SCIENCE

(For 7th class)

T1I6G9

ਸਮੱਗਰ ਸਿੱਖਿਆ ਅਭਿਆਨ

ਪੜ੍ਹੋ ਸਾਰੇ ਵਧੋ ਸਾਰੇ

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FOREWORD

Punjab School Education Board has continuously been engaged in the preparation and review of syllabi and text books. In today's scenario, imparting right education to students is the joint responsibility of teachers as well as parents. With a view to carry out entrusted responsibility, some important changes pertaining to present day educational requirements have been made in the textbooks and syllabus in accordance with NCF 2005 and PCF 2013.

Science has an important place in school curriculum and a good textbook is the first requisite to achieve desired learning outcomes. Therefore, the content matter of class 7th has been arranged in such a manner so as to develop reasoning power of the students and to enhance their understanding of the subject. Graded questions and exercise have been included to suit the mental level of the students. While preparing the book CBSE syllabus has been followed. This step has been taken to maintain the uniformity in the Science subject so that Science students do not face any problem while appearing in the common entrance test at senior secondary stage.

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

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Contents

1 NUTRITION IN PLANTS

W1G1S6

In class VI we learnt that food is essential for all living organisms. Carbohydrates, fats, proteins, vitamins and minerals are essential components of food. They fulfil the requirements of the body and are known as **nutrients**. How do living beings take these nutrients ? Let's learn.

1.1 Nutrition

The process of obtaining and utilizing food by an organism is called **nutrition**. Nutritional habits are not same for all organisms. On the basis of food habits, nutrition is of two types:- Autotrophic and Heterotrophic.

1.2 Autotrophic Nutrition:

Organisms which make their own food from simple substances are known as autotrophs and this type of nutrition is called autotrophic nutrition. All green plants and some bacteria are autotrophs or producers.

Euglena is an organism that shows both types of nutrition, autotrophic as well as heterotrophic and has both plant and animal like characters.

Euglena

PHOTOSYNTHESIS : (Photo = Light ; Synthesis = to prepare)

Leaves of plants are called food factories of plants because synthesis of food occurs in leaves. Leaves have a green coloured pigment, called chlorophyll which helps to capture the energy of sunlight. With the help of this energy, plants convert carbon dioxide (from air) and water (from soil) into carbohydrate (glucose) and oxygen.

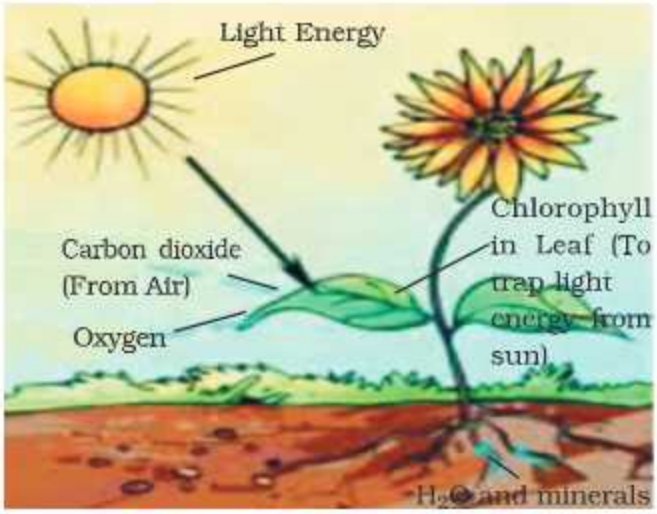


Fig 1.1 Photosynthesis

Photosynthesis is a process in which green plants prepare their own food with the help of chlorophyll in the presence of sunlight, carbon dioxide and water.

In this process green plants convert light-energy into chemical energy.

$$6CO_2 + 6H_2O \xrightarrow[chlorophyll]{sunlight} C_6H_{12}O_6 + O_2$$

Carbon dioxide + water $\xrightarrow[chlorophyll]{sunlight}$ Glucose + oxygen

Raw materials for Photosynthesis :

It is clear from the above equation that carbon dioxide and water are the raw materials for photosynthesis and are nutrally presant available in surrounings. Chlorophyll and sunlight are also essential for it.

Carbon dioxide

Carbon dioxide from air is taken through tiny pores present on the surface of leaves these pores are called **Stomata**. stomata are surrounded by **guard cells**.

Fig 1.2 Stomata with guard cells

Water and Minerals

Water and minerals are absorbed by roots from soil and then transported to other parts of plant through **xylem tissue.** You will learn more about transport of materials in plants in chapter 11.

Fig 1.3 Roots

Sunlight

Sun is the ultimate source of energy for all living organisms. During photosynthesis light energy from sun is converted into chemical energy.

Chlorophyll

The leaves are green due to the presence of a green coloured pigment called **chlorophyll**. It helps the leaves to trap sunlight. Leaves of some plants are not green in colour. This is due to the presence of additional pigment which masks the green colour. e.g. red in coleus (Fig 1.4) and purple in red cabbage (Fig 1.5), such leaves still perform photosynthesis because green coloured pigment chlorophyll is present.

Fig 1.4 Coleus

Fig 1.5 Red cabbage

Photosynthesis is a unique process as all the living organisms directly or indirectly depend upon the food prepared by plants.

Products of Photosynthesis

Oxygen gas and glucose are the initial products of photosynthesis. Glucose is further converted into starch (wheat, maize and rice etc.) for storage and oxygen gas is released in the atmosphere. Proportion of gases remain balanced in nature.

1.3 Heterotrophic Nutrition:

Organisms, which cannot prepare their own food and depend upon others, for food are called heterotrophs. This type of nutrition is called heterotrophic nutrition. All animals and few plants are heterotrophs or consumers.

Fig 1.6 Cuscuta

There are some other plants which do not have chlorophyll and cannot synthesize their own food because they lack chlorophyll. They depend upon other plants for food. Such plants are called heterotrophic plants. On the basis of nutrition; heterotrophic plants are classified as below :-

1.3.1 Parasitic Plants : Some heterotrophic plants depend on other plants and animals for food. Such plants are called parasites and the plant on which they depend is called host. e.g. Cuscuta (*amarbel or dodder*). This is a plant with yellowish thread like structures without leaves. It climbs on plants or trees, covers these plants fully and takes food from the host plant.The plant on which it climbs is called **host** and Cuscuta is called **parasite**, Cuscuta deprives the host of its nutrients. This type of nutrition is known as **Parasitic nutrition**.

1.3.2 Insectivorous Plants : There are few plants which have special structures to trap and digest inscets such plants are called insectivorous plants. e, g, the leaves of pitcher plant are modified as pitcher shaped bodies to trap the insects. The opening of pitcher is lined with downward pointing hair. When insect sits on the opening of pitcher it slips down, cannot climb back and gets trapped, It gets digested by digestive juices present in the pitcher. Such insect eating plants are called insectivorous plants e.g. picther plant.

Fig 1.7 . Pitcher plant

1.3.3. Saprophytic Plants : These are the plants that feed on dead and decaying matter. The food gets digested outside the cells or even outside the body of the organisms. The organisms secrete digestive juices directly on food. These digestive juices make the food soluble and organisms absorb it directly. e.g. Rhizopus, Yeast, Mushrooms (Agaricus) etc. This type of nutrition is called saprophytic nutrition.

Fig 1.8 (a) Rhizopus

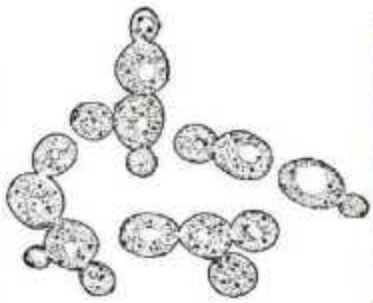


Fig 1.8 (b) Yeast cell

Fig 1.8 (c) Mushrooms

1.3.4.Symbiotic Plants : Two different kind of organisms live together and share shelter and nutrition. This is called symbiotic relationship. In this both the organisngs are benefitted from each other e.g. certain fungi live in the roots of trees. They receive shelter and nutrition from the tree and in return, they help the tree to absorb water and minerals from soil.

Fig. 1.9 Example of Symbiotic relationship

Lichen is a living example of mutual partnership between algae and fungi. The fungi absorbs water and provide shelter and in return algae provide food.

Activity 1 : To study saprophytic nutrition

Material required : Bread slice, magnifying glass or dissecting, microscope

Method : Dip a slice of bread in water. keep it in warm and moist place for 2-3 days until it starts decomposing and you see cotton like structures (spots) on it. These structures may be of white, green, brown or any other colours.

Obsevation : You will obseve cotton like structures of many colours.

Conclusion : These cotton like structures are saprophytic plants. They take their nutrition from decaying bread.

1.4 How Nutrients are replenished in the soil?

Plants absorb water, minerals and nutrients from the soil. These nutrients need to be replenished in to the soil so that soil remains fertile. Farmers usually enrich the soil by adding manures and fertilizers (materials that contain one or more nutrients).

But in forests, no one goes to add fertilizers. The decomposers decompose dead leaves and animal matter which in turn enrich the soil.

Rhizobium is a bacterium that lives in the roots of leguminous plants. It converts atmospheric nitrogen into usable form which is utilized by plants and in return plant provides shelter to this bacterium.

KEYWORDS

- Nutrients
- Autotrophic
- Heterotrophic
- Saprophytic
- Parasitic
- Photosynthesis
- Chlorophyll
- Carbohydrate
- Stomata
- Host
- Lichen
- Fertilizer
- Rhizobium

Points to Remember

- *All components of food which are necessary for our body are called nutrients.*
- *The process of obtaining and utilizing food is known as nutrition.*
- *There are two types of nutrition: autotrophic and heterotrophic.*
- *Autotrophs are organisms which make their own food from simple substances.*
- *Heterotrophs are organisms which depend on others for their food.*
- *Heterotrophs are divided into four categories: Saprophytes, Parasites, Insectivores and Symbiotic.*
- *Organisms which depend upon dead and decaying matter for their food are called Saprophytes.*
- *Organisms which derive nutrition from the body of other living organisms are called Parasites.*
- *In symbiotic relationship two organisms live in close association and develop relationship that is beneficial to both organisms.*
- *Insectivorous plants feed on small insects.*
- Symbiotic relationship involves mutual benefit of two different kind of organisms, living together for shelter and nutrition.

Exercise

1. Fill in the Blanks:

(i) The process of obtaining and utilization of food by an organism is called ..... .

(ii) ..... from the air is taken in through the tiny pores called stomata present on the surface of leaves .

(iii) ..... is the initial product of photosynthesis.

(iv) The plants which depend on the food produced by other plants are called ..... .

2. State true or false:

(i) Carbohydrate is not an essential component of food.

(ii) All green plants are autotrophs.

(iii) Euglena is an organism that has both plant and animal like characters.

(iv) Sunlight is not necessary for photosynthesis.

