SCIENCE

STANDARD SEVEN

TERM II

Ravi visited the site of their newly built house. He asked his father how a house is constructed. His father explained that a house is made of sand, bricks, stones and cement. Ravi wondered what his body is made of.

When we compare the structural organization of a human body with that of a building, we see that we can more or less match:

a cell with a brick

tissues with bricks, mortar and iron rods

organs with the walls

an organism with the house

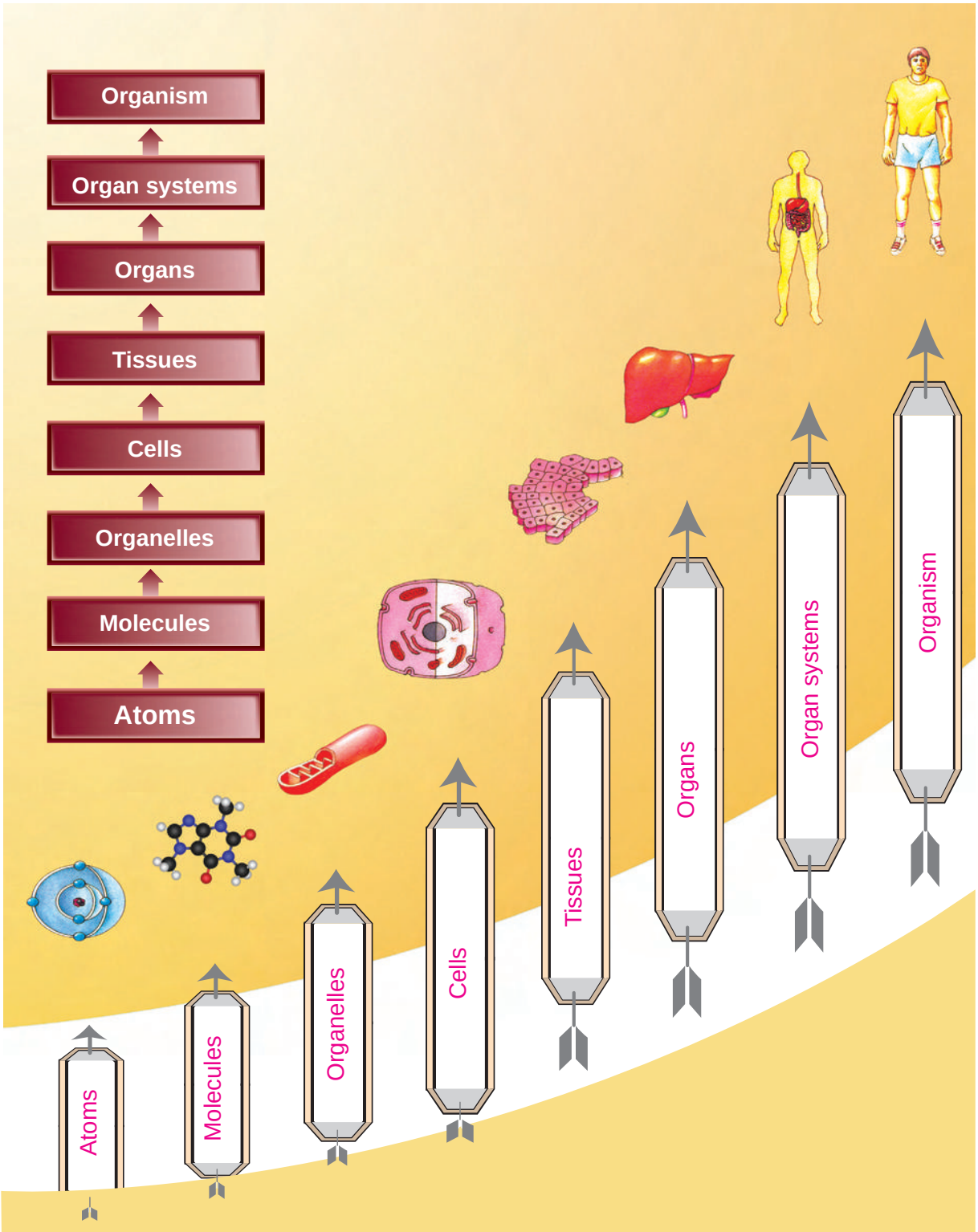


Fig 1.1 Levels of Organization

Children, let us know....

One of the striking features of all living things is their excellent organization. The human body is composed of special structures with specific forms and functions. All these structures work in co-ordination with one another.

1.1. STRUCTURE AND FUNCTIONS OF THE HUMAN ORGAN SYSTEMS

We have already learnt that our body is made up of many organ systems. There are about ten organ systems in our body.

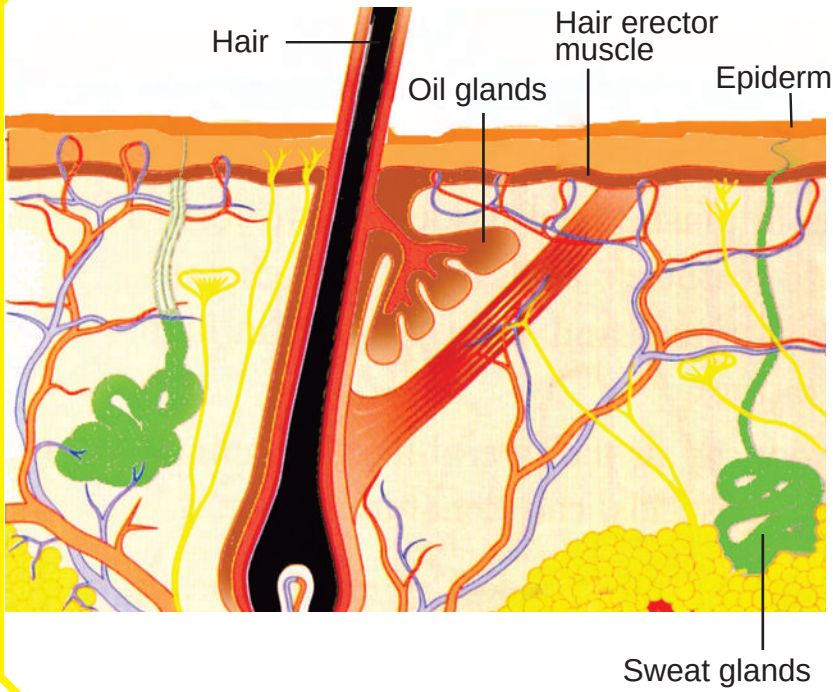
Let us study about human organ systems in brief.

MORE TO KNOW

The skin is the heaviest organ of our body and it weighs about 7 kg.

1. The Integumentary System

The Integumentary System includes the skin, hair, nails, sweat glands and oil glands.



Raju was playing in the garden. He was pricked by a thorn. He was curious to know how we feel pain.

The Skin is a sense organ. It helps us to feel the pain.

Fig 1.2 Cross section of the Skin

Functions:

1. It protects the inner parts of the body.
2. It works as an excretory organ by way of sweating.
3. It acts as a sense organ.
4. It helps to produce Vitamin D.

2. The Digestive System

The digestive system consists of mouth, food pipe, stomach, liver, intestines and the secretory glands.

Functions:

1. Ingests and digests different types of food.
2. The digested food molecules are absorbed and distributed through the bloodstream.
3. The undigested food is egested as waste.

3. The Respiratory System

Respiration is essential for the survival of living organisms. It is a process in which food is broken down

into simpler forms with the help of oxygen and enzymes.

Functions:

1.Lungs procure oxygen from the surrounding and conduct it to the tissues through the bloodstream. (Inspiration)

2.Oxygen is used to combust the food and the carbondioxide produced in this process is released into the surrounding through lungs.(Expiration)

Fig 1.3. Skeletal System

4. The Skeletal System

The Skeletal System includes bones and other tissues such as cartilages and ligaments. in our body. The Skeletal System is made up of 206 bones. All the bones are connected by joints and form the framework of the body.

Functions:

1. The Skeletal System provides a framework to the body and enables body movements.
2. It protects many internal organs such as brain, heart, lungs etc.
3. Bone marrow produces blood cells like Red Blood Cells, White Blood Cells and Platelets.

5. The Muscular System

The Muscular System is made up of three types of muscles. They are skeletal muscles (striated muscle), smooth muscles (non-striated muscle) and cardiac muscles.Skeletal muscles are attached to the bones. Smooth muscles are found in the walls of blood vessels and in the lining of hollow organs such as stomach, intestines etc. Cardiac muscle is exclusively found in the heart.

Functions:

1. Skeletal muscles give shape to the body and make the movements of our body possible.
2. These muscles generate the heat required for maintaining our body temperature.
3. Other muscles enable movements in the internal organs.

Fig 1.4.
Muscular System

SCIENCE

MORE TO KNOW

Our facial expressions are formed by the action of about forty muscles.

6. The Circulatory System

The Circulatory System transports substances from one part of the body to another. It is made up of the heart and the blood vessels. The heart is the pumping organ. It pumps the blood into the blood vessels, which carry the blood to all parts of the body and bring it back to the heart.

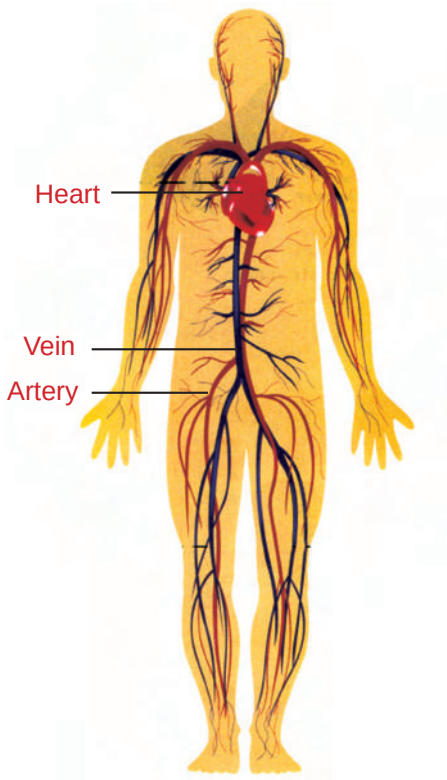


Fig 1.5 Circulatory System

"Valli, all animals have red blood, don't they?"

"No Selva, some animals like lobsters and crabs have blue blood. The blood of the cockroach is colourless."

Functions

1. Blood transports nutrients, oxygen, wastes and hormones.
2. It regulates the water level and the body temperature.

RBC contain red pigments called haemoglobin, which gives red colour to the blood.

ACTIVITY 1.1 **I DO**

Aim : To measure the pulse rate, per minute.

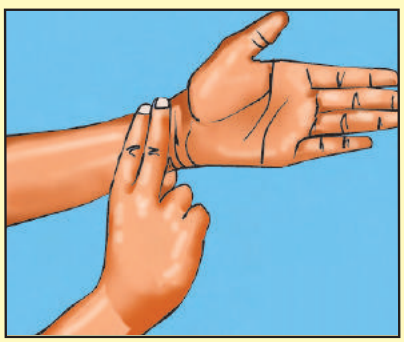
Method : i) I measure my pulse by placing the index finger and the middle finger over the underside of the opposite wrist, below the base of the thumb.

ii) I count the beat for 30 seconds.

iii) Then I double the result to get the number of beats per minute.

The normal pulse rate is 72 / minute.

From the pulse rate, I shall know how my heart functions.



SCIENCE

7. The Nervous System

The Nervous System is composed of the brain, the spinal cord and the nerves. The nervous system is divided into two types. They are the Central Nervous System (CNS) and the Peripheral Nervous System (PNS). There are five sense organs, which help us to know the outside world. They are eyes, nose, ears, tongue and skin.

The CNS consists of the brain and the spinal cord. The PNS consists of the cranial nerves and the spinal nerves.

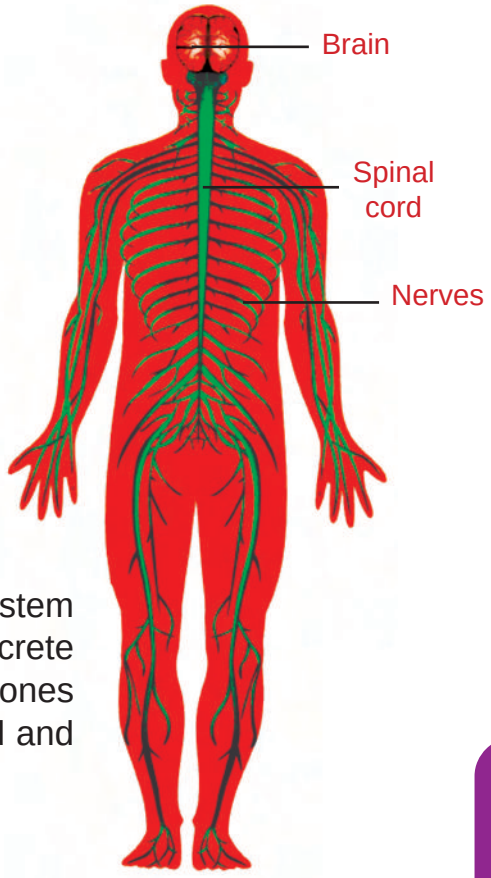


Fig 1.6 Nervous System

8. The Endocrine System

A group of ductless glands in our body form a system called the Endocrine System. These glands secrete certain chemicals called hormones. These hormones are transported to the target organs through blood and regulate various functions of the body.

9. The Excretory System

The Excretory System helps in the elimination of wastes from our body. It comprises a pair of kidneys, a pair of ureters, a urinary bladder and urethra. The blood is filtered and the waste is separated to form urine, which is expelled periodically.

10. The Reproductive System

The Reproductive System is mainly composed of testes in males and ovaries in females. The testes produce male gametes called sperms. The ovaries produce female gametes called eggs. This system helps in producing new individuals for the survival of human race.

1.2. THE BODY AND ITS HEALTH AS UNDERSTOOD IN THE INDIAN SYSTEM OF HEALTH CARE

Health Care is prevention of illness and treatment for illness. Most of the rural people rely on two types of medicines. They are the Siddha and the Ayurveda systems of medicine.


Fig 1.7. Siddha vaidhya

SCIENCE

Siddha system of medicine (Tamil maruthuvam)

Siddha vaidhya is an indigenous traditional system originated in Tamilnadu. It has references from age-old literature such as 'Thirumandiram', 'Thirukkural' and 'Tholkappiam'. The Siddha is a traditional Tamil system of medicine which is also practised in the neighbouring states of Kerala, Karnataka and Andhra pradesh. The Siddha Medical System was founded by a group of 18 spiritual people called Siddhars. The word 'Siddhar' is derived from "Siddhi" which means "Eternal Bliss". Agastiyar, being the first Siddhar, is called the Father of Siddha Medicine.

The concept of the Siddhars is "FOOD IS MEDICINE, MEDICINE IS FOOD". Diet and lifestyle play major roles in maintenance of good health and in curing diseases. The medicines are prepared from plants (mooligai), metals and minerals (dhatu) and animal products (jeeva). Around 1,200 herbs are used in the preparation of Siddha medicine. The concept of treatment is to treat the sick with leaves, and subsequently with roots of the herbs. If the severity of illness is not reduced, then they go for powders (paspam).

Some of the medicines used in Siddha are **Chooranam, Mathirai, Thailam, Legiyam, Rasayanam, Paspam, Chendooram** and so on.

Ayurveda

Ayurveda is a 'System of healing using natural means' (herbs). It which originated in India. 'Ayurveda' means the Science of Life (Ayur = Life, Veda = Science).

ACTIVITY 1.2 **I DO**

Given below are names of some medicinal plants. I shall find out their medicinal uses.

Pepper (Milagu)	
Turmeric (Manjal)	
Garlic (Poondu)	
Thulasi	
Neem (Vembhu)	
Aloe vera (Katrazhai)	
Mint (Pudhina)	

The object of Ayurveda is to counteract the imbalance of Vaatham, Pitham and Kabam which originate from the body. This system of healing is believed to treat the ailments of body, mind and spirit. The most amazing part of Ayurveda is that it includes almost all methods of healing like Yoga, Meditation, Purification and so on.In this system, herbs, massages, diet and exercises are used individually and collectively to cure a number of ailments.

Fig 1.8. Ayurvedha

MORE TO KNOW

Homeopathy Medicine

Homeopathy is a form of alternative medicine, first proposed by the German Physician Samuel Hahnemann, in 1796.

Unani Medicine

Unani Medicine is a form of traditional medicine based on the teachings of the Greek physician Hippocrates and the Roman physician Galen, and is developed into an elaborate medical system by the Arab and the Persian physicians.

1.3. DISEASES, DISORDERS AND PREVENTION

Valli :- Can we prevent diabetes?

Inba:- Yes. Diabetes can be prevented by practising healthy food habits and regular physical activity.

Valli:- Inba, what are healthy food habits?

Inba:- Healthy food habits are:

1. eating right amount of food and right type of food at regular intervals.
2. drinking 3 to 5 litres of water per day.
3. increasing intake of fibre rich foods like greens, leafy vegetables, whole grains and seasonal fruits.

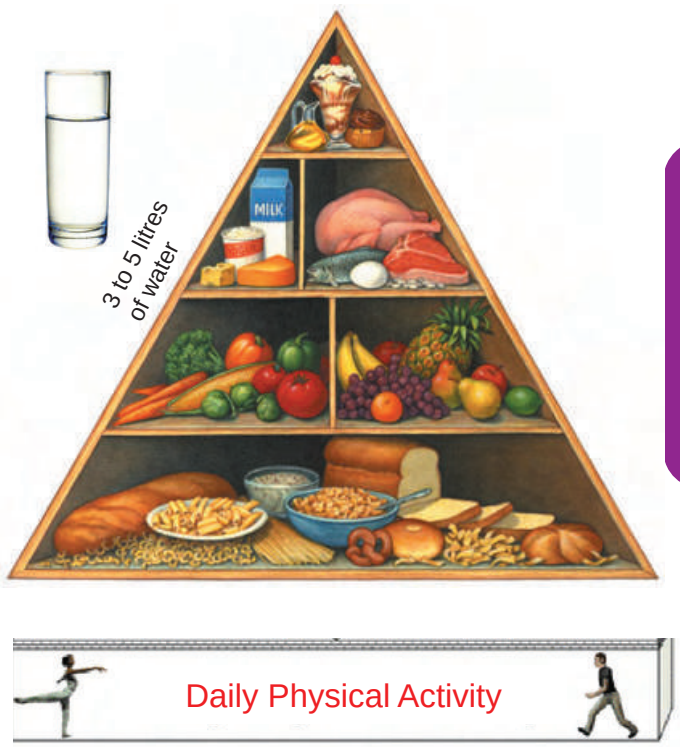


Fig 1.9. Healthy Indian diet pyramid

Diabetes mellitus

The food that we eat is broken down into glucose. Glucose is a source of energy needed for all living beings. Insulin is a hormone secreted by pancreas to control glucose level. When the glucose level in blood exceeds the normal limit (80-120mg/dl), the person is said to be affected by Diabetes.

