to increase the resistance.

Variable resistor

The above mentioned fixed resistor has a definite resistance. There are resistors made by connecting several resistors to vary the current flowing through a circuit. They are called variable resistors. Figure 10.23 shows such a variable resistor.

Figure 10.23 ▲ Variable resistor

Activity 10.7

You will need:- A Filament bulb, two dry cells, a switch, a milliammeter, a variable resistor, connecting wires

Method:-

- Connect the bulb, the switch, the dry cells, the milliammeter and the variable resistor as shown in Figure 10.24.
- Turn the adjustable key of the variable resistor to the maximum value.
- Close the switch and let the current flow through the circuit.
- Observe the brightness of the bulb and record the milliammeter reading.
- Shift the adjustable key of the variable resistor to decreasing resistance values. Observe how the brightness of the bulb and the milliammeter reading change.

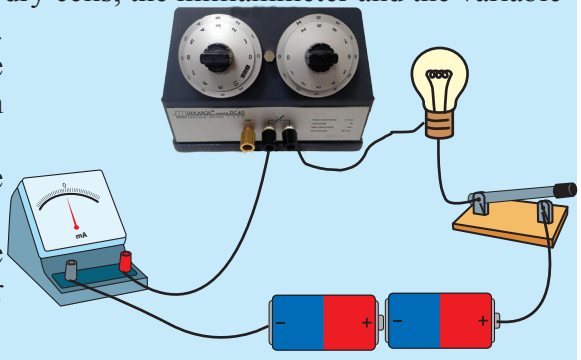


Figure 10.24 ▲

According to the observations of Activity 10.7, current flowing through the circuit decreases when the resistance is increased.

Rheostat

It is revealed in the activity above, that the current flowing through a circuit can be changed using a variable resistor.

However, in a variable resistor like the one shown in Figure 10.23, by changing the resistance a current with a necessary value cannot be obtained.

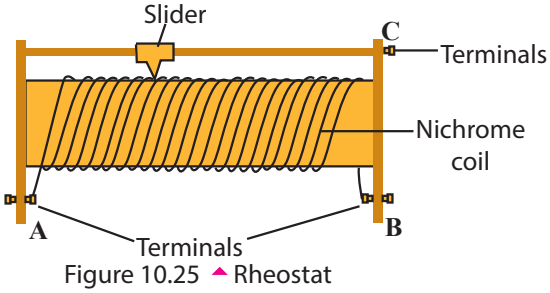


Figure 10.25 ▲ Rheostat

A rheostat is a variable resistor in which the current with a necessary value can be obtained. Such a rheostat is shown in Figure 10.25.

A rheostat is connected to the circuit by the terminals A and C or B and C. Necessary value of the resistance can be adjusted by moving the slider.

Activity 10.8

You will need:- A rheostat, a filament bulb, two dry cells or any other current supply, a switch, an ammeter or a milliammeter, connecting wires

Method:-

- Connect the bulb, the rheostat, the switch, the milliammeter and the cells to construct the circuit as shown in Figure 10.26.
- Close the switch. The bulb lights and the milliammeter shows the reading relevant to the current flow.
- Then, shift the slider of the rhesotat to and fro. You can observe the change of the brightness of the bulb and milliammeter reading.
- Now, shift the slider of the rheostat to read the values of current you selected, in milliammeter (such as 100 mA, 200 mA, 500 mA)
- According to this activity, it is clear that the current flowing through a circuit can be changed to our requirement using a rheostat.

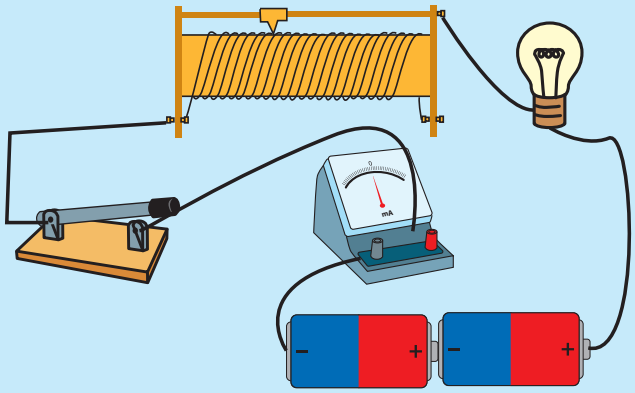


Figure 10.26

Light dependent resistor

There are resistors that change their resistance when the intensity of light falling on them changes. Such resistors are known as **Light dependent resistors (LDR).**

Figure 10.27 shows light dependent resistor.

Figure 10.27 Light dependent Resistor

Activity 10.9

You will need:- A light dependent resistor, a filament bulb, a milliammeter, two dry cells (1.5V), a switch, an electric torch

Method:-

- Construct the circuit connecting the bulb, the milliammeter, the light depentent resistor, the switch and the dry cells as shown in Figure 10.28.

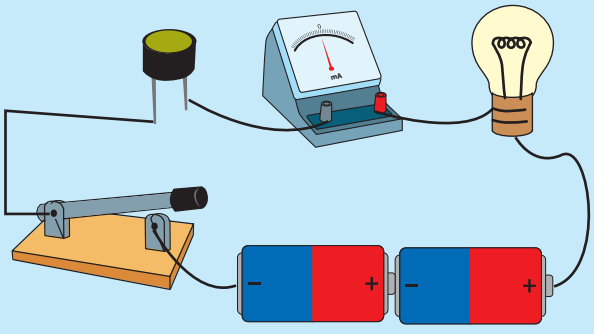


Figure 10.28

- First, cover the light dependent resistor, so that no light falls on it. Record the observations.
- Then, remove the cover and let light in the environment falls on the light dependent resistor. Record the observations.
- Next, light the electric torch and direct its light on the light dependent resistor. Record the observations.
- Discuss the reasons for your observations.

When light falls on a light dependent resistor its resistance decreases. Therefore, current flowing through the circuit increases.

When the intensity of light falling increases, the resistance decreases. Therefore, current flowing through the circuit increases further.

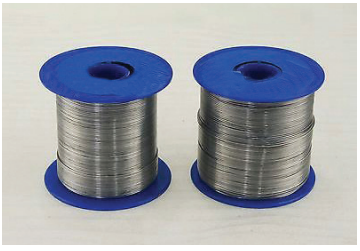
Hence, the light dependent resistor can be used to control the electric current flowing through a circuit.

Soldering tools

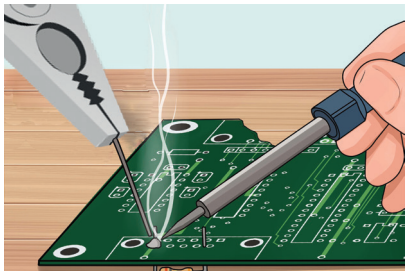
Have you ever constructed an electrical circuit ? In those instances what is the method you used to connect the components to the circuit. Most probably you may have used a type of adhesive tape. Sometimes the joints are not properly connected when adhesive tapes are used. Then, the circuit does not work properly. As a solution to those problems, the joints are soldered when componets of circuits are assembled.

Let us find out how this soldering is done. A tool, shown in Figure 10.29 (a) is used for this purpose. When electricity is supplied to the tool the tip of this tool gets heated. So, the melted soldering lead is applied to the joints of the circuit. Then joints are firmly connected by soldering lead and are not disconnected.

(a) Soldering tool (Soldering iron)



(b) Soldering lead



(c) Soldering

Figure 10.29 ▲ How soldering is done

For your attention

The tip of the soldering tool gets highly heated, therefore some materials that come into contact, can be burnt.

Therefore, soldering tool should not be kept on things that are damaged by heat. So this tool should be carefully handled.

10.4 Household electrical appliances

Electricity is very important for various day-to-day work. Electricity is one of the ways used to gain energy. Electrically powered equipment can be used to ease our work and do it efficiently and economically. Those electrically powered equipment are known as **electrical appliances**.

For your attention

The voltage in Volts (V) that should be supplied and the power in Watts (W) of an appliance at that voltage is mentioned on it. If a voltage, higher than that is mentioned is supplied, the appliance will be damaged.

Assignment 10.3

- List out the electrical appliances used in your home and in your school.
- Tabulate those appliances according to their use.

Table 10.3

Use	Name of the appliance	Voltage (V) used	Power (W)
Lighting	1.		
	2.		
	3.		

Cooking	1.		
	2.		
	3.		
	4.		
Air conditioning	1.		
	2.		
Communication	1.		
	2.		
	3.		
Other (mention the use)			

There are some important facts that should be considered when using electrical appliances.

1. Selection of an appliance to suit the need

e.g. 1 :- When reading books at night, you can use a table lamp with a bulb of 5W/ 10W instead of 40 W bulb.

e.g. 2 :- A rice cooker of 240 V/ 700 W is suitable to cook rice for a few people, and a rice cooker of 240V/ 2000W is suitable to cook rice for a group.

The number of electrical units used, can be reduced by selecting appliances appropriately. Hence, the expenses for household electric bill can be reduced.

2. Selection of an efficient appliances

The efficiency of appliances is indicated on some of them. such information is useful to select more efficient appliances.

e.g.:- CFL of 240 V/14 W gives an intensity of light equal to a filament bulb of 240V/ 60 W or LED of 240V/ 7W. Therefore, it is suitable to use a 240 V / 14 W of CFL or 240V/ 7W of LED instead of a filament bulb.

3. Safe use of appliances, so that user and the others are out of danger

Some examples are given below.

e.g. 1:- It is important to operate electrical appliances away from water taps, places of leaking water, hearths and fire.

e.g. 2:- Test whether the connecting wires are damaged before using the appliances.

e.g. 3:- Refrain from wrong practices when connecting plug tops to plug bases.

4. Usage of household electric circuit and the appliances without getting damaged

Household electric circuits may be short circuited when they are being used. Then, the circuit may fuse and the components may be damaged. Therefore, care should be taken before using electrical appliances.

It is not suitable to use several high power electrical appliances when they are connected to the same socket. For instance, when several appliances like electric iron, refrigerator, electric ovens, washing machine and grinder are connected to the same socket it draws a large current from the household electric circuit. This causes heating of the connecting wires and as a result they can catch fire. Usage of such a high current is called over loading.

10.5 Heating effect of electric current

When an electric current is flowing through a wire, electric energy is tranformed to heat. Therefore, the conducting wires get heated. This is called the **heating effect** of electric current.

Activity 10.10

You will need:- A filament bulb (2.5 V), two electric cells, a switch, connecting wires

Method:-

- Connect the bulb, two electric cells and the switch as shown in Figure 10.30.
- Touch the glass cover of the bulb.
- Close the switch and let electric current flow for few seconds.
- Touch the glass cover of the bulb again. (As it is dangerous to touch an electric bulb or a part of a circuit, refrain from touching electric circuit without the teacher's instructions.)

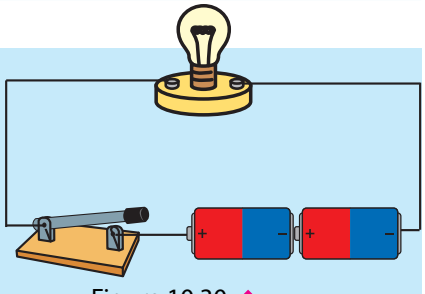


Figure 10.30

You will feel that the bulb has heated after the flow of electricity for some time. This reveals the heating effect of current.

Activity 10.11

You will need:- A nichrome wire and a copper wire of same length (30 cm) and thickness, a piece of plank, three nails, a dry cell, a switch, connecting wires, a hammer

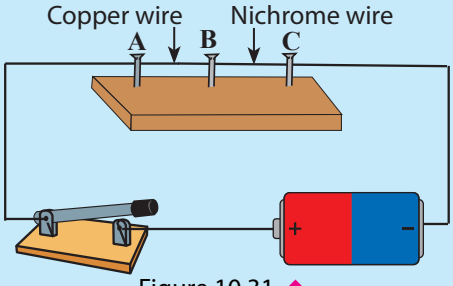


Figure 10.31

Method:-

- Fix the three nails A,B and C on the plank, keeping 30 cm gap between each other as shown in Figure 10.31.
- Tie the copper wire between A and B nails and nichrome wire between B and C nails. Both wires should be well stretched.
- Then, connect the nails A and C of the plank to the switch and the dry cell with connecting wires as shown in Figure 10.31.
- Touch the copper and nichrome wires. Then, close the switch for about one minute to allow current to flow and touch the two wires again. (As it is dangerous to touch a part of a circuit, refrain from touching electric circuits without the teacher's instructions.)
- Discuss the observations.

Here, same electric current flows through both wires. But nichrome wire is heated more than the copper wire.

For extra knowledge

Resistance of wires made of nichrome and manganese is higher than that of wires made of copper or aluminium.

Heating effect of an electric current depends on the resistance and the current flowing through a conductor.

When the resistance of the conductor is high, more heat is generated. When the current flowing through the conductor is high, more heat is generated.

Resistance of a conductor depends on the material it is made of, its length and its thickness (area of cross section).

Therefore, very thin, long nichrome wires are used in electrical appliances in which, heat is generated using heating effect of electricity. In our day-to-day life there are electrical appliances that use heating effect of electricity as well as the appliances where the same effect is disadvantageous.

Assignment 10.4

- List out some day-to-day appliances in which the heating effect of electricity is effectively used.
- Tabulate the appliances, you identified according to their use.

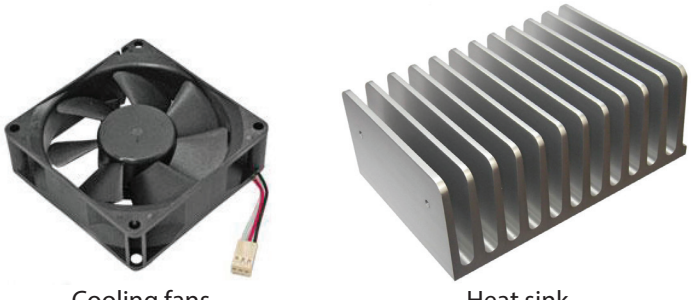
Table 10.4

Name of the appliance	Purpose

Heating effect of electricity is a disadvantage in some electrical appliances. Various methods are used to avoid damages that happen due to the heat generated in them.

e.g.:-

- Heating effect of electricity is a disadvantage in some electrical appliances such as computers. Cooling fans are used to cool such appliances.
- Heavy duty semi conductors such as transistors produce heat. Therefore, heat sink is used to cool the appliance.



Cooling fans Heat sink

Figure 10.32

For extra knowledge

Nichrome is an alloy. It is made by mixing nickel, chromium and iron.

10.6 Light effect of electric current

Junctions of most junction diodes get heated when electric current flows through them. It happens because part of the electric energy is emitted as heat energy at the junction.

In some junction diodes, part of the electric energy is emitted as light energy at the junction. Then, the junction is illuminated. This emission of part of the electric energy as light energy is known as the **light effect** of electric current. Such diodes that emit light are known as **Light emitting diodes (LED)**.

Activity 10.12

You will need:- Several LEDs of various colours (red, green, blue), a multicolour LED, connecting wires, a switch, two dry cells

Method:-

- Prepare the circuit by connecting an LED, the switch and two dry cells using connecting wire as shown in Figure 10.33.
- Close the switch and observe the LED.
- Connect each LED to the circuit and observe the colour of light emitting.

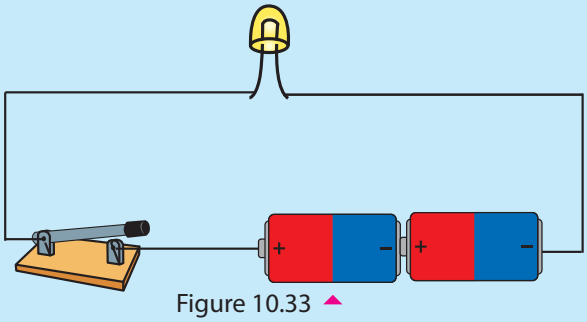


Figure 10.33

Various light emitting diodes

Light emitting diodes emit various colours of light. Colour of the light emitted depends on the compound used to make the junction of LED.

Some LEDs emit several colours. They are known as multi colour LEDs.

LEDs are used for light decorative purposes as well as indicators to show whether circuit equipment are in active mode.

There is a high demand for lamps made of LEDs than for other types of electric lamps and bulbs because of the prevailing energy crisis. The reason for this is the higher efficiency of LED lamps, than the other types of lamps.

Figure 10.34 shows an LED and its circuit symbol.

When an LED is being connected to a circuit the positive and negative terminals should be connected correctly.

There is a minimum voltage that should be supplied to an LED to light it. Voltage supplied should exceed that minimum value for the LED to light it up.

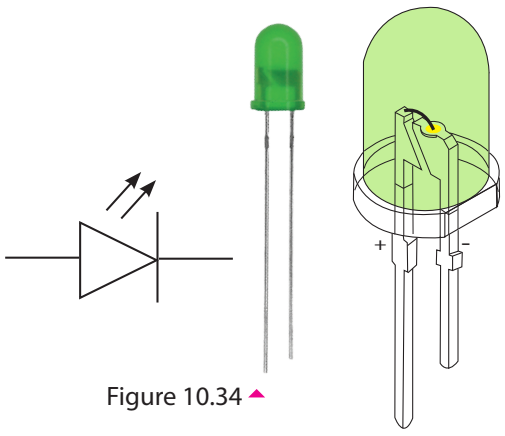


Figure 10.34

10.7 Magnetic effect of electric current

You may have seen that iron nails and pins are attracted to a magnet. Same way you can see that the indicator is deflected when a compass is brought colse to a magnet.

When a compass is kept close to a current carrying conductor also, its indicator deflects. When the current flowing through the conductor is stopped, indicator of the compass returns to its initial position. It happens because a magnetic field is generated by an electric current carrying conductor. This phenomenon is known as the **magnetic effect** of electric current.

Activity 10.13

You will need:- A compass, a piece of plank 20 cm x 5 cm, two iron nails, copper wire, a dry cell, a bulb, a switch

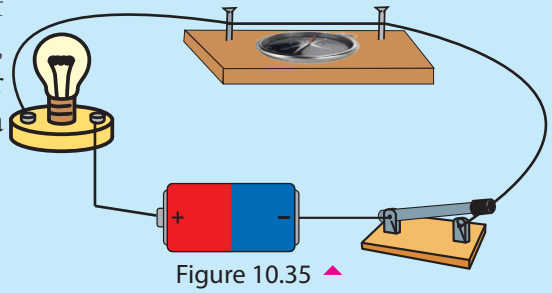


Figure 10.35

Method:-

- Fix two iron nails at the corners of the piece of plank as shown in Figure 10.35.
- Stretch well and tie the copper wire to the nails. Connect the two ends of the copper wire to the bulb to the dry cell and to the switch as shown in Figure.
- Place the compass under the stretched copper wire. Turn the wire to north-south direction of the earth. So, that the copper wire and the compass needle will be parallel to each other.

- Now, close the switch. The bulb will light and a deflection of the compass needle can be observed.
- Open the switch again. The bulb will not illumintate and the compass needle will turn back to its initial position.

This activity shows that a magnetic field is generated by a conductor which carries current and such a conductor acts as a magnet. In the chapter about magnets, it is magnetic effect of eletricity that you used to make temporary magnets.

Activity 10.14

You will need:- Two iron nails of 10 cm length, enamel plated copper wire, two dry cells, an ammeter, a switch, some pins

Method:-

- Make a coil by winding enamal plated copper wire round a nail.
- (Step 1) Connect the coil to the ammeter, switch and one dry cell in series as shown in Figure 10.36. Close the switch. Bring the coil close to the pins. You will find that the pins are attracted to the nail. Count the number of pins attracted and record.

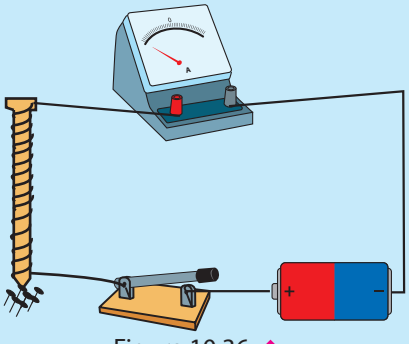


Figure 10.36

- (Step 2) Open the switch and remove the iron nail from the coil carefully as shown in Figure 10.37. Then, close the switch and bring the coil close to pins. The pins will be attracted. Count the number of pins attracted and record.

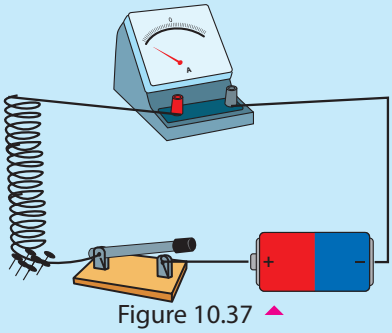


Figure 10.37

- (Step 3) Connect two dry cells in series to the circuit as shown in Figure 10.37, instead of one cell. Then, close the switch and bring the coil closer to the pins. It will be observed that the ammeter reading is increased and more pins are attracted. Count the number of pins attracted and record.

- (Step 4) Make another coil by winding more number of turns of copper wire round an iron nails as shown in Figure 10.38. Connect this coil with the nail to the circuit as before. Connect only one dry cell as shown in Figure 10.38. Close the switch and bring the nail closer to the pins. Count the number of pins attracted and record. Record the ammeter reading also.

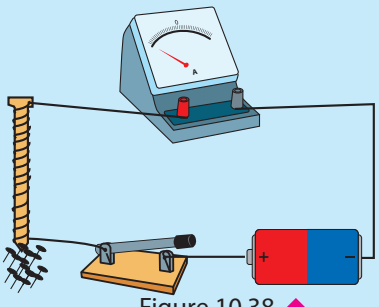


Figure 10.38

Table 10.5

Occasion	Number of pins attracted	Ammeter reading
Step 1		
Step 2		
Step 3		
Step 4		

- Identify the factors affecting the strength of an electromagnet by comparing the number of pins attracted.

According to the activity above, it is revealed that the strength of an electromagnet depends on;

- The type of core in the coil
- The electric current flowing through the coil
- The number of turns of the coil

Thus, the strength of an electromagnet;

- increases when there is a magnetic medium as the core of the coil.
- increases when the electric current flowing through the coil is increased.
- increases when the number of turns of the coil is increased.

Uses of electromagnets

Have you ever dismantled any electrical appliance which are out of use ? With the guidance of your teacher or an adult, do so and examine what is inside.

In some electrical appliances, electro magnets are used.

e.g.:- Electric fans, electric bells, electric grinders, electric water pumps, washing machines, some automatic switches

Electromagnets are used to separate iron from metal wastes. Such an instance is shown in Figure 10.39.


Figure 10.39
Usage of an electromagnet

Assignment 10.5

- Use a bell cup, a hacksaw blade, a bolt of 1 cm with a nut, metal rods of 4 cm length, enamal plated copper wire, a wooden strip to the size 12 cm x 10 cm x 1cm, Two bolts of the length of 1.5 cm, conducting wires, two dry cells and a sand paper
- Make an electric bell using the above items. Get the assistance of your teacher when necessary.

10.8 Chemical effect of electric current

You can see a gas bubbling around a piece of zinc, dipped in diluted hydrochloric acid. It happens because of the chemical reaction between zinc and hydrochloric acid.

Acidulate about 200 ml of water in a beaker with a few drops of hydrochloric acid. Dip two copper plates or rods which are connected to the terminals of a dry cell into this beaker. You can see a gas bubbling near the plates. Here the electrical energy is converted to chemical energy. This phenomenon is known as the **chemical effect** of elctric current.

Activity 10.15

You will need:- A beaker of 250 ml, two dry cells, two carbon rods with metal caps taken from worn out dry cells, 150 ml of acidulated water, connecting wires

Method:-

- Clean the carbon rods using a sand paper.
- Connect two wires to the caps of cleaned carbon rods securely.
- Connect the other ends of the wires to the set of two dry cells joined in series.
- Then, dip the carbon rods in the beaker of acidulated water, as shown in Figure 10.40.
- Bubbling of a gas can be observed near the carbon rods.

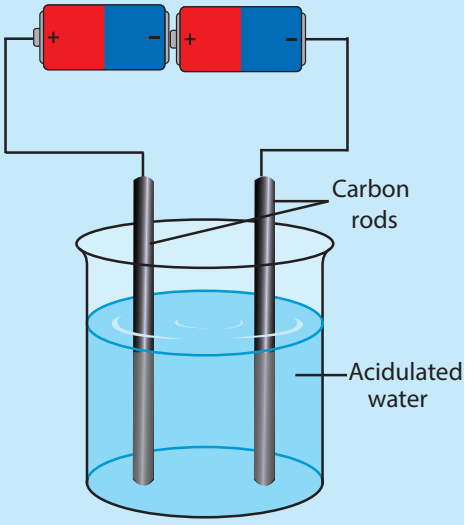


Figure 10.40

- When the dry cells are removed and both ends of the wires are connected together while the rods are still in acidulated water, no bubbling can be observed.

This activity reveals that when an electric current flows, a chemical reaction occurs at the electrodes (carbon rods).

Electroplating

A metal can be plated on metallic object a using the chemical effect of electric current. This is known as electroplating. Some examples of its usage are given below.

- Plating gold or silver on jewellery
- Plating metals like chromium or nickel on equipment like spoons, forks, knives, bath room sets made of iron to prevent rusting and to give them an attractive appearance
- Plating tin inside iron containers, used for canning food

Activity 10.16

You will need:- A beaker of 250 ml, two dry cells, 100 ml of concentrated copper sulphate solution, a cleaned copper plate of 6 cm x 1cm, an iron spoon

Method:-

- Add copper sulphate solution to the beaker.
- Connect two connecting wires to the coppper plate and iron spoon securely. Connect the free ends of the two connecting wires to a set of two dry cells joined in series.
- Then dip the copper plate and the spoon in the beaker of copper sulphate solution, at the same time.
- Observe the spoon after about 10 minutes.

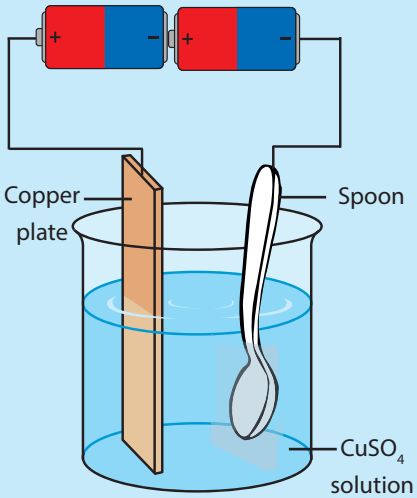


Figure 10.41

It can be seen that the part of spoon dipped in copper sulphate solution has turned copper colour. This happens because a thin layer of copper is deposited on the spoon. This is known as electroplating.