3. Match the following :

A	B
(i) Agaricus	A Parasite
(ii) Rhizobium	B Leaves
(iii) Chlorophyll	C Leguminous plants
(iv) Cuscuta	D Saprophyte

4. Choose correct option :

(i) An Organism that fixes atmospheric nitrogen in the soil is

(a) Amarbel ☐ (b) Mushroom ☐

(c) Rhizobium ☐ (d) Chlorophyll ☐

(ii) The Organisms that cannot prepare their own food and depends on others for food are known as

(a) Autotrophs ☐ (b) Heterotrophs ☐

(c) Nutrients ☐ (d) Minerals ☐

(iii) Food factory of the plants is

(a) Leaf ☐ (b) Stem ☐

(c) Root ☐ (d) Flower ☐

(iv) Which of the following is a saprophyte ?

(a) Rhizobium ☐ (b) Agaricus ☐

(c) Cuscuta ☐ (d) Protein ☐

5. Very Short Answer Type Questions:

(i) Define Nutrition?

(ii) What is Photosynthesis?

(iii) Name the raw materials required for photosynthesis?

(iv) What are insectivorous plants?

6. Short Answer Type Questions:

(i) What do you mean by parasitic mode of nutrition?

(ii) Explain symbiotic relationship.

(iii) How does pitcher plant catch insects?

7. Long Answer Type Questions:

(i) How are nutrients replenished in the soil?

(ii) What do you mean by nutrients? Explain various modes of nutrition in plants.

2 NUTRITION IN ANIMALS

You have learnt in chapter 1 that plants can make their own food but animals cannot. Animals get their food either directly or indirectly from the plants. Animals eat complex food materials and break down into simple form. Nutritional requirments, mode of intake of food and the way of utilization in the body is different in different animals.

You have already studied in class VI that on the basis of their food habits, animals are categorised into three types:-

1. Herbivores : The animals that eat only plants are called herbivores. e.g. cow, deer, goat, buffalo etc.

Fig 2.1 Herbivores

2. Carnivores : The animals that eat other animals are called carnivores. e.g. lion, tiger etc.

Fig 2.2 Carnivores

c. Omnivores: The animals that eat both plants as well as animals are called omnivores. e.g. Man dog and bear etc.

Fig 2.3 Omnivores

2.1 Modes of Food Intake

The methods of intake of food are different in different organisms. e.g. sparrow has a short beak to pick up seeds and worms while humming bird has long and tubular beak to suck nectar from flowers, snake like python, swallows the animals it preys upon.

Fig 2.4 (a) Humming bird

Fig 2.4 (b) Sparrow

Modes of Nutrition

We have studied in previous chapter that animals are heterotrophs as they cannot synthesize their own food. Their nutrition has further three types:

1) Saprophytic nutrition : In this type of nutrition organisms obtain food from dead and decaying matter. They secrete enzymes and digest organic food

Fig 2.5 Saprophytic nutrition

and absorb it in the form of soluble organic compound. This digestion is called **extracellular digestion**. e.g. Fungi and soil bacteria.

2) Parasitic Nutrition: In this type of nutrition organisms (parasite) obtain food from some other living organisms (host). Parasite may live on (ectoparasite) or in the other living organisms (endoparasite). e.g. round worm, tapeworm, lice, leech, etc.

Fig 2.6 : Round worm

Fig 2.7 : Tape worm

3) Holozoic Nutrition : In this type of nutrition food is taken into the body and then broken down into simple soluble compounds which are absorbed by the body. e.g. Amoeba and human beings.

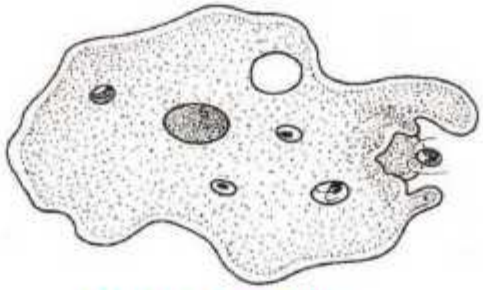


Fig 2.8: Amoeba

2.2 Nutrition in Human Beings

Humans depend upon plants and animals for food. The various steps involved in this process are as follows:

1) Ingestion: The process of taking food into the body is called Ingestion. Teeth help in chewing the food.

2) Digestion: It is the process in which complex substances break down into simple substances. Certain chemicals (which are released in our body) help in this process are called as enzymes. Digestion starts from the mouth (buccal cavity) and is completed in the small intestine.

3) Absorption: Digested food is absorbed by the walls of small intestine and then passed into the blood.

4) Assimilation: In this process absorbed food is utilized by different parts of body for growth and maintenance.

5) Egestion: The undigested food gets eliminated from the alimentary canal. This process is called Egestion.

Human Digestive System

The human digestive system consists of the following parts:

Mouth and Buccal Cavity:

There is a long alimentary canal present inside our body. This canal begins from the mouth and ends at the anus. The food is broken down from complex substances to simple compounds by various enzymes present in it. Then these simple compounds are carried by blood to different parts of body.

Food is taken in through the mouth from where it goes into the buccal cavity, Here food is chewed with the help of different types of teeth, and **saliva** is mixed with food. Saliva is produced by salivary glands in mouth, which contain enzyme called salivary amylase that breaks down startch into sugar. The tongue rolls and pushes this food into oesophagus.

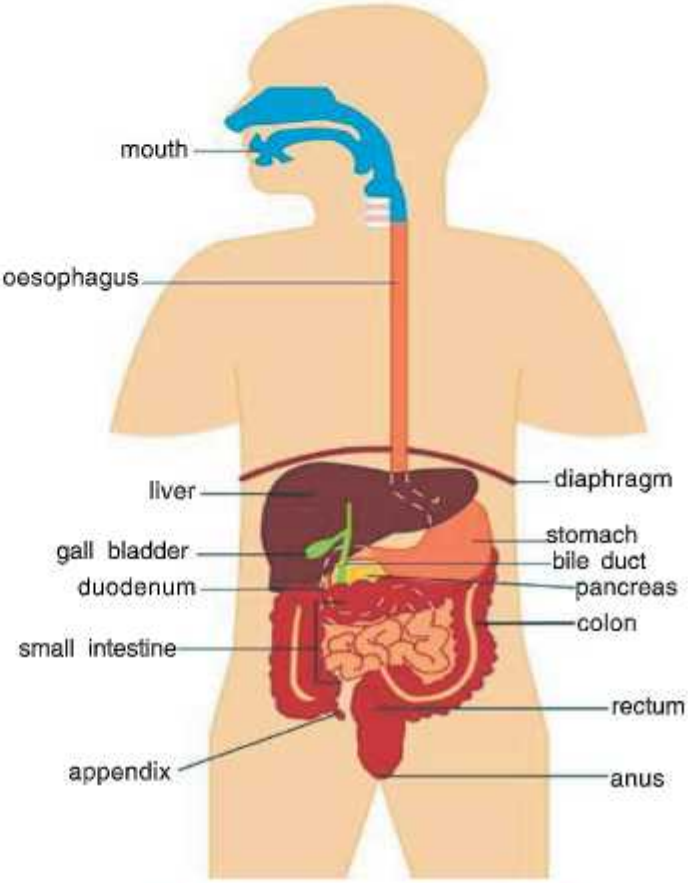


Fig 2.9 Human Digestive Systen

Activity 1 : To study the effect of chewing on starch.

Material Required: 2 Test Tubes, dropper, boiled rice, Iodine solution, water.

Method:- Take two test tubes, dropper, water, boiled rice and iodine solution. Put boiled rice in test tube A, add some water and then add few drops of iodine solution. Note the colour change in test tube A. Now put boiled rice in your mouth and chew it properly for 2 to 3 minutes till it tastes sweet to you. Now put this paste of chewed rice in test tube B. Add some water and iodine solution in it. Note the colour change.

Observation : You will see that colour of rice in test tube A turns blue/ violet but there is no colour change in test tube B.

Conclusion : This shows that chewing and mixing of boiled rice with saliva turn starch into sugar which does not give test of starch.

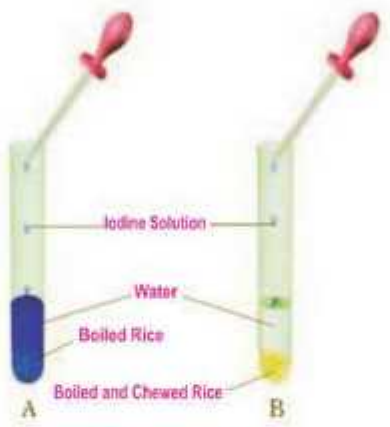


Fig 2.10

Think And Answer

1. Name the solution secreted by the salivary glands of mouth?
2. What changes are seen in starch on adding iodine solution?
3. In which form the starch is converted after digestion in mouth?

Teeth :

Teeth are fitted in the jaw. They are covered by strong protective material called **enamel**. The enamel is the hardest substance in our body.

An adult human has 32 teeth i.e. 16 in upper jaw and 16 in lower jaw.

Human beings develop two sets of teeth in their life span. The first set has 20 small teeth also called as milk teeth. They grow during infancy and fall off at the age between six to eight years. Milk teeth are replaced by permanent teeth (32). They are of four types that perform different functions in humans.

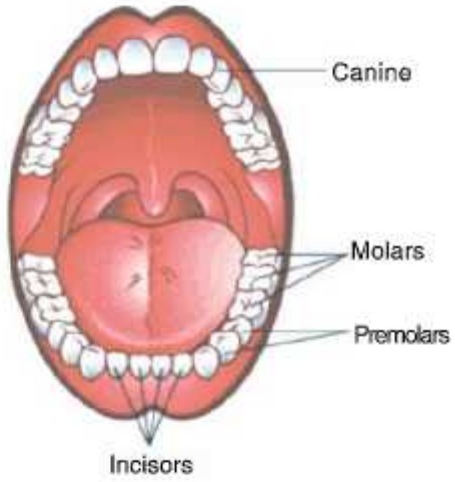


Fig 2.11 Types of Teeth

- **Incisors** :- Used for cutting.
- **Canines** :- Used for tearing.
- **Premolars** :- Used for chewing and grinding.
- **Molars** :- Also used for grinding.