Diabetes is not a disease but a disorder. It may lead to harmful conditions like obesity, hypertension, heart ailments, etc., It is caused due to lack of physical activity, unhealthy food habits and lack of insulin.

1.3.1 ADVANTAGES OF PHYSICAL ACTIVITY

One evening, Chandra and Amara went to a park with their grandfather. The children became tired after playing for sometime. But they found their grandfather still walking brisky. Chandra asked her grandfather, how he could be so active. Grandfather replied that he had neither been to a hospital nor had he taken any medicine in his life. He added that his daily exercises had helped him keep his body fit.

Shall we find out the importance of physical exercises?

Physical exercise is essential for all human beings. Aerobic exercises supply oxygen efficiently to the muscles, heart, lungs and the circulatory system. A good supply of oxygen to the body is a sign of good health.

Some examples of aerobic exercises are:

1. Jogging
2. Playing basketball
3. Playing football
4. Swimming
5. Cycling
6. Brisk walking for a long distance
7. Yoga and aerobic dancing

These exercises can be followed daily.

Advantages of physical exercise

1. Exercise makes the muscles of the heart, lungs and various parts of the body strong. Children must be physically active for at least 60 minutes everyday.
2. It burns unwanted calories, reduces weight and prevents obesity.
3. It helps in lowering the blood glucose level.
4. It helps in reducing blood cholesterol level.
5. It reduces hypertension and improves the quality of life.

Playing football

Cycling

Walking

Swimming

Fig 1.10 Aerobic Exercises

1.4. PRESERVATION OF FOOD

When milk or meat is left uncovered on a table for a day, it gets spoiled. But when rice or sugar is stored at room temperature, they do not get spoiled. Why? There are certain food items which get spoiled soon at room temperature due to the excess of moisture content in them. Such food items are called **perishable food**. eg. fruits, vegetables, milk, meat etc.

There are certain food items which do not get spoiled at room temperature as they are dry in nature. Such food items are called as **non-perishable food**. eg. rice.

In order to avoid wastage of food from spoilage, food items are processed and preserved in different ways. The milk we get in sachets is an example. There are several methods of preserving food. Some are age-old methods and others are the results of modern development in science.

What is preservation of food?

The process of keeping the food for a long time without spoilage is called preservation of food.

The Purpose of Food Preservation

1. To prevent food from spoilage.
2. To retain the colour, taste and nutritive value of the food.
3. To make food available throughout the year.
4. To add variety to our meal.

1.4.1. METHODS OF PRESERVATION

Preservation involves prevention of the growth of bacteria, fungi and other microorganisms in the food.

Even the action of the enzymes within the food should be prevented. Some common methods of preserving food are: drying, freezing, heating, addition of salt or sugar. Some modern methods like irradiation is also used to preserve food. Let us study some of the common methods of food preservation.

Drying

This method involves the removal of water content from the food by drying. The harvested cereal grains are properly dried in the sun to reduce the moisture in them. This prevents the food from the attack of insects, fungi and bacteria.

Heating

Heating is a method of food preservation. It kills the microorganisms and denatures the enzymes present in the food. Hence food is stored safely. eg. boiling of milk before it is stored or used. Whenever we think of heating, the word 'pasteurized milk' comes to our mind. The process of heating milk

Fig 1.11 Drying of Fish

SCIENCE

at a temperature of 70° c to 75° c for some time and immediately cooling is called **pasteurization**. This method was discovered by Louis Pasteur.

Fig 1.12 Milk

Freezing

Frozen food like meat and fish at very low temperature prevents water activity in the food material. Thus the microbial growth and enzyme activity can be prevented.

Addition of salt: When salt is added to food, it removes the water from food by osmosis. When there is no moisture in the food, microorganism and enzymes cannot act on the food. Food like meat, fish, gooseberry, lemon, tamarind, raw mangoes etc. are preserved by salting.

Fig 1.13 Refrigerator

Addition of sugar: When sugar is added to food, sugar dissolves in the water content of the food and does not allow the water to be available. So, in the absence of water, microbes do not grow. Hence the food is preserved. Preservation of food by adding sugar not only saves the food from spoilage, but also produces new food such as jam, jelly, murrabbas, squash etc.

1.4.2 FAST FOOD AND ITS ILL EFFECTS

Fast food is liked by almost everyone today for many reasons. Fast food is easy and convenient to be cooked within a short time. Its taste and flavour is also appreciated by everyone. Food, today is no more home cooked wholesome food but processed with multiple additives.

Fast food, if eaten in large quantities on a regular basis can cause many ailments like obesity, diabetes, high blood pressure etc..

Fast food covers a wide range of products, like processed food, pre-prepared food like burgers, fries, vadai, samosa, bajjis etc. These food items are unhealthy and do not contain the nutrients and vitamins of a wholesome home-cooked meal.

They are low on the nutritional elements and hardly provide any benefit to the body. Food like pastas, pizzas,

burgers, noodles, bajjis, samosas etc. are high on the taste quotient.

Fast food, if consumed on a regular basis over a period of time, can have devastating effects on the overall health of an individual. Most families have a number of earning individuals, which leave them with no time or energy to do conventional cooking using fresh food ingredients.

Negative effects of fast food

Fig 1.14 Fast Food

1. Fast food item have a very high energy density. Food item with a high energy density confuse the brain's control system.

2. Continuous intake of fast food leads to weight gain and obesity. This is because fast food interferes with the normal appetite control systems.

3. The human appetite was designed for low energy density food and not for high energy density food.

4. Fast food may speed up the risk of clogged arteries, which may lead to heart attacks.

Fast food meals are high in saturated fats, low quality carbohydrates and high salt content.Our body requires fibre and healthier saturated fats. Fast food represents a dietary pattern that is the opposite of what is recommended for a healthy body.

"Fast food can be delicious but it is a silent killer".

1.5. SCIENCE TODAY-IRRADIATED FOOD PRESERVATION

Heating, drying, pickling, cold storage are some traditional methods of preserving food. But, nowadays, food can be preserved by some modern methods like irradiation - a process by which food is exposed to X-rays, Gamma rays or Ultraviolet rays. These rays are powerful enough to kill the bacteria and the moulds.

Will irradiation destroy the taste and nutritional value of the food? No, Irradiation does not destroy the taste

Fig 1.15 Irradiated foods

or nutritive value of foods. Onions, potatoes, sprouted grams etc. remain fresh, when exposed to radiation.

Some people are of the opinion that irradiation may lead to formation of toxic substances, but it is not so.

SCIENCE

EVALUATION

1.Pick out the correct answer:

a) The skeletal system is made up _____bones.

i) 206

ii) 306

iii) 606

b) The muscle found exclusively in the heart is _____

i) skeletal muscle

ii) cardiac muscle

iii) smooth muscle

c) The endocrine glands secrete chemicals called _____

i) Enzymes

ii) Vitamins

iii) Hormones

d) _____is an ancient system of natural medical healing that originated in India.

i) Siddha

ii) Ayurveda

iii) Unani

e) Pasteurization method was discovered by _____.

i) Hippocrates

ii) Louis Pasteur

iii) Agastiyar

2. The following words are the various levels of organization in living organisms. Arrange them in correct sequence:

Atoms, Cells, Organs, Organelles, Tissues, Organism, Molecule, Organ system.

3. Observe the given table with a set of organs in column A. In each set, there is an odd organ. Pick the odd one out and write it in column B. In column C, write the system to which the remaining three belong.

S.No.	A	B	C
1.	saliva, bones, liver, pancreas	bones	digestive system
2.	skin, hair, nail, tooth		
3.	arteries, veins, fingers, capillaries		
4.	brain, spinal cord, nerves, kidneys		

4. Match the following:

a) Drying	Jam
b) Boiling	Fish
c) Addition of sugar	Silent killer
d) Freezing	Dry cereals
e) Fast food	Milk

5. Write any two functions of each of the following:

i) Kidney (1)_____

(2)_____

ii) Bone (1)_____

(2)_____

iii) Skin (1)_____

(2)_____

iv) Blood (1)_____

(2)_____

6. What happens when :-

i) You eat fast food.

_____

ii) Your blood glucose level exceeds 120mg/dl.

_____

7. Diet and lifestyle play a major roles in preventing sickness and keeping us healthy. Write down any 3 things that you will do and any 3 you will not do tomaintain good health.

S.No.	I will do	I will not do
1.	exercise daily	eat fast food
2.		
3.		
4.		

8. Ravi is obese and overweight. His glucose level is also high. His mother seeks the advice of a doctor. The doctor suggests a daily activity programme. What could be the suggested activities?

_____

_____

_____

FURTHER REFERENCE

Books:

How the body works - Steve Parker, D.K.Ltd., London.

Places of scientific importance for visit

GASS FOREST MUSEUM - Coimbatore.

Chandru, Murugan and their friends were playing football in the playground. After they finished playing, they felt tired and were breathing harder and faster. Let's now know and understand how we breathe and why we breathe harder, after running or playing.

2.1. NEED FOR RESPIRATION

Living things need energy to do any kind of work. They stop doing work, when their energy levels drop. Our body needs energy to carry out all its activities. Even when we are idle, certain organs of our body, such as the heart, brain, kidneys and lungs keep working. Hence, our body needs energy all the 24 hours.

Where do we get energy from? We eat food. Food contains energy. The food is broken into simpler forms in the alimentary canal. They are then absorbed by the small intestine and carried by the blood to all parts of the body. The energy supply of food is of no use until it is released from the food.

Why do your parents insist that you should eat food regularly? We get energy from food. Energy is released from the food during respiration. So, respiration is a vital process in living organisms.

When we breathe, oxygen is transported to the lungs and gets mixed with blood. The oxygen-mixed blood flows to all parts of the body and finally to all the cells. When oxygen combines with the food in cells, oxidation (burning) of food takes place. During this process, energy is released along with water and carbon dioxide as waste. The process of oxidation of food to release energy along with water and carbon dioxide as wastes in living cells is called respiration or cellular respiration.

ACTIVITY 2.1 **I DO**

Let me now sit quietly and count how many times I breathe per minute. (The average breathing rate is 16 to 18 times per minute)

SCIENCE

Types of respiration

Respiration is of two types: (a) Aerobic respiration and (b) Anaerobic respiration. Most of the living organisms use oxygen to break up the food in order to get energy. So, the respiration that requires usage of oxygen is called aerobic respiration. It is represented by the equation below:

$$\text{Glucose} + \text{Oxygen} \longrightarrow \text{Carbon dioxide} + \text{Water} + \text{Energy}$$

Anaerobic respiration

Some microorganisms like yeast and bacteria obtain energy from food in the absence of oxygen. So, the respiration that takes place in the absence of free oxygen is called anaerobic respiration. Anaerobic respiration takes place in our skeletal muscles.

$$\text{Glucose} \xrightarrow{\text{absence of Oxygen}} \text{Ethyl alcohol} + \text{Carbon dioxide} + \text{Energy.}$$

MORE TO KNOW

Bacteria and fungi can respire anaerobically, which is useful in converting sugar into alcohol. Alcohol, on one hand can be bad for the society. On the other hand, it can be used as a fuel. Yeast is a one-celled fungus and respires anaerobically to produce alcohol. Therefore, it is used in making wine and brewing beer.

ACTIVITY 2.2 **WE DO**

We'll find out how many times your friends breathe, per minute.

Name of your friend	Normal	Brisk walk	Running	At rest
1.				
2.				
3.				

Differences between breathing and respiration

Breathing	Respiration
1. It is a physical process because only the air moves from one place to another .	1. It is a chemical process because the food undergoes chemical changes.
2. Energy is not released.	2. Energy is released.
3. It takes place in breathing organs.	3. It takes place in living cells.

Respiration is the process of burning food with the help of oxygen to release energy. Then, what is the difference between the burning of food in cells and burning of wood?

Respiration	Burning of wood
1. It takes place in living cells.	1. It takes place outside.
2. Heat energy is liberated.	2. Heat and light energy are liberated.
3. Energy is released step by step in small quantities.	3. Energy is released all of a sudden in a large quantity.

You have learnt about photosynthesis. Can you distinguish respiration from photosynthesis?

Respiration	Photosynthesis
1. It takes place during day and night.	1. It takes place only during day time.
2. All living organisms respire.	2. Only green plants prepare food trough photostnthesis.
3. Food is consumed.	3. Food is synthesized.
4. During this process oxygen is taken in and carbon dioxide is given out.	4. During this process, carbon dioxide is taken in and oxygen is given out.

2.2. RESPIRATION IN MAN:

The human respiratory system consists of nose, nasal cavity, trachea, bronchi and lungs. The lungs are present in the chest cavity. We have muscles in our chest that help us breathe. Some are fixed to our ribs and make the ribcage move in and out. Below the lungs is a strong, flat sheet of muscle called the diaphragm.

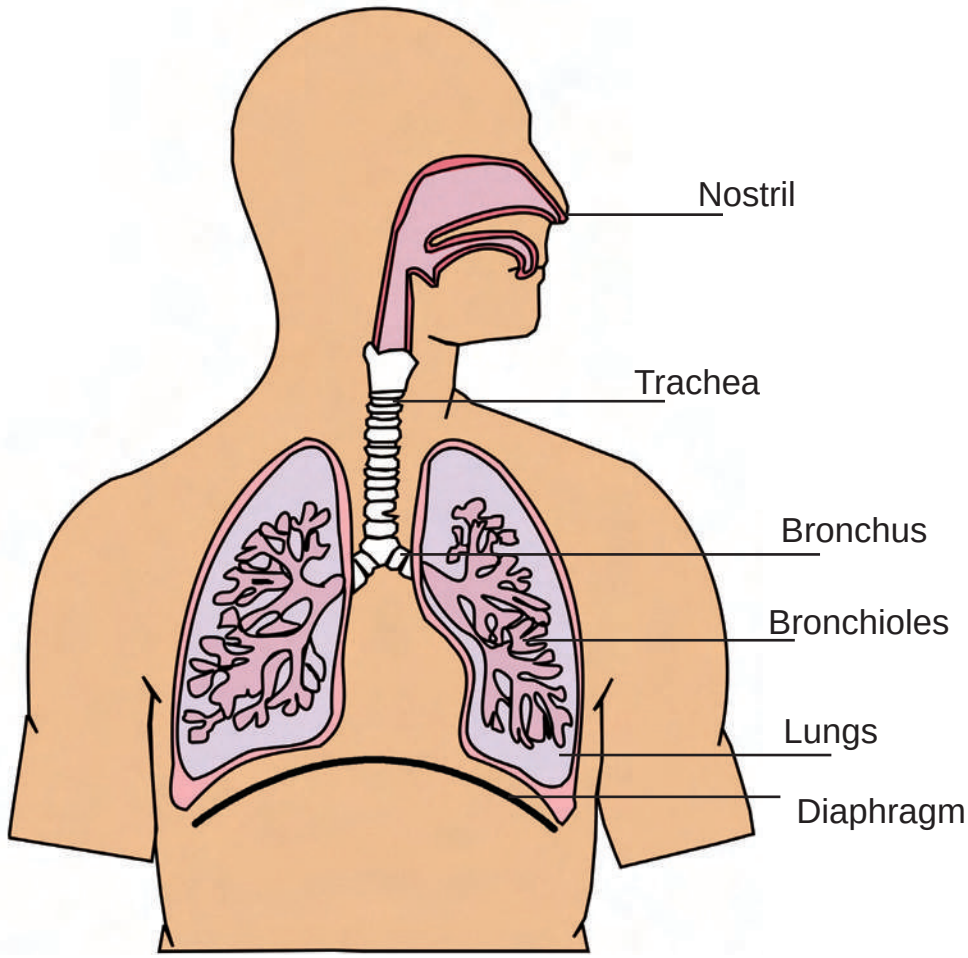


Fig 2.1 Human respiratory system

Our nose has two openings called nostrils. Nostrils lead to nasal cavity which in turn leads to trachea (wind pipe). The trachea divides into two branches called bronchi. (singular – bronchus). Each bronchus enters the lungs and divides into small tubes called bronchioles. The bronchioles end up in air sacs called alveoli. (singular – alveolus).

The walls of alveoli are supplied with thin blood vessels called capillaries which carry blood in them. Oxygen from the lungs enters the blood and carbon dioxide from the blood reaches the lungs in the regions of alveoli.

How do we breathe ?

Breathing involves both inhalation and exhalation. It is a continuous process which takes place all the time and throughout the lifespan of organisms. The number of times a man breathes in a minute is called the breathing rate.

As we breathe in, the diaphragm moves down and ribs move up and expands. This movement increases the space in our chest cavity.

Then the air, rich in oxygen rushes into our lungs from outside through the route given below:

Nose → Nasal Cavity → Trachea → Bronchi → Bronchiole → Alveoli

SCIENCE

As we breathe out, the diaphragm moves up to its original position and the ribs move down. This reduces the size of the chest cavity and air is pushed out of the lungs through bronchi, trachea and nose.

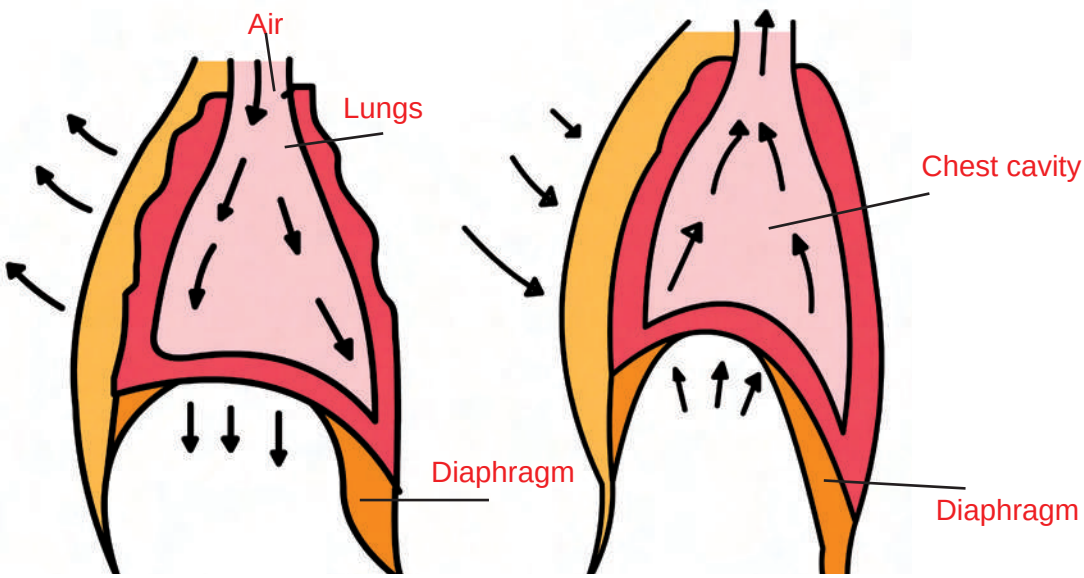


Fig 2.2 Inhalation - Exhalation

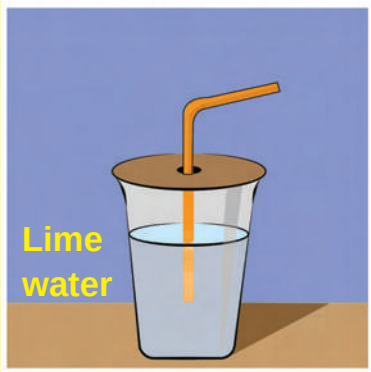
ACTIVITY 2.3 I DO

Aim : To verify that exhaled air contains more amount of carbon di oxide.