Summary

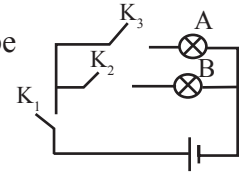
- Bulbs can be connected in series or in parallel in circuits.
- Cells can be connected in series or in parallel to supply electricity to the circuits.
- There is a simple eletric circuit in the electric torch.
- Switches and resistors are current controlling components.
- Tap key and plug key are two types of switches.
- Fixed resistors, variable resistors, rheostat and light dependent resistors are also current controlling components.
- Equipment used to perform useful tasks using electricity are called electric appliances.
- Some electrical appliances use heating effect of electric current to generate heat.
- Light emitting diode is a component that use the lighting effect of electric current
- Electromagnet is a component that uses the magnetic effect of elecric current.
- The strength of an electromagnet depends on the type of core in the coil, the electric current flowing through the coil and the number of turns of the coil.
- Electroplating is an instance where the chemical effect of electric current is used.

Exercise

Multiple choice questions

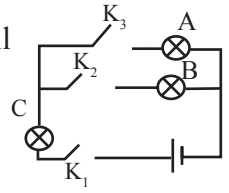
1) Select the most suitable answer.

1. What are the keys (switches) in the circuit that should be closed to light bulb A only ?



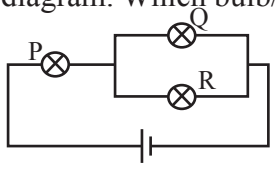
1. K_3 only
2. K_3 and K_2 only
3. K_1 and k_3 only
4. K_1, K_2 and K_3 keys

2. There are four answers about the key combinations that will turn on bulb C on what is the **false** answer out of those ?



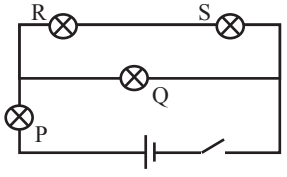
1. All the keys
2. K_1 and K_2 only
3. K_1 and K_3 only
4. K_1 only

3. P, Q and R are identical bulbs in the circuit given in the diagram. Which bulb/ bulbs give the brightest illumination ?



1. Bulb P
2. Bulb Q
3. Bulb R
4. Bulbs Q and R

4. What is the correct answer about the brightness of the bulbs, when the switch is closed ?



1. P gives the brightest illumination.
2. Q gives the brightest illumination.
3. R and S give the brightest illuminaion.
4. Any bulb does not illuminate.

5. The device, that can be used to vary the electric current of circuit continuously is,

1. Switch
2. Variable resistor
3. Rheostat
4. Fixed resistor

6. Which one below is an observation of heating effect of electric current ?

1. Light emitting when an electric current is flowing through a LED.
2. Heating of the bulb, when a current is flowing through a filament bulb.
3. Bubbling near the copper plates due to chemical reaction
4. Attraction of pins to the coil due to electromagnetism.

7. Several phenomena are given below.

A. Emission of light when an electric current flows through a LED.

B. Attraction of pins to a copper coil when a current is flowing through it.

C. Flow of an electric current when sunlight falls on an LDR connected to a circuit.

D. Plating gold on jewellery in electroplating.

Which one above is **not** an effect of electric current ?

1. A
2. B
3. C
4. D

8. When the electric current flowing through a conductor is reduced the strength of the magnetic field generated;

1. Increases
2. Decreases
3. First decreases and then increases
4. Does not change

9. What are the factors below, on which the strength of the magnetic field, generated in a current - flowing coil depends ?

A. Amount of electric current flowing
B. Type of core in the coil
C. Number of turns of the coil
D. Direction of the current flowing

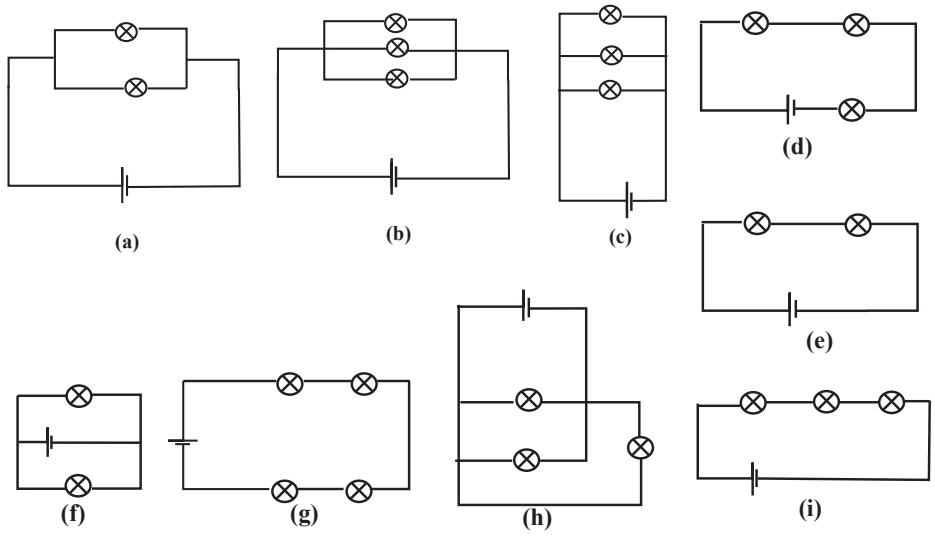
1. A and B only
2. B and C only
3. C and D only
4. A, B and C only

10. Which of the following electrical appliance does **not** use an electromagnet ?

1. Electric bell
2. Electric fan
3. Immersion heater
4. Hand drill

Essay questions

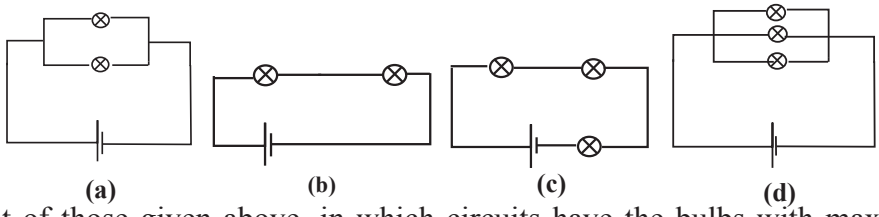
1) Circuits below show different ways of connecting several bulbs with a cell.



a) What are the circuits here in which the bulbs are connected in series ?

b) What are the circuits here in which the bulbs are connected in parallel ?

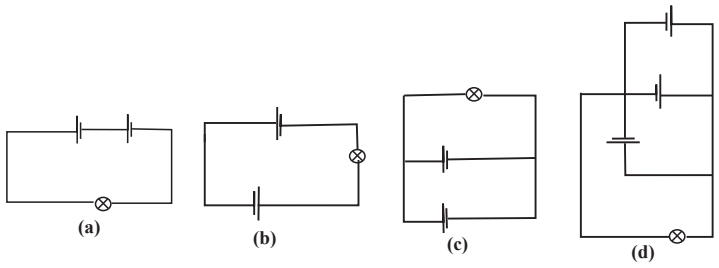
2) In the circuits below all the cells are identical and all the bulbs also are identical.



a) Out of those given above, in which circuits have the bulbs with maximum brightness?

b) In which circuits have the bulbs with minimum brightness ?

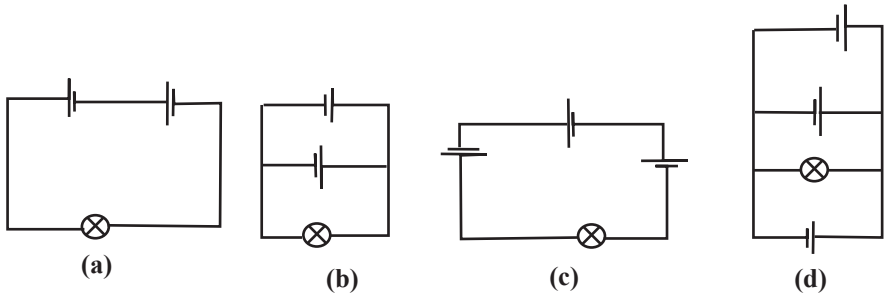
3) Circuits given below show different ways of connecting several cells with a bulb.



a) Out of those given above, which circuit contains dry cells connected in a series manner?

b) Select the circuits in which dry cells are connected in parallel.

4) Several electric circuits are given below. All bulbs used, are identical and all the electrical cells also are identical.



a) Which circuit has the bulbs with maximum brightness ?

b) Which circuits have the bulbs with minimum brightness ?

Write down the answers for the following questions.

5) What are the components which can be used to control the electric current ?

6) Explain briefly, how the electric current is controlled by a light dependent resistor in a circuit.

7) What are the points that attention should be paid when using electrical appliances ?

8) i. Name some of the effects of electric current ?

ii. State the energy transformation that occurs in each effect you mentioned.

iii. Mention one electrical appliance found in daily usage with using each effect of electric current mentioned above.

9) i. Using diagrams describe briefly, the way of making a simple electromagnet.
ii. What are the factors on which the strength of an electromagnet depends ?

10) i. What are the effects of electric current used in the LED and in the filament bulb ?

ii. Discuss the importance of using an LED instead of a filament bulb.

Technical Terms

Series circuit	-	ශ්‍රේණිගත පරිපථ	-	தொடர்ச்சுற்று
Parallel circuit	-	සමාන්තරගත පරිපථ	-	சமாந்தரமான சுற்று
Electrical appliance	-	විද්‍යුත් උපාංග	-	மின்சாதனம்
Tap key	-	ටැප යතුර	-	தட்டு சாவி
Plug key	-	පේනු යතුර	-	செருகு சாவி
Resistance	-	ප්‍රතිරෝධය	-	தடை
Resistor	-	ප්‍රතිරෝධකය	-	தடையி
Rheostat	-	ධාරා නියාමකය	-	இரையோதற்று
Light dependent resistor (LDR)	-	ආලෝක සංවේදී ප්‍රතිරෝධකය	-	ஒளிஉணரித்தடையி
Compact fluorescent lamps	-	සංඝනිත ප්‍රතිදීපන පහන්	-	புளோரசன் விளக்கு
Short-circuit	-	පරිපථ ලුහුවත් වීම	-	மின்கசிவு
Overloading	-	අධිභරණය	-	மிகையோட்டம்
Nichrome	-	නික්‍රෝම්	-	நிக்குரோம்
Electromagnet	-	විද්‍යුත් චුම්බක	-	மின்காந்தம்
Electroplating	-	විද්‍යුත් ලෝහාලේපනය	-	மின்முலாமிடுதல்
Magnetic field	-	චුම්බක ක්ෂේත්‍රය	-	காந்தப் புலம்
Heating effect	-	තාපන ඵලය	-	வெப்ப விளைவு
Light effect	-	ප්‍රකාශ ඵලය	-	ஒளி விளைவு
Magnetic effect	-	චුම්බක ඵලය	-	காந்த விளைவு
Chemical effect	-	රසායනික ඵලය	-	இரசாயன விளைவு
Light emitting diode (LED)	-	ආලෝක විමෝචක ඩයෝඩය	-	ஒளிகாலும் இருவாயி
Electric bell	-	විදුලි සීනුව	-	மின்மாணி
Compass	-	මාලිමාව	-	திசைகாட்டி
Deflection	-	උත්ක්‍රමණය	-	திரும்பல்
Electrode	-	ඉලෙක්ට්‍රෝඩය	-	மின்வாய்
Terminal	-	අග්‍රය	-	முடிவிடம்

11 Main biological processes in plants

Plants are considered as the main living component that contributes much for the proper existence and security of environment.

Plants carryout a number of biological processes for their existence. Let us study about such biological processes taken place inside plants.

11.1 Photosynthesis

Plants are autotrophic; which means they can produce their own food. Hence, plants contribute for the existence of themselves as well as animals.

Observe Figure 11.1 to study about photosynthesis, that is the biological process carried out by the plants to produce food.

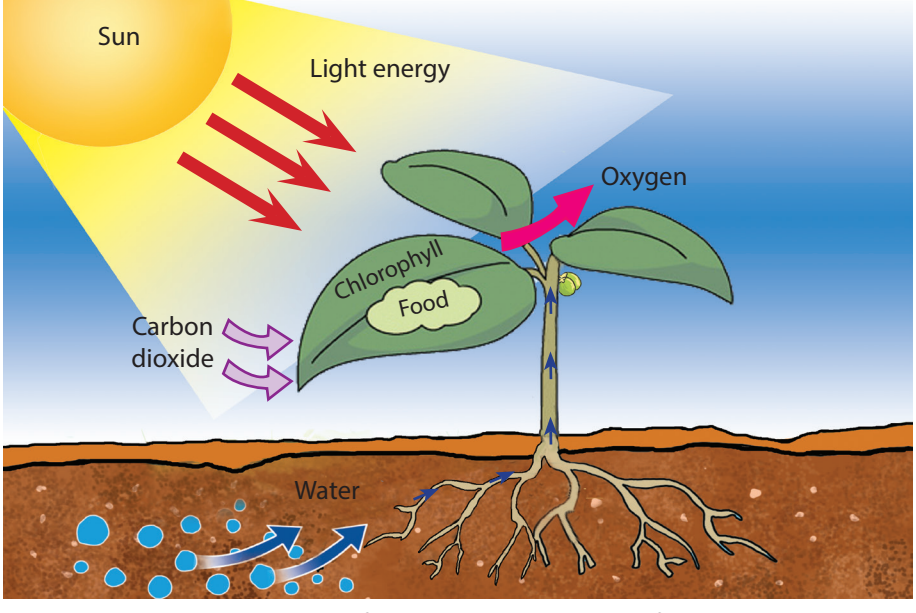


Figure 11.1 ▲ The essential factors and the products of photosynthesis

Leaf is the main organ, which produce food. The factors necessary for photosynthesis and the method of obtaining these factors are given below.

- Carbon dioxide :- Enters into the leaf through stomata from atmosphere
- Water :- The root hairs absorb water from soil. Then, it is transported to the leaf through the xylem.
- Chlorophyll :- A green colour pigment which is found within the chloroplast in cells. They absorb light.
- Light energy :- Chloroplast absorb the light energy from the sunlight fallen on the surface of the leaf.

Food is produced in an organ called chloroplasts, which can be found in plant cells.

Photosynthesis is the process of producing food in chlorophyl containing cells, using CO_2 and water by absorbing light energy from the light. The products of photosynthesis are glucose and oxygen.

The reaction of photosynthesis can be given as the following word equation.

$$\text{Carbon dioxide + Water} \xrightarrow[\text{Chlorophyll}]{\text{Light energy}} \text{Glucose + Oxygen}$$

Glucose, produced in leaves is converted into starch in the leaves. Later this starch is converted to sucrose and transported to the necessary places of the plant (growing parts and storage organs).

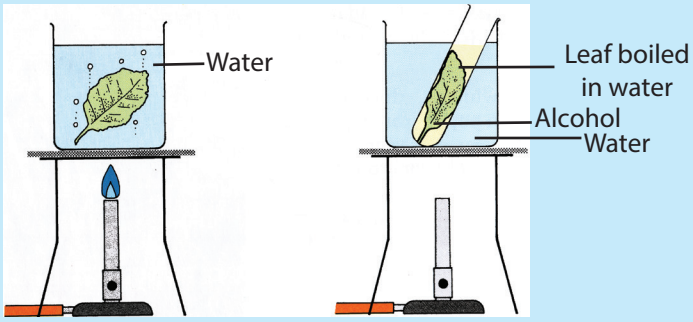
Let us do the Activity 11.1 to test whether photosynthesis has taken place in leaves. If the leaves contain starch and thus we can come to a conclusion that photosynthesis has taken place in leaves.

Activity 11.1

You will need:- A beaker, watch glass, tripod, bunsen burner, some leaves that are exposed to the sun light well (sun flower/chilli/drumstick), alcohol, boiling tube, iodine solution, forceps

Method :-

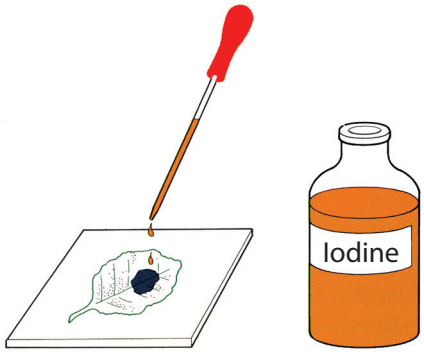
- Dip the leaves in hot water and boil.
- Then put them into a boiling tube with alcohol and boil them in a water bath as shown in Figure 11.2 b until the leaves become colourless.



a - boiling in water b - boiling in alcohol in a water bath

Figure 11.2 ▲ Preparing the leaves for the test

- Take the leaves away and wash well. Keep them on the watch glass and put some iodine drops on to the leaves.
- Note the observations.



You will observe that the leaves turn into dark blue colour when iodine is added. Iodine is an indicator that turns to dark blue in the presence of starch. So, this experiment demonstrates that the leaves perform photosynthesis and produce starch, when necesary conditions are supplied.

Let us do the Activity 11.2 to study that oxygen is produced during photosynthesis.

Activity 11.2

You will need:- A funnel, some aquatic plants, water, a trough, boiling tube, a glowing splinter

Method :-

- Fill the jar with water and keep some *Hydrilla* plants. Place the funnel as shown in Figure 11.4. Close the free end of the funnel with the boiling tube filled with water.
- Expose the set-up to sunlight.
- Note your observations.
- Take the boiling tube out carefully and insert a glowing splinter into the boiling tube.
- Observe what happens.

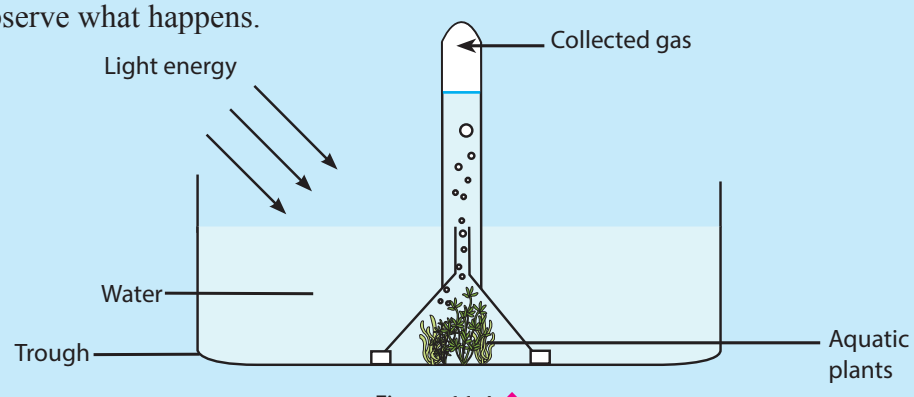


Figure 11.4

You will observe that air bubbles released from the plants and get collected in the upper part of the test tube. You must take the test tube out very carefully and insert the glowing splinter. You will see the glowing splinter reignite and bursting into flame indicating the presence of oxygen inside the test tube. So, you can come to conclusion that oxygen is produced during photosynthesis.

Have you seen air bubbles coming out from a fish tank during the day time? The air bubbles are oxygen, a product of photosynthesis. Now you can understand the importance of growing aquatic plants in fish tanks.

Figure 11.5 Releasing oxygen gas from submerged aquatic plants

Photosynthesis is important for the existence of the living world. Let us engage in Assignment 11.1 to study the importance of photosynthesis.

Assignment 11.1

Collect and compile a report on the global importance of photosynthesis to display on your wallpaper.

Figure 11.6 shows the description of the global importance of photosynthesis.

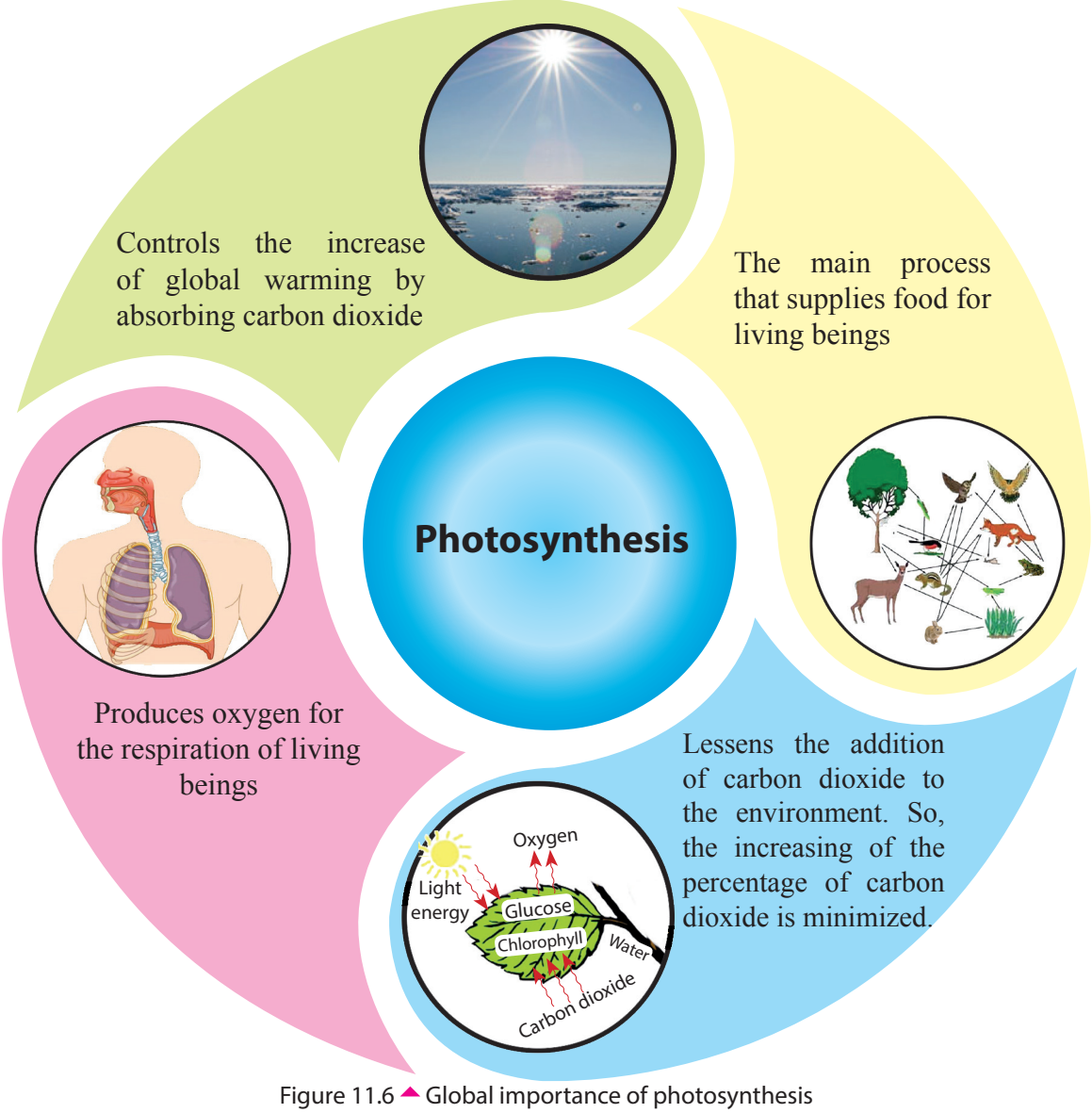


Figure 11.6 ▲ Global importance of photosynthesis

Have you ever thought about the ways that plants intake the raw materials for photosynthesis and how the products are transported to the different parts of the plant ? You will understand how it happens with further studies.

11.2 Transportation

Plants in taking the raw materials for different biological processes and taking the products of these processes to the appropriate places of the plant is known as **transportation.** Some examples are given below.

- Transportation of atmospheric air through the stomata to the cells of the leaves.
- Transportation of water and minerals from soil to the leaves through root hairs.
- Transportation of food produced by photosynthesis from leaves to the other parts of the plant.

There should be a mechanism within the plants for transportation. Let us do Activity 11.3 to study about it.

11.2.1 Diffusion

Activity 11.3

You will need :- Condis, water, a beaker

Method:-

- Fill the beaker with water.
- Put some condis into it.
- Observe how the particles spread throughout water.

Figure 11.7 ▲ How condis particles spread throughout water

Spreading of condis in water can be described using Figure 11.8

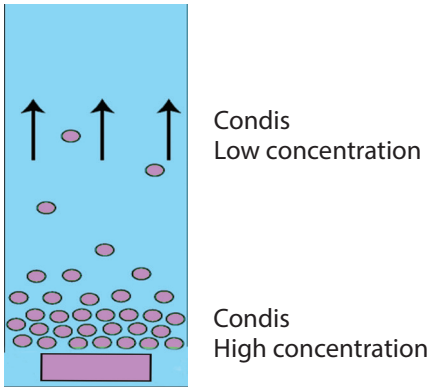


Figure 11.8 ▲ Spreading of condis particles in water

When the cube of condis is put into water more particles of condis can be seen around the cube. That is the concentration of condis particles is high around the cube, which means there are more condis particles within a unit volume. There is less amount of condis particles in the upper part of the water beaker. Condis particles move randomly from a region of higher concentration to a region of lower concentration. This movement of particles occur not only in the liquid but also in the gas medium.

When skin of an orange is peeled off, the smell can be felt for a person who is even a little far away. That is because the orange skin contains volatile materials. These volatile materials randomly move through the air from the higher concentrated area to the low concentrated area. Spreading the smell of joss sticks and the smell of perfumes is also done according to the above method.

The process in which a movement of a substance from an area of higher concentration to an area of lower concentration is called diffusion.

Diffusion is one of the main processes in plants that helps for the transpotation of substances.

Following are some instances where diffusion takes place.

- Diffusion of carbon dioxide from atmosphere to the plant leaves through stomata for photosynthesis.
- Diffusion of oxygen through stomata to the leaves for respiration.
- Oxygen, a product of photosynthesis diffusing out of the stomata to the atmosphere.
- The products of respiration, carbon dioxide and water vapour diffusing from stomata to the atmosphere.

11.2.2 Osmosis

Assignment 11.2

Uproot a Balsam plant carefully without breaking the roots. Wash soil in the roots. Put some water into a container and dissolve some red ink in it. Now, dip the plant in the water you prepared with ink. Observe after few hours.

Figure 11.9 ▲ Ink solution goes up through the stem

You will see that roots absorb the red ink solution and it goes up to the stem. There is a mechanism that water particles and ink particles travel through the root cells and enter the xylem tissue.

Thus, there is a mechanism that water particles travel from cell to cell. To study about this mechanism let us do Activity 11.4.

Activity 11.4

You will need:- A thistle funnel, a piece of colourless cellophane, 500 ml beaker, rubber bands threads, salt solution, water, condis solution

Method :-

- Fill the beaker with water.
- Cover the mouth of the funnel with the piece of cellophane.
- Place the funnel in the beaker and put condis solution and salt solution into the funnel.
- Mark the starting level in the thistle funnel.
- Note your observations after a few minutes.