Dental Caries

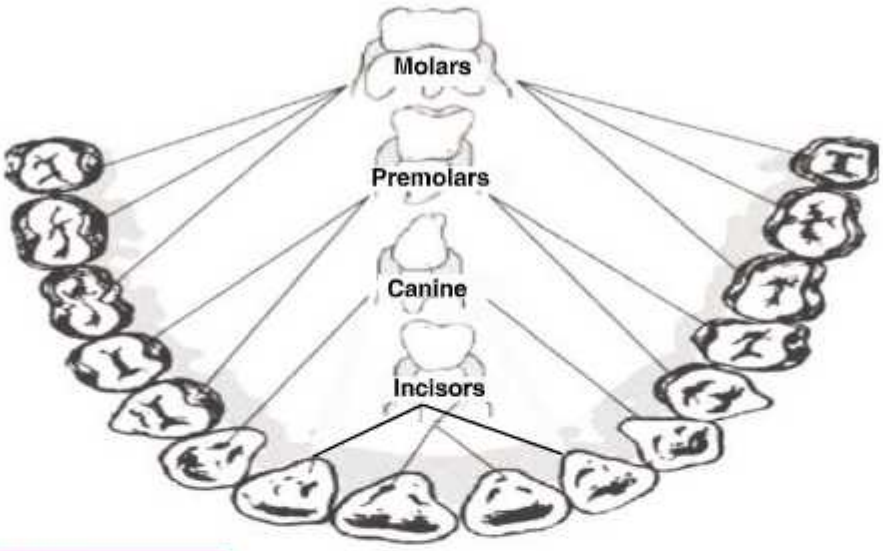
Eating too much sweets and poor teeth cleaning invite harmful bacteria which may damage our teeth. If we do not brush/clean our teeth the food particles left in teeth are decomposed by bacteria which produce acids. These acids destroy enamel of teeth and cause dental caries. So we must clean our teeth after every meal or sweets especially after night meal.

Activity 2 : To study various types of teeth.

Select four to five members of different age groups from your family or neighbourhood. (0-6, 6-10, 10-20, 20-30 years and above). Count the teeth of each person by touching with handle of spoon, note down the number and complete the following table :

Age Groups	Teeth present in upper and lower jaws and their counting				
	Incisors	Canines	Premolars	Molar	Total Teeth
0 to 6					
6 to 10					
10 to 20					
20 to 30					
Above 30					

You will note that infants or children below 6 years have only few teeth such as incisors, canines and premolars. These are called milk teeth. A boy/girl of age around 10 years will have 18 to 20 teeth in his/her mouth. (Some may have missing teeth also. These teeth are replaced by permanent teeth) At age around 30 years (Adults) you will find all types of teeth present in jaws. Persons above the age of 50 years or above may loose premolars or molars.



Think and Answer

1. Give other name for cutting teeth.
2. Which age group has both premolars and molars?
3. What is the maximum number of teeth present in an adult?

Tongue

The tongue is a fleshy, muscular organ attached to the floor of buccal cavity. It is free at the front to move in different directions. It helps in chewing and mixing up the food with the saliva. It has four types of taste buds. i.e. sweet, sour, bitter and salty.

Activity 3 : To study various taste buds on tongue

Material Required : A dropper, sugar solution, salt solution, bitter gourd juice, lemon juice.

Method : Make four solutions containing sugar, salt, bitter gourd juice and lemon juice. Select four students of your class and blindfold them. Take a dropper with sugar solution in it. Ask one student to protrude his tongue and put one drop of sugar solution on back side, one drop on front side, one drop each on lateral sides. Ask him/her where he feels the taste of sugar? Similarly, repeat this with other solutions on each of four students. And note where they feel, sweet sour, salty and bitter taste.

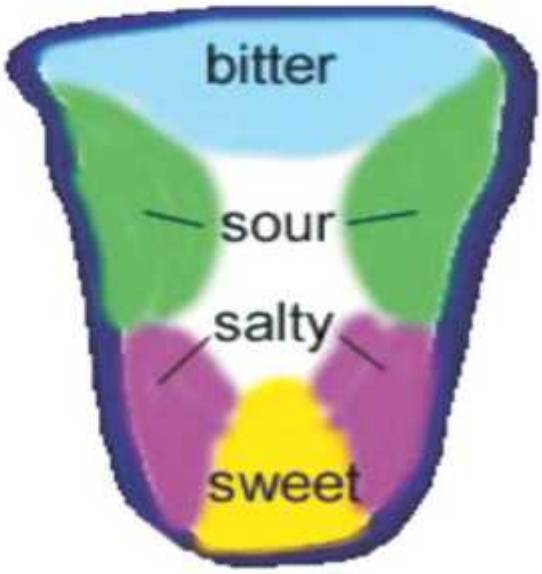


Fig 2.13 Taste buds on tongue

Think and Answer

1. At which region of the tongue sour taste is felt?
2. Why don't we feel bitter taste at front part of the tongue?

Oesophagus

It is a long muscular tube which connects buccal cavity to the stomach. Food is pushed down by the movements of muscular wall of food pipe or oesophagus into the stomach.

Stomach

It is a thick walled and sac like muscular organ. It is the widest part of alimentary canal. Inner lining of stomach secretes mucous, hydrochloric

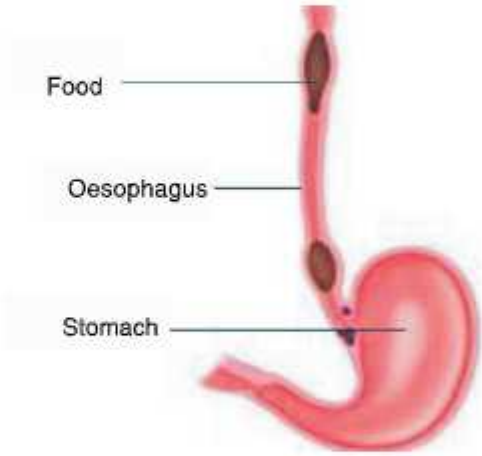


Fig 2.14 Oesophagus and Stomach

acid and digestive juices. Acid kills many bacteria and also provides acidic medium for the digestion of proteins by enzymes present in the digestive juices. So some parts of food are digested.

Small intestine

It is highly coiled and about 6 to 7 meter long. It helps in further digestion by using three types of secretions.

1) Secretion from Liver :- Liver is the largest gland in our body. It secretes bile juice, which is stored in gall bladder. Bile helps in digestion of fats.

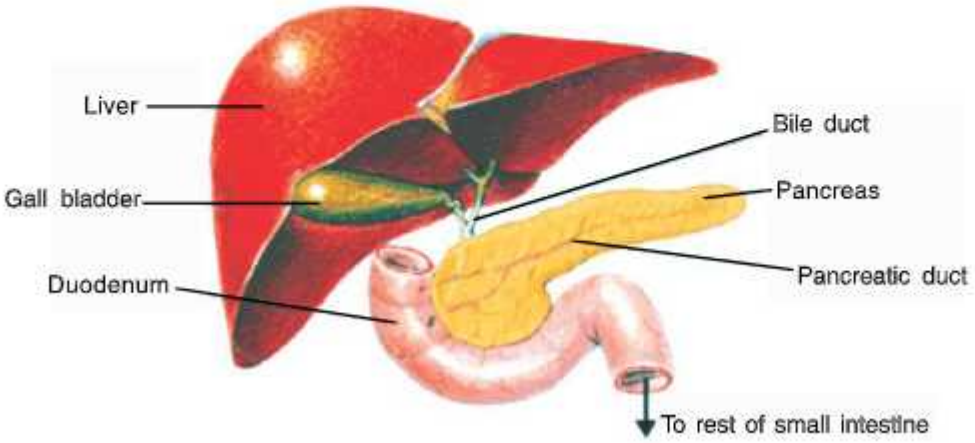


Fig 2.15: Liver and Pancreas

2) Secretion from Pancreas :- It is a yellow leaf shaped gland located just below the stomach. It secretes pancreatic juice that helps in digestion of fats, carbohydrates and proteins.

3) Secretion from small intestine :- It secretes intestinal juices which digest all components of food. Carbohydrates get broken down into glucose, fats are converted into fatty acids and proteins into amino acids.

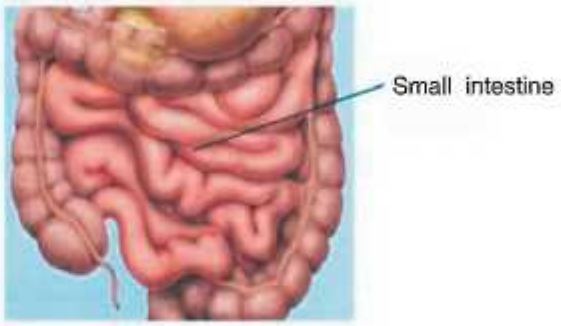


Fig 2.16: Small intestine

Absorption of digested food in small Intestine

Now digested food passes into the blood vessels of intestine. This process is called **absorption**. A number of finger like small projections called villi are present on the inner wall of small intestine. These villi increase the area of

absorption of food. Each villus has network of thin and small blood vessels which is close to its surface. This absorbed food is transported to different parts of body through blood. This is called **assimilation**.

Large Intestine :

The large intestine is wider and shorter than small intestine. It is about 1.5 meter in length. It absorbs excess water and some salts from undigested food. And then undigested food passes into the rectum and remains there as semi solid faeces. Faeces are eliminated through the anus. This process is called as **egestion**.

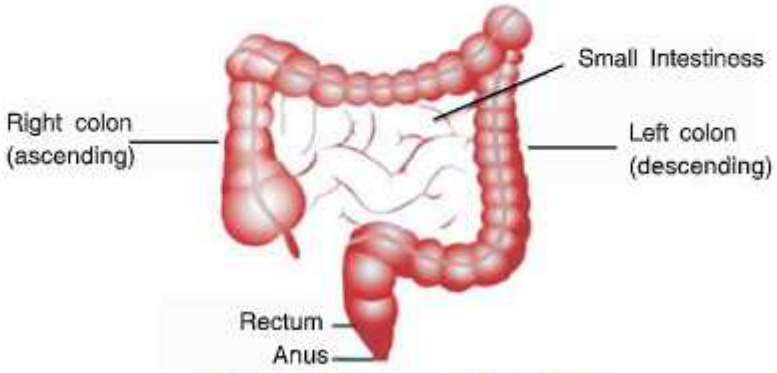


Fig 2.17 Large Intestine

2.3 Digestion in Grass Eating Animals

Grass eating or cud chewing animals are called as **ruminants**. Cow, Deer, Camel and Buffalo etc. are examples of ruminants.