I Need : Two transparent glasses with cover, one straw and limewater.

Method : i) I fill both the glasses with limewater and cover them. I make a hole on the cover of one cup.

ii) I insert the straw and blow some air into the first glass alone. observe the changes.



The limewater in the first glass turns more milky than that in the second glass.

Carbon di oxide has the property of turning limewater, milky. So the limewater in the first glass turns milky. From this observation, I conclude that the exhaled air contains more amount of carbon di oxide.

MORE TO KNOW

Shall we find out why we sneeze?

We sneeze when foreign particles such as dust or pollen enter and irritate the nasal cavity. A sneeze expels unwanted and harmful particles from the nasal cavity.

Exchange of gases

When oxygen-rich air reaches the alveoli, oxygen is absorbed by the blood and it combines with the haemoglobin. It is then carried as oxy-haemoglobin to all cells of the body. In the cells, oxygen is used for oxidation of food to release energy along with water and carbon dioxide. This carbon dioxide is absorbed by the blood and is transported to the lungs, where it is exhaled.

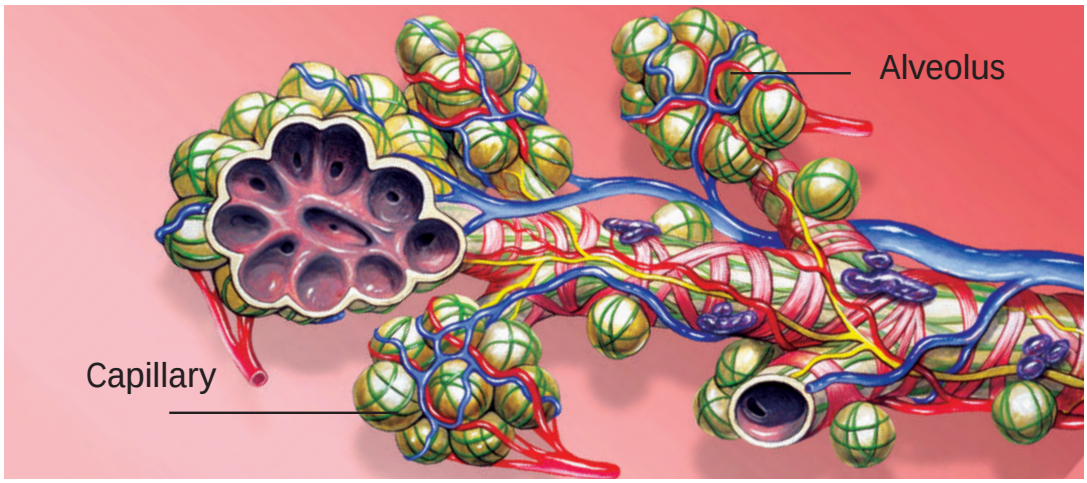
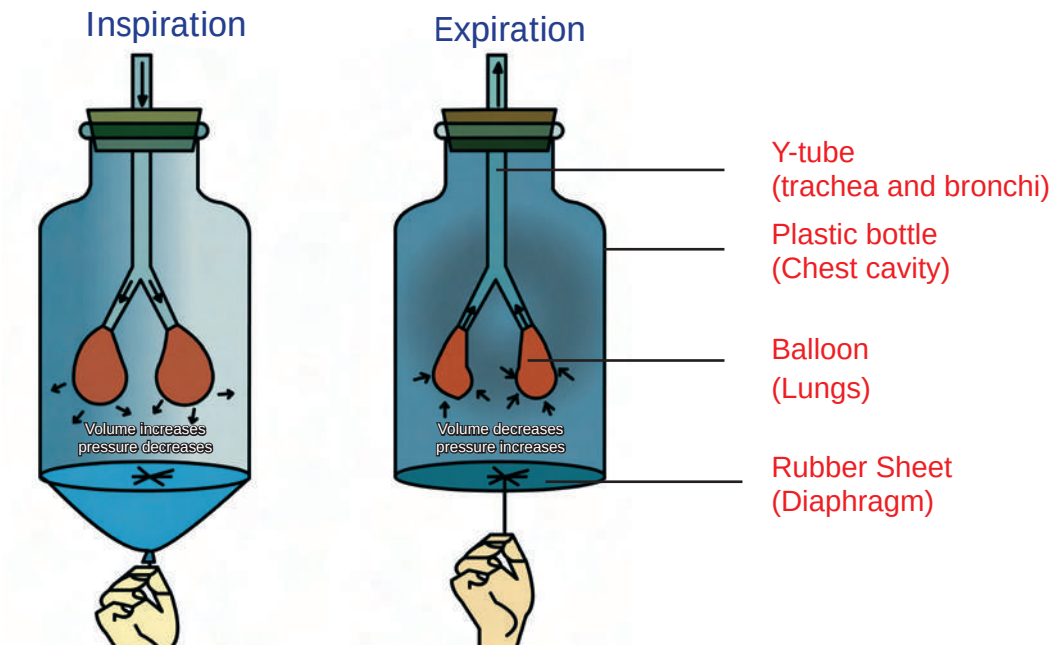


Fig 2.3 Structure of alveoli

ACTIVITY 2.4 **WE OBSERVE**

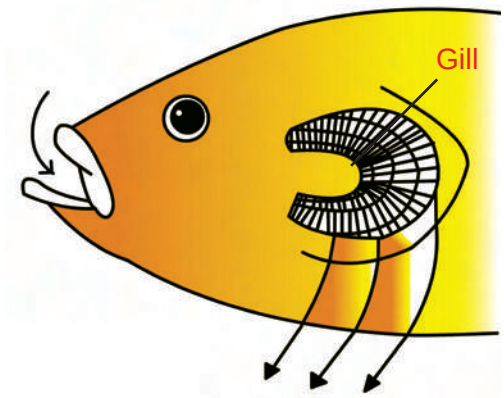
Let us take a wide plastic bottle. Remove the bottom. Get a Y-shaped glass tube. Make a hole in the lid so that the tube may pass through it. To the forked end of the tube, fix deflated balloons. Introduce the tube into the bottle. To the open base of the bottle, tie a thin rubber or plastic sheet. When the plastic sheet is pulled, air from outside rushes into the balloon to inflate them. When the sheet is pushed to its original place, the volume inside the bell jar gets reduced and the air in the balloon is sent out. This shows the breathing mechanism.



MORE TO KNOW

- Air pollution causes many respiratory disorders.
- Smoking can cause lung cancer.
- Sound (voice from voice box) is the useful byproduct of the respiratory system.

2.3. RESPIRATION IN ANIMALS



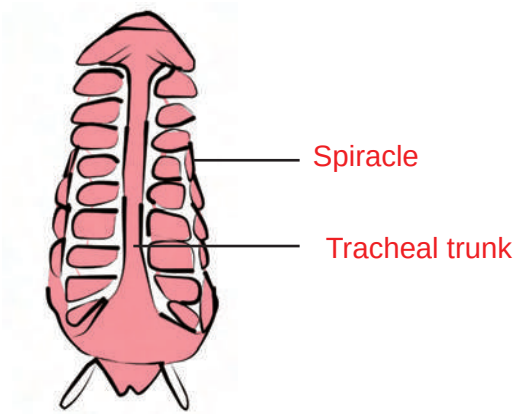


Fig 2.4 Fish - Cockroach

Like human beings, animals and plants also breathe and respire. The basic process of respiration is the same in all organisms. Let us study the structures of some animals and how they enable them to respire.

(a) In unicellular and smaller multicellular animals, all the cells take in oxygen from the surrounding air or water and give out carbondioxide by diffusion.

eg. Amoeba, Paramecium

(b) Creatures like the earthworm and the leech respire through their skin, which is moist and slimy.

Fig 2.5 Earthworm (Mannpuzhu)

(c) In insects, there are several small openings called spiracles on the lateral side of their bodies. These spiracles lead to air tubes called trachea. Exchange of gases takes place through spiracles into trachea.

(d) Fishes have special organs called gills, which are used to absorb oxygen dissolved in water.

(e) Animals like reptiles, birds and mammals have lungs for breathing.

(f) Animals such as frogs respire through their skin and lungs.

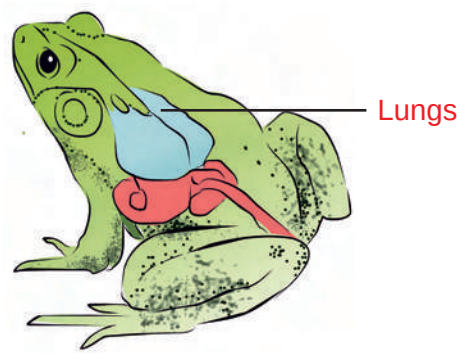


Fig 2.6 Frog

2.4. RESPIRATION IN PLANTS

Like other living organisms, plants also respire to get energy from food. Generally, plants do not have any special organ for breathing. They do not show breathing movements like that of animals.

Plants breathe through tiny pores in the leaves called stomata. Oxygen from the air diffuses into the leaves and carbon dioxide from the leaves diffuses out through **stomata**. Stems have minute openings on their surfaces. These openings help in the exchange of gases. Roots also respire independently. Roots draw in air from the air spaces present between the soil particles. Thus, all parts of the plant like the root, stem and leaf respire independently. Aquatic plants directly exchange gases with the water that surrounds their leaves, roots and stems.

The process of photosynthesis in plants takes place during the day. During this process, carbon-di-oxide is used and oxygen is released.

A part of the oxygen released during photosynthesis is used by the plants for respiration and the rest is sent out through the stomata. Carbon dioxide released during respiration is used up by the plant for photosynthesis. During the night, photosynthesis does not take place.

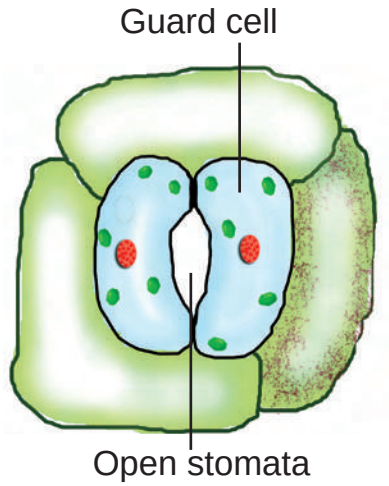


Fig 2.7 Stomata

The carbon dioxide that is released as a result of respiration is sent out through the stomata into the atmosphere. The oxygen in the atmosphere is taken in and used for respiration.

Types of Respiration

Respiration is of two types depending upon the presence or absence of oxygen.

1) Anaerobic respiration and

2) Aerobic respiration.

In lower organisms like the yeast and the bacteria, anaerobic respiration takes place.

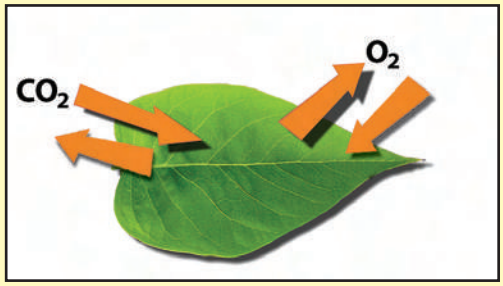
In higher organisms like plants, aerobic respiration takes place.

SCIENCE

MORE TO KNOW

Plants take in O_2 and give out CO_2 during respiration. They take in CO_2 and give out O_2 during photosynthesis.

They are two contrasting and yet complementary processes.



EVALUATION

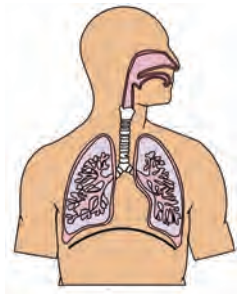
1.Match the animals with their organs of respiration.

ANIMALS	ORGANS OF RESPIRATION
a) Cockroach	Gills
b) Frog	Lungs
c) Fish	Lungs and skin
d) Earthworm	Spiracles
e) Dog	Skin

2. Arrange the following parts of the Respiratory System in order:
trachea, nose, alveoli, bronchi, nasal cavity, bronchiole.

3. The diagram of the Respiratory System of man is given here. Label the following parts in it.

nose, trachea, bronchi, lungs, bronchiole.



4. Pick out the correct answers:-

a) The clean air we breathe is rich in _____ . (oxygen / carbon dioxide)

b) Respiration that takes place in the absence of oxygen is called _____. (aerobic / anaerobic) respiration.

c) Plants breathe through tiny pores in the leaves called _____ (trachea / stomata)

5. Fill up the missing words in the equation given below.

a) _____ + Oxygen ⟶ _____ + _____ + Energy

b) Glucose ⟶ _____ + Carbon dioxide + _____

6.Name the organs of respiration in the :

i) Amoeba _____ ii) Fish _____ iii) Frog _____

7. Photosynthesis takes place only during day time. Respiration takes place all the time.

i) Write down the names of gases exchanged during these processes.

ii) How does the exchange of gases take place in a leaf?

FURTHER REFERENCE

Books:

Biology Understanding Life (3rd edition) - Jones and Barthlett. Barthlett publishers U.K

Biology - Sylvia.S Mader - Brown Publishers U.S.A

Everyday we notice a variety of changes that takes place around us. These changes may involve one or more substances. For example, ice melts, water evaporates, sugar dissolves in water and milk turns into curd. A change occurs in all these instances. 'A rubber band that is stretched' also represents a change since the action causes the change. Changes in matter occur under certain conditions. In this chapter, we shall perform some activities and closely examine the nature of these changes. The changes that take place around us are of two types:

1. **Physical changes**
2. **Chemical changes**

3.1. PHYSICAL CHANGES

Fig. 3.1. Broken Stick

ACTIVITY 3.1 **I DO**

I need: A small stick.

Let me break the stick into two pieces and shall find out the change that happen. I break a stick into two pieces. I keep the pieces on a table in such a way that the pieces acquire the shape of the original stick. Obviously, I cannot join the broken pieces together to obtain the original stick. It is because the stick has undergone a change in the size (physical appearance), but no change has taken place in the chemical composition. Hence I conclude, it is just a physical change that has taken place.

ACTIVITY 3.2 **I DO**

I need: A sheet of paper, A pair of scissors.

Now, let me cut a paper into small pieces and see what change it undergoes.

I cut a sheet of paper into four square pieces.

Further , I cut each square piece into four square pieces.

Then I lay the pieces on a table in order to get the original shape back.

The original paper has undergone a change only in size (physical appearance), and not in chemical composition, It is only a physical change that has occurred.

Do you know that the melting of an ice stick is an example of physical change?

Fig. 3.2. Melting of ice stick

Fig. 3.3. Separation of iron fillings from sand using magnet

ACTIVITY 3.3 I DO

I need: Magnet, tray, sand, iron fillings.

Does sand react with iron fillings to form a new chemical substance? Let us find out what happens by doing an activity. I take some sand and iron fillings in a tray and mix them well. I notice that no new substance is formed. I move a magnet over the mixture. The fillings are easily attracted by the magnet, while the sand remains on the tray. Since, no new substance has been formed, it is a physical change that has taken place.

We found that no change had taken place in the chemical composition and no new product was formed. Only a **physical change** had taken place in all the cases. From this we understand that a physical change does not involve the formation of any new substance and it is readily reversible.

ACTIVITY 3.4 WEOBSERVE

CRYSTALLIZATION

AIM: To show that crystallization is a physical change.

We need: China dish, Funnel, Conical Flask, Tripod stand, Wire gauze, Burette stand, Funnel holder, Sulphuric acid, Copper sulphate,Filter paper and Bunsen burner.

Procedure :

- Take a little amount of water in a china dish.
- Add sufficient amount of copper sulphate crystals to get a saturated solution. Add a few drops of acid (Sulphuric acid- $H_2 SO_4$) to this solution.
- Heat the solution till the crystals are completely dissolved. Allow the solution to cool and then filter it.
- Continue to cool the filtered solution for some more time, without disturbing it. After sometime, crystals are formed in the solution.

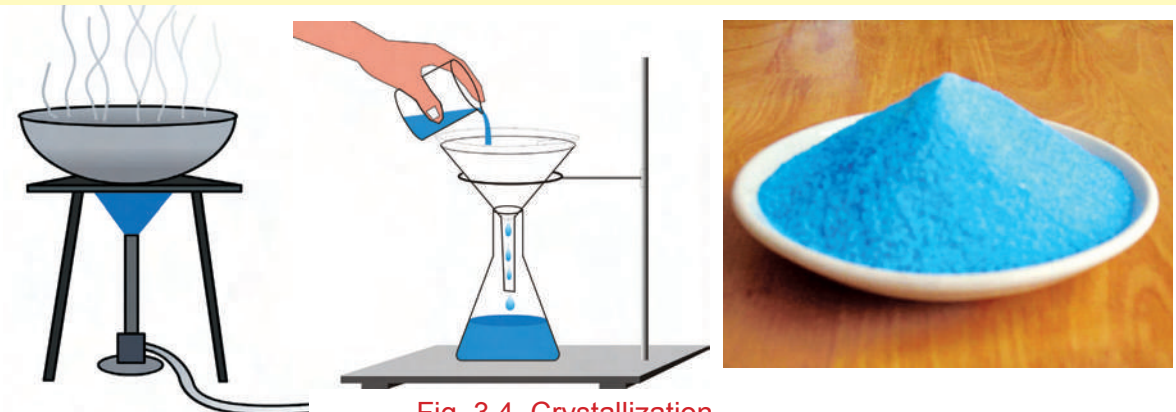


Fig. 3.4. Crystallization

SCIENCE

From this activity we observe that the copper sulphate crystals that we dissolved in water have turned into crystals again. Therefore, dissolution of copper sulphate is a physical change. We also observe that the newly formed crystals have definite geometrical shape and size. Thus crystals of pure substance can be obtained from their solution. This process of crystal formation is known as crystallization.

ACTIVITY 3.5 **WE OBSERVE**

SUBLIMATION

Aim: To show that sublimation is a physical change.

We need: Camphor, China dish, Funnel, Tripod stand, Wire guaze, Bunsen burner.

Procedure:

- Take a small amount of camphor in a china dish.
- Invert a funnel over the dish.
- Close the stem of the funnel with a cotton plug. On heating it gently, camphor is converted into vapour. The vapour of camphor gets condensed on the walls of the funnel.