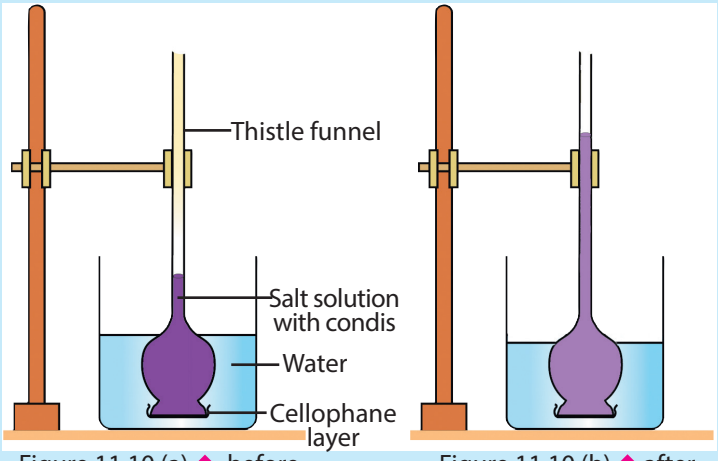


Figure 11.10 (a) ▲ before

Figure 11.10 (b) ▲ after

After few minutes, you will observe that the level of the liquid in the funnel rises up and the colour of the condis is faded.

The reason for the rising up the level of liquid can be explained as below.

The concentration of water molecules is higher in the beaker compared to the solution in the thistle funnel. So, water molecules tend to move from area of higher concentration (beaker) to area of lower concentration (thistle funnel) across the cellophane. Cellophane allows only the water molecules to pass through and prevents salt and condis molecules to get in. Such membranes are called **semipermeable membranes**.

A semipermeable membrane allows only some selected molecules to pass through. You can do the same experiment using an egg membrane instead of the cellophane. Egg membrane is also considered as a semipermeable membrane.

Diffusion of water molecules through a semipermeable membrane from an area of higher water concentration to an area of lower water concentration is known as osmosis.

To study about the osmosis let us do Assignment 11.3.

Assignment 11.3

- Take a petiole of a papaw leaf (with a closed end) and fill it with a salt solution. Place it in a water container as in Figure 11.11.
- Observe what happens.

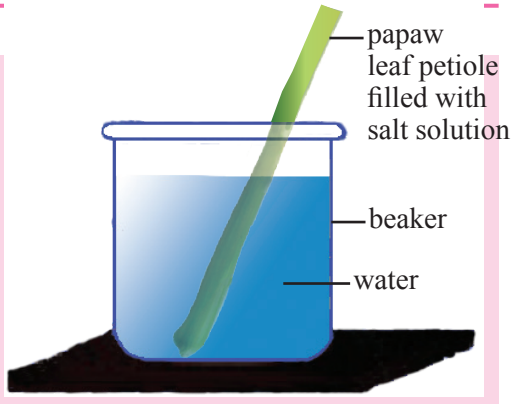


Figure 11.11

Many minerals are dissolved in soil water. The root hairs of plants absorb these water particles by osmosis. From root hair up to the xylem, water particles move from cell to cell by osmosis. The cell membrane inside the cell wall act as a semipermeable membrane.

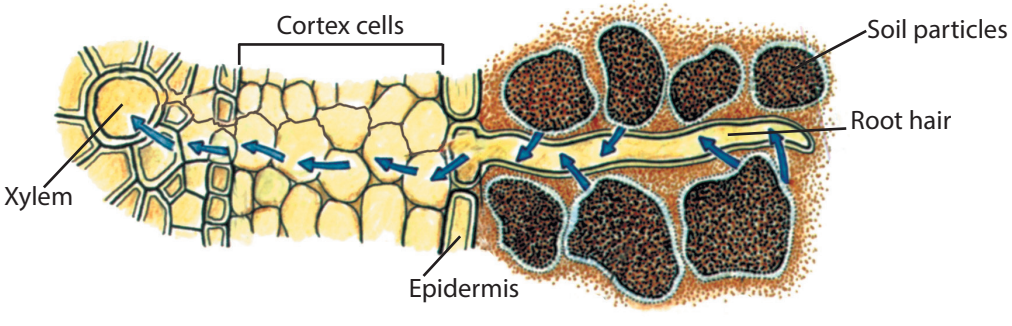


Figure 11.12 Transportation of water absorbed by the root hairs to the xylem

Root hairs absorb water by osmosis. Energy is not needed for this. But energy is needed to absorb minerals. Food produced in leaves are also transported to the other parts of the plant through the phloem tissues. These photosynthetic products are transported as a unit along the phloem tissues and that process is known as **mass flow.**

Some methods of transportation in plants are given below.

- Diffusion
- Osmosis
- Mass flow

11.3 Transpiration

Let us engage in Activity 11.5 to identify another important biological process that takes place in the plants.

Activity 11.5

You will need:- A potted plant, transparent polythene bag, rubber bands

Method :-

- Cover a branch of the plant using a polythene bag.
- Observe after one hour.

Figure 11.13

You will notice that there are droplets in side the polythene bag. When some anhydrous copper sulphate crystals are put on the droplets the crystals turn from white to blue. So, that you can conclude that the droplets were water droplets.

These water droplets mainly come out from the leaves.

The process of evaporation of water through the aerial parts of a plant is termed as transpiration. This happens mainly through the stomata in leaves.

Engage in Activity 11.6 to show that plants absorb water to fill the gap of water due to transpiration.

Activity 11.6

You will need:- A leafy shoot (you should cut this under water), coconut oil, rubber cork, grease/paraffin, "U" tube, water

Method :-

- Fill the "U" tube with water.
- Cut a leafy shoot under the water and fix it to the rubber cork and fix the cork to the one arm of the "U" tube.
- Seal it using grease and put some coconut oil to the other arm of the "U" tube and mark the level of water.
- After an hour observe the water level in the arm with coconut oil.

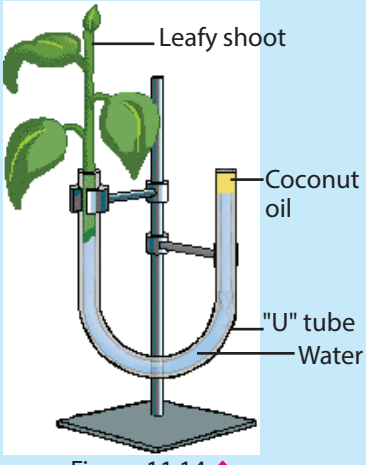


Figure 11.14

You will observe that the water level in the free arm of the "U" tube decreases. The shoot loses water through transpiration. Therefore, it absorbs the same amount of water from the "U" tube. This is the reason for the decreasing of water level in the free arm of the "U" tube.

The speed of the transportation within the plants increases due to transpiration. In addition to this there are some other functions of transpiration. They are,

- The transpiration pull is responsible for the continuous ascent of water and nutrients from the roots to the top most parts of the plants.
- As the water is evaporated, transpiration helps the plant in cooling.
- Maintains the water cycle by evaporating water.

Therefore, transpiration is a process, favourable not only for the plants but also for the environment.

Severe heat, strong wind, strong light increase the rate of transpiration. Transpiration during dry condition may affect the plant to dry. There are many adaptations of plants that live in such weather conditions to conserve water. Recall what you have studied in chapter 3.

Some adaptations are given below.

- Thick epidermis in aerial parts e.g. - Temple trees
- Leaves reduced to spines e.g. - Cactus
- Leaves turned to scale leaves e.g. - 'Kasa'/ 'Savukku'
- Reducing the size of leaves e.g. - 'Navahandi'/ 'Kally'
- Hairs on epidermis e.g. - Sun flower, Pumpkin
- Sunk stomata e.g. - Oleander
- Leaves fall during the dry season e.g. - Rubber, Teak
- Fleshy leaves e.g. - *Aloe*
- Rolled leaves during dry seasons e.g. - 'Maha ravana reula'/ 'Ravanan meesai' - 'Bim thamburu' / 'Vatralai'

11.4 Guttation

Figure 11.15

When the humidity is high at nights the margins and tips of leaves in some plants such as anthurium, acacia ooze liquid drops. Think for a while the reason for these droplets.

At night the percentage of water vapour in the atmosphere is high and transpiration occurs very rarely. Therefore, the margins and the tips of leaves in small plants secrete water in the liquid form. They are exuded from the hydathodes.

The process of water being exuded in the liquid form through hydathodes of the leaves is known as **guttation.**

Guttation occurs from the tips of the plants such as 'habarala'/'nersshembu', anthurium, grass etc. and from the margins of the plants such as potato, tomato etc. The water in the droplets, release from guttation gets evaporated during the day time. But the salt get left behind and can burn the tips of the leaves. You would have seen such burns in the plants such as 'habarala'.

The differences between transpiration and guttation are shown in Table 11.1

Table 11.1

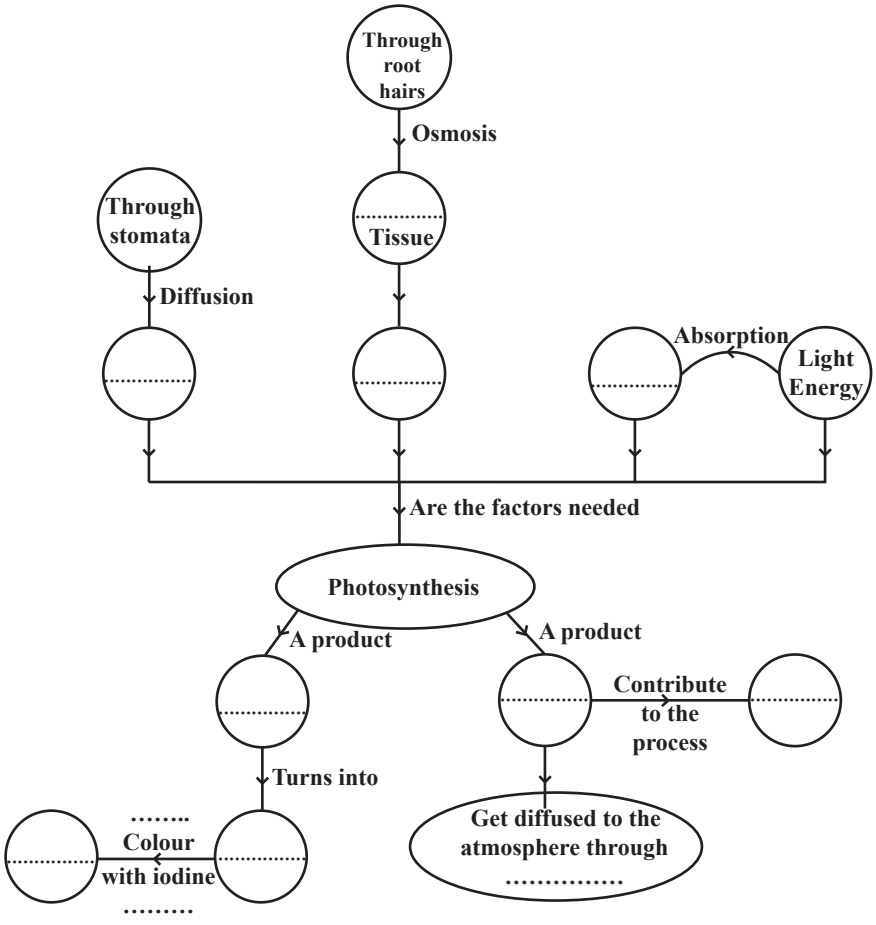
Transpiration	Guttation
1. Water release in the form of water vapour	Water release in the form of drops/liquid.
2. Occurs mainly through stomata.	Occurs through hydathodes
3. Only pure water is released.	Water and salts are released
4. Occurs during both day and night time.	Mostly occurs during night.
5. When humidity in the atmosphere is increased, rate of transpiration is decreased.	When humidity in the atmosphere is high, it increases the guttation.

Summary

- Plants are considered as the main living component that contributes much for the proper existence and security of environment.
- Plants ensure their existence by the biological processes.
- Some biological processes carried out by the plants are photosynthesis, transportation and transpiration.
- It is important to transport water, a raw material of photosynthesis to the leaves and also starch, a product of photosynthesis to the necessary parts of the plant.
- The mechanisms such as diffusion, osmosis, help for the plant to absorb water from soil by the root hairs.
- Mass flow is the mechanism used to transport produced food along the phloem.
- Transpiration and guttation are important for the efficiency of transportation within the plants.
- The plants in xeric environments show many adaptations to minimize transpiration.
- The existence of plants ensures the conservation of environment.

Exercise

1) The following is a concept map prepared by a grade eight student. Fill the blanks using suitable words.



2) Select the correct answer.

1. Following are three statements that a student wrote about transpiration.

A - Loss of water as vapour to the atmosphere.
B - Occurs only during night.
C - Mainly occurs through stomata

Out of these three the correct statement/s are,

1. A and B Only 2. A and C Only 3. B and C Only 4. A, B and C

2. The leaves of a plant that grows in a certain area has reduced to scale leaves. An example for such a plant is,

1. cactus 2. 'nawahandi' 3. 'kasa' 4. oleander

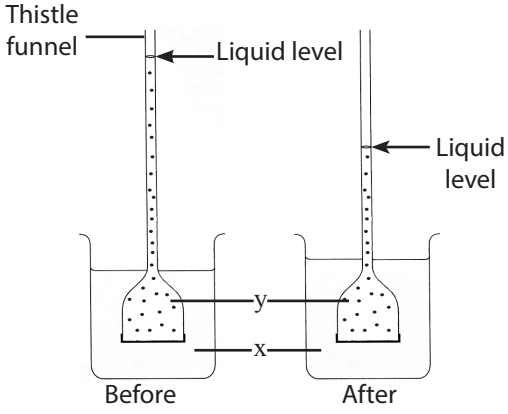
3. The biological process demonstrated by the following figure is,

1. photosynthesis
2. mass flow
3. osmosis
4. transpiration

4. The group of plants that shows the guttation is,

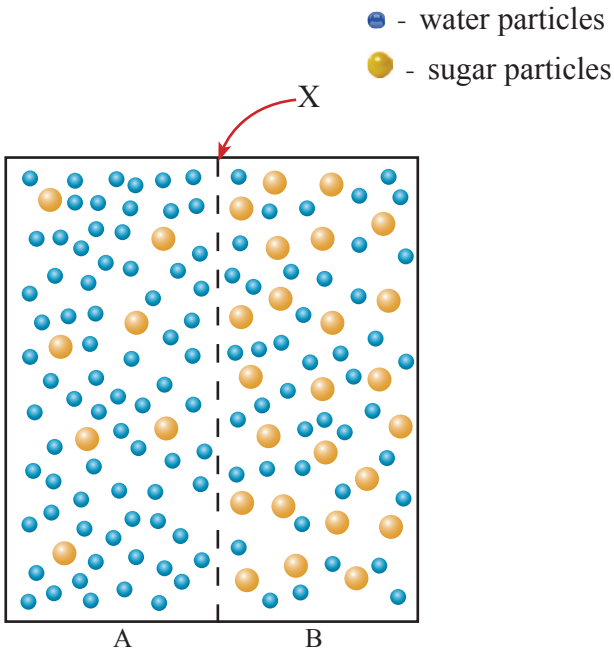
1. acacia, potato, temple tree
2. anthurium, tomato, acacia
3. cactus, temple tree , potato
4. aloe, oleander, pumpkin

5. It can be observed the levels of liquids in thistle funnel has been changed after few minutes in the set-up. According to the difference of liquid levels in thistle funnel, x and y are respectively,



1. sugar solution and water
2. water and sugar solution
3. water and water
4. sugar solution and sugar solution

6) Following is a model of a method of transportation in plants.



i. What is denoted by X ?
ii. What is the method of transportation in the model ?
iii. What is the direction of net movement ?
iv. What are the other methods of transportation in plants ?

Technical Terms

Photosynthesis	-	ප්‍රභාසංශ්ලේෂණය	-	ஒளித்தொகுப்பு
Transportation	-	පරිවහනය	-	கொண்டு செல்லல்
Osmosis	-	ආස්‍රැතිය	-	பிரசாரணம்
Diffusion	-	විසරණය	-	பரவல்
Mass flow	-	ස්කන්ධ ප්‍රවාහය	-	திணிவுப்பாய்ச்சல்
Transpiration	-	උත්ස්වේදනය	-	ஆவியுயிர்ப்பு
Guttation	-	බින්දූදය	-	கசிவு

12 Life cycles of living organisms

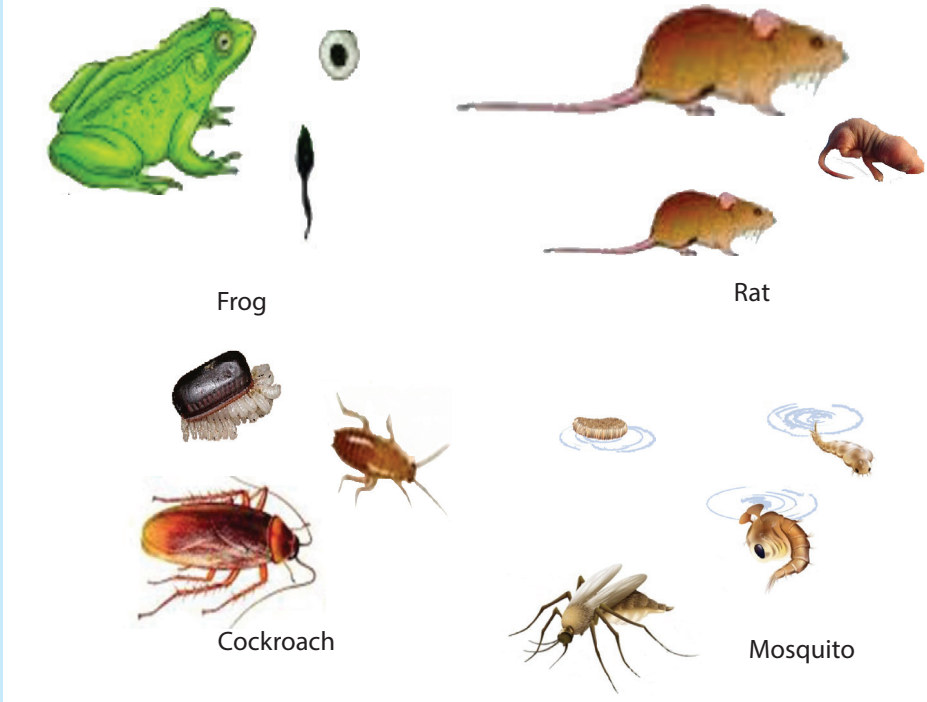
By observing the environment carefully you will notice that all living beings are born from an egg / a seed or as a small creature, and they pass through many different stages. A grown-up organism produces offspring of its own by the reproductive process. These stages are repeated in each generation through and it ensures the survival of living organisms in the environment.

The sequence of events in stages of development as a cyclic process, which a living organism passes from its birth to death is termed as a life cycle.

Let us do Activity 12.1 to study about the life cycles of living organisms.

Activity 12.1

You will need :- Some pictures of animals with the stages of life cycles



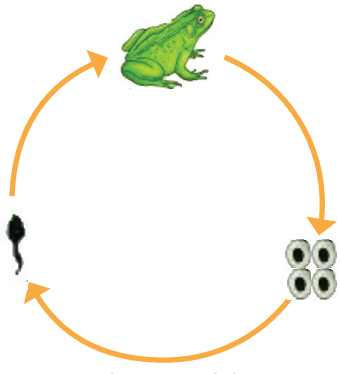
Paddy plant Jak plant

Figure 12.1 ▲ Stages of life cycles of some living organisms

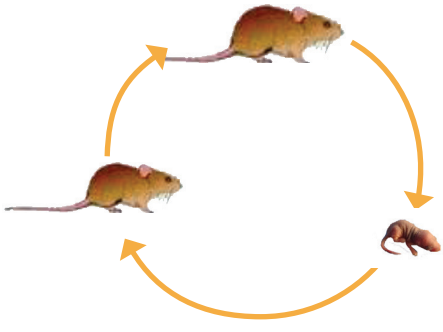
Method :-

- Observe the pictures given in Figure 12.1 and identify the different stages of each organism.
- Make the different stages in order and write the life cycle of each organism.

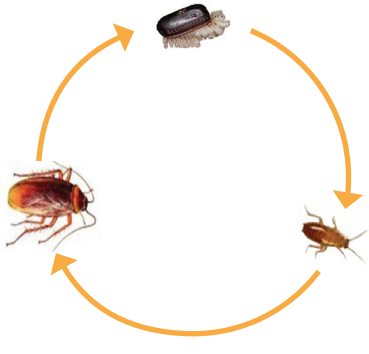
Compare the life cycles you prepared with the following.



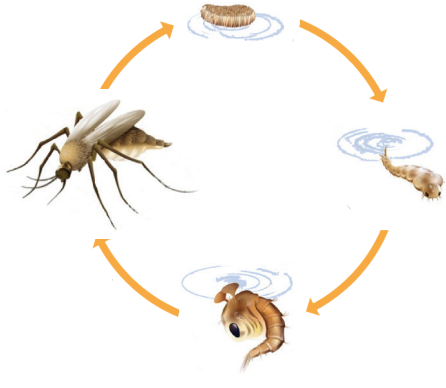
Life cycle of frog



Life cycle of rat



Life cycle of cockroach



Life cycle of mosquito

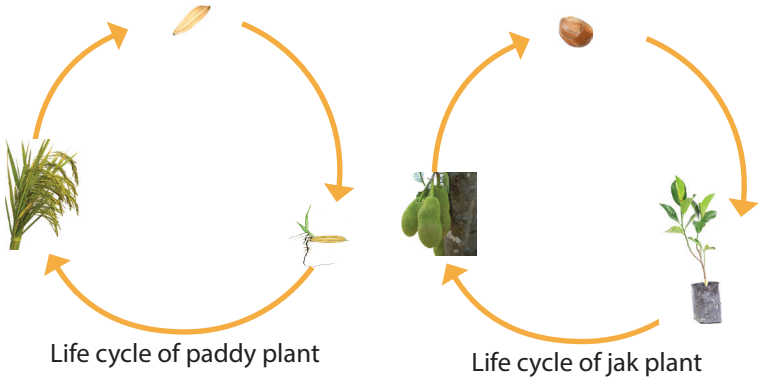


Figure 12.2 ▲ Life cycles of some organisms

When you have completed arranging the stages of life cycles of plants and animals in order you would have understood that life cycles of organisms can be build up.

12.1 Life cycles of animals

To study about the life cycles of animals engage in Activity 12.2

Activity 12.2

You will need:- Life cycles of butterfly, frog, cockroach, mosquito, rat, human

Method :-

- Observe the life cycles well and identify the special characteristics of each stage of animals.
- Tabulate your observations depending on the differences of shapes/ patterns of the different stages.

Table 12.1

With different morphological forms of stages	Without different morphological forms of stages

You would have noticed that there are no different morphological forms in different stages of rat and human, while there are morphological changes in different stages of cockroach, butterfly, mosquito and frog.

Some animals (e.g. :- rat) born morphologically similar to their parents, but smaller in size. Some species have slightly complicated life cycles. That is, they go through different morphological forms before becoming an adult.

Some animals such as butterfly, mosquito, cockroach, frog etc, are hatched from an egg. As the nutrients in the eggs are not sufficient for them to become an adult, they go through different stages. During these stages most of the feeding is done for them to become an adult. Going through different stages in the life cycles ensures their survival.

Also the adaptations of these stages for different environments secure their survival.

There are different stages in human life cycle. Although the infant is differ in body size, he has similar appearance of the adult. The infant goes through the life stages childhood, adolescence and becomes an adult. Stages of human life cycle have approximately the similar morphological features that they will have as human adults.

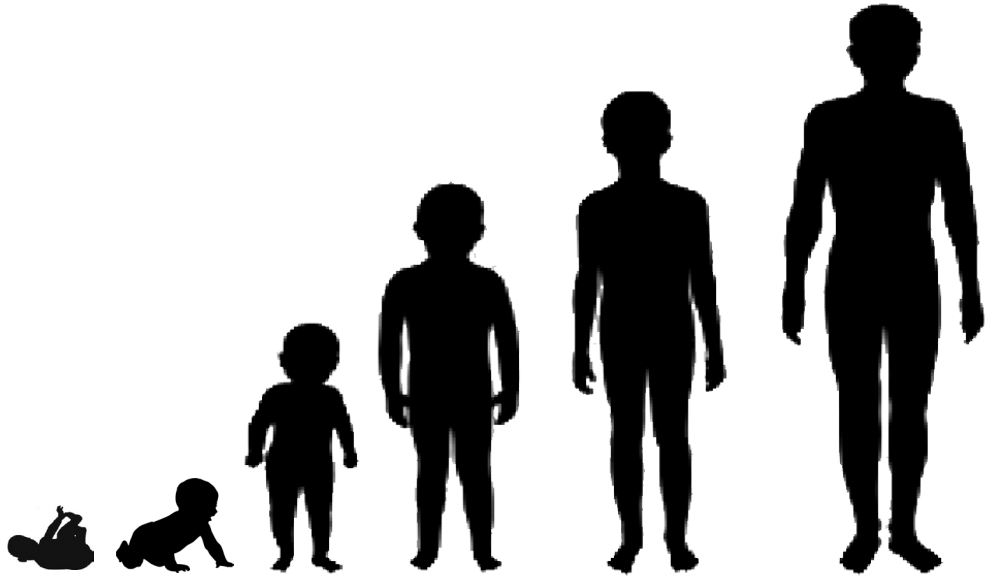


Figure 12.3 ▲ Some stages of human life cycle

Hence, you may have noticed that some organisms who undergo changes with different morphological features while some have similar morphological features in their different stages of life cycle.

Would you have noticed that the egg of the butterfly hatch and a larva is born ? After some days larva becomes a pupa and later becomes a beautiful butterfly with colourful wings. These stages of life cycle have different morphological features.

The process with different morphological changes in different stages of life cycle that some living organisms go through to become adults is referred to as **metamorphosis**.

Animals like rat and man who do not show morphological differences in life cycles do not have metamorphosis in their development.

Are the morphological changes of different stages of every organism that undergo metamorphosis, significant ? Let us do Activity 12.3 to study about it.

Activity 12.3

You will need:- Some pictures that show the life cycles of frog, cockroach, butterfly, mosquito, grasshopper, white ant

Method :-

- Observe the pictures well.
- Are the morphological changes of different stages of every creature significant ?
- Tabulate your answer.

Table 12.2

The creatures that have significant differences in stages of life cycle	The creatures that do not have significant differences in stages of life cycle

The organisms hatched from eggs of cockroach, grasshopper, termite are smaller in size but they resemble adult in appearance. The creatures hatched from eggs of butterfly, mosquito, frog are completely different from the adult.

Metamorphosis is commonly exhibited by insects and amphibians. Metamorphosis is a reason for successful existence of insects.

There are two common forms of metamorphosis.