They have specially four chambered stomach. The first chamber is **rumen** which is the largest part of the stomach. Animals first swallow food quickly and store it in this part of stomach. Here food gets partially digested. This partially digested food is known as **cud**. Later the cud returns to the mouth in the form of lumps and animals chew it. This process is known as **rumination** and such animals are called as **ruminants**. During rumination food is broken down from cellulose into simpler compounds. This is then digested in liquid form in the rest of three chambers. Ruminants have sac like

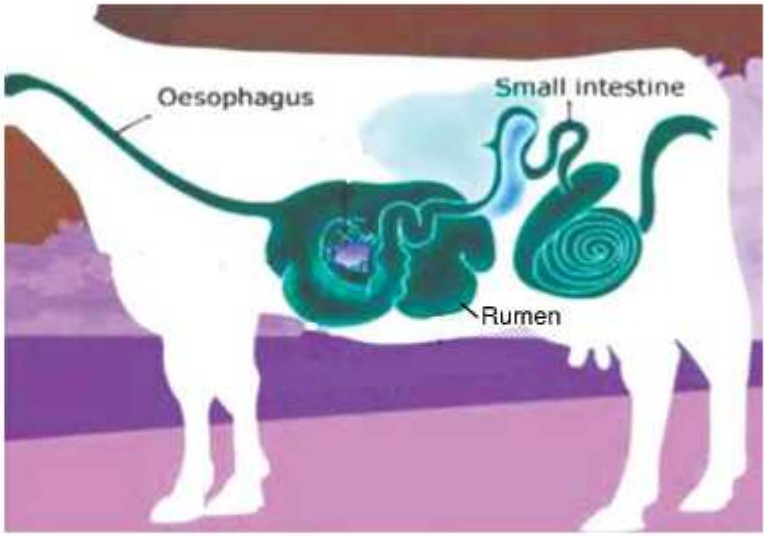


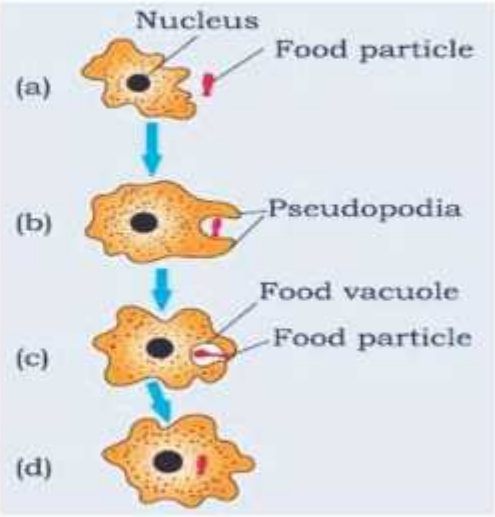
Fig 2.18 Digestive system in Ruminant

structures between small intestine and large intestine known as **caecum**, where some bacteria are present that help in digestion of food.

2.4 Nutrition in Amoeba

Amoeba is a microscopic unicellular organism found in ponds and lakes.

It is surrounded by cell membrane and move with the help of false feet called **pseudopodia**. These are outward projections which help in movement and capturing of food, when it comes in contact with food particle. During **ingestion**, cell membrane of amoeba (in pseudopodia) fuses with food particle and food vacuole is formed and then digestive juices are secreted in this food vacuole and nutrients get absorbed. After that undigested food present in food vacuole is expelled out from the body of amoeba. This is called **egestion**.



KEYWORDS

Carnivores	Assimilation	Oesophagus
Omnivores	Egestion	Gall Bladder
Ingestion	Buccal Cavity	Bile
Digestion	Enamel	Cud
Absorption	Mucous	Ruminants
		Pseudopodia

Points to Remember

- Nutrition in animals include nutritional requirement, mode of intake of food and its utilization in the body
- In animals process of nutrition involves Ingestion, Digestion, Absorption, Assimilation and Egestion.
- The human digestive system consists of Buccal cavity, Oesophagus, Stomach, Small Intestine, Large Intestine, Rectum and Anus.
- There are four types of teeth present in humans, Incisors, Canines, Premolars and Molars.

- Digestion begins in buccal cavity and continues till small intestine.
- Absorbed substances are transported to different parts of body through blood.
- Water and some salts are absorbed in the large intestine.
- Undigested and unabsorbed residue in the form of faeces is stored in rectum and is eliminated through anus.
- Cud chewing animals are called as ruminants. They first quickly swallow food and store it in rumen and then return it to mouth in the form of cud and then chew it thoroughly.
- Amoeba ingests food with the help of false feet called as pseudopodia.

Exercise

1. Fill in the blanks:

(i) The animals that eat both plants as well as animals are called ..... .

(ii) ..... of the food in human beings start in mouth and is completed in the ..... .

(iii) ..... is the largest gland in human beings.

(iv) The large intestine absorb excess ..... and ..... from undigested food.

2. State true/false.

(i) The tongue helps in mixing of food with saliva. (T/F)

(ii) In humans digestion is completed in the stomach. (T/F)

(iii) Cud chewing animals are called ruminants. (T/F)

(iv) Amoeba capture food particle with the help of pseudopodia. (T/F)

3. Match the column.

A		B
(i) Ruminant	a	Bile
(ii) Carbohydrate	b	Store undigested food
(iii) Gall bladder	c	Glucose
(iv) Small intestine	d	Cow
(v) Rectum	e	Digestion is completed

4. Choose correct option:

(i) Animals that eat only plants are called :

(a) Carnivores ☐ (b) Herbivores ☐

(c) Omnivores ☐ (d) Saprophytes ☐

(ii) Extracellular digestion occurs in :

(a) Parasites ☐ (b) Carnivores ☐

(c) Saprophytes ☐ (d) Herbivores ☐

(iii) The process of taking food into the body is called :

(a) Ingestion ☐ (b) Digestion ☐

(c) Absorption ☐ (d) Egestion ☐

(iv) Secretion of Liver is :

(a) Proteins ☐ (b) Bile ☐

(c) Carbohydrates ☐ (d) Saliva ☐

(v) Nutrition in Amoeba is :

(a) Parasitic ☐ (b) Holozoic ☐

(c) Saprophytic ☐ (d) Assimilation ☐

5. Very Short Answer Type Questions:

(i) What is holozoic nutrition?

(ii) What do you mean by absorption?

(iii) Define assimilation?

(iv) Name the parts of alimentary canal?

6. Short Answer Type Questions:

(i) What do you mean by milk teeth and permanent teeth?

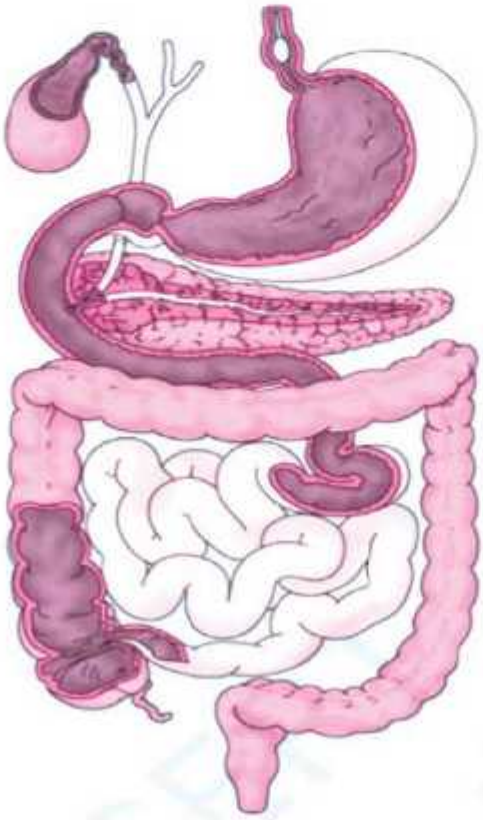
(ii) Write four types of human teeth and their functions?

7. Long Answer Type Questions:

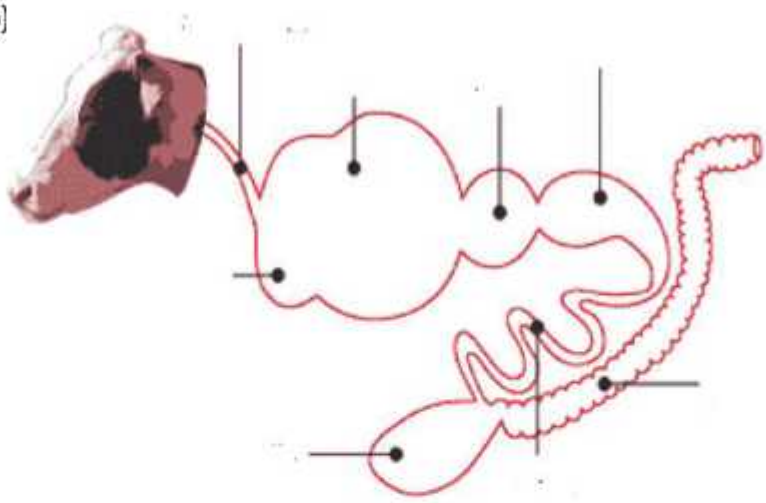
(i) Explain nutrition in Amoeba with the help of a diagram.

(ii) Label the following diagrams.

(a)



(b)



3 FIBRE TO FABRIC

Fibre to Fabric

In class VI we have learnt that there are two kinds of fibres-Natural and Synthetic fibres. Lets have a quick look on them with the help of figure 3.1. We know that fibres are long, strong and flexible thread like structures that are used to make fabrics.

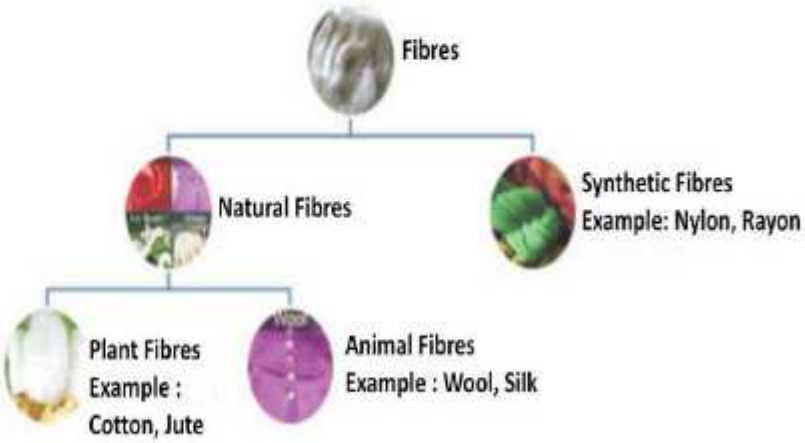


Fig 3.1 Kinds of Fibres

Natural Fibres are obtained from plants and animals. Cotton and jute are obtained from plants and are called plant fibres. Wool and silk fibres are obtained from animals and are called animal fibres. Wool is obtained from the fleece (hair) of sheep, goat, yak and some other animals (fig 3.2). Silk fibres come from cocoons of the silk moth. Nylon, Terylene, Rayon, etc are few examples of synthetic fibres or human made fibres.

(a) Sheep

(b) Wool

(c) Silk Cloth

(d) Silk moth

Fig 3.2 Animal Frbres

Do you know which part of the sheep's body yields fibres? Do you know how these fibres are converted into the woollen yarn that we buy from the market to knit sweaters? Do you have any idea how silk fibres are made into silk, which are woven into saris? In this Chapter we shall try to find answers to these questions.

Animal fibres --Wool and Silk

3.1 Wool:

Wool comes from sheep, goat, yak and some other animals. These wool-yielding animals bear hair on their body. Do you know why these animals have a thick coat of hair? Hair trap lot of air. Air is a poor conductor of heat, it does not allow the body heat to escape and keep the body warm as you would learn in Chapter 4. That's is why, woolen clothes are worn in winters. Wool is derived from these hairy fibres.

The fabrics made from wool have ability to retain shape better than the fabric made from other natural materials. It has a high tensile strength and has high elasticity. It can absorb a large amount of water and can be dyed easily.

Activity 1 :

Feel the hair on your body and arms and those on your head. Do you find any difference? Which one seems rough and which one are soft?