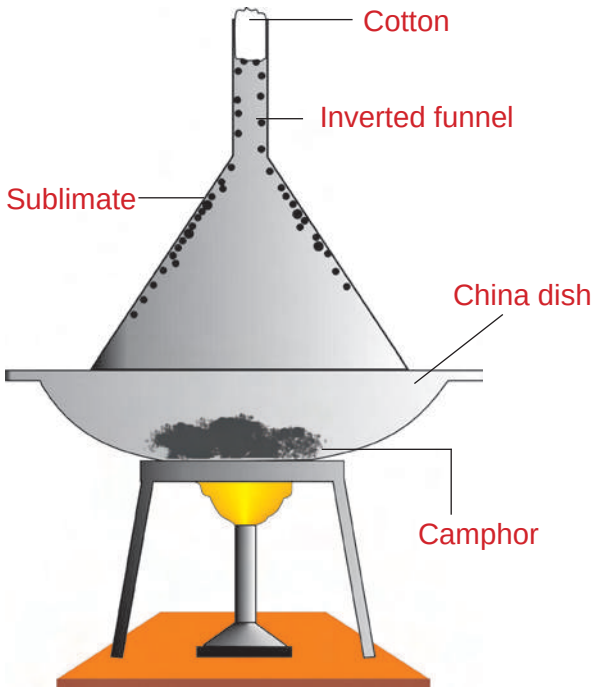


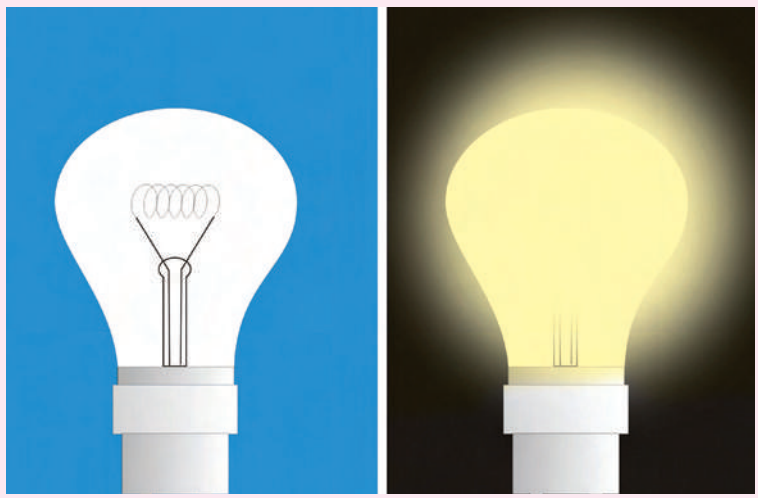
Fig. 3.5. Sublimation

From this activity, we observed that the camphor first got vapourised, but it was deposited back as camphor on the sides of the funnel. Also, the chemical composition of camphor had not changed and the reaction was reversible. Therefore, we understand that heating of camphor is a physical change.

The process of converting a solid directly into its gaseous state is known as **sublimation**.

TO THINK...

When electric current is passed through the filament of a bulb, the filament starts glowing and there is a change in the appearance of the filament. When the current is cut OFF, the bulb stops glowing and its original appearance is restored. Do you think the burning of electric bulb is a physical change?



Bulb before switching ON — Glowing Bulb

Fig. 3.6.

ACTIVITY 3.6 WE OBSERVE

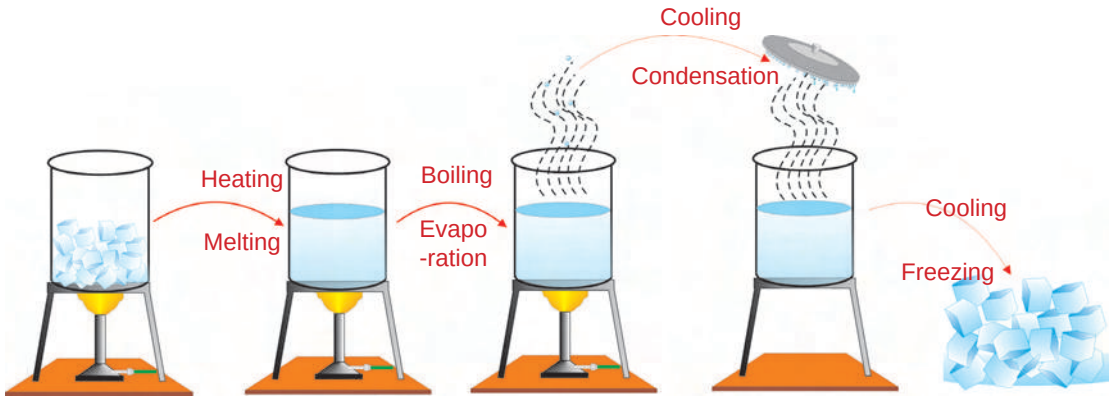


Fig. 3.7. Changes in the state of water due to heating and cooling

Aim:

To show that the change of state is a physical change.

We need

Beaker, Ice cubes, Bunsen burner,Tripod stand, Plate.

Procedure :

- Take some ice cubes in a beaker and place it on a tripod stand and heat it with the help of a burner. What do you observe? Ice melts to form water.
- Can we change this water into ice again? Suggest a method for it.
- Take some water in a beaker and boil it. What do you observe?
- You can observe the water evaporating into water vapour.
- Cover the beaker with an inverted plate.
- Do you notice some water droplets condense on the inner surface of the plate and fall into the beaker?
- Can we change this water into ice again?

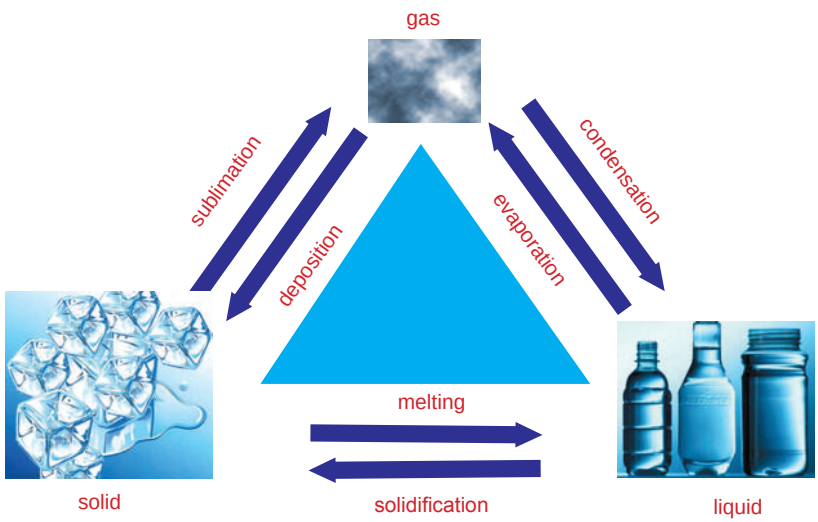


Fig. 3.8. Change of States

SCIENCE

From this activity, we see that

- On heating, water changes from solid state (ice) into liquid state (water) and from liquid into gas (vapour) and then gas changes into a liquid. Water (liquid) can be changed into a solid (ice), again when it is frozen.
- In all these changing processes, the chemical composition of water does not alter.Therefore, this is a physical change. Solids change into liquids on heating. This process is called melting.

Liquids change to gas on heating. This process is called evaporation.

The vapour, when allowed to cool,condenses into its liquid state. This process is called condensation.

Water, when cooled to zero degrees, changes into ice. This process is called freezing.

In all the above activities, the changes take place only in the physical properties of a substance, such as shape, size, colour and temperature. A physical change occurs when the substance changes its physical state but does not change its chemical composition. A change in which a substance undergoes changes only in its physical properties is called a **physical change**. A physical change is generally reversible and no new substance is formed.

3.2. CHEMICAL CHANGES:

You are quite familiar with the rusting of iron. If you leave an iron object such as bolt or iron rod in the open air or in the rain, a reddish brown layer is deposited on its surface. **The layer thus formed is called rust and the process is called rusting**.

In the presence of moisture, iron reacts with oxygen present in air to form hydrated 'iron oxide' known as **rust**. Oxygen and water are two essential ingredients for the rusting of iron.

Fig.3.9(a)-rusted nut

Fig.3.9(b) Rusted vehicle

ACTIVITY 3.7 WE OBSERVE

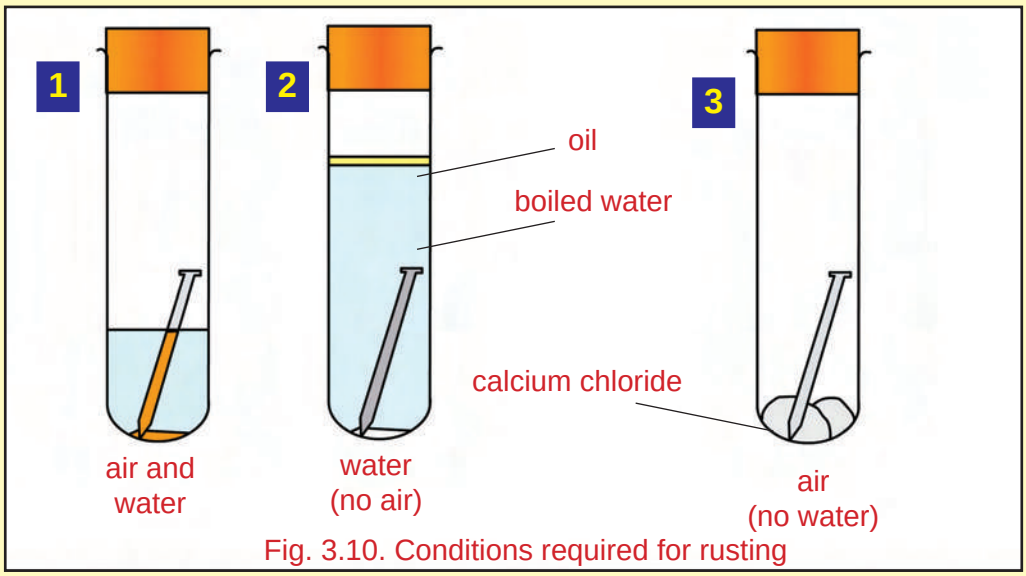


Fig. 3.10. Conditions required for rusting

Aim: To show that both oxygen and water are essential for rusting.

We need: test tube, iron nail, oil, calciumchloride, cork

Procedure :

- Take three test tubes and label them 1, 2 & 3.
- Place a clean iron nail in each of them.
- In test tube-1, pour a small amount of tap water.
- In test tube-2, add boiled and distilled water and add some vegetable oil to keep off the air.
- In test tube-3, add a small amount of calcium chloride (a dehydrating agent).
- Keep them undisturbed for three to four days and observe the nails in each of the test tubes.

We notice that the nails in test tube-2 and 3 have not rusted, while the nail in test tube-1 has rusted. From this activity, you can infer that both oxygen and water are essential for rusting.

Rust is a brittle substance that flakes off easily from the surface. Rust is different from the iron on which it gets deposited. It means a new substance has formed.

MORE TO KNOW

Burning of a candle is an example of a chemical change. Wax molecule is converted into carbon dioxide and water molecules.

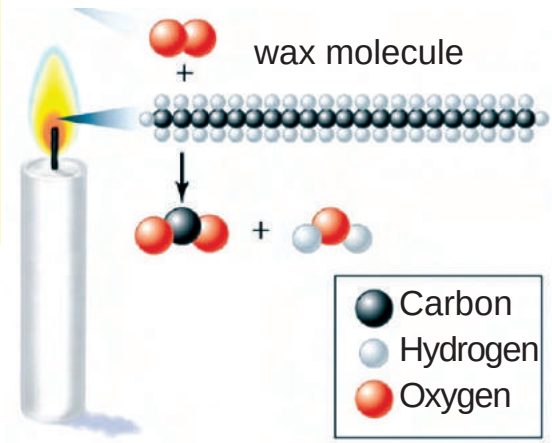


Fig. 3.11. Burning of candle

SCIENCE

ACTIVITY 3.8 WE OBSERVE

Aim:

To show that the burning of magnesium ribbon is a chemical change.

We need :

Magnesium ribbon, bunsen burner, holder.

Procedure :

Take a fine strip of magnesium ribbon. Bring the tip of the strip near a candle flame. It burns with a brilliant white light and finally leaves behind a residue of powdered ash.

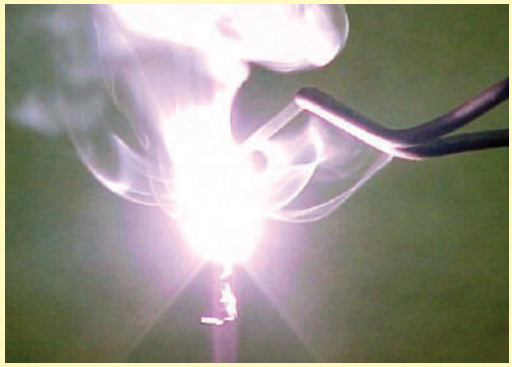


Fig. 3.12.
Burning of magnesium ribbon

Does the ash look like the magnesium ribbon?

No, we cannot get it back. Can we get the magnesium ribbon back from the ash?
No, we cannot recover the magnesium ribbon from the ash.

In this experiment a new compound is formed whose chemical composition is different from that of magnesium. This is a chemical change.

SCIENCE

MORE TO KNOW

Phenolic compounds are responsible for the bright colours, aroma and flavour of many fruits and vegetables. They reduce the risk of heart disease and certain types of cancer.

MORE TO KNOW

Vegetables and fruits turn brown on cutting. It is due to the reaction between the phenolic compound in fruits and the oxygen in air. Phenolic compound and oxygen react to form a brown pigment known as **melanin**.

TOTHINK...

During Diwali, we enjoy lighting firecrackers with our family members. The combination of colour and sound creates an exciting light show and we have a spectacular display. Do you ever think, what happens to the crackers after they are burnt completely? Similarly, burning of paper or wood produces heat and light and finally you get a small amount of ash, (i.e.) a new substance is formed. In all these cases, we cannot get back the original substances. Say what change has taken place here.

Fig. 3.13. Bursting of crackers

ACTIVITY 3.9 — WE OBSERVE

Aim: To show that the reaction of baking soda with lemon juice is a chemical change.

We need: lemon juice , baking soda, test tube, test tube holder.

Procedure:

Take a teaspoonful of lemon juice (citric acid) in a test tube. Add a pinch of baking soda to it.

We would hear a hissing sound and see gas bubbles coming out.

The gas that is formed is carbon dioxide.

Lemon juice (citric acid) + Baking soda ⟶ Carbon dioxide + Salt + Water

The sound produced is due to the evolution of gas (carbon dioxide) in this reaction. It is a chemical change.

ACTIVITY 3.10 — WE DO

Curdling of Milk:

Aim: To show that curdling is a chemical change.

We need: Milk, buttermilk (or) curd.

procedure :

- Boil the milk and cool it to lukewarm temperature
- Add a teaspoon of buttermilk or curd starter into it. Keep it aside for a few hours.

Do you notice any change?

The milk has changed into curd. As both milk and curd have different properties, a **chemical change has occurred**.

Find out

what happens if excess of buttermilk or curd starter is added?

What happens if buttermilk or curd starter is added to milk at a very high temperature?

Will the curd set faster when it is placed outside or inside the refrigerator?

When a large quantity of starter buttermilk / curd is used, What happens to the taste of the curd? Find out the reason for your answer.

milk

curd

Fig. 3.15. curdling

In all the above activities, you can see that one or more new substances are formed. The properties of the new substances are not the same as that of the original ones. These processes are also irreversible. This type of change is called a **chemical change**. Any change that results in the formation of one or more new substances is called a chemical change. A complete and permanent change in the properties of the substance is produced in the process. A chemical change is also referred to as a **chemical reaction**.

MORE TO KNOW

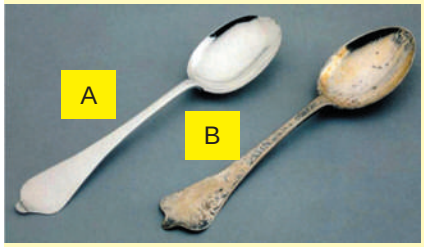


Fig. 3.14. Tarnishing silver spoon

If you have any object made of silver you know that the bright, shiny surface of silver gradually darkens and becomes dull. This discolouration is known as tarnishing. Look at the picture of two silver spoons 'A' and 'B'. 'A' shines well but 'B' does not. What happens? Why does this discolouration occur? This happens because silver undergoes a reaction with sulphur contained in the air. You can use chemistry to reverse the tarnishing reaction, and make the silver shine again.

Chemical changes are very important in our day- to- day life. A medicine is a product of chemical reaction. Useful materials like plastic, detergents, dyes and paints. are also produced by chemical reactions.

In addition to the new products formed, the following may also accompany a chemical change.

- Heat or light may be given off or absorbed
- Sound may be produced
- Colour change may occur.
- A change in smell may take place.

SCIENCE

AMAZING FACT!

Iron Pillar

In New Delhi, near Qutub Minar, stands an iron pillar which is more than 7 meters tall and weighs more than 6000 kg. It was built 1,600 years ago. Strangely, even after such a long period of time, it has not rusted. Scientists from all over the world have examined its quality of rust resistance. It shows the advancement India had made in metallurgy technology as far back as 1600 years ago.


Fig. 3.16. Iron Pillar in Delhi

Fig. 3.17. A Ship in Chennai Port

MORE TO KNOW

You know that ships are made of iron. A part of the ship always remains under water. Since seawater contains a great amount of salt, the ship suffers a lot of damage from rusting inspite of being painted. These rusted parts need to be replaced every now and then. Imagine the loss of money incurred this way!

3.2.1. DIFFERENCES BETWEEN PHYSICAL CHANGE AND CHEMICAL CHANGE

Table 3.1

S.No	Physical change	Chemical change
		
1	The physical changes are reversible.	The chemical changes are irreversible.
2	New subtances are not formed.	New substances are formed.
3	The molecular composition of the substance remains the same.	The molecular composition of the substance changes.
4	No energy change is involved.	Energy change is involved.
5	Temporary change.	Permanent change.

Fig.3.18-Painted Window

MORE TO KNOW

Rusting of metals can be prevented by:

1. Applying oil, paint or grease.
2. Galvanisation (deposition of zinc over iron)
3. Chrome plating (deposition of chromium over iron)
4. Tinning (coating of tin over iron)

SCIENCE

3.3. ACIDS, BASES AND SALTS

On Sunday, Keerthivasan's mother boiled an egg for his lunch. Since it was very hot, she took a bottle of water from the fridge, poured some into a bowl and put the egg in it to cool. She went to the market and forgot all about the egg. When she came back and took the egg out of water, she was surprised to find that the hard shell of the egg had disappeared. She wondered what happened. She smelt the liquid and realized her mistake. She had poured vinegar into the bowl, instead of water. Can you say what would have happened? Perhaps you can do it at home with the help of your mother.