- **Complete metamorphosis**
- **Incomplete metamorphosis**

Metamorphosis with significant morphological differences in the different stages, is known as **complete metamorphosis.**

The feeding mechanism and locomotion are different in each stage. As an example butterfly larva feeds on plant leaves while moves using legs. The adult butterfly feeds on nectar and flies using wings.

e.g. :- Mosquito, butterfly

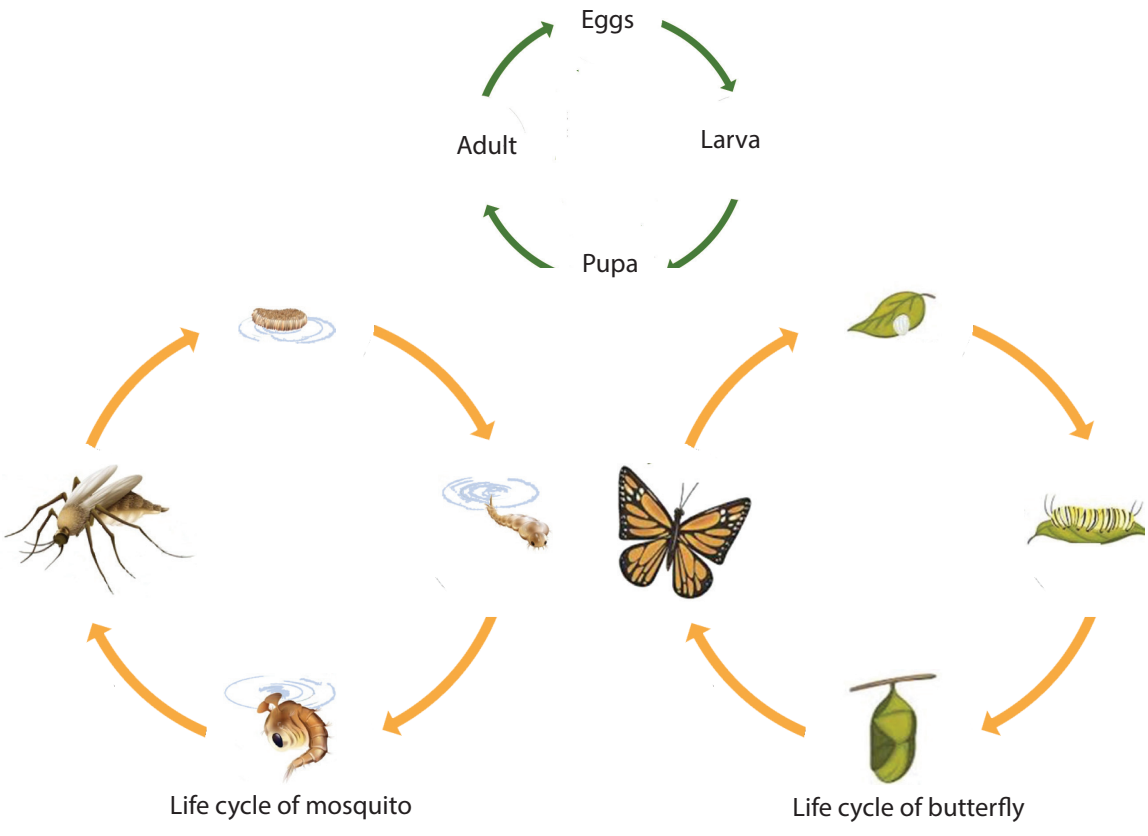


Figure 12.4 ▲ Life cycles of mosquito and butterfly showing complete metamorphosis

Metamorphosis that does not show any significant morphological changes in the stages of life cycle is known as **incomplete metamorphosis.**

The young hatched from the egg, is known as the nymph. Nymph is morphologically similar to the adult with only slight changes. Nymph does not have wings. They are small in size and not sexually matured.

e.g :- Cockroach

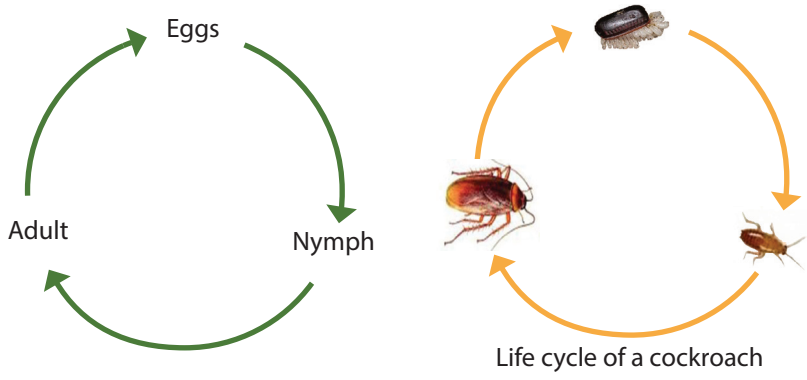


Figure 12.5 ▲ Life cycle of a cockroach that shows incomplete metamorphosis

Assignment 12.1

- List separately creatures that exhibit complete metamorphosis and incomplete metamorphosis.

Frog is a vertebrate that exhibits metamorphosis. Let us study the life cycle of a frog.

12.1.1 Life cycle of a frog

The female frog lays eggs in water. The eggs are covered with a jelly type layer. A tiny tadpole emerges from a hatched egg. It is similar to a fish. It can swim in water and breaths using gills. It feeds on aquatic plants as a herbivore.

Several morphological changes take place within water in the tadpole to become an adult (Figure 12.6).

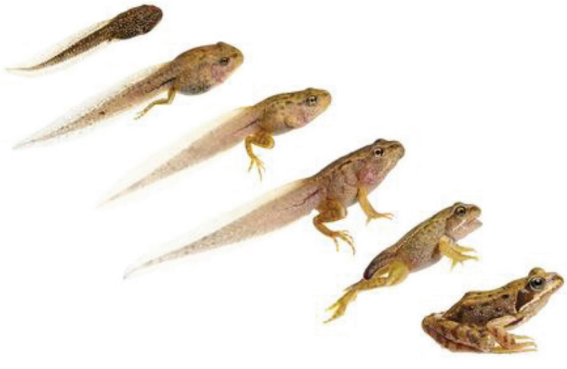


Figure 12.6 ▲ How a tadpole becomes a frog

Adult frog has completely different morphological features compared to the stages of tadpole. It has legs for locomotion and lungs for respiration. They feed on small insects. They are insectivores.

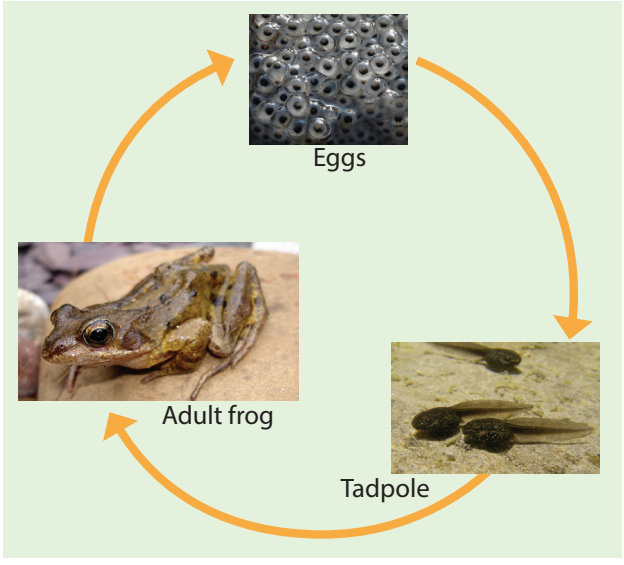


Figure 12.7 ▲ Life cycle of a frog

Assignment 12.2

- Conduct a field visit to a nearest aquatic environment. Eg :- A pond.
- Observe the different stages of frog; eggs, tadpoles and adult frog.
- Identify the special characteristics of those stages.

Let us study the life cycle of a butterfly, an insect that goes through complete metamorphosis.

12.1.2 Life cycle of a butterfly

Butterfly shows complete metamorphosis. The adult butterfly lays eggs. These eggs hatch and larva emerge. This larva is called a caterpillar. Caterpillar becomes a pupa after sometime. Pupa stays inside a cocoon. It stays inactively without feeding. However there are some changes take place in the body to become an adult.

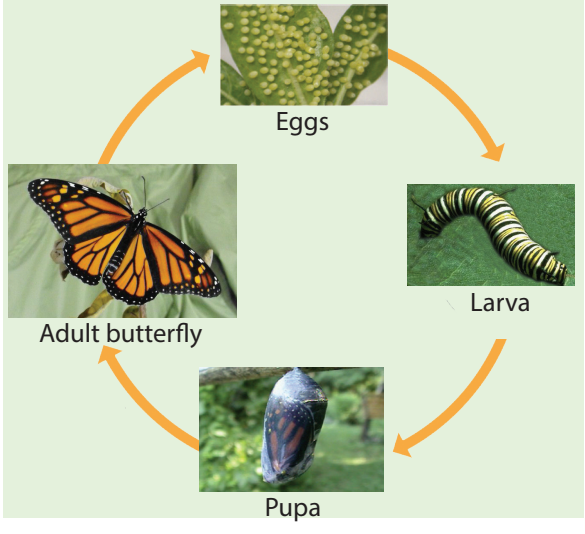
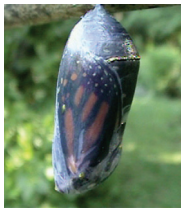


Figure 12.8 ▲ Life cycle of a butterfly

Specific features in each developmental stage of butterfly is given in Table 12.3.

Table 12.3

 Eggs of butterfly	 Larva	 Pupa	 Adult
• Eggs stick on the lower surface of plant leaves.	• Caterpillar is the larva of butterfly. • Caterpillars are normally match with the surface they attach to. They use legs for locomotion. • Caterpillar feed on tender leaves and grow. There are specified mouthparts for it. • There are hairs containing venom to protect from predators.	• Pupa is an inactive stage in a pupal cocoon. It does not feed. • Body parts of the butterfly form in the pupal cocoon. • Pupa stick on to a surface.	• Adult emerges breaking the cocoon. • Adult feeds on nectar. There is a specialized organ called proboscis to suck nectar.

Let us study the life cycle of a cockroach, an insect that goes through incomplete metamorphosis.

12.1.3 Life cycle of a cockroach

After hatching the eggs nymphs are emerged. Although the nymph is smaller in size, it is morphologically similar to the adult. They do not possess wings. Nymphs are not sexually matured. Nymphs become adults by passing through number of nymphal stages (by shedding their exoskeleton).

Figure 12.9 ▲ Some nymphal stages of cockroach

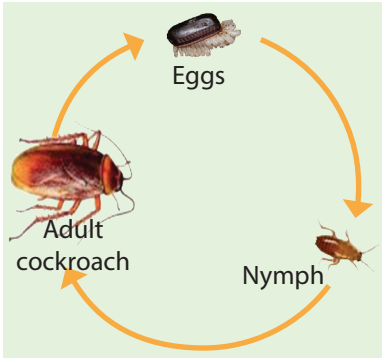


Figure 12.10 ▲ Life cycle of a cockroach

12.2 Life cycles of plants

Flowering plants also pass different stages from seed germination to growing to a mature plant.

Let us do Activity 12.4 to find out more about the life cycles of flowering plants.

Activity 12.4

You will need:- Some pictures showing the life cycles of flowering plants

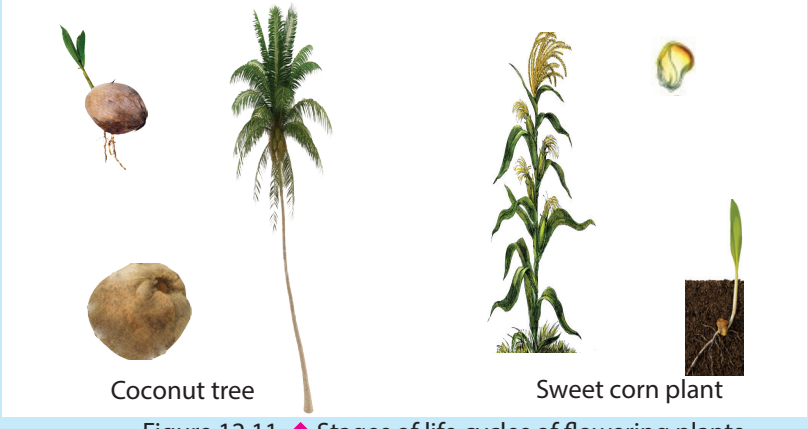


Figure 12.11 ▲ Stages of life cycles of flowering plants

Method :-

- Observe the pictures well. (Get the help of your teacher)
- Write the stages of the life cycles in order.

The stages of a life cycle of a flowering plant can be represented as follows (Figure 12.12).

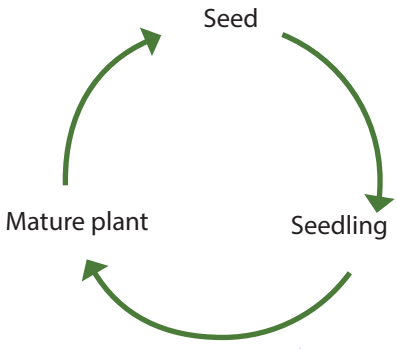


Figure 12.12

Assignment 12.3

- Collect some seeds and fruits of some plants, that can be easily found (grass, love grass, chillies, tomato)
- Collect the flowers of those plants.
- Press them keeping between the pages of a paper, for some days.
- Use them and try to present the life cycle of each plant.

12.3 Importance of learning the life cycles

The importance of learning about the life cycles are;

- For pest control
- For control of disease vectors
- For conservae of biodiversity

12.3.1 Pest controlling

An organism that harms or destroys crops, garden plants or trees that are useful for human is known as a pest.

It is important to study the life cycles and the behaviour of these pests in order to control them.

Let us study the life cycle of a fruit fly, a pest insect that involves in destroying the crops a lot (Figure 12.13).

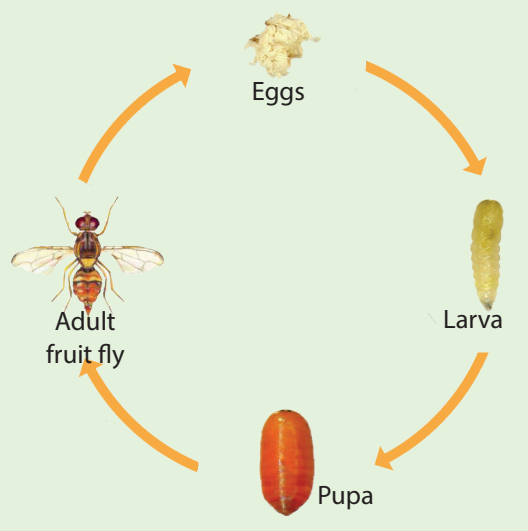


Figure 12.13 ▲ Life cycle of a fruit fly

The adult female fruit fly lays eggs by pricking the fruits such as mango, guava etc. The larva feeds on the flesh of the fruit, gradually moving in by making tunnels in the fruit. So, the fruits get rotten and become unsuitable for human consumption. The value of the fruit also gets reduced.


Figure 12.14 ▲ The damage of the fruit fly

The larval stage is the most likely and easiest way to control the fruit fly.

- Regular inspection of the fruit is important to can control the fruit fly. If larvae are found in fruits the fruits must be destroyed.
- The fallen fruits that are infected by larvae should be collected and destroyed.

Activity 12.5

You will need:- Articles or magazines written on pests that destroy crops and their life cycles

Method :-

- Make a list of pests that destroy crops.
- Tabulate your findings in Table 12.14.

Table 12.4

Pest insect	Crop/crops affected	Mostly affected part of the crop	Stage of life cycle that destroy the crop
Fruit fly Coconut red weevil Paddy bug Mealy bug			

Compare your answer with the following.

Table 12.5

Insect pest	Crop/crops affected	Mostly affected part	Stage of life cycle that destroy the crop
Fruit fly	Mango, banana	Fruit	Larva
Coconut red weevil	Coconut	stem	Larva and adult
Paddy bug	Paddy plant	milky, seed	Adults and nymph
Mealy bug	Mango, rose apple, guava, papaya, brinjal, chillies	Leaves, fruits	Adults and nymph

The actual methods you can use to control pests and the ways these methods can be used together is based on an understanding of their life cycles. The method used to control the larval stage can not be used to control the adult stage of the pest insect or its any other stage.

Therefore, controlling of pests can be achieved effectively by controlling different stages of their life cycle. Pests can be pest insects and also pest plants that destroy the crops.

e.g. :- 'Bajiri', 'Kudametta', 'Thunessa' are pest plants of rice crop

Many pest controlling methods are used to prevent the harm of pests on crops / harvest. It is our duty and the responsibility to protect the living beings in the environment. This will help to conserve the biodiversity and the environmental equilibrium.

The traditional methods of controlling pests used by our ancestors are eco-friendly and nowadays farmers tend to use these methods to control pests.

Engage in Assignment 12.4 to study about the traditional methods.

Assignment 12.4

- Find and list out the traditional methods used in the past to control different stages of pests.
- Write your ideas on the importance of those traditional methods.

Nowadays, there is a special attention on eco-friendly pesticides. Obtaining knowledge about the preparation and usage of such pesticides causes environmental protection.

Engage in Assignment 12.5 to study about eco-friendly pesticides.

Assignment 12.5

- Make a list of eco-friendly pesticides that can be used to control the pest insects pests.
- Write the raw materials needed to prepare these pesticides.

Use of chemical pesticides can damage the environment by destroying beneficial organisms. This can throw the whole eco-system out of balance. So, chemical control should be applied when the pests cannot be controlled by biological or by simple mechanical methods.

Excessive and unsafe use of chemical pesticides may affect the water bodies. These chemicals can accumulate in water. Consuming this contaminated water may cause cancers and kidney diseases.

For extra knowledge

- When chemical pesticides are used in fruits and vegetables it is very important not to harvest them until the recommended period. If they are harvested before the safe period the toxic chemicals enter the human body. Accumulation of these toxic chemicals for a long time in the body leads to diseases such as cancer, kidney diseases.
- Therefore, it is very important to wash the fruits and vegetables well before consuming.

Let us do Assignment 12.6 to study the adverse effects of chemical pesticides.

Assignment 12.6

- Design a poster to show the adverse effects of using chemical pesticides.

12.3.2 Control of disease vectors

An agent that carries and transmits pathogens (virus, protozoa) from an infectious organism to a healthy organism is called a disease vector. Mosquito is a disease vector. It acts as the vector of different diseases that human suffers such as dengue, malaria etc.

To control the disease vector it is important to know about the life cycle of the organism.

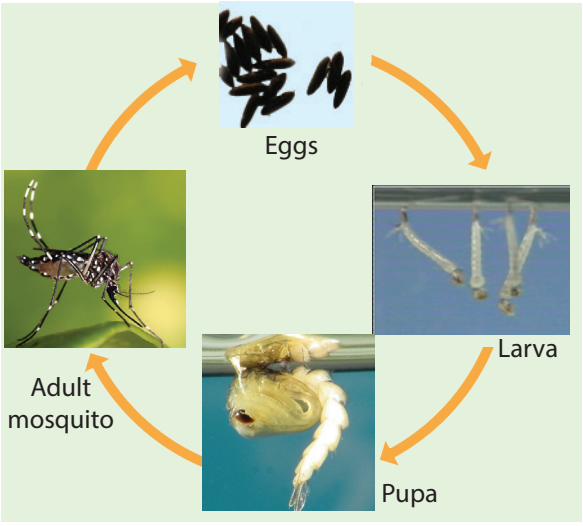


Figure 12.15 ▲ Life cycle of mosquito

Fish species that feed on mosquito larva can be bred in water bodies in order to control mosquito larva. This is considered as a biological control. This way of controlling pests are eco-friendly than spraying chemical to control mosquito.

Assignment 12.7

- List out some diseases that are transmitted by mosquito.
- Collect information about fish species that prey on mosquito larvae.
- List the most suitable methods that can be used to control the adult mosquito.
- What are the precautions that can be taken to prevent mosquito breeding ?
- Design a poster about controlling mosquito breeding.

12.3.3 Life cycles for conservation of biodiversity

Some stages within the life cycles of some animal species have become threatened within their habitat. Some growth stages of animals can be completely destroyed due to becoming victims of animals, unfavourable environmental conditions and scarcity of food. Such stages can be considered as the **sensitive stage** of the particular organism. A species may face total extinction if the sensitive stage is destroyed.

Valubale stages of some animals are given below.

- Some insects - Larvae
- Fishes - Eggs
- Turtles - Eggs and young turtles
- Frogs - Eggs and tadpoles

To protect the biodiversity it is important to understand about sensitive stages of particular organisms. If pay special attention about the sensitive stages of organism, it would be easier to conserve those organisms. Then, it will help to protect biodiversity.

Summary

- Every living organism has a life cycle with different stages.
- Some organisms have significant differences in the stages of life cycle, but some do not have significant differences in the stages.
- The process with a sequence of morphological changes that some living organisms go through to become an adult is known as metamorphosis.
- Metamorphosis with significant morphological changes in the stages is known as complete metamorphosis.
- Metamorphosis without significant morphological changes in the stages is known as incomplete metamorphosis.
- Flowering plants too go through different stages from growth of the seed till becoming an adult plant in its life cycle.
- The creatures that harm the crops and harvest of human is called as pests.
- For a successful pest control there should be a knowledge about the harmful stage of the particular pest.
- It is important to protect the valubale stages of the life cycle of organisms for conservation of biodiversity.
- In conservation of endangered species is important to consider about the sensitive stage of the endangered organism.

Exercise

01. Select the most suitable answer.

1) The animal that goes through a complete metamorphosis is,

1. human 2. mosquito 3. cockroach 4. rat

2) The order of different stages of the life cycle of mosquito is,

1. egg, pupa, larva, adult
2. egg, nymph, larva, adult
3. adult, larva, pupa, egg
4. egg, larva, pupa, adult

3) The organism that go through an incomplete metamorphosis is,

1. butterfly 2. cockroach 3. mosquito 4. fruit fly

4) What is the stage that can not be seen in the life cycle of the cockroach?

1. eggs 2. larva 3. nymph 4. adult

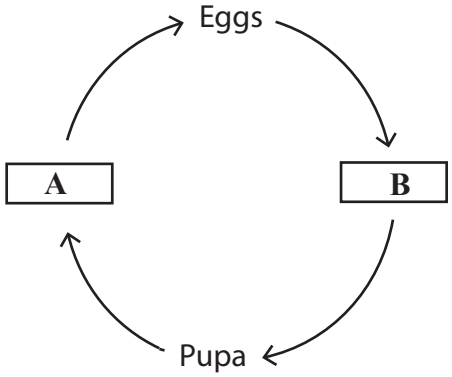
5) It is not important to know about the life cycles of animals for,

1. controlling pests
2. conservation of biodiversity
3. controlling non-infectious diseases
4. controlling disease vectors

02. Place a tick (√) if it is correct and a cross (x) if it is incorrect.

1. Rat does not go through metamorphosis. ( )
2. The stages of life cycle of cockroach are egg, nymph and adult. ( )
3. The frog spends some stages of its life cycle in water. ( )
4. The best method to control pests is use of chemical pesticides. ( )
5. Going through many different stages in a life cycle ensures the survival of the organism. ( )

03. Answer the questions using the diagram given below.



1) What are A and B?

2) Name two insects that go through a similar life cycle as above.

3) Is the above insect go through a complete metamorphosis or incomplete metamorphosis ? Give reasons for your answer.

04. State three factors of importance of studying about animal life cycles.

Technical Terms

Life cycle	-	ජීවන චක්‍රය	-	உருமாற்றம்
Metamorphosis	-	රූපාන්තරණය	-	நிறையுருமாற்றம்
Complete metamorphosis	-	සම්පූර්ණ රූපාන්තරණය	-	குறையுருமாற்றம்
Incomplete metamorphosis	-	අසම්පූර්ණ රූපාන්තරණය	-	பூக்கும் தாவரம்
Flowering plants	-	සපුෂ්ප ශාක	-	பீடைகள்
Pests	-	පළිබෝධයින්	-	உணர்திறன்மிக்க பருவம்
Sensitive stage	-	සංවේදී අවධිය	-	எதிர்ப்புப் பருவம்
Biological control	-	ජෛව පාලනය	-	இரசாயனக் கட்டுப்பாடு
Chemical control	-	රසායනික පාලනය	-	உயிரிப்பல்வகைமை
Biodiversity	-	ජෛවවිවිධත්වය	-	வாழ்க்கைச் சக்கரம்

13 Food preservation

13.1 Need of food preservation

Food spoils mainly due to the growth and action of microorganisms on food.

e.g. :- Coagulation of milk, growth of mould on bread, spoilage of fish, rancid of coconut oil

Figure 13.1 ▲ Fresh food and spoiled food

In addition to the microbial activity food is also spoiled by the damage caused by macroorganisms such as weevils and grain borers growing on food.

e.g. :- Weevils spoil cereals and pulses such as paddy, gram and green grams

Food, such as vegetables, fruits and cereals become unsuitable for human consumpiton due to not following the correct technological methods during processing. From harvesting to market they are subjected to Bruises, cuts, lacerations, squashes and bumpt. Therefore, such food becomes unconsumable. As microorganisms readily act on such damaged food, they spoil fast.

Natural changes in food occur because of the action of various chemical substances such as enzymes present in food. It is called self degradation.

e.g. :- Maturation, ripening and putrefaction of fruits

Different methods are used to preserve food, and it will help to fulfill the nutrient requirements of man.

The process of making food stay longer by artificially controlling the factors affecting food spoilage is called food preservation.

Hence, attempts are made to preserve the nutritional value and other characteristics of the food item during the food preservation.

Aims of food preservation are reduction of food spoilage, prevention of food poisoning and use of excess food by processing to use in off seasons.

Let us engage in Activity 13.1 to distinguish preserved food from several food types.

Activity 13.1

You will need:- Cow milk, rice, fresh fish, a bottle of sterilized milk ('kalkiri'), a packet of dried sprats, dried jak fruit ('atukos'), lime pickle ('lunudehi'), dried fish

Figure 13.2

Method:-

- Keep the samples of food provided to you exposed to air.
- Observe the colour and texture of those samples everyday for about a week under the guidance of your teacher.
- Tabulate your observations as follows.

Table 13.1

Food type	Observation

From the observations, it is clear that properties like colour, odour and texture change within a few hours in food items such as cow milk and fresh fish.

It can be observed that in sealed bottled milk ('kalkiri'), 'atukos', dried fish, 'lunudehi' and dried sprats had no observable change in properties such as colour, odour and texture. It is because those food items are preserved.

13.2 Methods of food preservation

In order to preserve food, mainly the factors causing food spoilage should be controlled. Some measures that can be taken are as follows.

- Preventing microorganisms getting to the food
- Controlling the temperature and water content of food to minimize the microbial activity
- Prevention of damage caused by macroorganisms

There are modern methods as well as traditional methods for food preservation.

Traditional methods of food preservation

From the distant past humans have adopted various methods to preserve food. Even today they are used with minor changes.

Assignment 13.1

- Collect information about the traditional methods used to preserve food.
- List traditional methods you discovered and provide examples for each of them separately.

Some traditional methods used to preserve food and examples for them are given in Figure 13.3.