Fig 3.3 (a)

Fig 3.3 (b)

Like us, the hairy skin of the sheep has two types of hair that form its fleece: (i) the rough beard hair, and (ii) the fine soft under-hair close to the skin. The fine hair provide the fibres for making wool. Some breeds of sheep possesses only fine under-hair. In case of animals, breeding is done to obtain animals with desired characterisitics. The two individuals of desirable characteristics are selected as

parents. These are then made to reproduce to obtain new breed of animals having desired characters of both the parents. This is called **Selective Breeding**. With the help of this process the sheep parents are specially choosen to give birth to sheep which have only soft under hair and thus high yield breeds of sheep are raised.

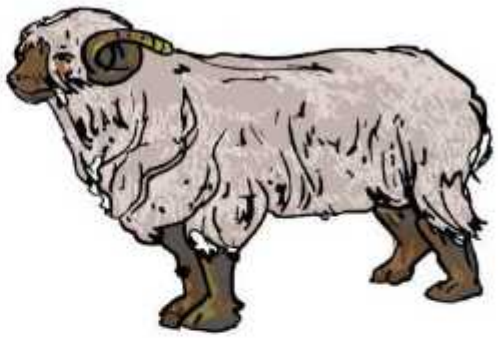


Fig 3.4 Sheep

Animals that yield wool

Several breeds of sheep are found in different parts of our country (Table 3.1). However, the fleece of sheep is not the only source of wool, though wool commonly available in the market is sheep wool. Yak [fig 3.5 (a)] is common in Tibet and Ladakh. Wool is also obtained from goat hair. Angora wool is obtained from angora goats, (fig 3.5 (b)) found in hilly regions such as Jammu and Kashmir. The under fur of Kashmir goat fig 3.5 (c) is soft. It is woven into fine shawls called Pashmina shawls. The fur on the body of camels is also used as wool [fig 3.5 (d)]. Alpaca and Llama found in South America, also yield wool [fig 3.5 (e) & (f)]. The names of some of the breeds of sheep in our country along with the quality and state where these sheep are found is given in the table 3.1.

Table 3.1 : Breeds of Sheep found in different states of India

Sr.No.	Name of Breed	Quality of Wool	State where found
1.	Lohi	Good quality wool	Rajasthan, Punjab
2.	Rampur Bushair	Brown fleece	Uttar Pradesh, Himachal Pradesh
3.	Nali	Carpet wool	Rajasthan, Haryana, Punjab
4.	Bakharwal	For woollen shawls	Jammu and Kashmir
5.	Marwari	Coarse wool	Gujarat
6.	Patanwadi	For hosiery	Gujarat

Fig 3.5 (a) Yak

Fig 3.5 (b) Angora Goat

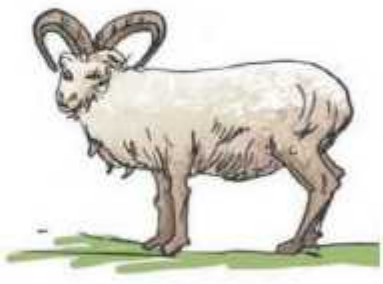


Fig 3.5 (c) Kashmiri Goat

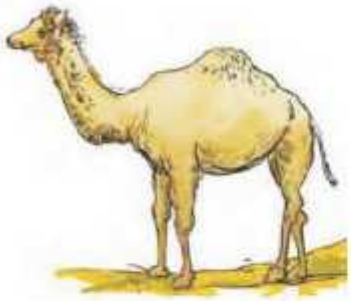


Fig 3.5 (d) Camel

Fig 3.5 (e) Alpaca

Fig 3.5 (f) Llama,

Think and Answer:

1. Name any two natural fibres obtained from plants.
2. Name any two natural fibres obtained from animals.
3. Name any three animals which provide us wool.
4. Why do some animals have a thick coat of hairs?

Activity 2 :

Procure outline map of India and the World. Find out and mark the places on the map where you find the animals that provide you wool. Use different colours to denote the location for different wool yielding animals.

Fig 3.6 (a) Map of India

Fig 3.6 (b) Physical map of world

From fibres to wool

For obtaining wool, sheep are reared. Their hair is cut and processed into wool. Let us learn about this process.

Rearing and breeding of sheep: If you travel to the hills in Jammu & Kashmir, Himachal Pradesh, Uttaranchal, Arunachal Pradesh and Sikkim, or the plains of Haryana, Punjab, Rajasthan and Gujarat, you can see shepherds taking their herds of sheep for grazing. Sheep are herbivores and prefer grass and leaves. Apart from grazing sheep, rearers also feed them on a mixture of pulses, corn, jowar, oil cakes (material left after taking out oil from seeds) and minerals. In winter, sheep are kept indoors and fed on leaves, grain and dry fodder.

Sheep are reared in many parts of our country for wool. Table 3.1gives the names of some breeds of sheeps reared in our country for producing wool. The quality and texture of the fibres obtained from them is also indicated in the table.

Certain breeds of sheep have thick coat of hair on their body which yields good quality wool in large quantities. As mentioned earlier, these sheep are "selectively breeded" with one parent being a sheep of good breed.

Once the reared sheep have developed a thick growth of hair, then, these hair are shaved off for getting wool.

Processing fibres into wool

The wool which is used for knitting sweaters or for weaving shawls is the finished product of a long process, which involves the following steps:

(i) Shearing (ii) Scouring (iii) Sorting

(iv) Combing (v) Dyeing (vi) Spinning

Step I : Shearing : When a sheep develops a thick coat of hair, it is sheared off to get fleece. The fleece of the sheep along with a thin layer of skin is removed from its body (fig. 3.7). This process is called **shearing**. Machines similar to those used by barbers are used to shave off hair.

Fig 3.7 : Shearing a sheep

Usually, hair are removed during the hot weather. This enables sheep to survive without their protective coat of hair. These hair provide woollen fibres, which are then processed to obtain woollen yarn. Shearing does not hurt sheep just as it does not hurt when someone get a hair cut or shaves his beard. Do you know why? The uppermost layer of the skin of sheep is made of dead cells. Also, the hair of sheep grows again just as your hair does. After shearing, a sheep is bathed or washed with a solution of insecticide so that it may not get any dermal infection.

Step II: Scouring : The sheard skin with hair is thoroughly washed in tanks to remove grease, dust, dirt, sweat, etc (fig 3.8 (a)). This process is called **scouring**. Nowadays, scouring is also done by machines (fig 3.8 (b)).

Fig 3.8 (a) Manually Scouring

Fig 3.8 (b) Scouring by machines

Step III : Sorting : After scouring, the wool is separated or sorted into various categories on the basis of its quality. Only long fleece of fine quality is sent to factories for further processes. This process is called **sorting** (fig 3.9).

Fig. 3.9 Sorting of Wool

Step IV : Combing : The small fluffy fibres called **lint** (tiny knots) are picked out from hair. These are the same lint which appear on your sweaters. The process of removing the lint from the fleece is called **combing**. The fibres are scoured again and dried. This is the wool ready to be drawn into fibres.

Step V : Dyeing: The fibres can be dyed in various colours, as the natural colour of fleece of sheep and goats is black, brown or white.

Step VI : Spinning: The fibres are straightened, combed and rolled into yarn (fig 3.10). The longer fibres are made into wool for sweaters and the shorter fibres are spun and woven into woollen cloth. The quality of wool is judged on the basis of thickness, length, shine, strength and fineness of the fibres.

Fig 3.10 Rolling into Yarns

Wool industry is an important means of livelihood for many people in our country. But sorter's job is risky as sometimes they get infected by a bacterium, anthrax, which causes a fatal blood disease called **sorter's disease**. Such risks faced by workers in any industry are called **occupational hazards**.

3.2 Silk

Silk fibres are also animal fibres. It gives smell of burning hair when burnt. Silk is a fine, strong, soft and shining fibre obtained from silkworm. Silkworms spin the 'silk fibres'. The rearing of silkworms for obtaining silk is called **sericulture**. Ask your mother / aunt / grandmother about the kind of silk

sarees they have. List different kinds of silk. Before we discuss the process of obtaining silk,it is necessary to know the interesting life cycle of the silk moth.

Life Cycle of silk moth

The life cycle of the silk moth can be summarised in following steps:

Step I. The female silk moth lay eggs, on the leaves of mulberry tree.

Step II. The eggs hatch larvae in two weeks to form worm like structures which are called **caterpillars** or **silkworms**. They grow in size and then the caterpillar is ready to enter the next stage of its life cycle called **pupa**.

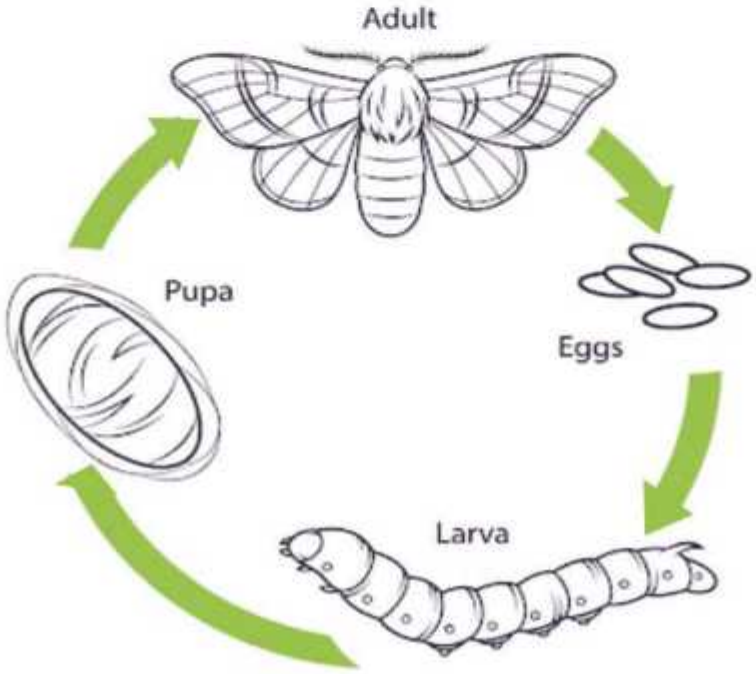


Fig 3.11: Life Cycle in Silk Moth

Step III. Pupa first weaves a net to hold itself. Then it swings its head from one side to another in the shape of ∞ . During these head movements, the caterpillar secretes fibre made of a protein which hardens on exposure to air and becomes silk fibre. Soon the caterpillar completely covers itself by silk fibres. This covering is known as **cocoon**. The further development of moth continues inside the cocoon. The silk yarn (thread) is obtained from the cocoon of the silk moth. Silk fibres are used for weaving silk cloth. Can you imagine that the soft silk yarn is as strong as thread of steel.

There is a variety of silk moths which looks very different from one another and the silk yarn they yield is different in texture (coarse, smooth, shiny, etc.). Silk like tassar silk, moonga silk, kosa silk, etc., are obtained from cocoons spun by different types of moths. The most

common silk moth is the mulberry silk moth. The silk fibre from the cocoon of this moth is soft, lustrous and elastic. It can be dyed into beautiful colours. Sericulture or culture of silkworms is a very old occupation in India. India produces plenty of silk on a commercial scale.