In our daily life, we use substances such as lemon, tamarind, tomato, common salt, sugar and vinegar. Do they all have the same taste? If you have not tasted any of these substances, taste it now and enter the result in table 3.2

CAUTION !

1. Do not taste anything, unless you are asked to.
2. Do not touch anything, unless you are asked to.

Table 3.2

Substance	Taste (sweet/sour/bitter/saline/any other)
Curd	
Orange juice	
Grapes	
Lemon Juice	
Tamarind	
Sugar	
Unripe Mango	
Gooseberry (Nelli)	
Baking soda	
Vinegar	
Common salt	
Tomato	

3.3.1 ACIDS,BASES AND SALTS USED IN OUR DAILY LIFE

During summer, when your grandmother prepares pickles (lime, mango, etc.), she adds vinegar to them. Did you ever ask her why she does that? If not, ask her now and find out the reason.

Curd, lemon juice, orange juice and vinegar taste sour. These substances taste sour because they contain acids. The chemical nature of such substances is acidic. The word 'acid' comes from the Latin word 'acidus' which means sour. We come across many acids in our daily life.

In general, acids are chemical substances which contain replaceable hydrogen atoms. Acids can be classified into two categories namely organic acids and mineral acids or inorganic acids.

Organic acids

Acids which are obtained from animal and plant materials are called organic acids. Many such acids are found in nature. Lemon and orange contain citric acid. Hence they are called citrus fruits. Milk that has turned to curd tastes sour. It contains an acid called Lactic acid. The acids found in food stuffs are weak. Soft drinks contain some carbonic acid which gives a tingling taste. Apple contains malic acid. Some common organic acids are shown in Fig.3.19.

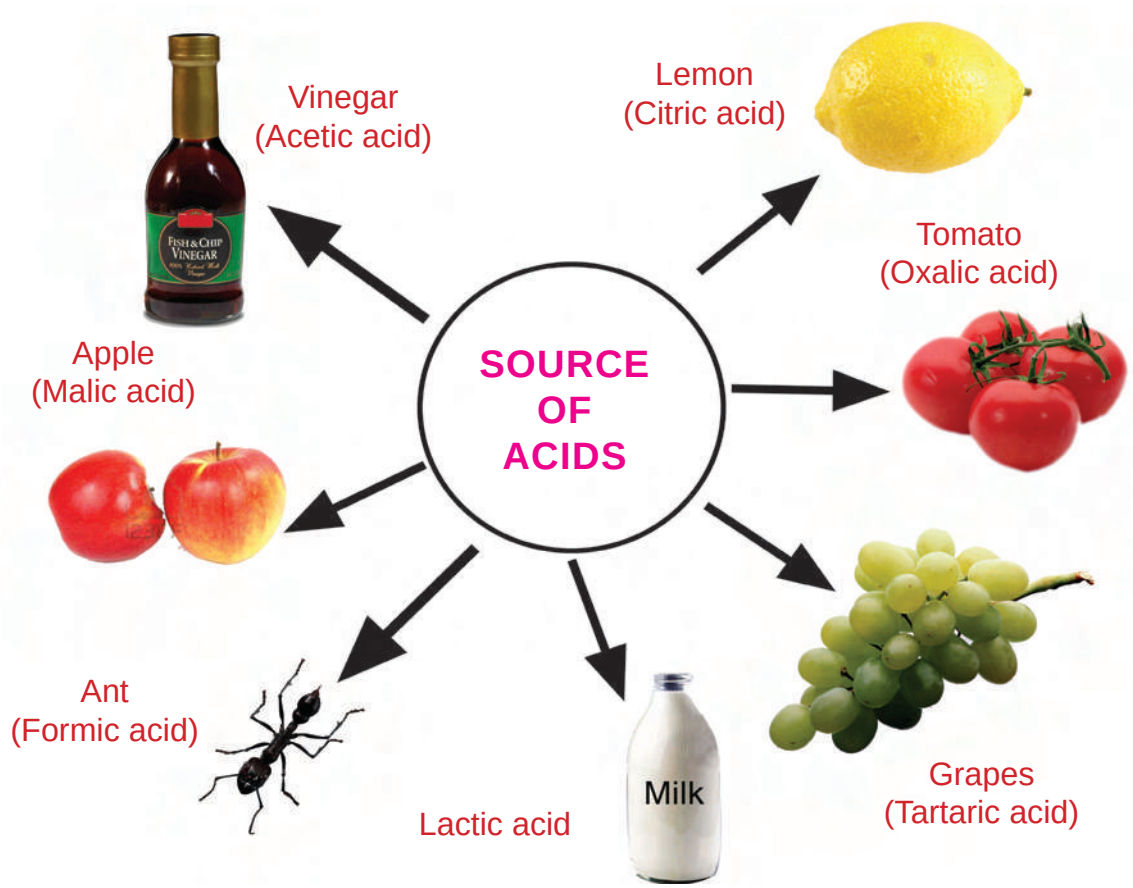


Fig. 3.19. Acids and their sources

Mineral acids

Acids that are obtained from minerals are called mineral acids or inorganic acids. For example, Hydrochloric acid, Nitric acid, Sulphuric acid (Fig.3.20) which are commonly available in the laboratory must be handled with a lot of care. They are corrosive. It means that they can eat away metal, skin and clothes. But they cannot corrode glass and ceramic. Hence they are stored in glass bottles.

An acid is a substance which contains replaceable hydrogen ions.

Fig. 3.20. Mineral Acids in Laboratory

Find out...

Observe how copper and brass vessels are washed in your house. Why is tamarind used for washing them?

Bases and alkalies in our daily life

Substances such as baking soda does not taste sour. It is bitter in taste. It shows that it has no acid in it. If you rub its solution with your fingers, it is soapy. Substances like these which are bitter in taste and are soapy to touch are known as bases. The nature of such substances is said to be basic. Bases are oxides or hydroxides of metals. They are chemically opposite to acids. Some bases like caustic soda [Sodium hydroxide] and caustic potash [Potassium hydroxide] are very corrosive.

Bases give hydroxyl ions when treated with water. Bases which are soluble in water are called Alkalies. The hydroxides of Sodium and Potassium are examples of alkalies. They are water soluble bases. **All alkalies are bases, but not all bases are alkalies**. The word 'alkali' is derived from the Arabic word 'alquili' which means plant ashes. Ashes of plants are composed mainly of sodium and potassium carbonates.

Some common bases used in our daily life are given in Table 3.3.

CAUTION !

Never taste or touch any unknown chemical.

Table 3.3

No	Name	Other Name
1	Quicklime	Calcium oxide
2	Potassium hydroxide	Caustic potash
3	Calcium hydroxide	Slaked lime
4	Sodium hydroxide	Caustic soda
5	Magnesium hydroxide	Milk of magnesia

Table 3.4

Name of Base	Found in
Calcium hydroxide	Lime water
Ammonium hydroxide	Window cleaner
Sodium hydroxide/ Potassium hydroxide	Soap
Magnesium hydroxide	Antacid

Test for identifying acids and bases

We should never touch or taste a substance to find out whether it is an acid or base because, both acids and bases are harmful and will burn the skin. A safe way to find it out is to use an indicator. Indicators are a group of compounds that change colour ,when added to solutions containing either acidic or basic substances. The common indicators used in the laboratory are litmus, methyl orange and phenolphthalein. Apart from these, there are some natural indicators like turmeric, red cabbage juice and beetroot juice.

Table 3.5

Indicator	Colour in Acid	Colour in base
Litmus	Red	Blue
Phenolphthalein	Colourless	Pink
Turmeric powder	Yellow	Brick red
Beetroot juice	Pink	Pale yellow
Red cabbage juice	Pink/Red	Green

3.3.2. NATURAL INDICATORS

Litmus: A natural dye

The most commonly used natural indicator is litmus. It is extracted from lichens (Fig. 3.21) and it has a purple colour when put in distilled water. When added to an acidic solution, it turns red and when added to a basic solution, it turns blue. It is available in the form of solution or in the form of strips of paper known as litmus paper. Generally, it is available as red and blue litmus paper.

Fig. 3.21. Lichens

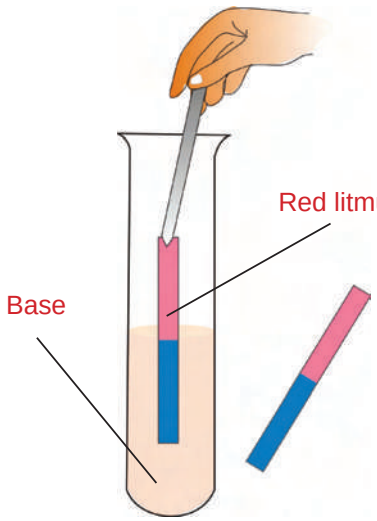


Fig. 3.22. Red litmus paper dipped in Base solution changes to blue

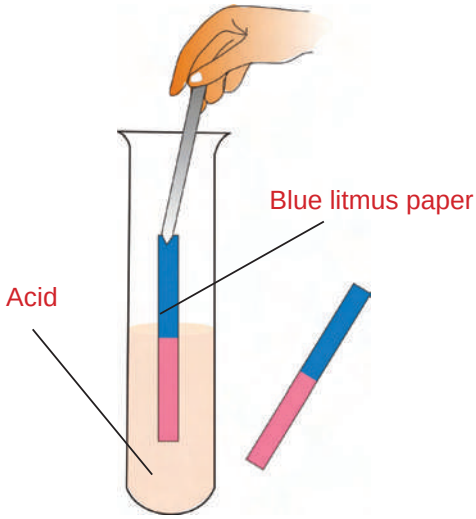


Fig. 3.23. Blue litmus paper dipped in Acid solution changes to red

Fig. 3.24. Students performing experiment

ACTIVITY 3.11 **WE OBSERVE**

Aim: To find out the nature of solution using litmus paper.

We need: Test solutions, Litmus paper, Test tube, Test tube stand.

Procedure: Add some water to orange juice in a test tube. Put a drop of the above solution on a strip of the red litmus paper with the help of a dropper. Is there any change in colour? Repeat the same exercise with the blue litmus paper.

Note down the change in colour. Perform the same activity with the following substances, and tabulate the results. If the solution does not change its colour to either red or blue on litmus paper, they are neutral solutions. These solutions are neither acidic nor basic. e.g. Distilled water.

Table 3.6

S.No.	Test solution	Effect on red litmus paper	Effect on blue litmus paper	Inference
1	Tap water			
2	Detergent solution			
3	Shampoo			
4	Common salt			
5	Sugar solution			
6	Lime water			
7	Washing soda solution			
8	Vinegar			
9	Milk of Magnesia			
10	Aerated drink			

Turmeric as a natural indicator

ACTIVITY 3.12 **I DO**

Making my own Greeting Card

- I prepare my own greeting card using turmeric powder.
- I take a tablespoon full of turmeric powder.
- I add a little water and make a paste.
- I spread the turmeric paste on a plain paper and dry it.
- I draw designs on the turmeric paper using soap solution.
- My greeting card is ready to use.
- I cut the yellow turmeric paper into thin strips.
- I use it for testing the test solution in the following table.

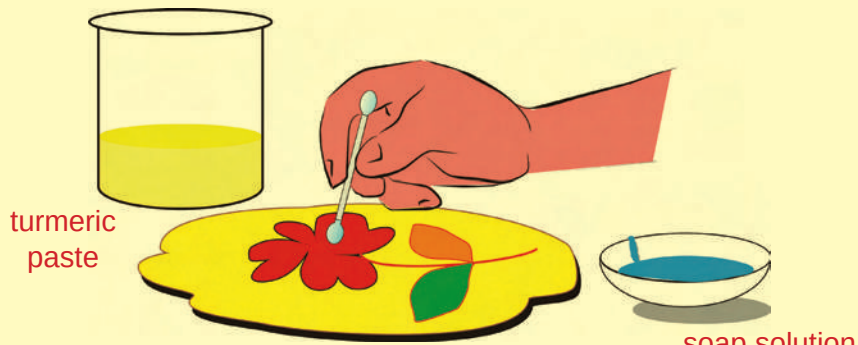


Fig. 3.25. Preparing Greeting Card

SCIENCE

Table 3.7

S.No	Test Solution	Effect on strips of turmeric paper	Remarks
1	Lemon juice		
2	Orange juice		
3	Vinegar		
4	Milk of Magnesia		
5	Baking soda solution		
6	Lime water solution		
7	Sugar solution		
8	Common salt solution		

Coffee is brown and bitter in taste. Is it an acid or a base?

Don't guess the answer without doing a test.

ACTIVITY 3.13 WE DO

Prepare our own indicator

Aim : To prepare our own indicator.

We need : Red cabbage, Beetroot, some bright coloured flowers such as hibiscus

Procedure :

- We take cabbage, beetroot and some bright coloured flower such as hibiscus.
- We grind each one of the above items separately using mortar.
- We mix each one to a suitable solvent with the help of our teacher.
- We filter and collect the filtrate in a separate bottle.
- Our indicator is ready to use.

Fig. 3.26. Materials to prepare indicator

MORE TO KNOW

Cells in the human body contain acids.

DNA (deoxyribonucleic acid) in cells controls the physical features of our body such as appearance, colour and height.

Proteins are bodybuilders and they contain amino acids.

Fats contain fatty acids.

Properties of Acids

1. They have a sour taste.
2. Strong acids are corrosive in nature.
3. Hydrogen is the common element present in all acids. However, all compounds containing hydrogen are not acids. For instance, ammonia, methane and glucose are not acids.
4. They react with metals and produce hydrogen.

   Metal + Acid $\longrightarrow$ Salt + Hydrogen gas
5. Acids turn blue litmus in to red.
6. The indicator phenolphthalein is colourless in acids.
7. The indicator methyl orange is red in acids.
8. They are good conductors of electricity.

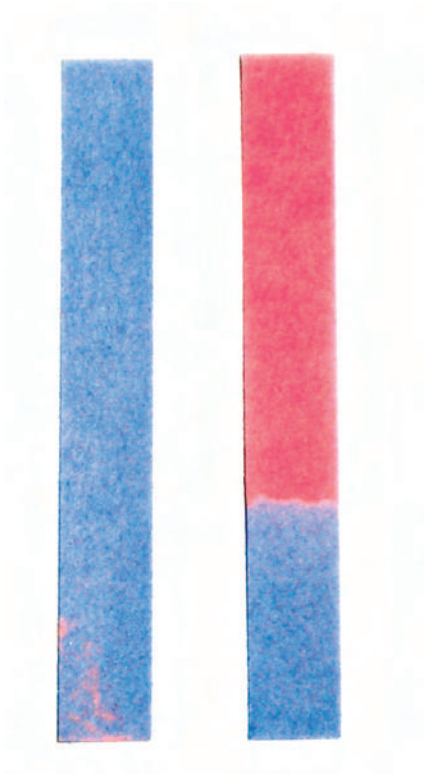


Fig.3.27-Litmus paper

SCIENCE

MORE TO KNOW

Pink or blue? Hydrangea macrophylla, an ornamental plant, can blossom in different colours depending upon the nature of the soil. In acidic soil, the colour of the flower is blue, in basic soil it is pink, and in neutral soil, it is white.

Fig. 3.28. Hydrangea macrophylla

Uses of Acids

Inorganic acids are used in:

1. Chemical laboratories as reagents.
2. Industries for manufacturing dyes, drugs, paints, perfumes, fertilizers and explosives.
3. The extraction of glue from bones and metals from their ores.
4. Preparation of gases like Carbon dioxide, Hydrogen sulphide, Hydrogen, Sulphurdioxide etc.
5. Refining petroleum.

Organic Acids like carboxylic acids are used:

- as food preservatives.
- as a source of Vitamin C.
- for preparation of baking soda.
- to add flavour to foodstuffs and drinks.

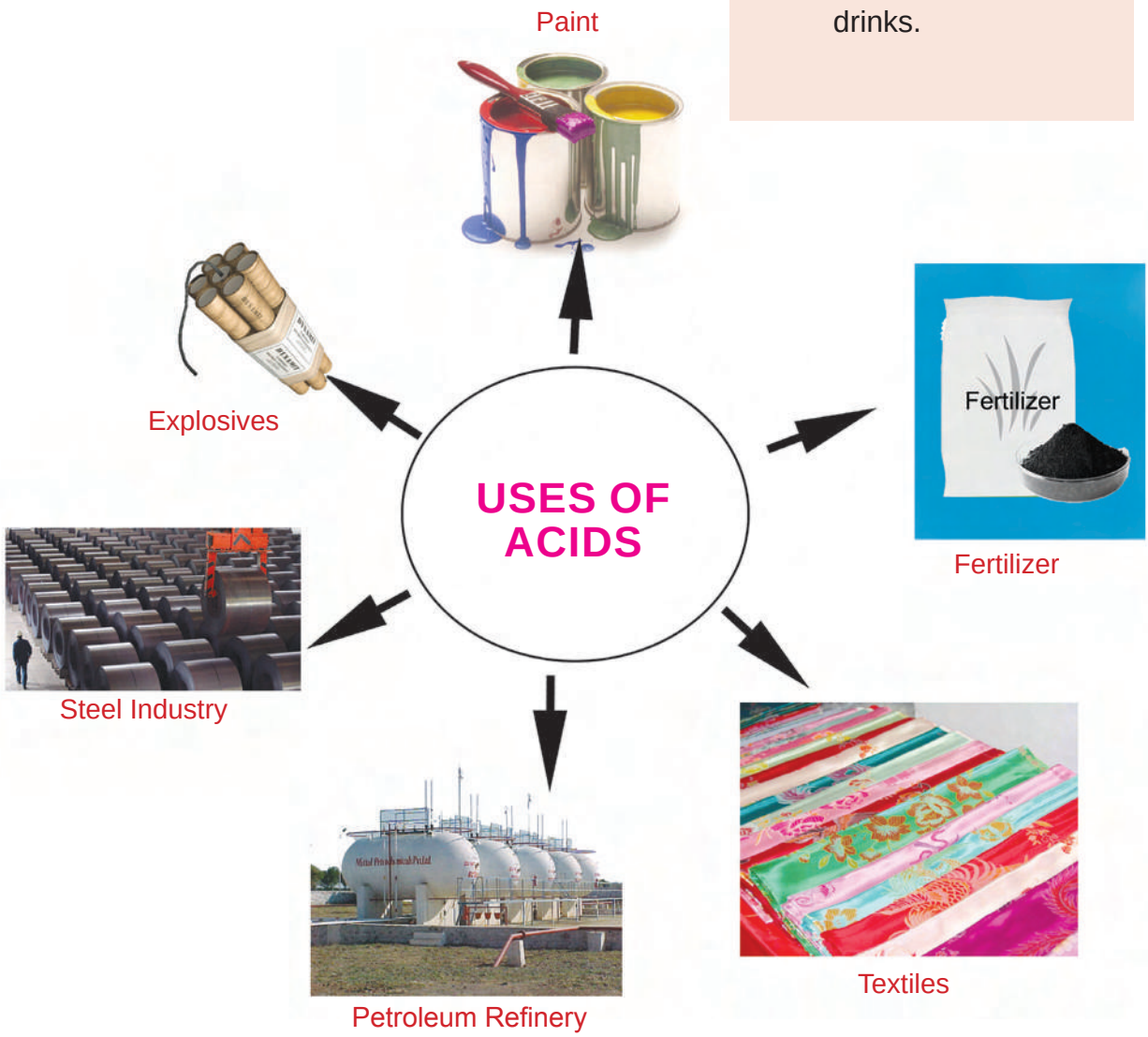


Fig. 3.29. Uses of Acids

Properties of Bases

1. Bases are bitter in taste.
2. Strong bases are highly corrosive in nature.
3. Generally, they are good conductors of electricity.
4. Basic solutions are soapy to touch.
5. Bases turn red litmus paper into blue.
6. Bases are compounds that contain hydroxide ions.