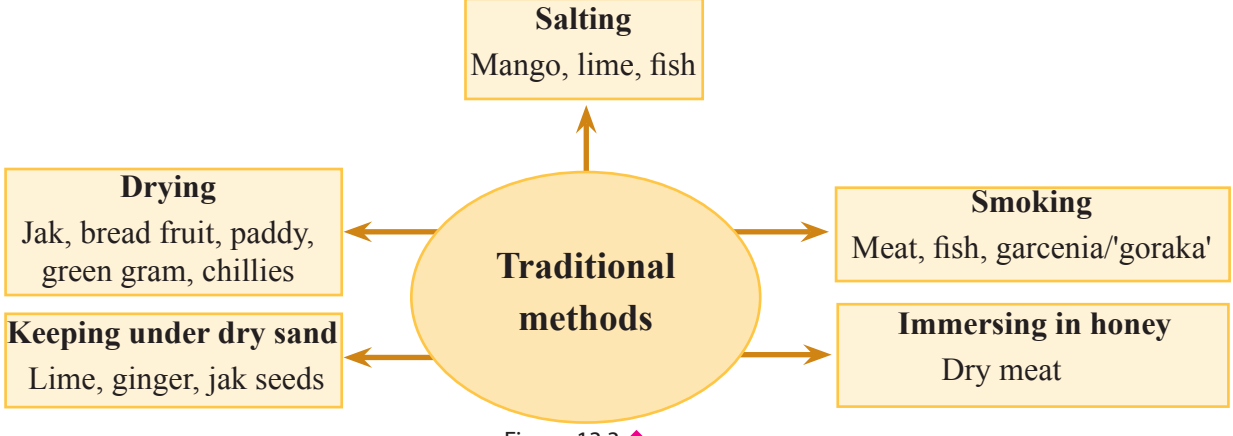


Figure 13.3

Salting - mango

Smoking - fish

Figure 13.4

Assignment 13.2

- Collect information about the modern methods wich are used to preserve food.
- Present how those methods help to preserve food. Along with examples.

Modern methods of food preservation

Given below are modern methods of food preservation some examples for each of the method.

- **Drying**

Drying by solar heat

Like in the past solar heat is used to dry food. At present the solar heat drier is used for this purpose (Figure 13.5). Since a closed condition prevails within the drier, more pure and dry food can be obtained within a shorter period of time. Mixing of wastes, damages caused by animals and rain can also be prevented by this.

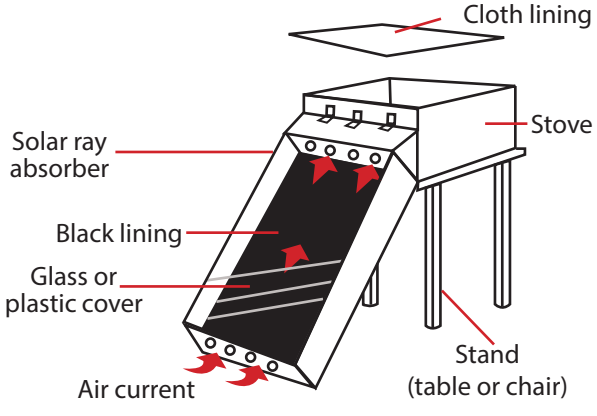


Figure 13.5 Drying food using a solar heat drier

This method can be used to preserve food items such as chillies, fruits, vegetables etc.

Stove drying

Ability to give the appropriate temperature for the food that is dried is an advantage of this method. Stoves which use electricity, gas and mineral oil are used for drying food.

This method can be used to preserve food items such as chillies, fruits, mushrooms etc.

Figure 13.6 ▲ A stove drying food

Spray drying

When water is removed, milk becomes a dry powder. Hot milk is sprayed onto a heated cylinder with high pressure. Microorganisms do not grow due to lack of water.

Figure 13.7 ▲ A machine producing milk powder

- **Temperature control**

A favourable temperature (40 °C) is essential for the growth of microorganisms. The growth of microorganisms could be controlled by reducing the temperature to a value that is unfavourable for their growth.

Freezing

The temperature of the food material is kept at a low value than the surrounding temperature. It is important to maintain the temperature of ordinary freezing chambers always below 4 °C.

Deep freezing

The temperature below -18 °C prevailing in deep freezers is adequate to prevent the growth of most microorganisms. By deep freezing the natural colour, taste and nutritive value of food can be protected to a large extent.

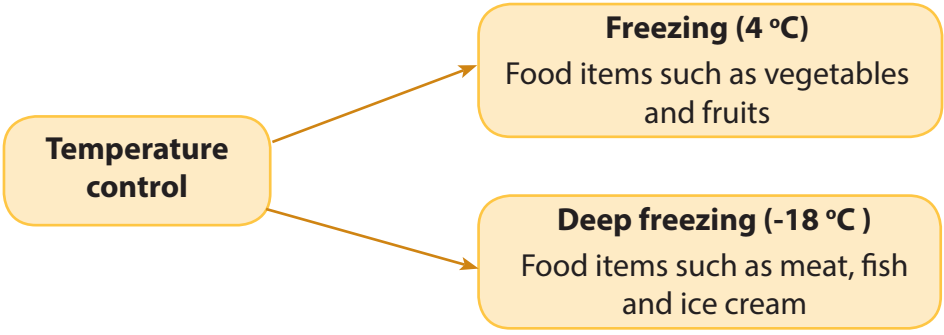


Figure 13.8 ▲ Domestic method of preserving food by controlling temperature

Assignment 13.3

- State some types of food that can be preserved by keeping in a refrigerator.
- Make a list of food that should be kept in a deep freezer for preservation.

• Concentration

In canning and bottling, water in food is removed. Hence, the concentration of the food is increased. This controls the growth of microorganisms. The microbial activity is further suppressed by the addition of preservatives.

This method can be used to preserve food items such as jam, cordial etc.

Figure 13.9 ▲ Concentrated food

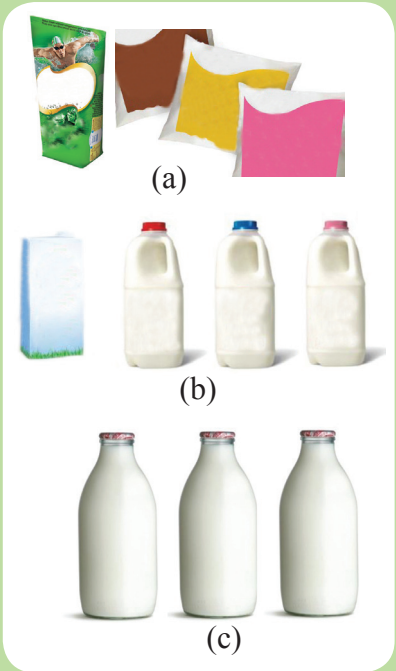
Let us summarize the reasons why it is possible to prevent spoilage of food and keep them longer by various preservation methods.

Table 13.2

Preservation method	Reason for preservation
Drying	Microorganisms do not grow on food due to removal of water
Control of temperature (freezing and deep freezing)	Control of the growth of microorganisms due to a favourable temperature for their growth is not available
Concentration/ immersing in honey	Control of the growth of microorganisms due to removal of water in food and destruction of microorganisms due to removal of water from them
Smoking	Minimizing microbial activity due to chemicals in smoke and removal of water from food due to drying
Adding chemicals (preservatives)	Control of the growth of microorganisms due to removal of water in food and destruction of microorganisms due to removal of water from them

For extra knowledge

- Liquid milk can be kept longer by pasteurization. In this method pathogenic bacteria in milk causing diseases are destroyed by heating milk for about 15 seconds at the temperature of 72 °C. Pasteurized milk can be kept for about two weeks in a refrigerator (a).
- Milk packets you drink have been pasteurized by subjecting to a temperature as high as 138 °C for about 1-2 seconds (Ultra pasteurization). Milk pasteurized by this method can be kept in refrigerators for about 2-3 months when stored in closed containers (b).
- Milk available in the market under the name 'Kalkiri' is sterilized milk. During sterilization all the microorganisms and the stages are destroyed. In sterilization, milk is heated for about 15 - 20 minutes at the temperature of 120 °C. This milk need not to be kept in a refrigerator for storage. But once opened, it should be kept in a refrigerator (c).


(a)

(b)

(c)

13.3 Food preservatives

The chemical substances added to the packaged food in preservation are called additives. Figure 13.10 shows some additives

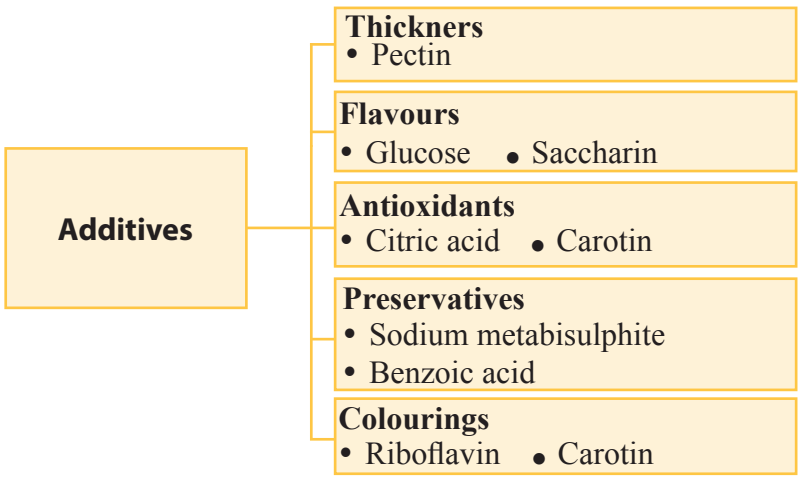


Figure 13.10

The substance used to prevent the action of microorganisms causing food spoilage and the effect of other external and internal factors are known as **preservatives**. Preservatives are a type of additives.

The code (E number) is adopted by the European Union to symbolise the food additives approved for use and are experimentally confirmed as safe.

The preservatives from E 200 to E 299 have been allowed to add to the food as synthetic food additives. Mainly acids and salts can be seen among these.

A few chemical substances prescribed to be used as synthetic food additives are given below.

- Sodium metabisulphite
- Sodium bisulphite
- Benzoic acid
- Sodium chloride
- Sodium nitrite and sodium nitrate
- Acetic acid

The additives mentioned above should be those prescribed by the food act in Sri Lanka and it is important that they are added in prescribed quantities. Any preserved food items that are not suitable for children should be clearly stated in the label.

For extra knowledge

Flavours are added to food such as instant food and soup cubes available in the market. But giving flavoured food to children under the age of three years is not safe as far as their health is concerned. Monosodium glutamate (MSG) added to food is a flavour and is not a preservative. Use of these beyond the preseribed dose is not favourable for health. Some food colourings are carcinogenic.

Let us engage in Activity 13.2 to study the preparation of jam as a preserved type of food.

Activity 13.2

You will need:- 500 g of fruits (mango, pineapple, orange), 500 g of sugar, 1g of citric acid, 10-15 g of pectin, about 0.25 g of sodium metabisulphite

Method:-

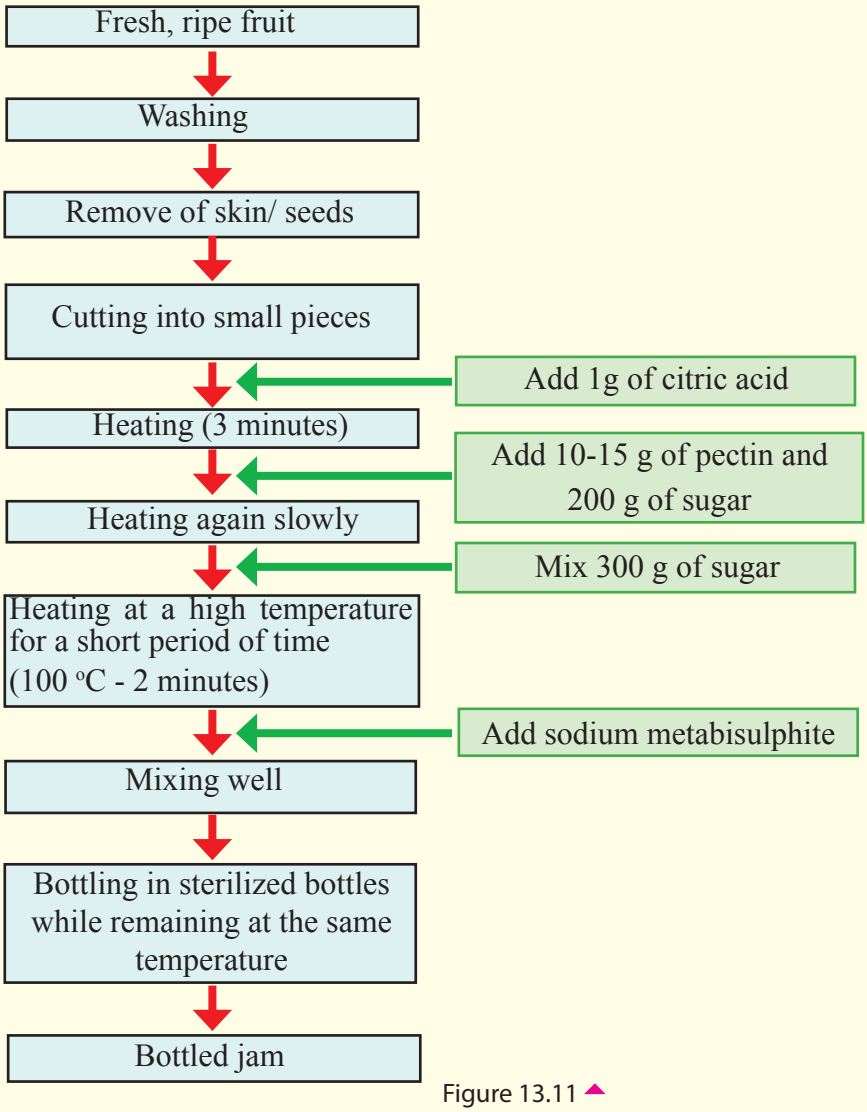


Figure 13.11

Assignment 13.4

- If there is a food processing factory in your area (such as canned fish, sauce, cordial, jam etc.) arrange a field trip to observe it.
- Observe the manufacturing process.
- Draw a flow chart to present the process.
- Prepare a booklet about your field trip.

Various types of preserved food

- Some preserved food can be directly consumed.

  e.g.:- Chutney, jam, sauce, fruit drinks etc.

- Some preserved food can be consumed after instant preparation. Those are food types packed after subjecting to a complex process and addition of preservatives. They are known as processed (pre-cooked) food.

  e.g.:- Meat balls, sausages, noodles, macaroni, coconut milk powder, cordial etc.

- Some preserved food needs to be cooked before consumption.

  e.g.:- Dried fish, cereals etc.

Assignment 13.5

- Prepare a list of processed food available in the market.
- Investigate how food items such as fruit cordial, 'lunudehi', tomato ketchup are prepared.
- Make those food and taste them either in the classroom in groups or at home.
- Indicate by flow charts how those food items are prepared.

13.4 Advantages and disadvantages of food preservation

Let us do Assignment 13.6 to study advantages and disadvantages of food preservation.

Assignment 13.6

- Study well about preserved or processed food and non preserved food.
- List separately the advantages and disadvantages of the consumption of preserved food and processed food.

Compare the advantages and disadvantages mentioned with the following facts.

Advantages of food preservation and processing

- Ability to prevent food spoilage

  Food poisoning and ailments caused by the consumption of spoiled food can be prevented.
- Ability to select according to appetite because the same source of food is prepared in different ways
- Ability to impart an attractive look for food
- Ability to increase the nutritional value of some food types (yoghurt, cheese) by changing their existing nature
- Utilize the surplus effectively
- Ability to keep them for off season consumption
- Minimize the damage caused by insects and other animals

Disadvantages of food preservation

- Running a risk of being prone to diseases for the addition of non permitted additives and addition beyond prescribed limits.
- Increase in the risk of causing diseases (e.g. :- cancer, diabetes, heart diseases) due to artificial additives such as flavours and colourings
- Possibility of destroying vitamins and other nutrients
- Tendency to change the characteristic flavour, smell and colour of the food.
- Reduce the desire for natural food and getting used to consumption of instant food

13.5 Information in a label of a food package

Let us do Activity 13.3 in order to study further about the facts we need to take into consideration as customers when buying packaged food items.

Activity 13.3

You will need:- A few labels of packaged food items

Method:-

- Study well the packets/cartons of the food items and their labels well and list the information relevant to ensure their quality.

Table 13.3

Number	Packaged Food	Method of preservation	Additives	Date of manufacture	Date of expiry

Compare the information you collected with the following.

Some important information given on the label of a packed food item are as follows.

- Date of manufacture and date of expiry
- Net weight / Total weight
- Standard
- Producer (Institution / Country)
- Environment friendliness / Consumer friendliness of the packet/ wrapper

Date of manufacture and date of expiry

Food can be packed only for a limited period of time protecting their nutritional quality. As time elapses, physical and chemical changes may take place in food. Moreover, food may get spoiled due to microbial activity.

Net weight / Total weight

The consumer should be aware of the amount of the substance in the package.

Standard

If the food item is prepared according to the standards prescribed by the Sri Lanka Standard Institute, the cover of the package should have the SLS logo along with the relevant numbers. If the food item is prepared according to the International standards the package should have the ISO logo along with the relevant numbers.

Figure 13.12 ▲ Quality certificate logos of standards

Food items with the standard certification are considered to be high in quality.

Assignment 13.7

- There are instances where quality of the food is adulterated by adding various substances for the purpose of making profit. Be cautious about such instances.
- Make a list of food items which are adulterated.
- In each example you mentioned, state the substance added to the food.

Details of the manufacturer

Information about the manufacturer or the country that produces the food item is important for taking legal action in case unexpected results are caused due to consumption of food.

Environment friendly/ consumer friendly nature of the wrapper

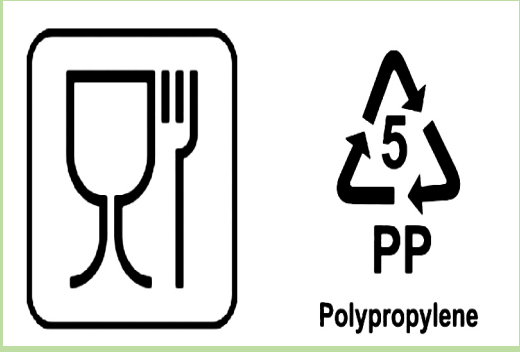
Since some food items contain flavours, colourings and preservatives, with time they may react with the packing and form substances injurious for health. These wrappings are harmful for personal health as well as the environment.

Therefore, when buying packaged food, it is very important to pay attention not only to the quality of food but also to all the information given in their labels. Proper packaging is essential to minimize wastage of food during transport. Some of its advantages are:

- Prevention of the entry of microorganisms and macroorganisms
- Protection of food from external factors such as air, water (moisture), light and heat
- Maintenance of quality and quantity of food
- Facilitation of transport and storage

For extra knowledge

Only prescribed varieties of plastics can be used to pack food. They are known as super grade plastics.



- The symbols given in the packaging which are suitable for food are given here.
- Recycled plastics should never be used as food wrappers.
- Plastics used to pack other materials should not be used to pack food.
- Oily or basic food types should not be packed in non- prescribed plastic containers.
- Strongly heated food is not suitable for packaging.

During food preservation synthetic flavours and colourings are added very often. Therefore food is subjected to a complex mode of processing. Hence, it is very important to get used to consume natural food.

Summary

- Food spoilage is mainly caused by the growth and action of microorganisms on food.
- Food preservation, is keeping food for a longer period of time by artificially controlling the factors affecting food spoilage.
- Minimizing food spoilage, utilization of surplus food, ability to consume some food types in the off-season and prevention of food poisoning are the advantages of food preservation.
- Food preservation descends from the past. At present, food is preserved by modern technological methods.
- When buying packed food, it is very important to that quality of food as well as the information given in the label, are taken into consideration.
- It is always favourable to consume natural food whenever possible, in order to maintain good health.

Exercise

1. Select the correct answer.

1. Which one of the following is a novel method of food preservation ?

1. Salting 2. Smoking
3. Freezing 4. Immersing in honey

2. Some aims of adding additives to food are given below.

A - Adding a flavour to food
B - Keeping food viscous
C - Preventing food from reacting with oxygen

Which one of the above statements are correct ?

1. A and B 2. B and C 3. A and C 4. A, B and C

3. An example for a pre-cooked food is,

1. Powdered coconut milk 2. Chutney
3. Jam 4. Fruit drink

4. Which of the following is a disadvantage of food preservation ?

1. Prevention of food spoilage
2. Imparting an attractive appearance for food
3. Increasing nutritional value of food
4. Reducing appetite for natural food

5. Which of the following is a food that does not spoil fast ?

1. Cow milk 2. Bread 3. Dry green gram 4. Fish

2. Place a tick (√) if it is correct and a cross (×) if it is incorrect.

1. Cow milk is a food which spoils faster. ( )
2. Use of food added with synthetic colourings or flavours is not very appropriate, for consumption. ( )
3. It is not faulty to wash and reuse food wrappings. ( )
4. It is compulsory to state the date of preparation of food in the label of a bottled food. ( )
5. Change in the nutritional quality of food due to drying, prevents microbial action. ( )

3. State the method/methods used in the preservation of following food types.

- Dried fish
- Jam
- Chutney
- Sterilized milk ('kalkiri')

4. State separately the reasons why food does not get spoiled in the follwing methods of preservation.

- Drying
- Keeping in the refrigerator
- Salting
- Smoking

Technical Terms

Food preservation	-	ආහාර පරිරක්ෂණය	-	உணவு நற்காப்பு
Preservatives	-	පරිරක්ෂක	-	நற்காப்புப் பதார்த்தங்கள்
Processed foods	-	පිරිසැකසුම් ආහාර	-	பதப்படுத்தப்பட்ட உணவுகள்
Traditional methods	-	සාම්ප්‍රදායික ක්‍රම	-	பாரம்பரிய முறைகள்
Technological methods	-	තාක්ෂණික ක්‍රම	-	தொழிநுட்ப முறைகள்
Artificial colourings	-	කෘත්‍රිම වර්ණක	-	செயற்கை நிறமூட்டிகள்
Standards	-	ප්‍රමිතිය	-	தரம்
Food flavours	-	රස ප්‍රවර්ධක	-	உணவுச் சுவையூட்டிகள்
Natural foods	-	ස්වාභාවික ආහාර	-	இயற்கை உணவுகள்
Additives	-	ආකලන ද්‍රව්‍ය	-	சேர்மானங்கள்
Quality	-	ගුණාත්මකබව	-	பண்புத்தரம்
Date of expiry	-	කල් ඉකුත් වීමේ දිනය	-	காலாவதித் திகதி
Date of manufacture	-	නිෂ්පාදිත දිනය	-	உற்பத்தித் திகதி
Net weight	-	ශුද්ධ බර	-	நிகர நிறை
Constituents	-	අඩංගු සංඝටක	-	அடங்கியுள்ள பதார்த்தங்கள்
Nutrients	-	පෝෂක	-	போசணை

14 Phenomena and exploration associated with the solar system

14.1 The solar system

A large number of celestial objects can be observed in the night sky. From ancient time people were curious about those celestial objects. They gathered information by observation of those objects.

Ancient people observed celestial objects with their naked eyes. Later on various instruments were used for this purpose. Telescopes, manned and unmanned space crafts and space stations are some of them.

Due to the information collected since ancient time, now we have the ability of understanding the solar system, which is a large system including the earth. Still the explorations are being carried out about this.

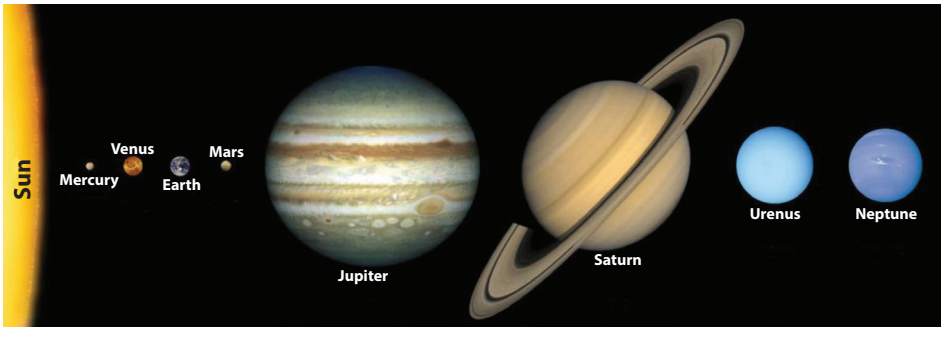


Figure 14.1 ▲ The solar system

Planets rotate around their own axis, while revolving around the sun. Rotational time of a planet is the time taken by the planet to turn once, around its own axis. It is the time span of a day of that particular planet.

e.g. :- The rotational time of the earth is 24 hours. So, that is a day of the earth.

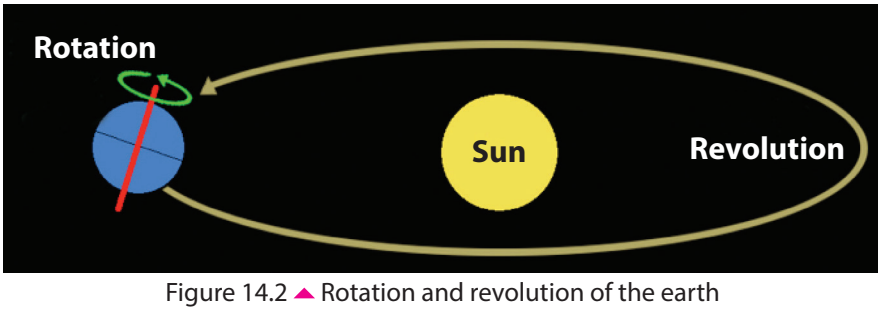


Figure 14.2 ▲ Rotation and revolution of the earth

Time of revolution of a planet is the time taken by the planet to revolve once around the sun. That is the year of that particular planet.

e.g.:- The time of revolution of the earth is 365.25 days. That is the year of the earth.

Figure 14.3

Consider a dancing event by a dancer to understand the concept of rotation and revolution. A dancer rotates around its own axis. It is called rotation. At the same time the dancer revolves around an imaginary point on the stage. This is called as revolution. (Figure 14.3).

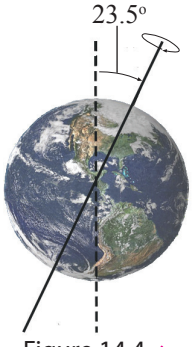


Figure 14.4

A planet rotates around its rotating **axis**. The path, along which a planet revolves around the sun is its **orbit**. All planets have a tilt to its orbital plane, when revolve.

e.g.:- The earth has a tilt of 23.5° the perpendicular axis of its orbital plane (Figure14.4)

There are sub-planets around most of the planets. They also rotate around their axis while revolving around the planet.

Mercury and Venus have no sub-planets. Information about the planets of our solar system are given in Table 14.1.