Activity 3 :

Collect pieces of silk cloth of various types and paste them in your notebook provided below and name it. You can find them in a tailor's shop among the heap of waste cut pieces. Take help of your mother, aunt or teacher and identify the types of silk such as mulberry silk, tussar silk, eri silk, moonga silk, etc. Compare the texture of these silks with that of the artificial silk pieces, which contain synthetic fibres. Try and collect pictures of different moths whose caterpillars provide the various types of silk.

Activity 4 : Burn test for Natural and Synthetic fibre.

Take an artificial (synthetic) silk thread, pure silk thread and wool. Burn these threads carefully and then answer the following questions.

Fig 3.12 (a)

Fig 3.12 (b)

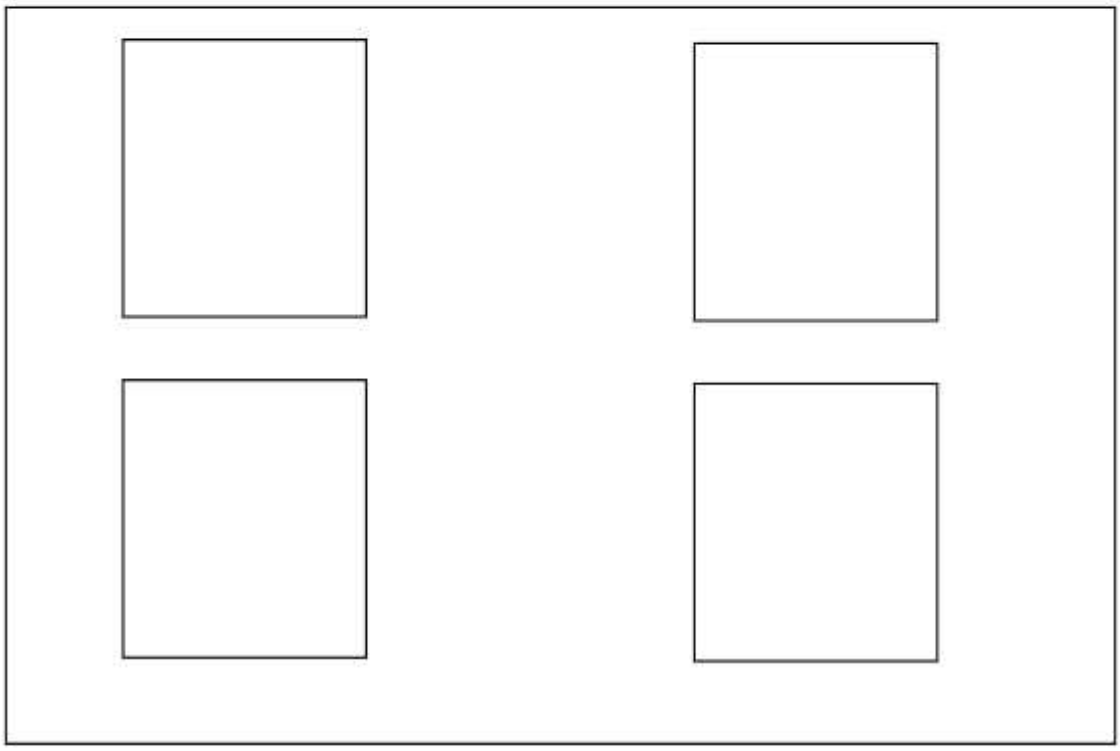
Note: *This activity should be performed with proper care and apparatus and in the presence of teacher and fire extinguisher, sand and water etc.*

Think and Answer:

1. What difference in smell you notice on burning silk thread, and wool?
2. What type of ash is formed in the above activity.
3. Does the smell of burning of silk thread is same as the smell of burning woollen thread?

Activity 5 :

Take Photocopy of figure 3.11. Cut out pictures of the stages of the life cycles of the silk moth, and paste them on pieces of cardboard of chart paper. Jumble them. Now try to arrange the stages in below given boxes in the correct sequence. Whoever does it fastest wins. You may also describe the life cycle in your own words. Write it down in your scrap book.



From cocoon to silk

For obtaining large quantity of silk on industrial scale silk moths are reared and their cocoons are collected to get silk threads.

Rearing silkworms: A female silk moth lays hundreds of eggs at a time (fig 3.13 (a)). These eggs are stored carefully on strips of cloth or paper and sold to silkworm farmers. The farmers keep eggs under hygienic conditions and also under suitable conditions of temperature and humidity. The eggs are warmed to a suitable temperature for the larvae to hatch from eggs. This is done when mulberry trees (fig. 3.13(b)] bear a fresh crop of leaves (fig. 3.13(d)]. The larvae, caterpillars or silkworms, eat day and night and increase enormously in size (fig. 3.13 (c)]. The worms are kept in clear bamboo trays along with freshly chopped mulberry leaves. After 25 to 30 days, the caterpillars stop eating and move to a tiny chamber of bamboo in the tray to spin cocoons (fig. 3.13 (e). Small racks or twigs may be provided in the trays to which cocoons

get attached. The caterpillar or silkworm spins the cocoon inside it which develops the silk fibers.

Fig. 3.13 Rearing Silkworms

Processing of Silk:

Processing of silk involves various steps. Let us discuss them in detail.

Step I. Boiling : The cocoons are first boiled in hot water or treated in ovens to kill larvae inside. If the larvae are not killed and allowed to grow. they will break the cocoon, thereby reducing the length of silk fibre. The hot water soften the silk gum, so as to allow unwinding of silk fibre as one continuous thread.

Step II. Reeling : The process of taking out threads from the cocoon for use as silk is called **reeling the silk**. Reeling is done with special machines, which unwind the threads or fibres of silk from the cocoon.

Step III. Throwing : This process is similar to spinning of cotton. The raw silk is twisted to produce thrown silk. This process is called **throwing**. This prevents the silk from splitting into individual fibres.

Step IV. Dyeing : Thrown silk is then dyed for making coloured fabrics. The dyed silk fibres are then spun into silk threads, which are woven into silk cloth by weavers.

KEYWORDS

Cocoon, Fleece, Reeling, Scouring, Sericulture, Shearing, Silk Moth, Silk Worm, Sorting, Reeling, Throwing

Points to Remember

- Wool and silk are two natural fibres obtained from animals.
- Wool is obtained from the fleece of sheep, goat and yak. Silk is obtained from silkworms.
- The hair of camel, Lama, Alpaca are also used to yield wool.
- In our country, sheep are mostly reared for getting wool.
- Hair of sheeps are sheared, scoured, sorted, dried, dyed, spun and woven to yield the wool.
- The lifecycle of silkworm invalues four stages i.e. egg, larval pupa, adult.
- Silkworms form a covering of fine filaments. This covering is called cocoon.
- Silk fibres are made up of proteins.
- Cocoons are placed in boiled water, they are reeled and piles of silk are prepared.
- Weavers use silk yarn to make cloth.
- Mulberry silk, Tussar silk, Moonga silk and Kosa silk are different types of silk.

Exercise

1. Fill in the Blanks:

(i) Wool is obtained from the ..... of sheep, goat and yak.

(ii) Long hair on the body protect animals from ..... .

(iii) Removal of fleece from the skin of animal is called ..... .

(iv) Rearing of silkworm is called ..... .

(v) The process of unwinding the filaments from the boiled cocoons, is called ..... .

2. Match the followings :

Column 'A'	Column 'B'
(i) Scouring	(i) Food of silkworm
(ii) Sericulture	(ii) Sheep found in Rajasthan and Punjab
(iii) Protein	(iii) Silk fiber made up of
(iv) Mulberry leaves	(iv) Rearing of silkworms
(v) Lohi	(v) Cleaning sheared fleece

3. Choose the correct Answer:

(i) The fibre which is not produced by animals,

(a) Angora Wool ☐ (b) Wool ☐

(c) Jute ☐ (d) Silk ☐

(ii) Wool is commonly obtained from :

(a) Sheep ☐ (b) Goat ☐

(c) Yak ☐ (d) all of the above ☐

(iii) Washing of sheared hair is called

(a) Scouring ☐ (b) Sorting ☐

(c) Shearing ☐ (d) Dyeing ☐

(iv) Wool is chemically:

(a) Fat ☐ (b) Protein ☐

(c) Carbohydrate ☐ (d) None of the these ☐

(v) The animal that does not yield wool is:

(a) Alpaca ☐ (b) Woolly dog ☐

(c) Camel ☐ (d) Goat ☐

4. Write True and False:-

(i) Air is a bad conductor of heat.

(ii) Air trapped in long hair does not allow body heat to escape from body.

(iii) In Tibet and Ladakh, wool is obtained from yak.

(iv) Rearing of silk moths is called apiculture.

(v) The cover around the body of caterpillar is called cocoon.

(vi) Tussar silk and moonga silk are produced by silk moth who have been feeding on non-mulberry trees.

5. Very Short Answer Type Questions:

(i) Name any two plant fibres and animal fibres.

(ii) What is sericulture?

(iii) Name the common animals who yield fleece.

6. Short Answer Type Questions:

(i) What do you understand by Angora and Kashmere wool?

(ii) Write the states where the following breeds of sheep are found:- Lohi, Bakharwal, Nali and Marwari.

(iii) Write all the steps involved in processing of fibres into wool.

(iv) Why do some animals have a thick coat of hair?

(v) How is silk moth reared?

7. Long Answer Type Questions:

(i) Write all the steps in processing silk from cocoons.

(ii) Draw a well labeled diagram and explain the life cycle of silk moth.

4 HEAT

INTRODUCTION :

We wear woollen clothes in winters and cotton clothes in summers. Woollen clothes keeps us warm in winters while we prefer light coloured cotton clothes in summers to keep our body cool. Do you know why?

In winters we feel cold inside the house and under the sun we feel warm. But in summers we feel hot even inside the house. How can we say if an object is hot or cold? In this chapter we will try to find answers to these questions.

4.1 Hot and Cold

In our daily life we deal with many objects. Some of the objects feels hot and some feel cold. We know tea feels hot and ice feels cold .Make a table of objects in your daily life and label them as hot or cold. You can also add few more objects to this list.

Table 4.1 Hot and Cold Objects

Object	Cold	Hot
Tea		
Ice Cream		
Soup		
Lemon Juice		
Flame of Candle		

We see some objects are cold and some are hot. Some objects are hotter than others while some are colder than others. How do we decide whether an object is hotter or colder than the other object? We often decide it by touching these objects. But this sense of touch is not a reliable method. Let us find this by doing an activity.

Activity 1 : To feel the temperature in all the tumblers.

Material Required : Three tumblers, hot water, cold water.

Method : Take three large tumblers. Mark them as A,B and C. Pour cold water in A, hot water in C and mix (hot and cold) water in tumbler B. Dip your left hand in A and right hand in C for 2-3 minutes and then simultaneously put both these hands in tumbler B as shown fig 4.1. Do both your hands feel same when you put them in tumbler B ?