Uses of Bases

1. in chemical laboratories, as a reagent
2. in industries, for manufacturing soap, textile and plastic.
3. for the refining of petroleum.
4. for manufacturing paper, pulp and medicine.
5. to remove grease and stains from clothes.

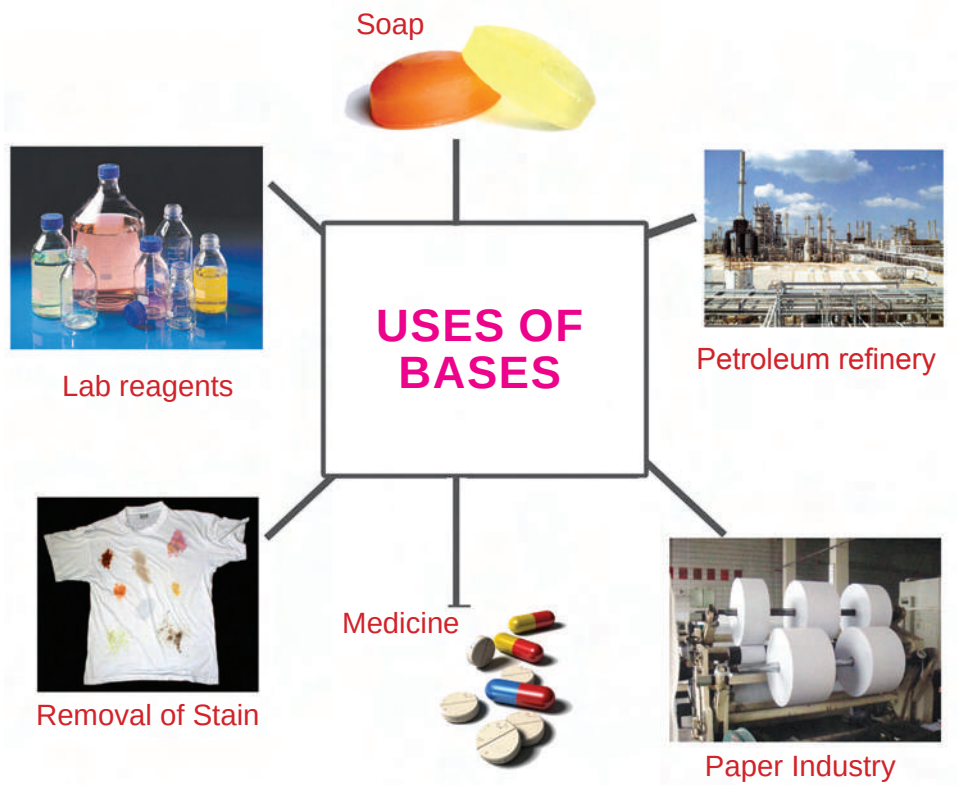


Fig. 3.30. Uses of Bases

ACTIVITY 3.14 **WE DO**

Debate on Acid Rain.

- We divide ourselves into small groups.
- Each group discusses and debates about acid rain formation and its impact on the environment.
- We ask the group leaders to present the views of their groups.
- Our teacher concludes and summarizes it.

SCIENCE

Neutralisation

You have learnt that acids turn blue litmus into red and bases turn red litmus into blue; hence they have different chemical properties. What do you think would happen when an acid is mixed with a base? Let us perform the following activity:

ACTIVITY 3.15 WE OBSERVE

Aim: To show that acid is neutralized by base.

We need: Hydrochloric acid, sodium hydroxide, phenolphthalein, beaker, glass rod, test tube, test tube stand.

Procedure :

- Take a test tube and add 5ml of (caustic soda) sodium hydroxide into it.
- Add 2-3 drops of phenolphthalein in it and you can see that the solution turns pink.
- Now add dilute hydrochloric acid slowly in drops and see what happens.
- The colour will disappear.
- This shows that the base is completely neutralised by the acid.

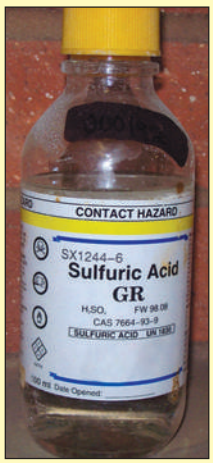
When an acidic solution is mixed with a basic solution, both solutions neutralise the effect of each other. When an acid solution and a base solution are mixed in suitable amounts, both the acidic nature of the acid and the basic nature of the base are destroyed. The resulting solution is neither acidic nor basic. Touch the test tube immediately after neutralisation. What do you observe? In the process of neutralisation, heat is always evolved or liberated. The evolved heat raises the temperature of the mixture.

In neutralisation reaction, a new substance is formed. It is known as salt. Salt may be acidic, basic or neutral in nature.

Neutralisation can be defined as a chemical reaction that takes place between an acid and a base. In this process, salt and water are produced with the evolution of heat.

Acid + Base ⟶ Salt + Water & heat is evolved.

MORE TO KNOW



Sulphuric acid (H_2SO_4) is called the **king of chemicals**, because of its industrial importance. The amount of sulphuric acid that a country uses indicates the economy of country. Fluorosulphuric acid ($HFSO_3$) is one of the strongest acids.

MORE TO KNOW

We know that even our stomach produces an acid. Once we start eating, acid is secreted in the stomach to start the digestion process. It is often not the food that we eat that causes acidity problems in the stomach, but an overproduction of this acid that is secreted does. In fact, some food can help to reduce the acidity in the stomach by neutralising (reducing) some of the acidity. Milk is one of the most beneficial food items that helps in reducing acidity in the stomach.

Salt

A salt is a substance formed by the neutralisation of an acid with a base.

Sodium hydroxide + Hydrochloric acid ⟶ Sodium chloride + Water + Heat
(Base) (Acid) (Salt)

Table 3.8

Name of acid	Salt formed	Names of salts
HCl	Chloride	Sodium chloride, Copper chloride, Ferric chloride
HNO_3	Nitrate	Sodium nitrate, Copper nitrate, Ferric nitrate

Uses of Salt (Table 3.9)

Name of Salt	Uses
For the human body Calcium phosphate, Calcium lactate, Ferrous sulphate, Sodium chloride etc.	For the proper functioning of the human body.
For domestic purposes	
1. Sodium chloride	Used as a preservative/ To add taste to our food
2. Sodium bicarbonate	In baking/ in effervescent drinks.
3. Hydrated potassium, aluminium sulphate	In purification of water.
For Industrial Purposes	
1. Sodium carbonate	In manufacture of washing powder.
2. Copper sulphate	As an insecticide.
3. Potassium nitrate	In manufacture of gunpowder.

SCIENCE

3.3.3. NEUTRALIZATION IN EVERYDAY LIFE

Indigestion:

Our stomach contains hydrochloric acid. It helps us digest the food we eat. Secretion of excess acid in the stomach will cause stomach upset or indigestion. Sometimes indigestion becomes painful. We take an antacid such as milk of magnesia to neutralise the excess acid.

Ant bite:

When an ant bites, it injects acidic liquid (Formic acid) into the skin. The effect of the acid can be neutralized by rubbing the bitten area with moist baking soda or calamine solution (Zinc Carbonate).

Factory wastes:

The wastes of many factories contain acids. If they are allowed to flow into the water bodies, the acids will kill the fish and other organisms. The factory wastes are therefore, neutralised by adding basic substances.

Soil treatment:

Excess use of chemical fertilizers makes the soil acidic. When the soil is acidic, plants do not grow well. So it is treated with bases. If the soil is basic, the organic matter releases acids, which neutralises the basic nature of soil.

Fill the table yourself:

Table 3.10

Acids	Bases
1. They have sour taste.	
2.	They turn red litmus to blue.
3. It contains hydrogen.	
4.	Generally good conductors of electricity.

EVALUATION

1. The physical change is generally reversible. The chemical change is irreversible. Classify the following changes as physical change or chemical change.

   a) Frying of egg b) Burning of petrol c) broken glass

   d) formation of curd from milk e) compression of spring

   f) photosynthesis g) digestion of food

2. Kumar had put some naphthalene balls in his wardrobe to keep the insects away. After a few days, he found that they had become very small. Give reason for the change. Name the phenomenon behind it.

3. Malarvizhi's father bought an apple. He cut it into slices and gave them to her. The slices turned brown after some time. Seeing the brown colour, she asked her father how it happened. What could be her father's explaination?

4. Sting operations!

   Bee stings can be very painful. If a bee stings your friend, how would you help him?

   a) What substance will you apply on the bite area?

   b) What chemical does that substance contain?

5. Answer the following:

   a) Tablets for prescribed indigestion contain a base. Why?

   b) Explain why the rusting of iron objects is faster in coastal areas.

6. Anaerobic bacteria digest animal waste and produce biogas (change A). The biogas is then burnt as fuel (change B). The following statements pertain to these changes. Choose the correct one.

   i) 'A' is a chemical change.

   ii) 'B' is a chemical change.

   iii) Both 'A' and 'B' are chemical changes.

7. Burning of wood and cutting a log of wood into small pieces are two different types of changes. Give reason.

8. Match the following:

a)	Vinegar	quick lime
b)	Milk	acetic acid
c)	Tamarind	milk of magnesia
d)	Calcium oxide	tartaric acid
e)	Magnesium Hydroxide	lactic acid

9. Fill in the blanks:

   a) Acids have _____ (bitter / sour) taste.

   b) Burning of a candle is an example of _____ (physical / chemical) change.

   c) Some commonly used natural indicators to identify acids and bases are _____ and _____.

10. Take a fresh iron nail and a rusted iron nail. Beat them up with a hammer and check for yourself which of the two is stronger? Why?

PROJECTS

1. Let us make a list of items that we use at home and classify them as acid, base or salt. You can organize your list under following heads:
   a) Accessories / toiletries (soaps, detergents, disinfectants, etc.)
   b) Cosmetics (lotions, shampoos, etc.)
   c) Food items (pickle, lemon, ajinomoto, soda water)
   d) Miscellaneous (car batteries, refrigerators, window cleaners, insect repellants, etc.)
2. Prepare a natural indicator. collect water samples (minimum 5 samples) from your area and test the samples using the indicator. Find out whether it is acidic, basic or neutral. Record your observations and tick (✓) the appropriate column in the table below. Discuss the results.

Water samples	Acid	Base	Neutral
Sample - 1			
Sample – 2			
Sample – 3			
Sample – 4			
Sample – 5			

After classifying various water samples, write down which of the samples you will use for the purpose of : (a) Drinking (b) Washing (c) Irrigation (d) Bathing.

FURTHER REFERENCE

Books:

1) *Introductory Chemistry - M Katyal, Oxford University Press, New Delhi*
2) *Advanced Organic Chemistry – Bahl and Arun Bahl Johnson*

Muthu's father sprang a pleasant surprise on his children one morning.

Father : Hurry up, children! get ready. We are going to visit the Indira Gandhi Centre for Atomic Research at Kalpakkam.

Muthu : Don't we have a nuclear reactor at Kalpakkam, Dad?

Father : Yes, there is a nuclear reactor at Kalpakkam, where electricity is generated. Do you remember, last year during the holidays, we went to Mettur Dam and saw how they generate electricity at the hydro-electric power station? The year before, we visited the Ennore thermal power plant, where coal is used. This year, we shall visit the kalpakkam plant, where nuclear energy is used for power generation.

Malar : That will be great, daddy. I really enjoyed visiting the power stations and see the way electricity is generated.

Father : You know how essential electricity is in our daily life.You will learn more interesting facts about electricity in your physics classes.

"Electricity plays an important role in our day to day activities. It is almost impossible to imagine life without electricity. Electricity has made our tasks easier and our lives more comfortable. Can you list the things you use which need electricity to work?"

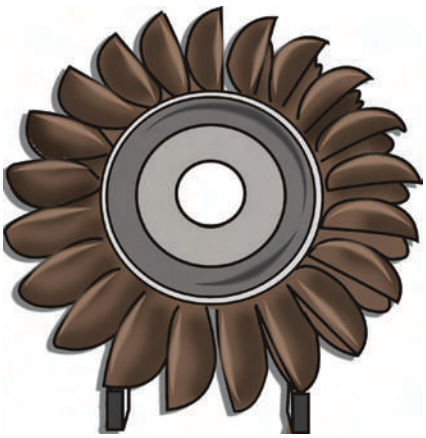
Electricity lights up the bulbs for us to see even in the dark and heats up the oven to cook food.

Electricity helps to transmit our voices along wires instantaneously. Electric trains carry people from one place to another at a faster pace.

Even Computers, which have become an integral part of our lives, run on electricity.

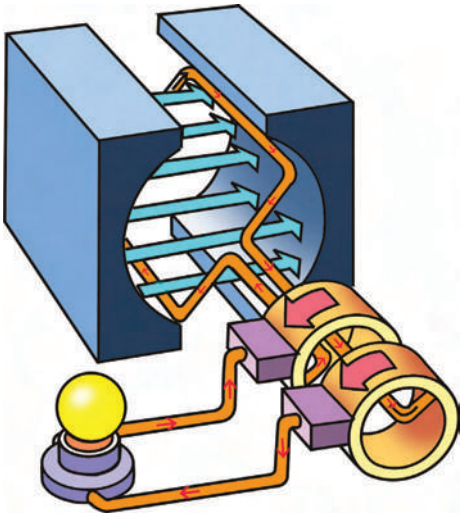
Where do we get this electricity from?

The electricity we use at home and school comes from the substation in the neighbourhood which draws power from the larger power stations. These power stations get electricity from the electrical plants. From the power station, electricity flows through cables and wires to the step up transformers where the voltage is raised to facilitate long distance travel. The substation transformers receive the current, lower the voltage and send it to pole transformers. From these transformers, electricity is supplied to homes, schools and buildings, wherever required. Inside the power stations, there are huge rotating wheels called turbines.



Turbine Fig 4.1

Each turbine is made of curved blades arranged like the sails of a windmill. These turbines are made to rotate by flowing water or steam. They are attached to the coils of electric generators.



Generator Fig 4.2

Generator

A simple generator consists of a coil of wire that rotates between the poles of a strong magnet. As the coil rotates, electric current is generated.

At Thermal power stations, steam is used to rotate the coil. Hot steam is allowed to fall on the blades of a turbine that spin and turn the shaft, which in turn makes the coil to rotate. Steam is made by heating water, burning fossil fuels like coal, oil or natural gas.

In Nuclear power stations, splitting of uranium atom produces energy to heat water and thereby produces steam, which in turn is used to rotate the turbines.

In Hydro-electric power stations, fast flowing water is used to rotate the turbines.

Tamilnadu Leads

Wind energy is an important, free, renewable, clean and non-polluting energy source. In a wind farm, huge windmills convert wind energy into electrical energy. Tamilnadu is the No.1 state in India, with the highest wind power generating capacity of about 5,000 MW. Most wind farms are in Thoothukudi, Kanyakumari and Thirunelveli Districts of Tamilnadu.

4.1. ELECTRIC CELL

Fig 4.3

The electric cell is a source of electric current. **It is a device which converts chemical energy into electrical energy.**

An electric cell has two different metal plates called electrodes kept inside a chemical called electrolyte.

Due to chemical reaction, one plate develops a positive charge and the other plate develops a negative charge and produces electric current.

TYPES OF ELECTRIC CELLS

There are two types of electrical cells.

PRIMARY CELLS:

Primary cells are intended to be used only once and then discarded. They cannot be reused as the chemicals get used up, when the cells are in use and cannot be recharged.

Example: Cells used in clocks, torches, digital watches, calculators etc.

SECONDARY CELLS (STORAGE CELLS)

Secondary cells can be recharged and reused many times. They are also called Storage cells.

Example: Batteries used in automobiles, cell phones, emergency lights etc.

The first electric cell was developed by an Italian scientist Luigi Galvani and then improved by Alessandro Volta. It has been further developed into the modern day cell or torch battery. Now, we also have rechargeable alkali cells and solar cells. These solar cells convert light energy into electrical energy.

Luigi Galvani

BATTERY SIZES IN EVERYDAY USE

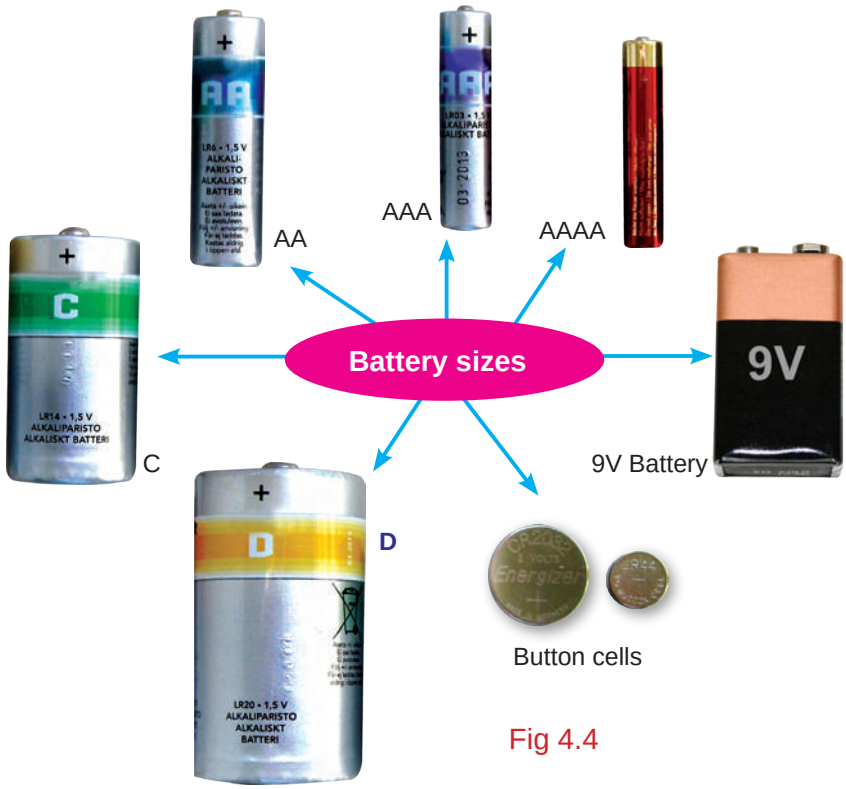


Fig 4.4

Let us observe the given pictures and group them as the appliances or devices that run on electric cells and those that do not:

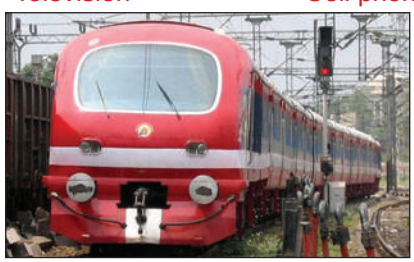

Refrigerator


Television


Cell phone


Wall clock


Microwave oven


Electric train


Calculator


Wrist watch


Computer


Electric Toy

SCIENCE

4.2. ELECTRIC CIRCUIT

An electric circuit is the continuous or unbroken closed path along which electric current flows from the positive terminal to the negative terminal of the battery.