Table 14.1

Planet	Distance from the sun (million km)	Diameter (km)	Rotational Time (earth days)	Revolutional time (Earth years)	Tilt to the orbital plane (degrees)	No. of sub planets (till 2016)
Mercury	57.9	4 879	58.65	0.24	0.1	0
Venus	108.9	12 104	243.00	0.62	177.4	0
Earth	149.6	12 756	1.00	1.00	23.4	1
Mars	227.9	6 792	1.03	1.88	6.7	2
Jupiter	778.6	142 984	0.41	11.86	25.2	67
Saturn	1433.5	120 536	0.44	29.46	3.1	62
Uranus	2872.5	51 118	0.72	84.01	26.7	27
Neptune	4495.1	49 528	0.72	164.80	97.8	14

Let us do Activity 14.1 to build up a model of solar system and to study about it.

Activity 14.1

You will need:- Styrofoam balls of suitable sizes to represent planets, suitable paints in given colours to apply on styrofoam balls, wooden strip to the length of 75 cm, black thread, glue, small styrofoam sheet

Method:-

- Select styrofoam balls to the sizes given below and paint them with colours indicated.

Table 14.2

Object	Diameter of the ball (cm)	Colour
Sun	15.0 cm	Yellow
Mercury	1.0 cm	Orange
Venus	2.0 cm	Bluish green
Earth	2.0 cm	Dark blue
Mars	1.5 cm	Red
Jupiter	10.0 cm	Orange
Saturn	9.0 cm ring 12.0 cm	Yellow Orange
Uranus	5.0 cm	Light blue
Neptune	4.0 cm	Dark blue

- Cut a ring for Saturn from the styrofoam sheet.
- When the paint is dry, fix balls to the wooden strip using glue.
- Paint the wooden strip black
- Make the model as shown in Figure 14.5
- Write the names of the planets.

Compare the model which you have made with the model shown in Figure 14.5.

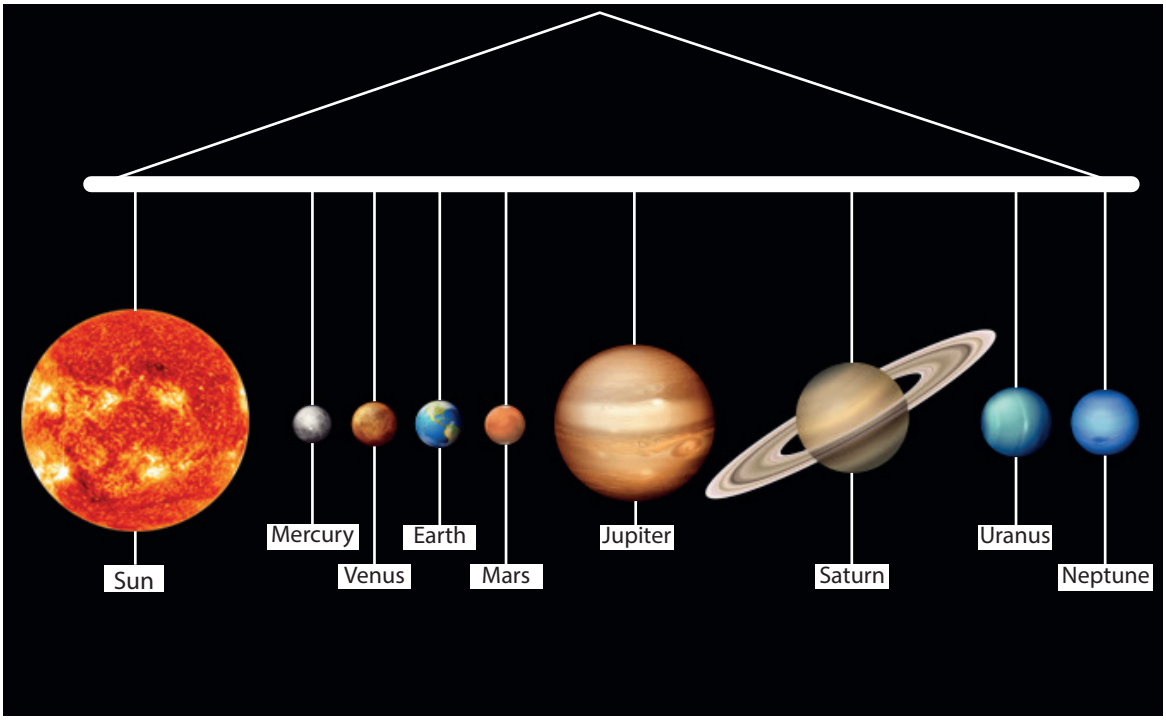


Figure 14.5 ▲ Simple model of solar system

Real ratio of the sizes of planets is not indicated in the model you made in the Activity 14.1. The real ratio of the sizes of them is given in Figure 14.6.

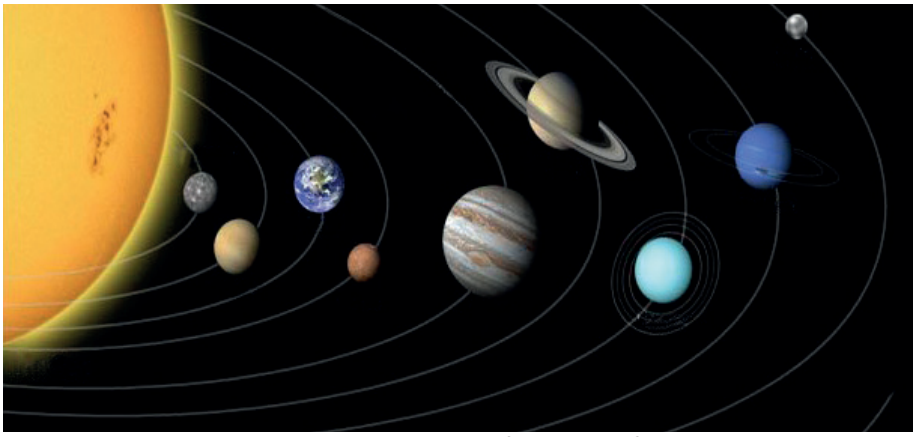


Figure 14.6 ▲ Comparison of the sizes of planets

Carry out Activity 14.2 to understand about the distances of planets from the Sun.

Activity 14.2

You will need :- Name boards of planets, measuring tape (in meters), a large yellow coloured balloon

Method:-

- Mark a point at the centre of the school play ground.
- Take that point as the centre. Draw circles taking the radius according to the ratio given in the table below. (Use the measuring tape for this purpose)
- Get the assistance of your teacher for this.

Table 14.3

Planet	Ratio of distance from the sun
Mercury	0.58 (0.5)
Venus	1.08 (1.0)
Earth	1.50 (1.5)
Mars	2.28 (2.2)
Jupiter	7.78 (7.8)
Saturn	14.24 (14.2)
Uranus	28.67 (28.7)
Neptune	44.89 (44.9)

- Place the inflated yellow balloon at the centre of the ground.
- Apply slaked lime on the circles marked on the ground. Place the name boards of each planet on each circle. Position a student at each name board.
- Give each student at the name board, a leaflet with information of that planet.
- Direct students in your class at a time to each name board.
- Direct the student at the name board to describe about the planet that he is responsible of .

Now you have a comprehensive knowledge about the planets. Figure 14.7 shows a model of solar system in the school laboratory.

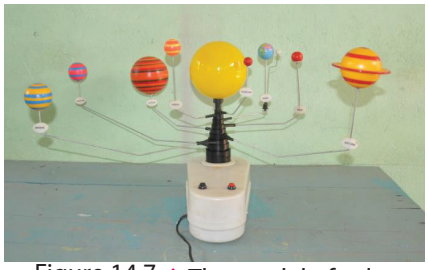


Figure 14.7 ▲ The model of solar system in the school laboratory

Engage in Activity 14.3 to study about the revolution of planets around the sun.

Activity 14.3

You will need :- A ball, a strong string of 50 cm in length

Method :-

- Tie the ball at one end of the strong string of 50 cm long.
- Take the other free end of the string to hand and rotate the ball fast enough above your head.
- Now observe, the manner ball rotates around you without falling, until you rotates it.

In this activity you might have observed that the ball rotates in a circular path without attract towards you.

This rotation can be explained as below.

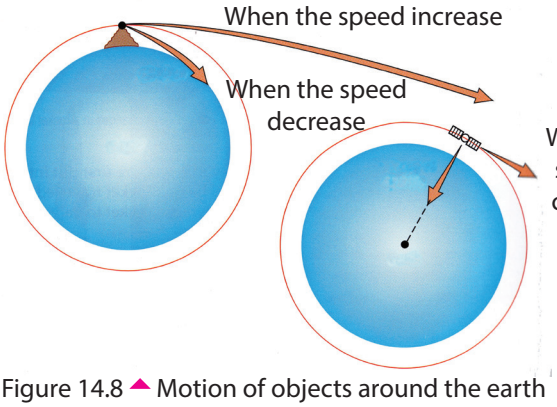


Figure 14.8 ▲ Motion of objects around the earth

Here a force is exerted from your arm to the ball. Therefore, ball is rotating in circular path at a constant speed.

Corresponding to the example given in Figure 14.8, revolution of planets around the sun also, can be explained. Comparative to the force applied by the arm towards the ball, a force is applied by the sun towards the planet that is called **gravitational force**. The planet should fall on the sun and be destroyed, due to this force. But, this does not happen because of the constant speed of revolution of the planet around the sun.

14.2 Occurance of seasonal changes

Seasonal changes is a phenomenon that occur due to the revolution of the earth around the sun, with a tilt to its orbital plane.

When it is the winter in England which is in the northern hemisphere of the earth it is the summer in Newzealand which is in the southern hemisphere. Let us find out how this happens.

It is known that the earth's axis has a tilt of 23.5° to its orbilal plane. Revolution of the earth with this tilt is the reason for seasonal changes on earth. Let us study how this happens.

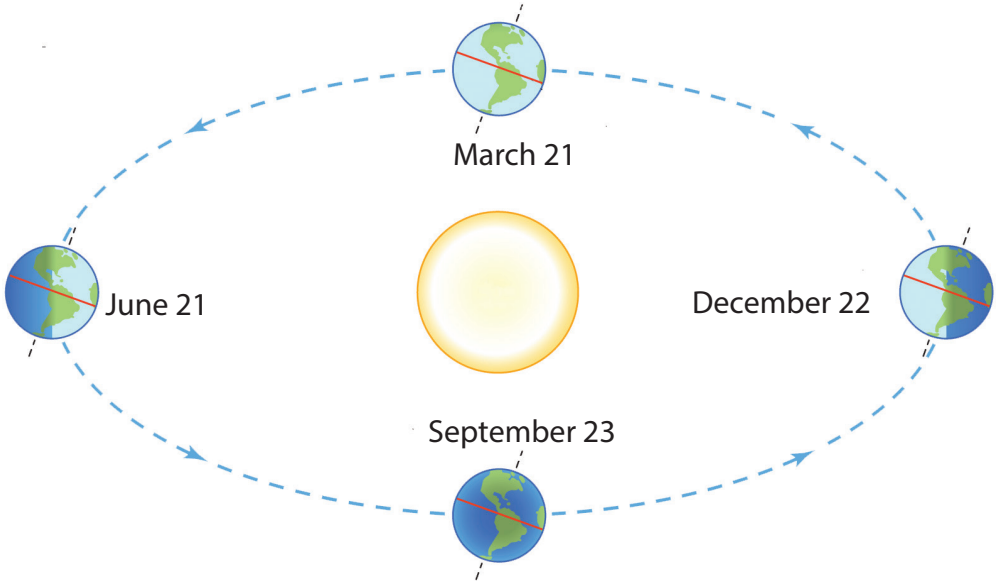


Figure 14.9 ▲ Occurance of seasonal changes on earth

Consider the position of the earth (Figure 14.9) on 21st of June. Here, rays of the sun fall perpendicular to the northern hemisphere.

Hence, it is summer to northern hemisphere. Same time rays of the sun fall with an inclination to the southern hemisphere. Therefore, it is cold and is winter to southern hemisphere.

Consider the position of the earth on 22nd of December (Figure 14.9). Rays of the sun falls perpendicular to southern hemisphere, and with an inclination to nothern hemisphere. Therefore, winter occur in nothern hemisphere and summer to the southern hemisphere.

Seasonal changes are distinct in polar regions. Countries like Sri Lanka, which are closer to equator, have no distinct seasonal changes.

14.3 Occurance of phases of moon

Phases of moon occur because of the revolution of moon around the earth. Half of the moon is always illuminated by the light of the sun. But that half is completely seen from the earth only on a full moon day. The part of the illuminated half of the moon, seen from the earth, changes daily due to its position. Thus, we can see various shapes or the phases of the moon.

Let us do Activity 14.4 to study how phase of moon occured.

Activity 14.4

You will need :- An electric bulb, a styrofoam ball fixed to a rod

Method:-

- Use the electric bulb instead of the sun and the styrofoam ball fixed to a rod, instead of moon. This activity is to be done in a dark room.

Figure 14.10 ▲ Demonstrating phases of moon

- Holding the styrofoam ball, turn around yourself and observe the illuminated part of the ball as in Figure 14.10.

In a calendar there is only one full moon day for a duration of one month. But sometimes very occasionally, there are two full moon days for some months. Figure 14.11 shows the calendar and the phases of moon during such a month.

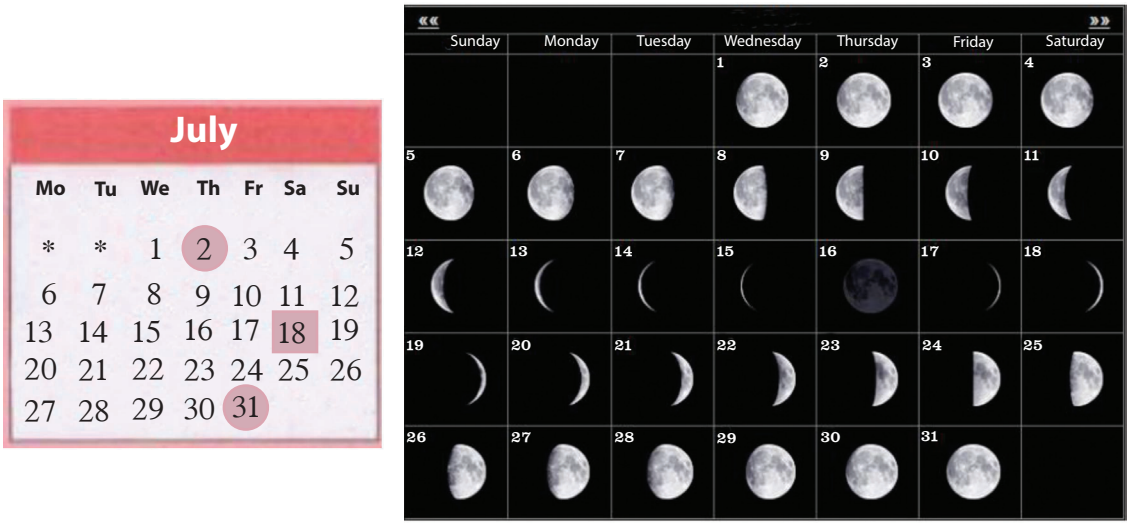


Figure 14.11 ▲ The calendar and the phases of moon during a month that has two full moon days

Answer the questions given below on the Figure 14.11

1. What are the phases of moon on the 2nd and 31st of this month ?
2. What is the name used for the phase of moon on the 16th ?

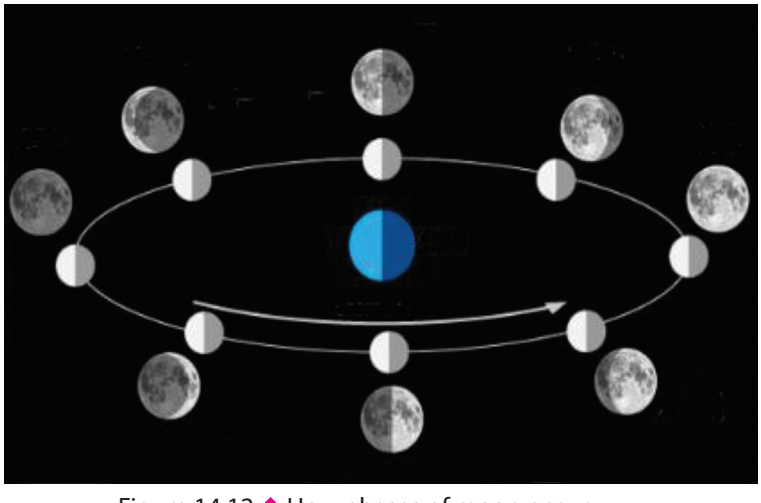


Figure 14.12 ▲ How phases of moon occur

Studying the Figure 14.12 you will understand clearly, how phases of moon occur.

14.4 Important incidents associated with solar system

Eclipses

Marvellous scenes that can be observed in the sky are eclipses. There are two types of eclipses.

- Solar eclipses
- Lunar eclipses

Solar eclipses

The moon revolves around the earth once every 27.3 days. During this journey in some occasions the shadow of the moon falls on the earth. The sun is invisible, fully or partially, to those who are in the shadow area for some time. This is called the solar eclipse. We see the sun and the moon equal in size, in the sky. The sun is a very large object. Moon is very small with respect to the sun. But, the sun is very far away from the earth and the moon. That is why we see them more or less equal in size.

Because of this reason the moon can totally cover the sun during a solar eclipse. Two areas can be identified in the shadow of moon, fallen on the earth. These areas are the umbra and the penumbra. (Figure 14.13)

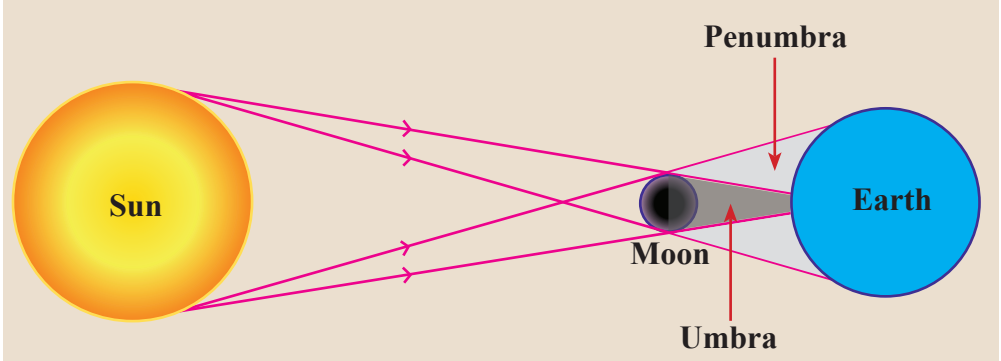


Figure 14.13 ▲ A solar eclipse

Those who are in the umbra can see a total solar eclipse, while those who are in the penumbra can see a partial solar eclipse.

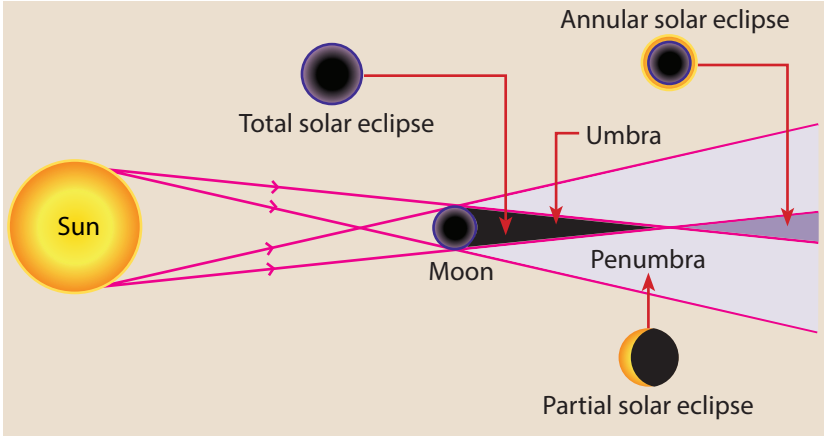


Figure 14.14 ▲ Types of solar eclipse

Umbra of moon covers an area of about 160 km^2 of the earth. This area moves because of the rotation of earth. It means that the umbra travels along the surface of earth. The maximum time duration that a point of earth experiences a total solar eclipse is 7.5 minutes.

Solar eclipse occurs on new moon days.

An experience of a solar eclipse

Sri Lanka experienced a total solar eclipse on 20th June 1955. The eclipse commenced at 8.11 in the morning and after 7 minutes it was over at 8.18.

A person who experienced that solar eclipse described it as follows.

"That day the sun was shining in the morning as usual. After eight in the morning it began to fall dark. Birds flew to their nests. Fowls settle on trees. Environment get cooled. Sky darkened completely. Stars began to twinkle. But moon was not there as it was a new moon day.

After sometime it dawned again. Birds come out of their nests. Fowl got down from the trees. Cattle came out from their lying places.

Meteorological department announced in advance, that a solar eclipse occurs on that day. Therefore, it was declared a school holiday."

I never forget this incident.

Again in 15th of January 2010, Sri Lanka experienced an annular solar eclipse.

Observing solar eclipses

Solar eclipses should never be observed with naked eyes. Eye covers/goggles can be used for this purpose. Welders also use eye covers. Even using those aids, it is advisable not to watch the sun directly for a long time. If do not follow these instructions will result in the blindness of your eyes for ever.

It is safer to watch the image of the solar eclipse taken on to a screen using a mirror or a telescope.

Using goggles

Taking the image on to a screen using a telescope

Figure 14.15

Indicated below are some solar eclipses observable in future in Sri Lanka

December 26, 2019 - An annular eclipse
June 21, 2020 - An annular eclipse

Lunar eclipses

The number of lunar eclipses we can observe is more than the number of solar eclipses. **Lunar eclipse occurs on a full moon day**. Lunar eclipses occur when the earth comes in between the sun and the moon, and are in a straight line (Figure 14.16).

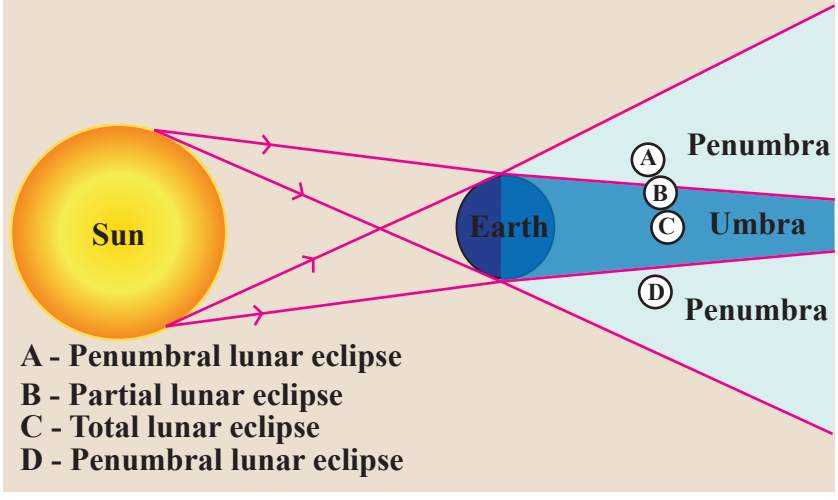
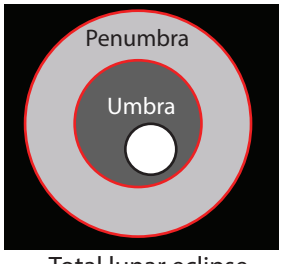


Figure 14.16 Occurance of lunar eclipses

Shadow of the earth also has two areas, named umbra and penumbra. There are three types of lunar eclipses according to the type of shadow fallen on the moon.

- Total lunar eclipse
- Partial lunar eclipse
- Penumbral lunar eclipse

Total lunar eclipse



Total lunar eclipse

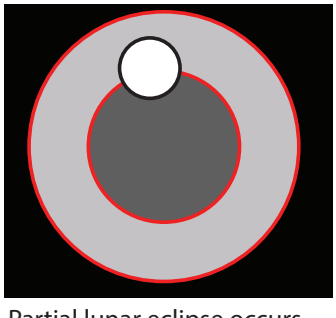

How the moon is seen during a total lunar eclipse

Figure 14.17

Total lunar eclipse occurs when moon enters completely into the umbra of the earth. This incident can be observed with your naked eyes. As a science student, it is very important for you to observe this. During a total lunar eclipse, moon can be observed in reddish brown colour. It lasts more than an hour (Figure 14.17).

Partial lunar eclipse

Instance in which a part of the moon is in the umbra of the earth and other part is in penumbra is called partial lunar eclipse. Here, the part of the moon in the umbra is seen in reddish brown colour (Figure 14.18).


Partial lunar eclipse occurs


How the moon is seen during a parital lunar eclipse

Figure 14.18

Penumbral lunar eclipse

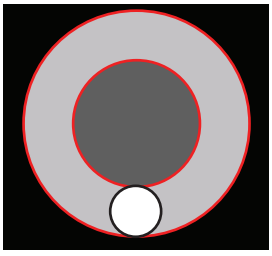


Figure 14.19 ▲ How a penumbral lunar eclipse occurs

When moon moves in the penumbra of the earth a penumbral lunar eclipse occurs. This is not easy to observe as the brightness of the moon does not reduce considerably (Figure 14.19).

Do Activity 14.5 to demonstrate the solar and lunar eclipses.

Activity 14.5

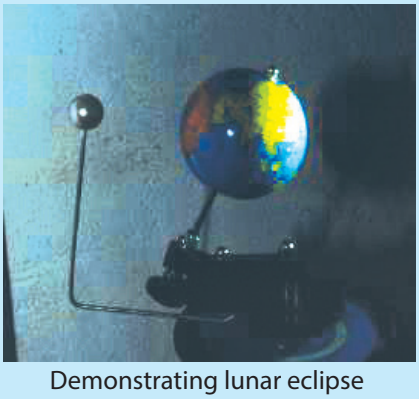
You will need :- The sun, earth and moon models in the school (Figure 14.20 and 14.21)

Method :-

- Do this activity in a dark place.
- Demonstrate the motion of the earth and moon, and also the eclipses using the models.
- Get the assistance of your teacher for this.

Figure 14.20 ▲ The equipment to demonstrate the motions of the earth and the moon

Demonstrating solar eclipse



Demonstrating lunar eclipse

Figure 14.21 ▲

The followng motions and phenomena can be demonstrated using this equipment.