Observation : You will observe that your hand (left) in cold water will feel warmer while your hand (right) in hot water will feel cooler.

Conclusion : Therefore, that sense of touch is not a reliable method to decide if an object is hot or cold.

Then how to find out how hot or cold an object really is? A reliable method is to measure the temperature of the object

Temperature is the degree of hotness or coldness of a body. It is measured by a device called **thermometer**

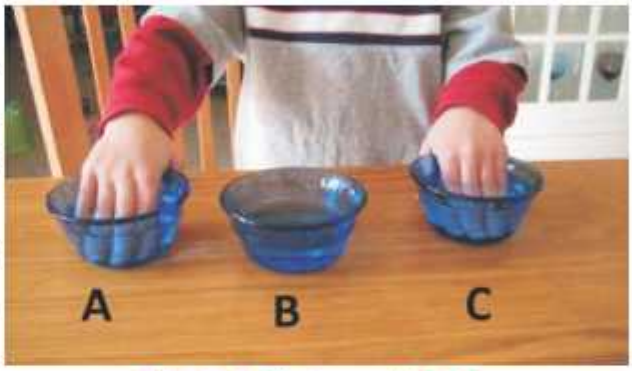


Fig.4.1 Hot or Cold?

4.2 Measurement of Temperature

Have you ever seen a thermometer? When you or someone in your family gets fever, the temperature of body is measured by a thermometer. Do you remember? The thermometer used to measure our body temperature is called **clinical thermometer** (fig 4.2).

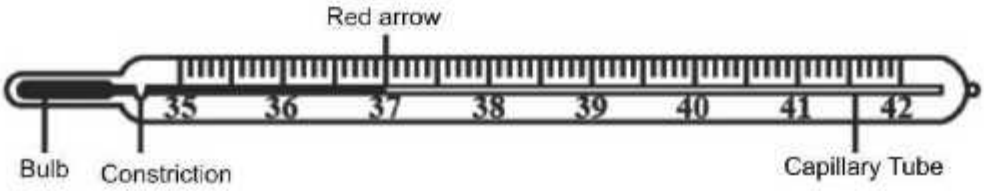


Fig 4.2 A Clinical Thermometer

A clinical thermometer is a long narrow and uniform glass tube having a bulb at one end which contains mercury. A white shining streak of mercury can be seen from outside the thermometer if seen carefully. A scale visible on the thermometer is either or both Celsius scale indicated by °C or Fahrenheit scale indicated by °F.

Reading a Thermometer

First of all note the temperature difference between the two bigger markings on the thermometer and note the number of divisions between them (indicated by smaller markings). If the difference between two bigger marks is one degree and there are ten divisions between them then one small division corresponds to $1/10 = 0.1$°C.

Now to measure your body temperature, wash the thermometer thoroughly with an antiseptic solution. Hold it firm and give few jerks to bring down the level of mercury below 35°C. Now place the thermometer under your tongue. After a minute, take it out and note the reading keeping the level of mercury

along the line of sight. This will be your body temperature. **The normal temperature of human body is 37°C.**

Note: The temperature should always be stated with its unit.

Activity 2 : To Measure the temperature using clinical thermometer.

Material Required: Clinical thermometer.

Method: Measure the body temperature of your friends with thermometer. Record your observations in a table 4.2. Is the body temperature of all your friends 37°C?

Table 4.2 Body temperature of friends

Name of the friend	Temperature (°C)
1.	
2.	
3.	
4.	
5.	

Observation : You will see that temperature of all your friends may not be 37°C. It may be slightly lower or higher.

Conclusion: Actually the normal temperature is the average body temperature of a large number of healthy persons.

The clinical thermometer is designed to measure the temperature of human body only. The temperature of human body normally does not fall below 35°C or go above 42°C. So the range of the clinical thermometer is from 35°C to 42°C.

Think and answer :

1. The normal temperature of our body is .....
2. The clinical thermometer can measure temperature above 45°C (T/F)

Note: Following precautions should be taken before reading a clinical thermometer

1. Thermometer should be washed before and after use, preferably with an antiseptic solution.
2. Ensure that the mercury level is at 35°C before use.
3. Read the thermometer keeping the level of mercury along the line of sight.

Caution

Also avoid keeping the thermometer in sun or near a flame. It may break.

4. Handle the thermometer with care because if it hits against some hard object, it can break.
5. Do not hold the thermometer by the bulb while reading it.

Caution : Avoid keeping thermometer under sun on near flame.

4.3 Laboratory Thermometer

To measure the temperature of other objects there are other thermometers. One of them is lab (laboratory) thermometer. Your teacher will provide you this thermometer. Looking it carefully, we see that the lowest and the highest markings on this thermometer as -10°C to 110°C.

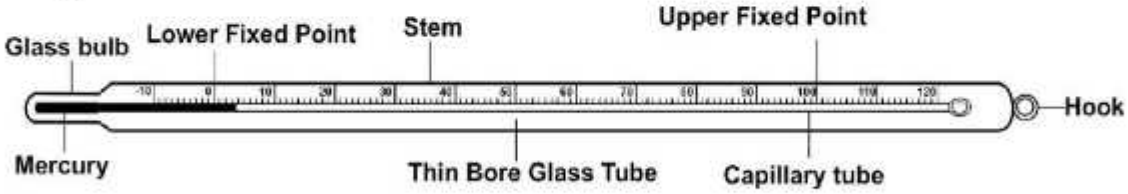


Fig. 4.3 a lab thermometer

Find out the measurement of the smallest division on this thermometer. You would need this information to read the themometer correctly. Now let's see how this thermometer is used.

Activity 3 : Measurement of temperature of water by using a laboratory thermometer.

Material Required : Laboratory thermometer, beaker, tap water, clamp stand.

Method : Pour some tap water in a beaker. Dip the lab thermometer in water so that its bulb is immersed in it but does not touch the bottom or sides of beaker. Hold the thermometer vertically as shown in figure 4.4. Use a clamp stand if necessary. Observe the movement of mercury column in the thermometer. Wait till it becomes stable. Note the reading. This is the temperature of water at that time. Compare the temperature of water recorded by each student. Are there any variation in the readings? Discuss the possible reasons. Can you see the mercury in the column moving upwards?

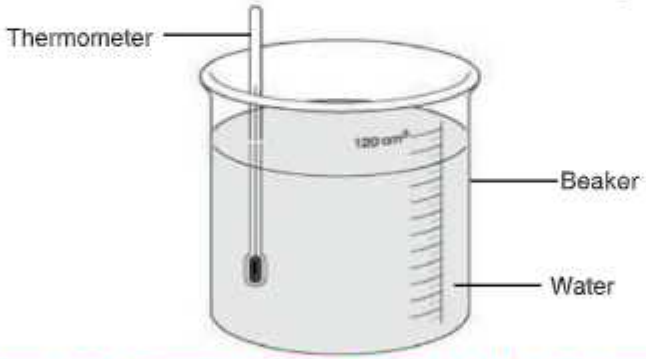


Fig 4.4 Measuring temperature by using laboratory thermometer

Observation : Without taking out thermometer from water, note this stable reading.

Conclusion : This stable reading will be the temperature of water at that time.

Think and answer :

1. Thermometer should be held from its bulb (True/False)
2. The thermometer should not touch the ..... of the beaker.

Now take out the thermometer from water and observe carefully. You will see that the level of mercury in the thread gradually begins to fall. This means that we must take the reading of temperature of water while it is still in water. otherwise we will get incorrect reading of temperature.

This is not the case with clinical thermometer. We note our body temperature after taking it out from our mouth. why this is so ? Actually, if you see carefully you will notice a kink near the bulb of clinical thermometer which prevents the level of mercury to fall down even after it is taken out of your mouth. Laboratory thermometer has no kink, so it is not used to measure the temperature of human body.

Note : In addition to the precautions needed while reading a clinical thermometer following precautions must be taken while reading lab thermometer :-

- It should be kept upright not tilted.
- The bulb of the thermometer should not be touching sides or bottom of beaker and should be surrounded from all sides by the substance whose temperature is to be measured.

4.4 Transfer of Heat

A pan becomes hot when kept on fire. It is because heat is transferred from flame to the pan. But when it is removed from flame it slowly cools down. It is because of reason that now heat is transferred from pan to the surroundings. So in both the cases we see that heat flows from hotter to colder object. In fact heat always flows from hotter to colder object. What are the mechanisms of heat flow? Let us find out the mechanism of heat flow.

Activity 4 : Flow of heat through a metal strip.

Material required : An iron rod or metal strip, clamp stand, a candle, and match stick.

Method : Take an iron rod or long metal strip. Put few wax drops from a burning candle on the rod at equal distances as shown in figure 4.5. Clamp the rod to a stand as shown in figure.

Fig. 4.5 Flow of heat through a metal strip

Now start heating the other end of the rod.

Observation : You will observe that the wax drops gradually begins to fall starting from the end nearest to flame.

Conclusion : This shows that heat is transferred from one end of the strip to the other end. The process by which heat is transferred from hotter end to the colder end of object is called **conduction**. A solid generally gets heated by the process of conduction.

All the substances do not get heated equally. You must have observed that cooking pans have a plastic or wooden handle. Such handle does not get heated easily because these are made of insulators

The substances which do not conduct heat easily are called **poor** conductor/ insulator of heat. For example wood or plastic. While substances which conduct heat easily are called **good conductors of heat**. For example metallic substances made of iron, copper, silver and aluminium etc.

Think and answer :

1. The handle of cooking vessels are good conductor of heat. (True/False)
2. Wooden handle of electric iron is good conductor of heat. (True/False)

The water and air are poor conductors of heat. Let us find out how does the heat transfer take place in these substances by doing an activity.

Activity 5 : Transfer of heat through liquids.

Material required : A glass beaker or round bottom flask, crystals of Potassium Permagnate, water, burner or spirit lamp, straw pipe.

Method : Take a beaker or round bottom flask and fill it more than half with water. Place it on tripod stand. Wait till the water in the flask is still. Gently place some crystals of potassium permanganate at the bottom of flask

using straw pipe. Now heat the water by placing a candle just below the crystals (fig 4.6)

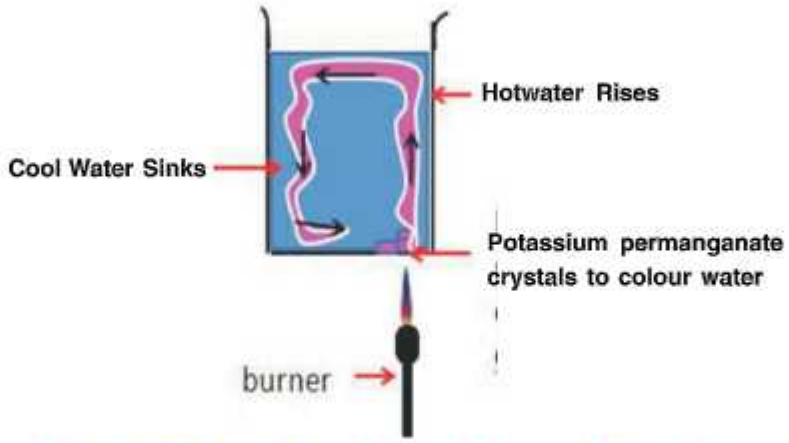


Fig 4.6 Transfer of heat through liquids

Observation : We will observe pink streaks (convection currents) emerging out of the crystals rising upwards and then eventually going downwards.