A circuit generally has:

a) A source of electric current - **a cell or battery**.

b) **Connecting wires -** for carrying current.

c) A device that consumes the electricity - a **bulb.**

d) **A key or a switch** – This may be connected anywhere along the circuit to stop or allow the flow of current. When the current flows, the circuit is said to be closed. When the current does not flow, the circuit is said to be open.

Look at the following figures:

(a) (b) (c)

Fig 4.5

Does the bulb glow in any of these figures shown? Can you say why?

In figure (a), the source that produces electric current is missing.

In figure (b), there is no wire for the electric current to flow through.

In figure (c), the path is broken or incomplete.

So, the bulb does not glow in any of the figures shown above.

A circuit with a cell and a bulb is given here:

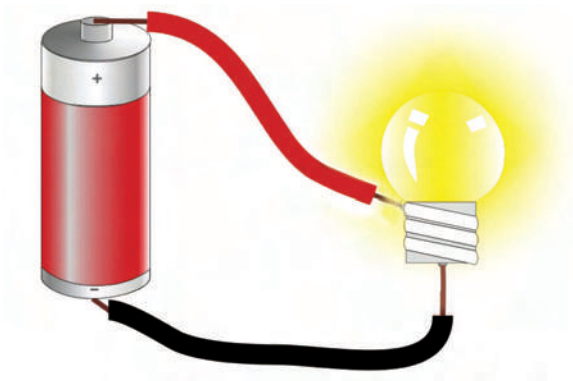
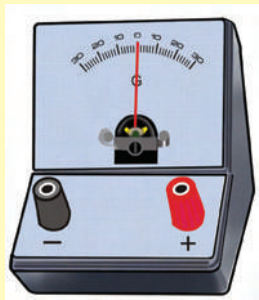


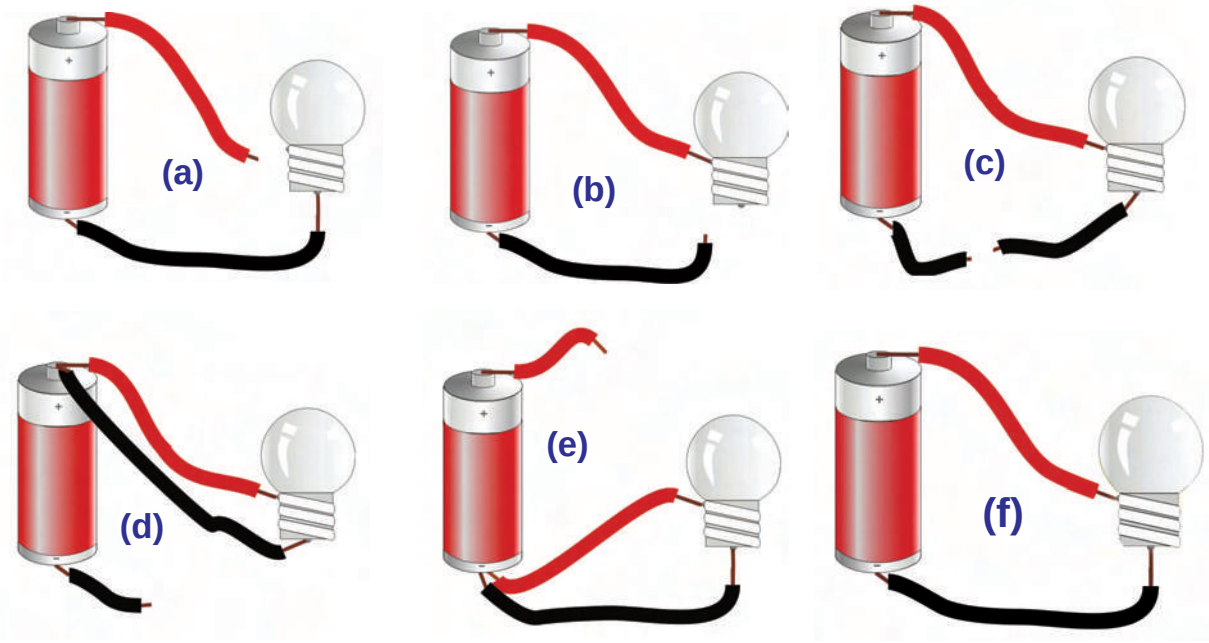
Fig 4.6

MORE TO KNOW



Galvanometer is an instrument used to detect the flow of current in electrical circuits. When current flows through the galvanometer, the needle gets deflected.

The following figures show a cell and a bulb connected in different ways. In which of these cases will the bulb glow? Give reasons.

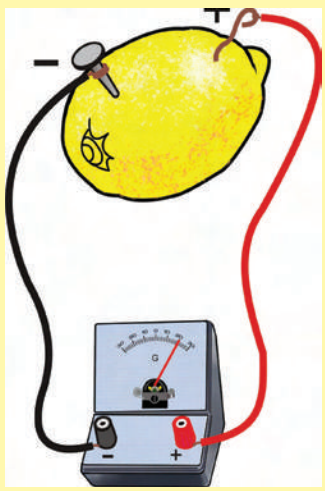


ACTIVITY 4.1 — WE OBSERVE

An electric lemon cell:

We need : a lemon, a 5cm length of copper wire, two plastic coated wires, an iron nail and a galvanometer.

1. Press the lemon on the table to make it soft and juicy.
2. Twist one end of a plastic coated wire around the copper wire and push the copper wire into the lemon. Connect the other end of the wire to one terminal of the galvanometer.
3. Wind one end of the other wire around an iron nail and push the nail into the lemon at a distance of 3 cm from the copper wire. Connect the free end to the other terminal of the galvanometer.
4. You can observe the galvanometer showing the deflection.In the lemon cell, lemon juice acts as the electrolyte, whereas the copper wire and the iron nail work as the electrodes. Since a single lemon cell can produce only very little electric current, three or four such cells should be connected together to make an LED glow.



In the above activity, the copper wire acts as the positive terminal, the iron nail as the negative terminal and the lemon juice as the electrolyte.

Try the same activity, using a potato or a beetroot instead of a lemon. Do they produce electricity?

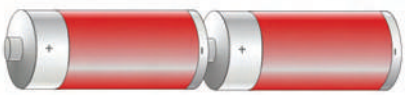
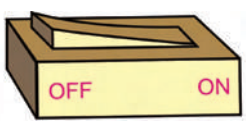
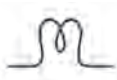
SCIENCE

Why symbols?

If you were to describe an electric circuit to someone, it is likely that you would want to draw it. It takes time to draw a circuit, because people might draw batteries, bulbs, etc., in different ways. This could be very confusing. This can be overcome by using standard symbols to draw a circuit.

4.3. SYMBOLS OF ELECTRIC COMPONENTS

The given table shows the symbols of electric components commonly used in electric circuits.

S.No.	Name of the component	Picture	Symbol	Explanation
1.	Cell			The longer line denotes the positive terminal and the shorter line denotes the negative terminal.
2.	Battery			Two or more cells when joined together form a battery
3	Switch (Key)			Switch is OFF– circuit is OPEN
				Switch is ON– circuit is CLOSED
4.	Bulb			Bulb does not glow
				Bulb glows
5.	Connecting Wire		———	used for connecting different components

4.4. ELECTRIC SWITCH

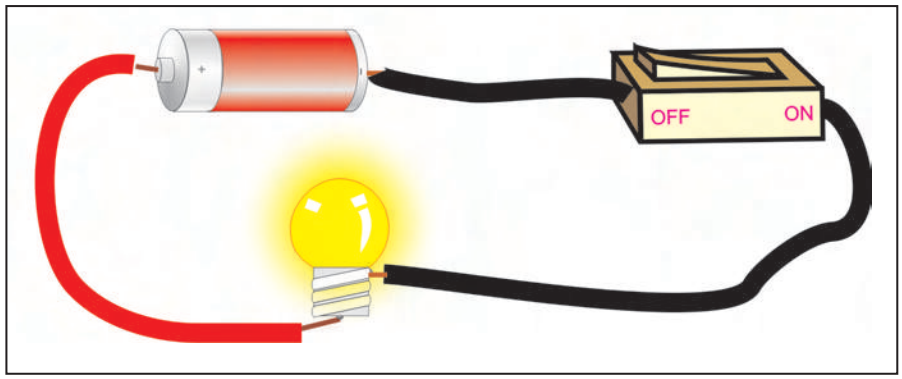
What is used to turn the light or fan ON and OFF ?

The device used is called a **switch or a key.**

An electric switch is a device that opens or closes an electric circuit.

When the switch (key) K is closed, the circuit is complete; current flows through the circuit and the bulb glows.

A circuit with the switch in the 'ON' position



Circuit with symbols (ON position)

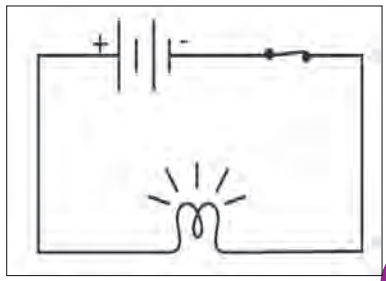
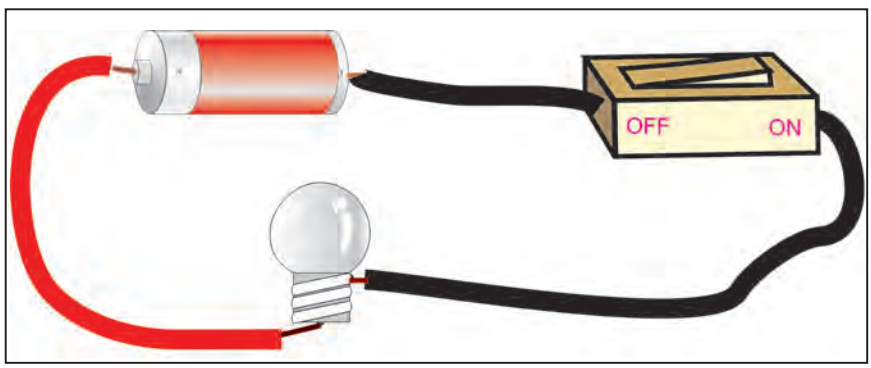


Fig 4.7

When the switch (key) K is open, the circuit is not complete; current does not flow through the circuit and the bulb does not glow.

A circuit with the switch in the 'OFF' position



Circuit with symbols (OFF position)

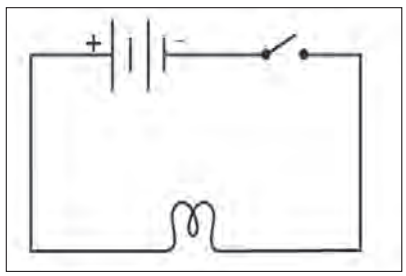
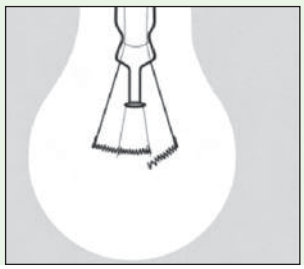


Fig 4.8

To Think...

If the filament inside the bulb is broken, will the bulb glow? Why?



SCIENCE

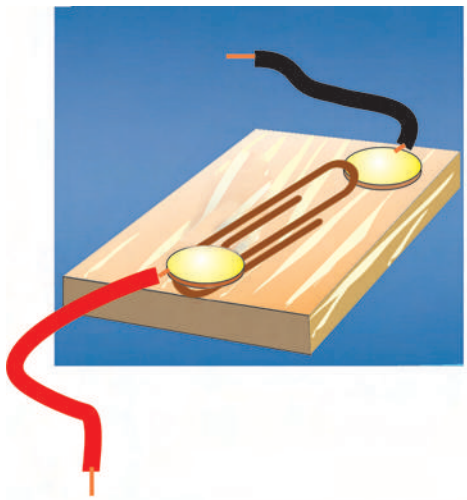
ACTIVITY 4.2 I DO

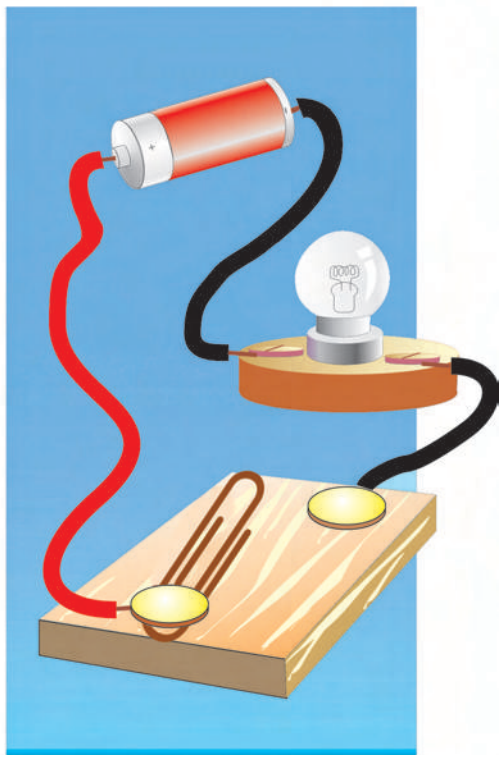
I shall make a simple switch

I need : a small block of softwood, a paper clip, two metal drawing (board) pins, 3 pieces of insulated wire, a small bulb with a holder and a battery.

1. I attach a piece of wire to each board pin. I push one pin into the flat side of the wood.
2. I push the second pin through the end loop of the paper clip and into the board. The drawing pins are about 1cm apart.
3. To test the switch, I connect the free end of one of the wires to the positive terminal of the battery.
4. I use the free wire to connect the negative terminal of the battery to the bulb holder.
5. I connect the free wire on the switch to the free screw on the bulb holder.
6. When the paper clip is turned to touch both the board pins, the bulb glows.

My switch is ready now.





Electric eel

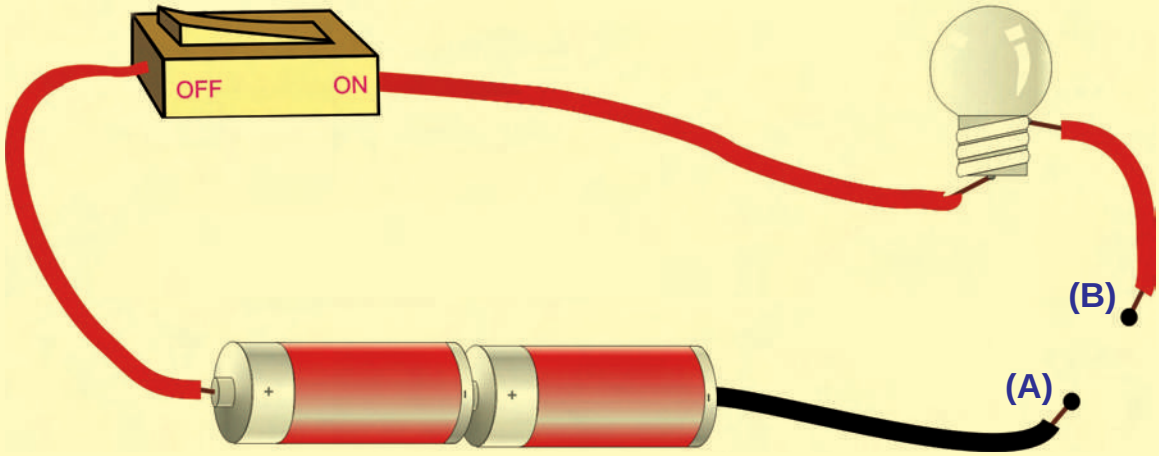
MORE TO KNOW

The Electric eel is an electric fish. It is capable of generating powerful electric shocks for hunting its prey and for self defence.

The electric eel lives in the fresh water of the Amazon and the Orinoco river basins in South America.

ACTIVITY 4.3 I DO

I need: a battery, a key, a small bulb, a plastic scale, a wooden scale, a copper wire, a metal key, a metal safety pin and a glass rod.



1. I connect the circuit as shown in the figure with the help of connecting wires.
2. I connect different materials between the points A and B, one by one.
3. I check if the bulb glows when key K is closed and I record the observation with a tick mark (✓) in the appropriate box.

S.No.	OBJECT	BULB GLOWS	BULB DOES NOT GLOW
1.	Metal key		
2.	Wooden scale		
3.	Plastic scale		
4.	Metal safety pin		
5.	Copper wire		
6.	Glass rod		

4. I see that the bulb glows when the copper wire, the metal safety pin and the metal key are connected. Now, I infer that current flows through these objects and the circuit is complete.
5. The bulb does not glow when the wooden scale, the plastic scale and the glass rod are connected. I infer that current does not flow through these materials and the circuit is incomplete.

Based on the observations of the above activity, we can classify materials as conductors and insulators.

4.5. CONDUCTORS AND INSULATORS

The materials that allow electric current to pass through them are conductors.

Examples: All metals like Copper, Iron, Silver, besides the Human body and the Earth.

The materials which do not allow electric current to pass through them are insulators.

Examples: Plastic, Wood, Rubber and Glass.

Copper wire Fig 4.9

Wood Fig 4.10

4.6. HEATING EFFECT OF ELECTRIC CURRENT

During rain storm, you must have seen bright flashes of light in the sky followed by sounds of thunder. We call these bright flashes of light as lightning. Lightning is nothing but a discharge of a huge spark of electricity between two charged clouds in the sky. When lightning strikes, it can burn trees and demolish buildings.

Burning of trees is due to the passing of electricity through them.

In an electric wire, do we see the flow of current?

In an electric wire, we do not see the flow of current. We only feel the effects of the flow of current.

Connect a thin wire between the two terminals of a battery. After a few seconds, touch it. How do you feel? Is it not hot? Yes. It is. Can we say that it has become hot due to the flow of current?