- Rotation of the earth
- Revolution of the moon
- Lunar eclipse
- Revolution of the earth
- Solar eclipse

For extra knowledge

The lunar eclipses that can be seen in Sri Lanka in the coming years

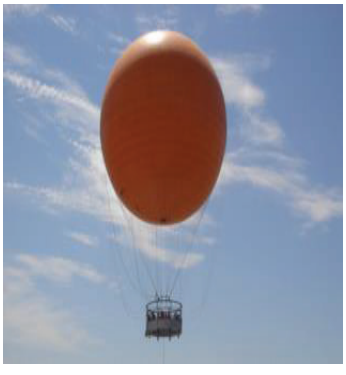
February 10, 2017	- Penumbral lunar eclipse
January 10, 2020	- Penumbral lunar eclipse
November 30, 2020	- Penumbral lunar eclipse
November 08, 2022	- Total lunar eclipse
October 28, 2023	- Partial lunar eclipse

14.5 Exploring the universe

Air cover around the earth is called the **atmosphere**. The atmosphere extends up to about 500 km from the surface of the earth. But it becomes very thin after about 100 km. The area that starts about 100 km far from the earth is termed as the **space**.

Since ancient times man has been exploring the space. However, the limits of the space, what it contains and how much does it contain such things are the questions man has not been able to find complete answers so far. The objective of science is to find out answers to such questions.

Initially man could reach the higher levels of atmosphere using balloons. Balloons filled with gases like hydrogen or helium which are lighter than air, can rise up into the sky. Balloons filled with hot air also rise up. Both of those can take man higher levels in the sky.



A balloon filled with hydrogen or helium

A balloon filled with hot air

Figure 14.22

Usage of rockets

Later man realised that the only way to reach the outer space is by using rockets. Tsiolkovsky, a Russian and Goddard, an American were the pioneers to work on rockets.

Assignment 14.1

Find the facts about the work done by Tsiolkovsky and Goddard on rockets and make a report.

Let us do Activity 14.6 to make a simple rocket and to study how it works.

Activity 14.6

You will need :- Megabottle of 1.5 l, a rubber stopper, a valve of a bicycle tube, an inflater, water

Method:-

- Bore a hole in the rubber stopper and fix the bicycle valve to it.
- Fill water up to 1/3 of the bottle and fix the rubber stopper with valve to it.
- Place the bottle with water as shown in the figure. Then, pump air into it using the inflater.
- Observe the reaction.

Figure 14.23 ▲
Water rocket

While inflating at a certain moment the bottle with water unplugs and rise up in the air as a rocket.

This water rocket can be modified to rise higher up in the sky.

Figure 14.24 ▲ A modified water rocket

Figure 14.25 ▲ A student preparing to fly up a water rocket

You can obtain more details about water rockets from the Arthur C. Clerke center at Moratuwa. National and international competitions on sending water rockets are also being organised.

The first rocket which used liquid fuel was launched in 1926. The simplest rocket consists of a combustion chamber, a fuel tank, a liquid oxgen tank and a tank containing igniter.

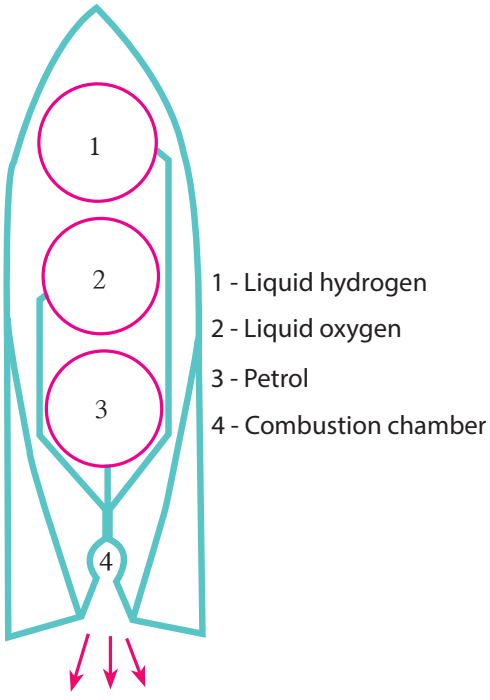


Figure 14.26 ▲ A sketch of a liquid fuel rocket

Liquid hydrogen and liquid oxygen (as fuel) and petrol (as igniter) are well mixed and pumped into the combustion chamber. Gases produced by the combustion were pushed down speedily through the **nozzle,** giving the rocket an upward force. This makes the rocket rise up into the sky.

Rising up of a rocket can be compared with the rising of the fire work called skyer.

14.6 Artificial satellites

The moon is attracted by the earth but moon does not fall on to the earth because it revolves speedily around the earth. Celestial bodies, smaller than the moon, which are orbiting the earth are called satellites.

An object launched to revolve around the earth, using a rocket is known as an artificial satellite. The first artificial satellite named Sputnik-1 which was launched by Soviet union on October 4th, 1957. With this historical victory man entered into the space age (Figure 14.27).

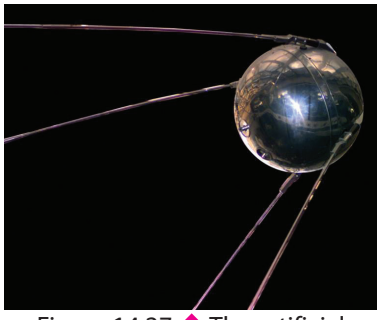


Figure 14.27 The artificial satellite (Sputnik -1)

The first American artificial satellite was Explorer-1 launched on January 31st, 1958.

NASA was established in 1958 to carry out the American space programme.

Assignment 14.2

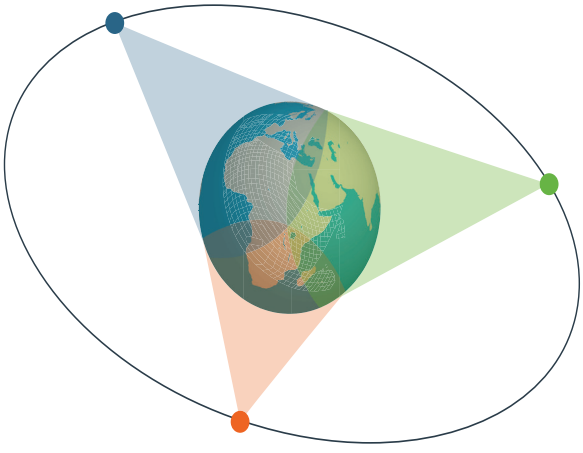
Make a booklet on the uses obtained by artificial satellites.

Observe the sky in a clear night between 7.00 pm and 8.00 pm. If you see a star-like object moving through the stars, it is a satellite. If you see a falling of star like object it may be a meteor.

Communication satellites

World's first commercial communication satellite was launched on July 10th, 1962. It was the Telstar-1. Until today, there are thousands of communication satellites orbited around the earth to provide telephone, television and web facilities.

Sir Arther C. Clerke came out with a new idea on communication by satellites. He said that if a satellite is orbited around the earth at the same speed as the speed of earth's rotation and at a certain height, it will be seen stationary from the earth. Such a satellite is called a Geo-stationary satellite. Sir Arther C. Clerke clarified that if three of such satellites are positioned around the earth, the whole globe can be covered with communication facilities.



Now the world is converted to "a global village" by the orbited geo-stationary satellites using the idea presented by Sir Arther C. Clerke in 1945.

Figure 14.28 ▲ Geo - Stationary satellite network

For extra knowledge

Space explorations

Launching of artificial satellites was commenced by Russia (then Soviet Union) in 1957 and by America in 1958. Some key points of space era, started since then, are given below.

Name of space craft	Year and country	Relevant historical incident/ importance
Luna - 1 (unmanned)	1959 Russia	• The first moon exploration satellite to travel near the moon. • Space craft that became the first artificial planet around the sun.
Luna - 2 (unmanned)	year 1959 Russia	• The first unmanned space craft to land on moon. • The first artificial object which reached to another world
Luna - 3 (unmanned)	Year 1959 Russia	• Take photography of the other side of the moon's surface for the first time.
Vostoc - 1 (manned)	Year 1961 Russia	• Yuri Gagarin became the first astronaut.
Vostoc - 2 (manned)	Year 1961 Russia	• Consumed food in the space for the first time.

Mercury -1 (manned)	Year 1961 America	• Allen shephard became the first American astronaut.
Mercury - 2 (manned)	Year 1962 America	• John Glenn became the first American astronaut to orbit completely around the earth.
Vostoc - 3 Vostoc - 4 (manned)	Year 1962 Year 1962 Russia	• Two space crafts came closer to each other in the space.
Vostoc - 6 (manned)	Year 1963 Russia	• Valentina Thereshkva became the first female astronaut.
Ranger - 7 (unmanned)	Year 1964 America	• Sent detailed photographs of the moons surface for the first time.
Ranger - 8 (unmanned)	Year 1965 America	• Sent photographs of a sea of tranquility which was a place expected to land appolo space crafts
Voscod - 2 (manned)	Year 1965 Russia	• First man to walk in the space (Alex Liyanof)
Gemini - 3 (manned)	Year 1965 America	• First computer to be taken to the space.
Luna - 9 (unmanned)	Year 1966 Russia	• Soft landing of a moon exploring craft on moon for the first time.
Gemini - 8 (manned)	Year 1966 America	• A manned space craft to join with a rocket in the orbit for the first time.
Surveyer - 1 (unmanned)	Year 1966 America	• Soft landing of the first American moon craft on moon.
Luna orbiter - 1 (unmanned)	Year 1966 America	• The first moon exploring craft to map the moon.
Appolo - 8 (manned)	Year 1968 (America)	• The first manned moon exploring craft to orbit the moon.
Appolo - 11 (manned)	Year 1969 July 21 (America)	• Neil Armstrong landed on moon. Michael Collins and Edwin Aldrin also joined this journey.

Neil Armstrong declared this statement after landing on the moon.

"This is a small foot step for a man but a giant leap for man-kind."

Astronauts of Appolo-11 placed a memorial plate on the moon. It says;

Figure 14.29 ▲ The memorial plate placed by Appolo - 11 astronauts on moon

"We are men from the planet earth, placed out foot on the moon. We came in peace for all mankind."

Appolo program was over in 1972. Twelve astronauts landed on various locations on the moon under this programme.

Mentioned below are some victories, in the field of space exploration, gained after landing on the moon.

- An unmanned space craft was sent to the moon and rocks from its crust were brought to the earth by Russia.
- Important information on Jupiter, Saturn, Uranus and Neptune was gathered by the space ships Voyages and Pioneer. Information on Mars and Mercury was collected by Marriner crafts.
- Various space crafts were landed on Mars and information on its crust was gathered.
- 'Hubble' space telescope was launched to observe celestial bodies which are difficult to observe from the earth.
- Earlier Russia and America established space stations separately. But, now both above countries in collaboration with some other countries maintain the International Space Station jointly.

Figure 14.30 ▲ International space station

Assignment 14.3

Prepare a booklet on the recent victories of space explorations.

14.7 Constellations

Ancient people who were watching stars in the night sky, imagined various star patterns by joining them.

Those ancient star patterns identified earlier and those named recently are called constellations. There are 88 constallations identified so far. Let us learn about a few of them.

It is important to identify the directions when observing the stars in the night sky. In the day time, directions can be found, using the direction of sun rise. Stretch your hands apart, and stand facing the direction of sun rise. Then, the front side is the east and back side is the west. Your right hand side is the south and left hand side is the north.

The buildings and tall trees can be used to find the directions at night, when you are watching night sky. The directions you identify in the day time will help you in this regard.

In the night sky, we see all the stars other than one star, apparently move from east to the west. But, actually what happens is that the earth rotates from west to the east. The star that does not change the position is the **Polaris**.

The position of Polaris does not change because it is located in line with the axis of the earth.

Figure 14.31 shows some constellations that can be seen in February - March in the sky about 8.00 pm.

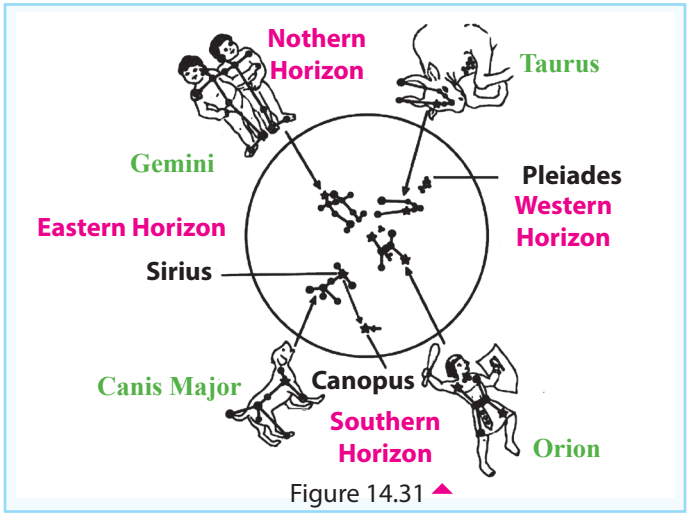


Figure 14.31

Orion or the hunter is a very popular constellation. Here, the head of the hunter is directed towards the north. So, it is useful to find north at night.

We see that all the stars in a constellation are in the same plane. But, the distance to each star from the earth are greatly varing.

The unit used to measure the distance between stars is light year. Light travels 300 000 km per second. Light year is the distance that light travels during a year.

The constellation Orion, and the distances to some stars of it from the earth are given in Figure 14.32.

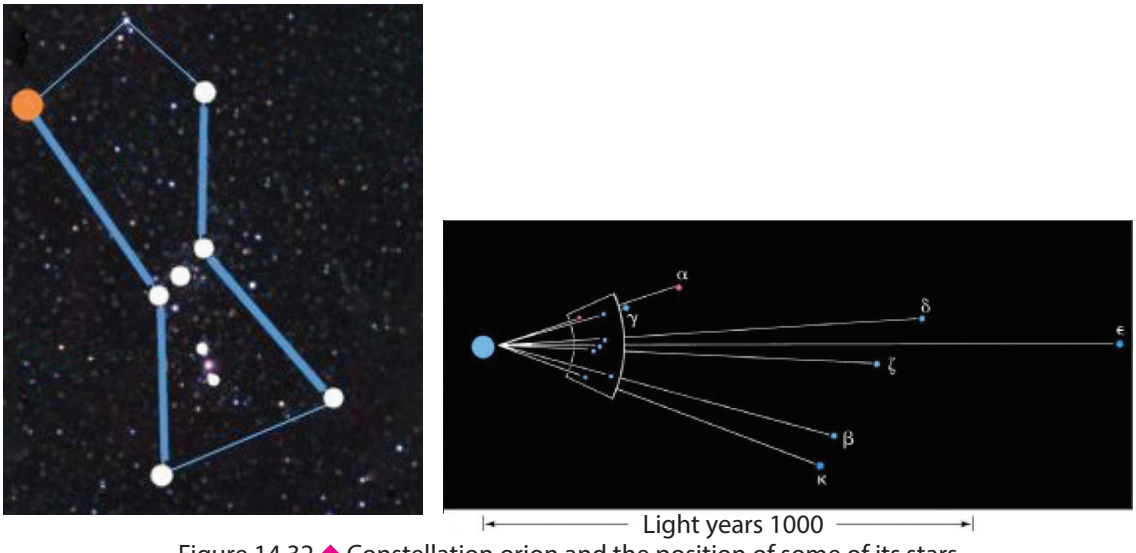


Figure 14.32 Constellation orion and the position of some of its stars

The constellation Orion is given with many other names.

Assignment 14.4

Find out the other names given for the constellation Orion.

Constellation Canis major can be found close by to Orion. The brightest star in the night sky, Sirius is found in this.

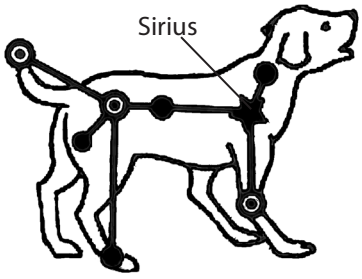


Figure 14.33

When you are learning about constellations it is not sufficient to study the diagrams in this book. **It is essential to observe night sky for constellations.** The book is only a guide line for that purpose (Figure 14.33).

If you observe towards north-east from Orion, another constellation, Gemini can be found. It denotes twins. The brightest star in it is Pollux (Figure 14.34).

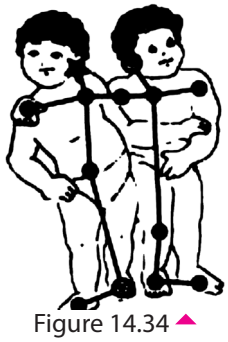


Figure 14.34

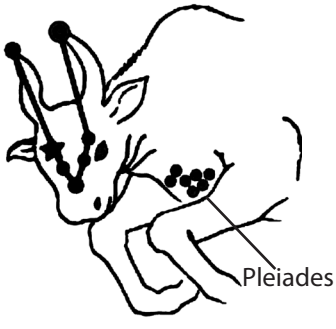


Figure 14.35

At this time the constellation Taurus can be seen in the north-west direction. There is a red star named Aldebaran for one of this bulls eyes (Figure 14.35).

Near the Taurus there is another constellation named Pleiades. Figure 14.35 shows some constellations that can be observed in the midnight during the February and March. All these constellation can be see in May and June nearly 8.00 pm in the night.

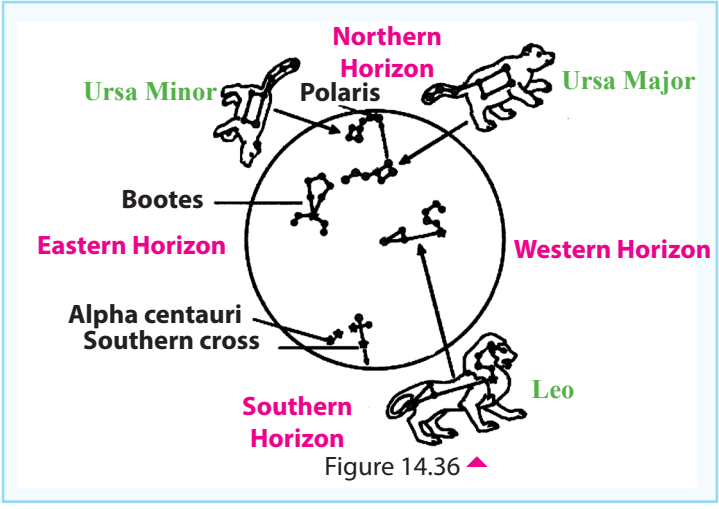


Figure 14.36

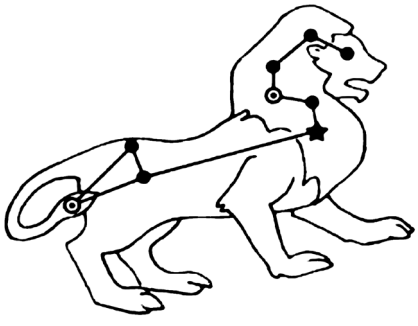


Figure 14.37

During this period constellation Leo can be seen near the Zenith. Brightest star in this constellation is Regulus (Figure 14.37).

During the same period constellation Ursa major can be observed 45° above northern horizon. This constellation helps to find the north at night. Seven sages and plough are two other names for the same constellation. There are seven bright stars in this (Figure 14.38).

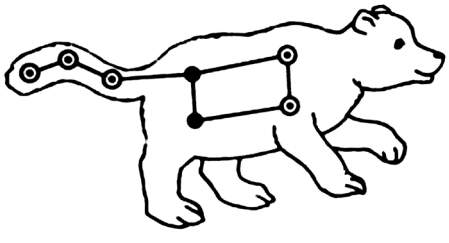


Figure 14.38

Ursa minor can be seen below the Ursa major closer to its northern horizon. Polaris is at the tail end of this bear. This star is closer to the horizon, when watched in Sri Lanka. Therefore, it can be watched only in a large plain, sea shore or on a hill top.

Assignment 14.5

Find out about the importance of the star Polaris and make a report.

During this period another constellation with the shape of tilted cross, can be seen in the southern sky towards the horizon. This is called the Southern cross. According to Figure 14.39, to the left of this constellation there are two bright stars, which are closer to each other. Out of these two, one which is very far away from the southern cross is called **Alpha Centauri.**

Figure 14.39

Assignment 14.6

Find out about the importance of the star Alpha Centauri and make a report.

Constellation Southern cross can be used to find south and north directions

Zodiac

The earth and the other planets revolve around the sun. Twelve signs in the outer space which are named as the zodiac from ancient times. Those 12 signs in the zodiac are as follows.

1. Aries
2. Taurus
3. Gemini
4. Cancer
5. Leo
6. Virgo
7. Libra
8. Scorpio
9. Sagittarius
10. Capricorn
11. Aquarius
12. Pisces

Assignment 14.7

There are 12 stamps in current usage which contain the diagrams of signs of the zodiac. Collect them and exhibit on a board.

When the earth is revolving around the sun, we see that the sun is apparently moving from sign to sign in the zodiac.

e.g.:- In the instance given in Figure 14.40 people on the earth see as the sun is in the sign Aries of zodiac

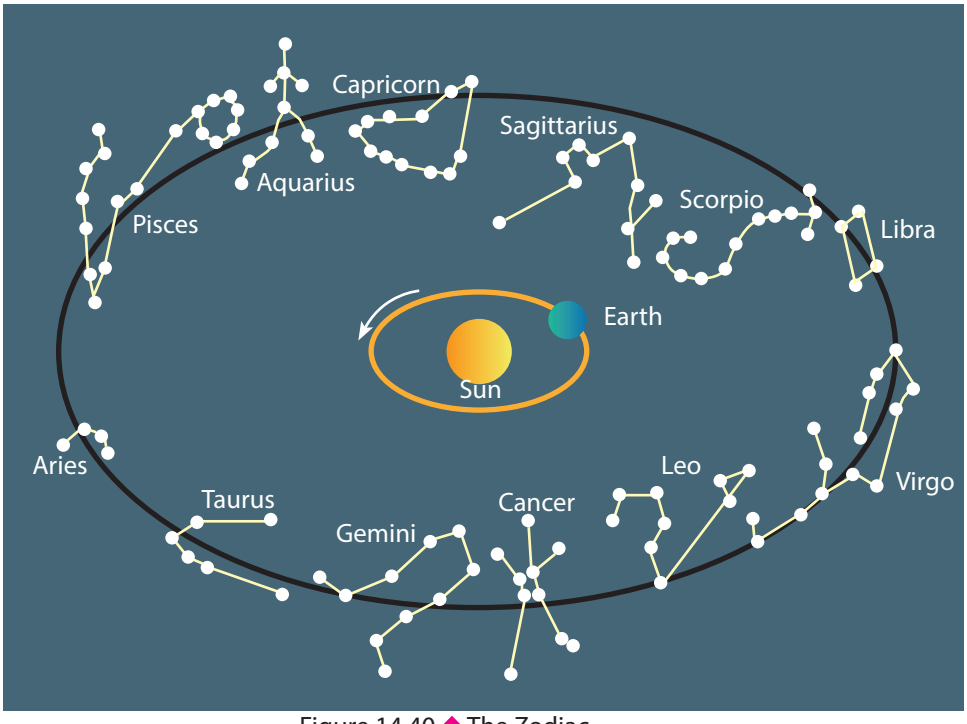


Figure 14.40 The Zodiac

According to the revolution of earth, the sun's next apparent destination is the sign Taurus.

Obervation of stars and planets

When the night sky is being observed it is realised that the relative position of stars does not change daily or monthly. But, there are some objects among the constellations in the zodiac the position of which changes with respect to the stars. Those objects are planets.

There are five planets which are observable with the naked eyes. They are mercury, venus, mars, jupiter and saturn. Mercury, venus, earth and mars are planets in solid nature and other planets occur in gaseous nature.

A star twinkles in the sky. But planets do not twinkle. Star is a bright point, even when observed through a telescope. But, when a planet is observed through a telescope it is seen as a disc.

Assignment 14.8

Select a planet in the background of a certain sign in the night sky. Get the assistance of your teacher or an adult for this. (Planets jupiter, saturn or mars is more suitable for this.) Note down how the position of the planet changes in the background of the sign, for about a month.

Let us do Activity 14.7 to construct an instrument to measure the altitude to a star or planet.

Activity 14.7

You will need :- A protractor, a cardboard tube/ PVC tube

Method :-

- Using a tube and a protractor, make the following instrument. It is called the clinometer.

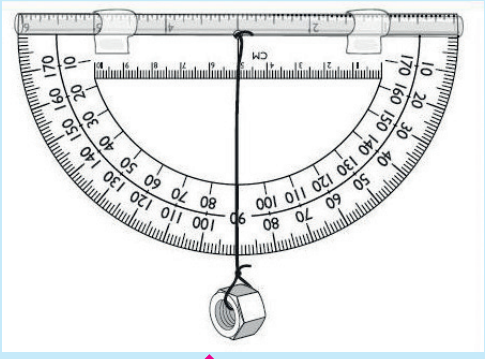


Figure 14.41 ▲ Simple clinometer

The way of measuring the altitude to a star, using the clinometer is shown in Figure 14.42. The clinometer can be fixed as shown Figure 14.43 to turn on a horizontal plane.

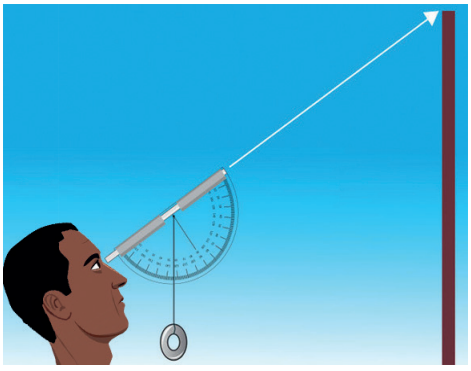


Figure 14.42 ▲ Measuring the altitude to a star using clinometer

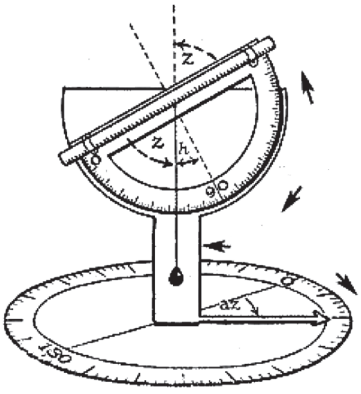


Figure 14.43 ▲ A clinometer that can be turned on a horizontal plane

Summary

- Planets in the solar system show two types of motions, rotation and revolution.
- Seasonal changes occur because of the tilt of the earth's axis to its orbital plane.
- Illuminated portion of the moon, viewed from the earth changes while it revolves around the earth. Because of this incident phases of moon occur.
- Lunar eclipse occurs on a full moon day when the moon enters into the shadow of the earth.
- Solar eclipse occurs on a new moon day, when the shadow of the moon falls on the earth.
- Rockets and space crafts are used for this explorations of the space.
- Constellations are the imaginary patterns constructed in mind, connecting the stars in the night sky.

Exercise

Select the most suitable answer.

1. What is the most suitable statement below to describe a solar system?

    1. A cluster of stars revolving around an object.
    2. A star revolving around a number of objects
    3. A number of objects revolving around a star.
    4. An object revolving around a cluster of stars.

2. Select the **false** statement about our sun.

    1. Sun is smaller than the moon.
    2. Sun is a source of energy.
    3. Planets revolve around it.
    4. Situated 150 million kilometers away from the earth.