Yes we can.The current flowing through a wire produces heating effect. In higher classes you will learn, why the flow of current produces heat?

To Think...

Why do electricians wear rubber gloves and shoes while at work?

Electrician gloves

ACTIVITY 4.4 — I DO

I need:

Three 1.5V cells, three pieces of wire, a small torch bulb, insulation tape, key or switch.

1) I strip the insulation at both ends of the three wires so that about 1cm of the metal portion is exposed.

2) I connect the negative end of the cell to one end of the key with a wire and the other end of the key to the threaded portion of the bulb with another wire. I secure both ends with insulation tape.

3) I connect the positive end of the cell to the bottom portion of the bulb with the third wire.

4) I find that the bulb glows, when the key is closed.

5) I touch the bulb, when the key is not closed.

6) I close the key and allow the current to flow for some time and then touch the bulb. I find that the bulb is hot.

I infer that the bulb gets heated due to the flow of current. I realize that current produces a heating effect.

7) I allow the current to flow for a longer time. I find the bulb hotter.

So I infer that the heat produced depends on the duration of the flow of current.

8) Then I connect two cells in the circuit so that more current flows through the bulb.

I find that the heat produced is greater. With three cells, the heat produced increases further.

From the above activity, we infer that the amount of heat produced depends on the duration and the quantity of current flow.

Shall we name a few appliances that work on the heating effect of current?

Electric kettle

Used for boiling water to make tea or coffee .

Electric bulb

Used to provide light.

Electric iron

Used for ironing or pressing clothes.

Electric toaster

Used to toast bread.

SCIENCE

How is heat produced in these appliances?

All heating appliances have a wire which produces heat, when current is passed. It is known as the heating element. This is the most important part of a heating appliance.

The element is a coil of wire made of a special material called nichrome which becomes very hot when current is passed. This heat is used to cook food (as in an electric stove), heat water (as in an electric kettle, electric heater) etc.

Inside an electric bulb, is a thin coil of wire made of tungsten called filament. It gets .heated and glows, when the current flows.

MORE TO KNOW

Nichrome is an alloy of nickel and chromium.

ELECTRIC FUSE

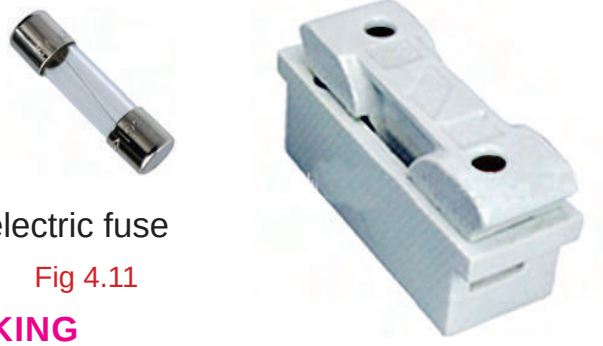
What will happen when a large amount of electric current passes through an appliance?

The wires will get overheated and the appliance will get damaged.

This situation arises as a result of some fault in the circuit and can be extremely dangerous as it could cause fire.

To prevent electric appliances from getting damaged as a result of excessive flow of current through them, a safety device called fuse is used.

The fuse is a safety device used in an electric circuit.



electric fuse

Fig 4.11

PRINCIPLE AND WORKING

The electric fuse works on the principle of heating effect of electric current.

An electric fuse consists of a wire usually placed inside a glass or a ceramic cartridge. The wire is made of a material that melts easily when heated.

It is designed such that only certain amount of maximum current can flow through it. If the flow of current exceeds this maximum amount, the heating in the wire causes it to melt. This breaks the circuit and stops the flow of current in the circuit.

The common symbol for an electric fuse : 

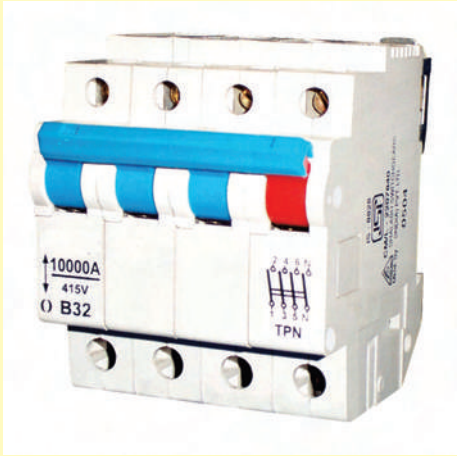
MORE TO KNOW

MINIATURE CIRCUIT BREAKER

A miniature circuit breaker is an automatically operated electric switch that protects an electric circuit during overload or short circuit.

Circuit breakers are available in different sizes, and can protect small household appliances as well as high voltage devices.

The circuit breakers have an advantage over fuses. They can be reset manually or automatically to restore normal position, whereas the fuses need to be replaced after every single operation.



4.7. MAGNETIC EFFECT OF ELECTRIC CURRENT

In the year 1820, Christian Oersted, a Danish scientist was giving a lecture in a classroom. He noticed that a magnetic needle kept on the table was not pointing in the North-South direction. He was surprised. On looking closely, he found that the needle was kept near a wire carrying current. When he took the needle away from the wire, it pointed in the North-South direction. He brought the needle near the wire once again and noticed that it deflected. Then he concluded that there is a magnetic field around the wire carrying current.

Christian Oersted

Fig 4.12.

Magnetic compass

The picture shows a compass, which has a magnetic needle pivoted at its centre, so that it can rotate horizontally.

The pivoted magnetic needle will always point in the North-South direction.

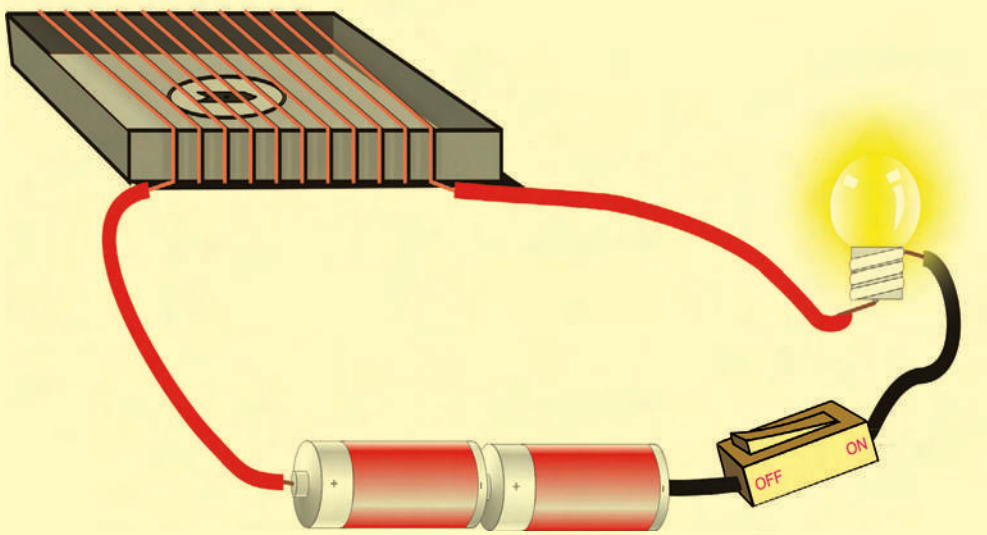
ACTIVITY 4.5 WE OBSERVE

We need:

An empty matchbox, a compass needle, two cells, a key or switch, a bulb and connecting wires

1. Let us take an empty matchbox. Place a small compass needle inside the matchbox tray.

2. Wind an electric wire a few times around the tray. Now connect the free ends of the wire to a battery through a switch, as shown in the diagram.



3. Keep the switch in the off position. Bring a bar magnet near the compass needle. We see that the needle gets deflected.

4. When you remove the magnet, the needle will come back to its original position.

5. Allow the current to flow by keeping the switch in the ON position. Does the compass needle deflect? Yes, it does.

6. Move the switch to the OFF position. Does the compass needle come back to its initial position? Yes, it does.

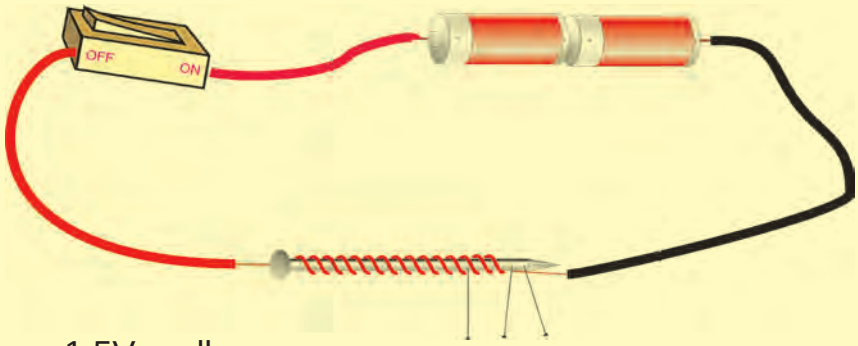
What does this experiment indicate?

It indicates that a magnetic field is produced around a current carrying conductor.

4.8.ELECTROMAGNET

ACTIVITY 4.6 **I DO**

Are magnets and electricity related?



I need: Four 1.5V cells, a copper wire, an iron nail, a key or a switch, some paper pins and connecting wires.

1) I wind a copper wire around an iron nail.
2) I connect one end of the wire to one end of the battery and the other end to the other terminal of the battery through a key, as shown in the figure.
3) I bring some pins near the nail after closing the key. I see the pins get attracted to the iron nail. I conclude that the iron nail becomes a magnet, when current is passed.
4) I now open the key and again bring the pins near the nail. The pins do not get attracted. I infer that the iron nail loses its magnetic effect, when the flow of current is stopped.
5) I repeat the activity by increasing the number of turns. I observe that the iron nail attracts more number of pins.
6) I repeat the activity by increasing the amount of current passed (by using three or four cells). I see that the iron nail attracts more number of pins.

From the above activity, I come to the conclusion that the magnetic strength of the iron nail increases, when the number of turns and the amount of current that flows increases.

A material that becomes a magnet when current is passed is called an electromagnet.

Electromagnets are used in many appliances like electric motors, telegraphs, telephones, electric bells, etc.

Many toys have electromagnets inside.

Doctors use small electromagnets to remove tiny pieces of magnetic materials that accidentally enter our eyes.

SCIENCE

4.9. ELECTRIC BELL (DOORBELL)

Have you visited any of your friend's house recently? How did you let him know of your arrival?

Did you knock at the door or ring a bell ? Wasn't it much easier to ring the bell? Let us understand how the electric bell works?

The picture of an electric bell circuit is shown:

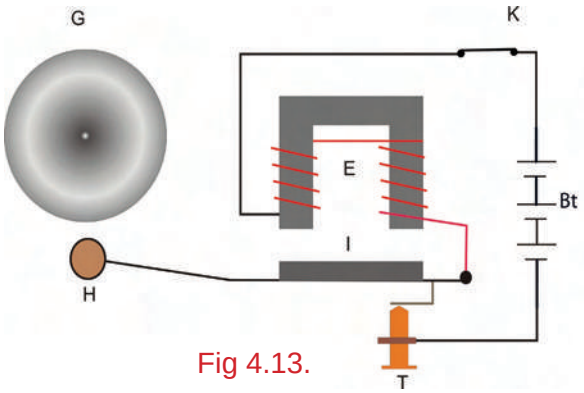


Fig 4.13.

Bt- Battery
T-Terminal
H-Hammer
G-Gong
I-Iron strip
E-Electromagnet
K-Key

Working

When the key is closed, current flows through the coil and the electromagnet gets magnetised. It pulls the iron strip and the hammer strikes the gong of the bell to produce a sound.

Now the circuit breaks and the current stops flowing through the coil. The electromagnet is no longer magnetized and the iron strip comes back to its original position. It touches the contact terminal again, completing the circuit and the process is repeated. The hammer keeps on striking the gong producing a ringing sound.

MORE TO KNOW

Huge electromagnets are used to remove iron scraps in the scrapyard.

EVALUATION

I. Choose the correct answer:

1. An electric cell converts _____.

a. chemical energy into electrical energy
b. mechanical energy into chemical energy
c. electrical energy into light energy
d. light energy into heat energy

2. The electric current flowing through the conductor produces _____ around it.

a. heat b. a magnetic field

c. a mechanical force d. all the above

3. Secondary cells _____ .

a. cannot be recharged b. cannot be reused

c. cannot be recharged or reused d. can be recharged and reused

4. Find the odd one out:

a. electric toaster b. electric fan

c. electric iron d. room heater

5. An electric fuse wire melts if the amount of current flowing through it is _____.

a. more than a minimum amount b. less than a minimum amount

c. more than a maximum amount d. less than a maximum amount

II. Fill in the blanks:

1) A drawing of an electrical circuit with standard symbols is called a/an _____. (circuit diagram / electric diagram)

2) Electric toasters and electric irons get hot when switched on because of the _____effect of current.(magnetic/heating)

3) A fuse is a _____device. (safety / heating)

4) The filament in an electric bulb is made of _____. (tungsten / nichrome)

5) A pivoted magnetic needle will always point to the _____ direction. (east - west / north - south)

III. Match the following:

1)	Electric cell	-	a) flow of charge
2)	Fuse wire	-	b) source of electric current
3)	Insulator	-	c) electromagnet
4)	Electric bell	-	d) prevents damage of electric appliances
5)	Electric current	-	e) does not allow current to pass through them

IV. Correct the following statements:

1) The longer line n the symbol for electric cell denotes the negative terminal.

2) When current is continuously passed through a bulb, it becomes cold.

3) A magnetic compass kept near a wire gets deflected.

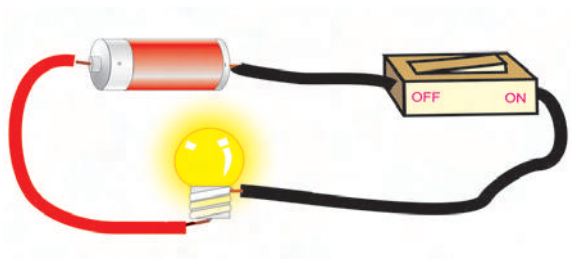
4) Conductors do not allow electric current to pass through them.

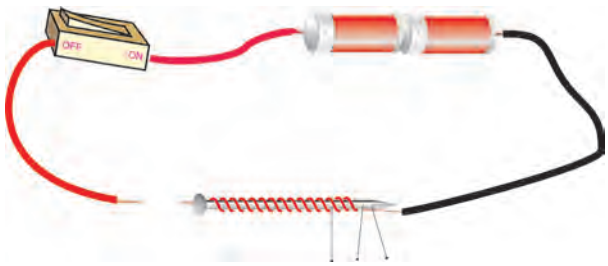
5) Plastic from scrap can be removed with an electromagnet.

V. Give reasons for the following:

1) If we touch an electric bulb that has been kept switched on for sometime, it will be hot.
2) For a fuse wire, we should choose a wire, which would melt easily.
3) If we bring a magnetic compass near an electric circuit, the needle moves.
4) Iron filings, which are attracted to an electromagnet, drop down when the electromagnet is switched off.

VI. Find out and write down what is wrong with the pictures given below:

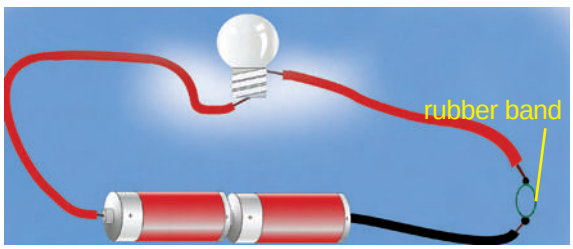




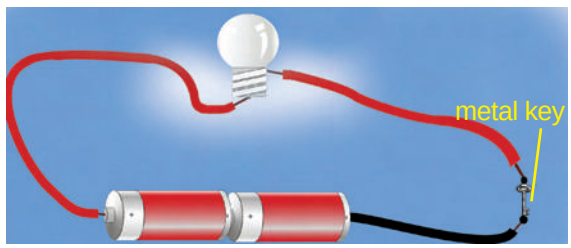
VII. You are given two cells - A and B. One is dead and the other works well. Suggest a way to identify which one is in working condition.

VIII. Observe the figures below and complete the sentences using the given options: (will glow / will not glow/ a conductor/ an insulator)

(a)

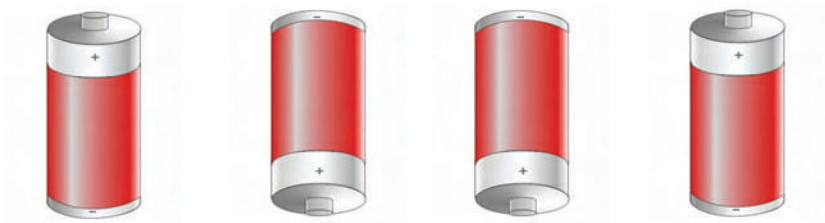


(b)



i) In figure “a”, the bulb _____, as the rubberband is _____.
ii) In figure “b”, the bulb _____, as the metal key is _____.

IX.

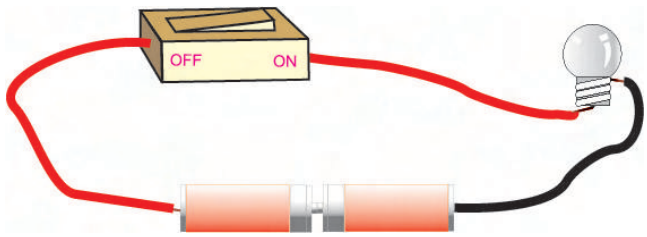


Show how these four cells can be connected to form a battery by drawing lines.

X. The symbols of electric components are given below. Use some of them to make a circuit, so that the bulb glows.

XI. Study the circuit given:

Find out the changes required to make the bulb glow. Draw the correct circuit using symbols.



PROJECTS

1. You are provided with three cells and a bulb. Connect the bulb with one cell and form a circuit See how the bulb glows. Do the same using two cells and three cells. See the variation in the glow of the bulb and record your observations by writing 'bright', 'brighter' and 'brightest' in the table.

Number of cells used	Nature of glow
One	
Two	
Three	

2. You are supplied with a long iron nail, a long insulated copper wire, 3 cells and a box of steel pins.

Make an electromagnet with 50 turns and connect it to a cell. Bring the box of pins near it. Count the number of pins attracted by the electromagnet. Repeat the experiment by using two cells and three cells.

Enter your observations in the table given below:

Number of cells	Number of pins attracted
One	
Two	
Three	

FURTHER REFERENCE

Books:

1. *Know about Science - Electricity - Anju Chawla, Dreamland Publication*

2. *Young Scientist - World Book, Inc.*

3. *New Science in everyday life - Oxford University Press.*

'I can, I did'

Student's Activity Record

Subject :

Sl. No.	Date	Lesson No.	Topic of the Lesson	Activities	Remarks