3. In which constellation is the star Polaris that helps to find the north.

    1. Ursa major
    2. Ursa minor
    3. Sign Leo
    4. Orion

4. What is the **false** statement given below?

i. The brightest star in the sky, Sirius can be found in constellation Canis major.

ii. Venus can be observed with naked eye.

iii. Sun is the nearest star to the earth.

iv. Polaris belongs to the constellation Ursa major.

5. What is the **false** statement given below ?

i. The seasonal changes occur due to the earth's revolution.

ii. The phases of moon occurs due to the moon's revolution.

iii. Solar eclipse occur when the moon stays in between the earth and the sun.

iv. Partial lunar eclipse occurs when moon enter to the penumbra of the earth.

Give short answers.

1. After observing the night sky, two students in grade eight came out with the following ideas.

Student A - When I was watching the night sky yesterday, I saw a star passed very speedily increasing its brightness and vanished at once.

Student B - I was watching the night sky yesterday at about 7.00 p.m. I saw a star travelling fast between other stars. It travelled from north to south.

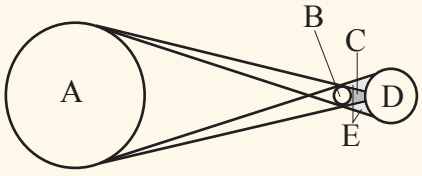
In the above discussion;

i What can be the object that A student observed ?

ii What can be the object that B student observed ?

2. i Fill the blanks of the following diagrams with the given terms.

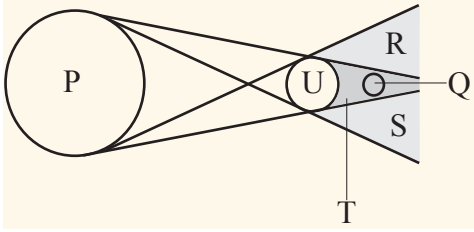
Sun, Moon, Earth, Umbra, Penumbra



A .....
B .....
C .....
D .....
E .....

Diagram - 1

ii



P .....
Q .....
R .....
S .....
T .....
U .....

Diagram - 2

Technical Terms

Rotation	-	භ්‍රමණය	-	சுழற்சி
Revolution	-	පරිභ්‍රමණය	-	சுற்றுகை
Seasons	-	ඍතු	-	பருவங்கள்
Lunar eclipse	-	චන්ද්‍ර ග්‍රහණය	-	சந்திர கிரகணம்
Solar eclipse	-	සූර්ය ග්‍රහණය	-	சூரிய கிரகணம்
Solar system	-	සෞරග්‍රහ මණ්ඩලය	-	ஞாயிற்றுத் தொகுதி
Constellations	-	තාරකා මණ්ඩල	-	உடுத் தொகுதி
Zodiac	-	රාශි චක්‍රය	-	இராசி வட்டம்
Space explorations	-	අභ්‍යවකාශ ගවේෂණ	-	விண்வெளி ஆய்வு
Satellites	-	කෘත්‍රිම චන්ද්‍රිකා	-	செயற்கைக் கோள்கள்

15 Natural disasters

Pay your attention to the news paper head lines shown in Figure 15.1

Figure 15.1 ▲ News on floods and landslides

Head lines given above are about some natural disasters that affected Sri Lanka.

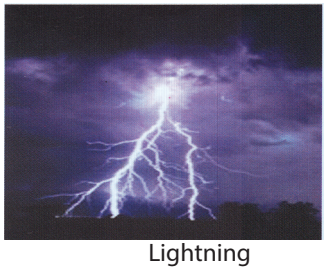
Natural disasters are naturally occuring destructive incidents, without the mediation of man, causing harm to human lives, property, environment and economy.

Some such incidents are shown in Figure 15.2


Drought


Landslide


Flood


Lightning


Forest fire


Tsunami


Cyclone


Volcano


Earthquake

Figure 15.2 ▲ Some natural disasters

Some examples for natural disasters are drought, landslide, flood, lightning, forest fire, cyclone, earthquake, tsunami, tornado and glacier erosion. The way that natural disasters occur and their influence differ from region to region, and from country to country.

Reasons for the occurance of natural disasters are the weather and climatic changes, changes occuring at the interior of the earth and the changes occuring in the biosphere. Human activities affect to increase the intensity of natural disasters.

Activity 15.1

Make a collection of news paper head lines written on natural disasters.

With referring to the collection, prepare a list of natural disasters occuring all over the world.

Some of the natural disasters that affect Sri Lanka are mentioned below.

- Drought
- Landslide
- Flood
- Lightning and thundering

We will study about them in this lesson.

15.1 Drought

Long term decrease of rain fall, due to the change of the pattern of rain fall is known as drought. Way of definition and the nature of identification may change from country to country, region to region and from time to time.

Decrease of the amount of rain fall during a given time period, and as well as the change of the rain fall pattern cause droughts.

Thus, the reasons that affect the pattern of rain fall, affect the drought also.

Let us do Assignment 15.1 to study the change of pattern of rain fall.

Assignment 15.1

Find the data of rain fall in Sri Lanka for past few years. Comparing those values, study the rain fall pattern. Data can be collected from the meteorological department or from internet. Ask the assistance of your teacher for this.

Reasons for drought

Natural reasons as well as human activities may affect this.

Natural reasons cause to change rain fall pattern and the amount of rain fall.

Some natural reasons for drought are mentioned below.

- Lack of timely monsoon winds
- Dry air currents
- The phenomenon of EL-NINO

As Sri lanka is an island, wind pattern basically affects the rain fall. Study the Table 15.1 given below.

Table 15.1 - Methods that bring rain fall to Sri Lanka

Method of rain fall	Time period	Region / Zone
South - West monsoon	May - September	Wet zone
North - East monsoon	November - February	Dry zone
Convectional / Intermonsoonal rain	March - April September - October	All regions

Dry air currents increase the rate of transpiration in plants. It increases the absorption of ground water by the roots of plants. Fountains dry up due to the reduction of ground water. This condition may cause a drought.

El-NINO is a phenomenon caused by the increase of temperature of the surface water in Pacific ocean. With the increase of the temperature of surface water in the ocean, normal circulation pattern of global air currents and oceanic water currents or the streams change.

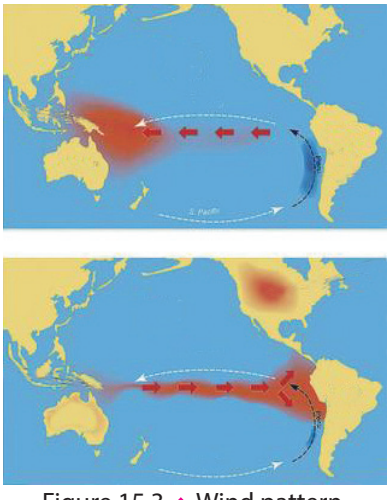


Figure 15.3 ▲ Wind pattern

Influence of the EL-NINO phenomenon may cause droughts as well as rain in Sri Lanka.

Drying up of water sources, decrease of water retention capacity in soil and global warming are the results of some human activities. These activities may cause the occurance or further intensifying of droughts.

Some human activities that may cause drought are mentioned below.

- Seepage of rain water into soil decreases due to various constructions. This decreases the water retention capacity in the soil. Water sources dry out because of deforestation for construction work.
- Wastage of water by irregular and over use is a reason for drought.
- Decrease of water retention capacity in soil and accelerated soil erosion are the results of irregular cultivation of crops. Thus, water capacity of reservoirs decrease, resulting spillage.
- Deforestation influences the water cycle directly or indireclty. Convectional rains and rain fall are affected by this.
- Global warming also change the pattern of rain fall. Gases like carbon dioxide released into the atmosphere due to human activities, leads to global warming. Such gases are known as greenhouse gases.

How droughts occur due to human activities and natural causes can be simply shown by Figure 15.4.

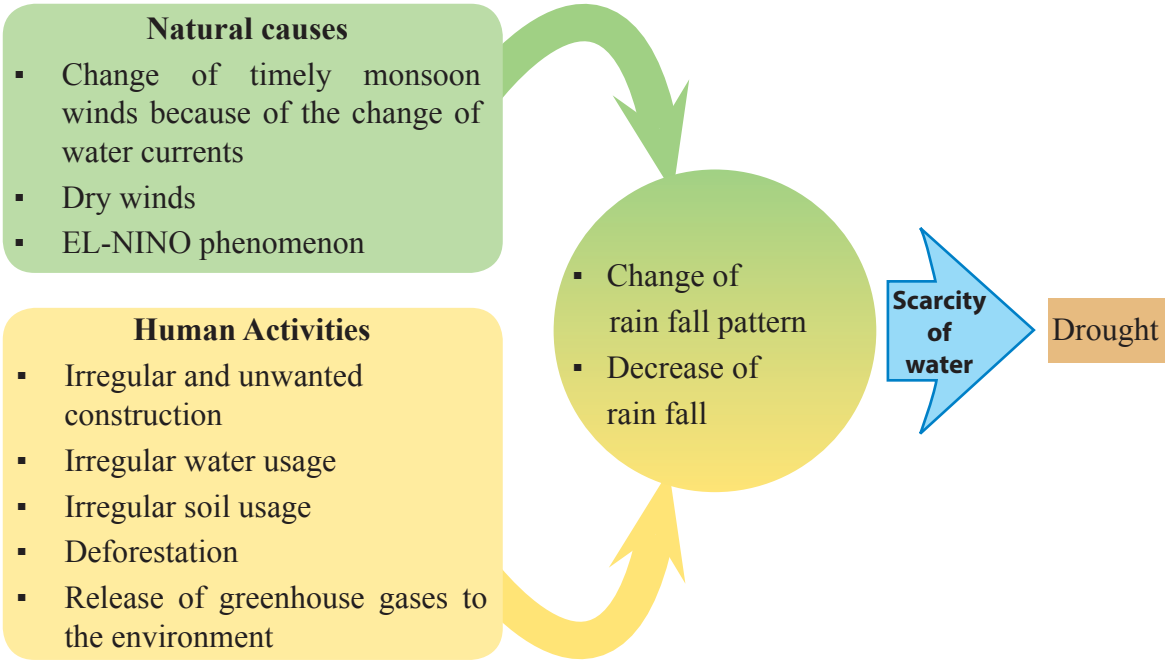


Figure 15.4

Drought basically affects the environment. Based on those environmental issues, various socio-economic issues also arise (Figure 15.5).

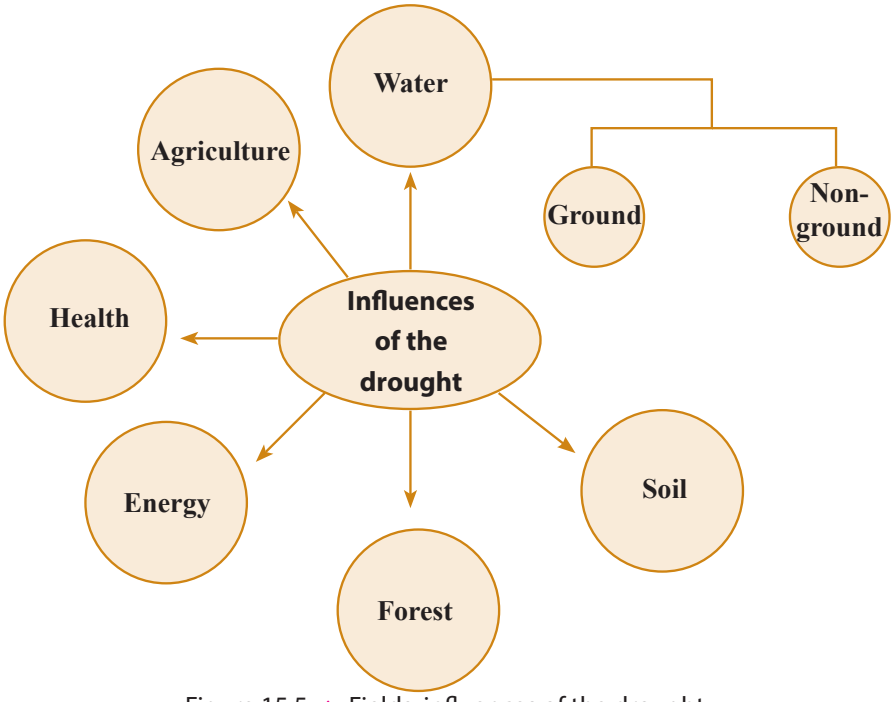


Figure 15.5 Fields, influences of the drought

Drought disaster management

There are three main steps that should be followed when managing any disaster.

- Readiness to face the disaster
- Mitigation of the damages caused by the disaster
- Adaptation to live with the disaster

Droughts are unavoidable. In the process of disaster management, readiness to face the disaster, mitigation and adaptation can be followed to minimize the damage caused by the disaster.

Some of the measures that can be taken in drought disaster management are given below.

- Avoiding the wastage and pollution of water - Rules and regulations should be introduced and people should be made aware of using water economically and without polluting.

- Planning agricultural activities with the view of conservation of water.
  - Practising economic water supply methods
  - Cultivating drought resistant crops
  - Mulching

Figure 15.6 ▲ Drought resistant corn plants

- Improving methods of collecting rain water.
  - Increasing the capacity of reservoirs
  - Usage of methods to collect rain water domestically
- Reforestation - Growing forests in lieu of cleared forests
- Usage of alternatives to hydropower for the generation of power.

  e.g.:- Wind power, solar power etc.

Figure 15.7 ▲ A method used to collect rain water domestically

15.2 Floods

Inundation of a usually uninundating area, due to heavy rain fall in a short period of time is known as a flood.

According to the way of occurance, they can be categorised as below.

- **Floods due to over - flowing** - These floods occur due to the over flowing of rivers and other water ways.
- **Instantaneous floods** - This situation occurs due to the blockage of water drainage systems in urban areas

Reasons for floods

- High rain fall
- Removal of forest cover
- Reduction of the capacity of reservoirs
- Irregular construction work
- Blockage of water drainage systems
- Irregular land use
- Irregular land filling

Influences due to floods

- Loss of lives
- Failure of power supply, transportation and public services
- Damage to houses, property and roads
- Spread of communicable diseases after floods due to contamination of water sources

Management of flood disaster

- Refraining from putting up houses in flood areas. If it is necessary to put up a house in such a place, it is advisable to build it on pillars.
- Leaving partially inundated houses as it is dangerous to stay in them.
- Disconnecting the electricity supply of the houses and refraining from touching electrical items while being in water.
- Having identified a place and a method to keep goods securely during a flood.
- Having identified an elevated place to reach for security.
- Having prepared a disaster kit, contains drinking water, dry food stuffs and other essential items to take in the case of leaving home.
- Having prepared with a battery-powered radio.

- Refraining from walking through fast-flowing water. One can be pushed down by running water of the depth of six inches (15 cm).
- Refraining from driving motor vehicles across flooded area. Leaving the vehicle and reach a higher land, if the vehicle is drowned.

15.3 Landslide / Earth slip

Slipping down of soil layers in slopy regions in highlands can be considered as a landslide.

Figure 15.8 ▲ A location of landslide

Landslides are a common disaster in central hills of Sri Lanka. Places of landslide danger are identified in some other districts, also. Those areas are in Badulla, Nuwara Eliya, Mathale, Kandy, Kegalle, Monaragala, Kurunegala, Rathnapura, Kaluthara, Galle, Mathara and Hambanthota districts. Such areas are shown in Figure 15.9.

What is happening during a landslide is the slipping down of a lump of soil or a layer of soil upon another layer under gravity.

Continuous heavy rain causes landslides in risky regions. Soil, soaked in rain water becomes heavy. The bond between soil particles and the bed rock getting weak at the same time. Due to the weaken bond, there is a point that the bed rock can not hold the upper soil layer further. At that moment soil particles start to flow down suddenly and soil particles near by the activity region join with the flow.

Gravitational potentional energy of the lumps of soil increases because of being in a higher elevation and absorption of water. This high potential energy is converted to kinetic energy while the layers of soil are slipping down. Because of this kinetic energy, lumps of soil and rocks collect everything in the route while flowing down. Sometimes the route of a landslide may be as long as 1 km.

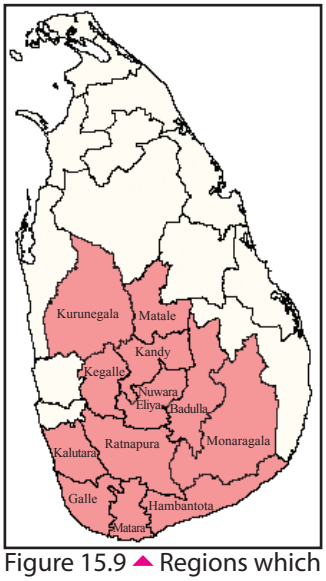


Figure 15.9 ▲ Regions which are subjected to the danger of landslides in Sri Lanka

Pre-signs of a landslide

If the following incidents are occuring with continuous heavy rainfall, it indicates a close-by landslide.

- Receiving more than 100 mm of rainfall within 24 hours
- Appearing new cracks on the surface of the slope
- Appearing cracks on buildings
- Depressions on earth
- Dying or slanting of trees on slopes
- Sudden leaking of muddy water on slopes
- Sudden surface run-off of water or disappearing of springs
- Animals showing abnormal behaviours
- Appearing new water springs
- Entering water into cracks of the earth and oozing out from some other places with mud

Management of landslides

- Removing the slide initiation area (slide initiation has a large rock or a thick layer of soil, under which there is an area of water or mud. That is the first place to collapse with a heavy noise during a landslide). Removing of slide initiation area is very difficult as it is not easy to reach the place. To avoid the destruction caused by landslide, the slide should be removed using cranes. This should be done by the relevant authorities.
- There are three main risk areas in a landslide namely initiation area, flow path and depositional area. Relevant authorities must be assigned power to take necessary measures to prevent landslides.
- Evacuating people from the areas subjected to landslides earlier and let the areas be stabilized.
- Bringing down water using pipe lines when it is collected in higher levels of a hill.
- Diging conteur ditches to drain rain water down the slope without letting it soak into soil.
- If a slope of a hill is necessary to cut, it should be cut in cascade manner. Water drainage systems should be prepared. Cover crops should be grown. e.g.:- Vetiver

- Stability of the land should be considered, when selecting a land to build a house. It is not suitable to build houses in slopy areas by cutting the slope. A place of prior landslide is also not suitable for putting up houses.

If a construction is to be done in a district of landslide threats, consulting National Building Research Organisation (NBRO) is necessary. Pepole can get necessary directions from the regional offices of the soil organisation. The web address is www.nbro.gov.lk.

15.4 Lightning and thundering

There are tiny water droplets and ice crystals in cumulonimbus clouds. Because of air currents, those water droplets and ice crystals are rubbed each other. Thus, they become **charged**.

Figure 15.10 ▲ A cumulonimbus cloud and a lightning

Positive charges collect in the top layers of the cloud and negative charges collect in the bottom layer of the cloud. Positive charges are generated on the earth, right below the cloud. When the amount of charges reach a certain level, an electrical discharge occurs. It is known as lightning and thundering.

According to the way of electrical discharge, there are three types of lightning (Figure 15.11).

- **Earth-lightning** is an electrical discharge that transfer from a cloud to the earth.
- **Cloud-lightning** is an electrical discharge that transfer through the cloud or between two clouds.
- **Air-lightning** is an electrical discharge that transfer from a cloud into the air.

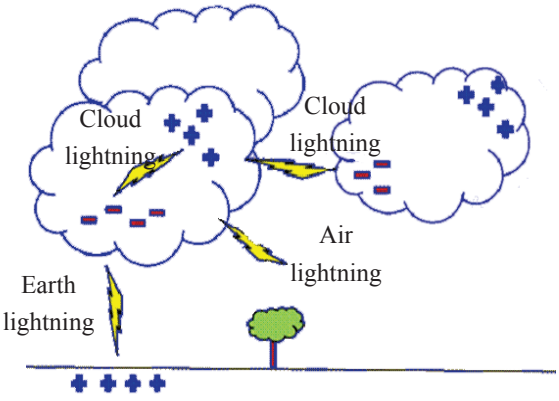


Figure 15.11 ▲ Types of lightning

Let us do Activity 15.2 to study about the discharging of electrical charges.

Activity 15.2

You will need :- Two thin dry plastic strips
Method:-

- Keep two plastic strips, one over the other. Hold them from one end to hang down.
- Rub the two strips down firmly using your thumb and another finger.
- Observe what happens.
- Try this activity using strips of transparent sheets.

You can observe that the plastic strips shift apart at the lower ends. That is because the strips are electrically charged.

If you drag apart the strips, you can observe a sound.

For extra knowledge

Voltage of a lightning stroke is about 100 million Volts. Electrical energy generated in lightning is very high. Electrical current of a lightning is about 25, 000 amperes.

Current flowing through a bulb of 25 W is about 0.1 A and Voltage of house hold electrical supply is 230 V.

Lightning danger is common during the inter-monsoons in Sri Lanka. Maximum number of accidents due to lightning were reported during the month of April. Each year, more than 50 deaths are reported due to lightning.

(from science data)

Tall buildings and trees are easily subjected to the hazard of lightning. The reason for this is that tall places provide the shortest path for the discharge of lightning from the clouds.

Management of Lightning hazards

Destruction of buildings by lightning can be avoided by fitting lightning conductors.

Lightning conductors should be fitted to the required standards. Some other protective measures from lightning are listed below.

- Avoid keeping the house connected to close-by trees with metallic wires. Metallic cloth lines and wires used to the trees that are slanted to the houses are some examples for this.
- Conducting wires in the environment (electricity supply wires, television antenna wires, protective wires, wire fences) help to conduct electric current of a lightning from place to place. Therefore, protective measures should be taken, when fixing them.

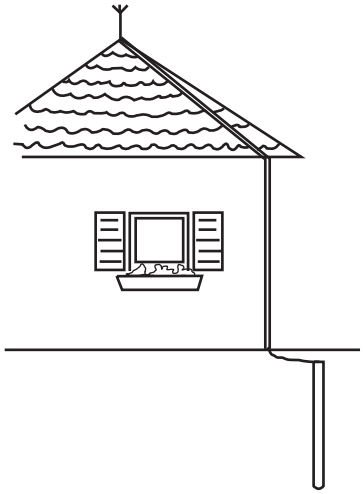


Figure 15.12 ▲ A building fitted with a lightning conductor

It is appropriate to follow the measures indicated below, when a lightning weather condition is forecast.

- Keeping the electrical appliances disconnected from the circuits.
- Keeping the disconnected plug of television antenna out of the house, near the ground.
- Refraining from using and touching metal equipments.
- Refraining from using telephones.

The things that should be done before a lightning weather condition are mentioned below.

- Going into a building or into a fully covered vehicle to minimize exposure to the environment.
- Going to a place of security, if the time interval between sight and the sound of the lightning thunder is less than 15 seconds.

Things to avoid during a lightning weather condition

- Avoid being in open places. If there is no time to go to a place of security, keep your legs close to each other and crouch to the ground.
- Refraining of being near tall trees and elevated places.
- Refraining from riding or driving open vehicles like cycles and tractors.
- Refraining from swimming, canoeing and walking on wet places.

Measures to be taken in connection with a person subjected to lightning hazard

All lightning hazards are not fatal. First aids should be given to a person subjected to such a threat.

If the limbs of the victim are numbed or stiffed, massaging can be done to recover.

If breathing is stopped, artificial breathing should be given. Both massaging and artificial breathing have to be given according to the nature of harm. Giving first aids should be continued till breathing starts.

It is not dangerous to touch a person subjected to a lightning hazard.

Activity 15.3

Construct a wall paper containing information on natural disasters that affect Sri Lanka. Pay your attention to the following points.

- Causes for the natural disasters
- Harms caused by disasters
- Measures that you can take to minimize the harms

Disasters and the reasons for their occurance discussed in this chapter can be summarized as below (Table 15.2).

Table 15.2 - Disasters and the reasons for their occurance

Disaster	Reasons for the occurance of disaster
Drought	Accelarated evaporation and transpiration, deforestation and burning of forests, human activities like are pollution, global warming due to climatic changes
Landslides	Heavy rain, nature of rocks that the mountains are made of, irregular human activities
Floods	Heavy rain, influence of tides and stormy waves, irregular human activities
Lightning and thundering	Shifting / discharging of electrical charges to the earth from the clouds.

Damages caused by natural disasters can be minimized by acting in accordance with the instructions published over the media by relevant authorities. It is a current need to pay our attention to take necessary actions personally in protection of the environment.

Summary

- Droughts, floods, landslides and lightning hazards are some of the natural disasters that Sri Lanka faces.
- Natural reasons as well as human activities influence the occurance of droughts, floods and landslides.
- Though the natural disasters are unavoidable, the harm caused by them can be minimized by taking necessary measures for readiness, mitigation and adaptation.
- Adaptations make people to live with some disasters for a long period of time.

Exercise

Select the correct answer.

1. Which of the following is **not** a human activity that affects the change of rain fall pattern ?
    1. Destruction of forests
    2. Reduction of forest cover
    3. Irregular soil management
    4. EL-NINO phenomenon
2. When is / are the cause of health problems that arise due to drought ?
    1. Scarcity of water
    2. Reduction of food supply
    3. Pollution of water sources
    4. All above

Answer following questions briefly.

1. Drought is one of the natural disasters that affects Sri Lanka.
    1. Mention three factors that contribute directly for drought.
    2. " Drought affects adversely for the generation of energy in Sri Lanka" Do you agree with the above idea? Describe reasons for your answer.
    3. Suggest three measures to be taken now to face the drought conditions that may occur in future.

2. From time to time, people of many countries have to face natural disasters like floods and landslides. One aspect of disaster management is to minimize the damages caused by such disasters.
    1. State two natural disasters that affect Sri Lanka other than those mentioned above.

2. What is the main reason for occuring floods?
3. State two reasons for the occurance of floods other than the one you mentioned above.
4. Write four essential items that should be included in a disaster kit prepared to face floods.
5. Name two communicable diseases that can spread after floods.
6. What is landslide ?
7. Write two human activities that affect landslides.
8. Mention three pre-signs / foreruns seen in the associated environment before a landslide.

3.

1. What is known as a lightning ?
2. How are the clouds charged to occur a lightning ?
3. What are the three types of discharging that happen in the charged clouds ?
4. What type of lightning, you mentioned above, is harmful to lives and property ?
5. In which month, that the lightning hazards are maximum in Sri Lanka ?
6. Mention three things that should not be done during lightning.
7. State three protective measures that should be followed during a lightning weather condition.

Technical Terms

Droughts	-	නියඟ	-	வறட்சி
Floods	-	ගංවතුර	-	வெள்ளம்
Landslides	-	නායයෑම්	-	மண்சரிவு
Lightning and thundering	-	අකුණු	-	மின்னலும் இடியும்
Mitigation	-	අවම කිරීම	-	இழிவளவாக்கல்
Readiness	-	සූදානම	-	தயார் நிலை
Adaptation	-	අනුහුරු වීම	-	இசைவாக்கம்