Conclusion : When water is heated, the water below the candle flame gets heated and rises up due to expansion. The cold water from sides moves towards the bottom near heat source to take its place. This process continues till whole of the water gets heated up. This type of heat transfer due to actual movement of heated parts of liquid is called **convection**. Similar is the case with gases. We will see this by performing an other activity.

Activity 6 : Transfer of heat through gases.

Material Required : Candle, glass tube open at both ends, match box.

Method : Light a candle and place a glass tube open at both ends over the candle.

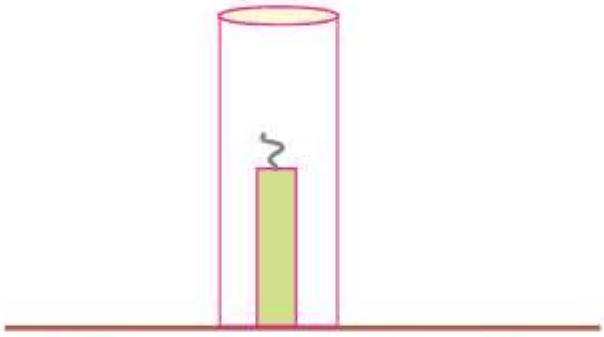


Fig 4.7 (a) Transfer of heat through gases

Observation : The candle flame goes off.

Conclusion : This is because the hot air rising up the glass tube doesn't allow the cold air from outside to come in so that the convection currents

cannot be set up inside the glass tube. Thus the oxygen supply to the candle is cut off and the flame dies down

Think and answer :

1. The ventilators in the rooms are used to expell cold air. (True/False)
2. The liquids are always heated from the bottom. (True/False

Repeat the same experiment again but this time when the flame is going to die out lift the glass tube upwards. You will see that the flames continue to burn again. By lifting the glass tube the cold air from the bottom draws in the glass tube to take the vacancy of hot air allowing the candle to burn.

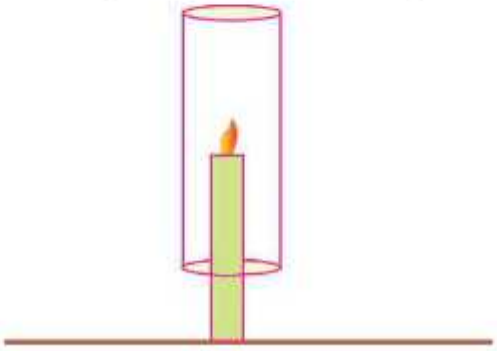


Fig 4.7 (b)

Now the glass tube is placed over the candle again but this time an aluminium T is introduced over the glass tube as shown in fig below. Observe that this time the candle flame does not go out but continues to burn. This happens because the aluminium T divides the glass tubes into two portions. From one portion the hot air from the flame rises up while from second portion cold air comes in to take its place, setting up convection currents by keeping a constant supply of oxygen to the flame.

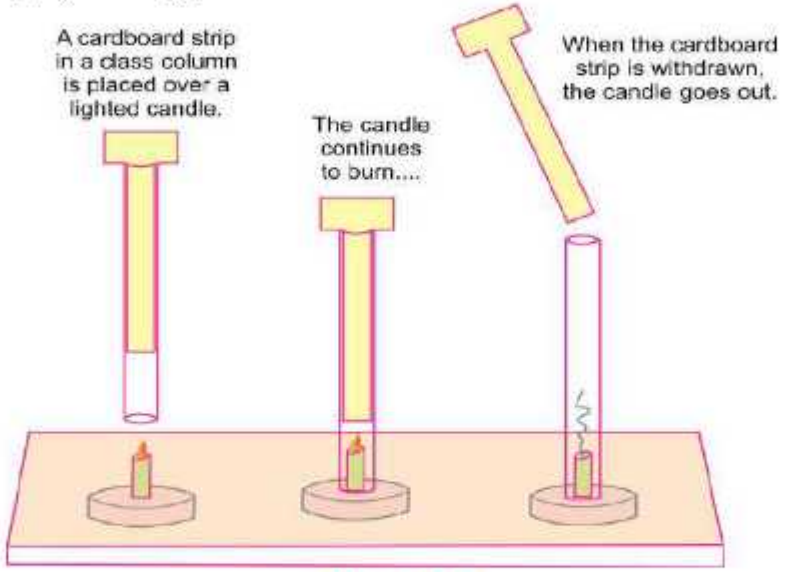


Fig 4.7 (c)

An interesting phenomenon is experienced by people living near coasts called **sea breeze** and **land breeze** relating to convection of air. During daytime the land gets heated due to sun. The air over the land gets heated, expands and rises upwards. The cooler air from the sea rushes towards the coast to takes its place and setting up convection currents. Therefore, the air rushing from the sea to the coast is called **sea breeze**. That is why people in coastal areas make windows of their houses facing the sea for fresh breeze.

During night time, exactly the reverse happens. Due to its higher absorption capacity the water cools down more slowly than the land, so cool air from the land move towards the sea. Therefore the air rushing from the land towards sea in called **land breeze**.

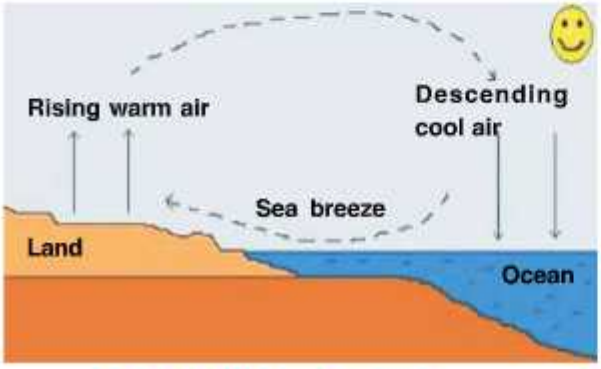


Fig 4.8 (a) Sea Breeze

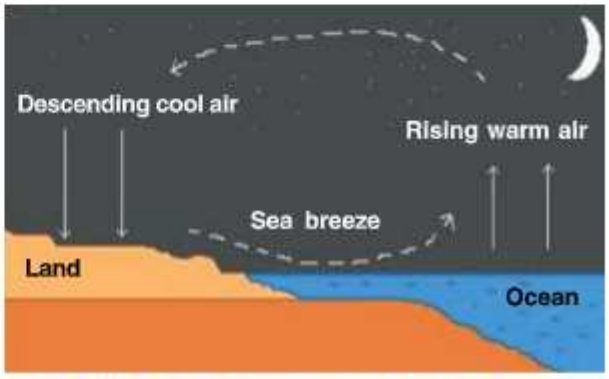


Fig 4.8 (b) Sea breeze and Land breeze

The heat from the sun cannot reach us by conduction or convection as there is no medium like air in most part of space between the sun and the earth. Heat from the sun comes to us by process called radiation which does not require any medium for propagation. Through radiation heat can transfered with or without medium. When' we sit near fire we get heated by the radiation of heat. Any hot body transfers heat to its surrounding by radiation and also receives heat from other hot bodies by radiation.

So, all hot bodies radiate heat. When this heat falls on the other object, a part of it may be absorbed, reflected or transmitted by the object. The temperature of the object increases only due to absorbed part of heat.

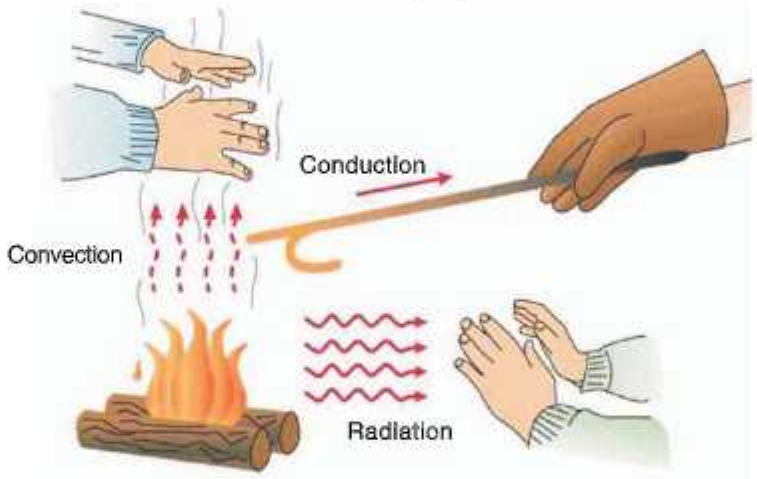


Fig 4.9 Three modes of heat transfer, conduction, convection and radiation

4.5 Kinds of clothes worn in summer and winter

We wear light coloured clothes in summer and dark coloured clothes in winter. Why is it so ? Let us find out by doing an activity

Activity 7 : Dark colour objects absorbs more heat.

Materials Required : Two metallic cans or tumblers, black paint, white paint, water, two thermometers.

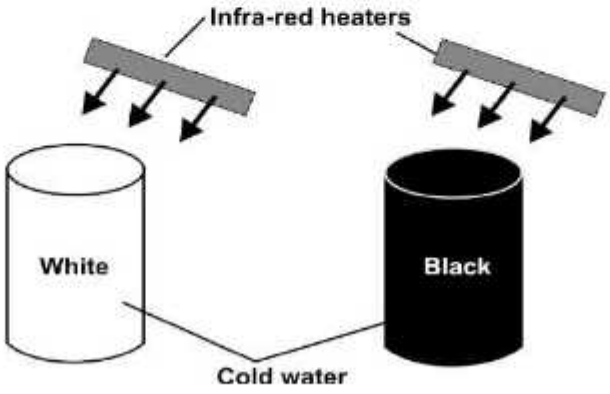


Fig 4.10

Method: Take two metallic cans or tumblers. Paint the outer side of one can black and the other one white. Pour equal amounts of water in each metallic can and leave them in the sun. After about an hour, measure the temperature of both the cans.

Observation: The temperature of water in the can coated black is more. You can feel the difference even by touching the two metallic cans.

This activity suggests us the reason we wear dark coloured clothes in winters and light coloured clothes in summers. Black or dark surfaces absorbs more heat than the light ones. Therefore we feel warmer in winters by wearing dark coloured clothes while in summers we prefer white or light coloured as they are poor obsorber of heat radiation.

Conclusion : Black colour is good absorber of heat radiations.

Think and answer :

1. We wear light coloured clothes in winters. (True/False)
2. Dark coloured clothes absorbs less heat. (True/False)

4.6 Woolen clothes in winters

Wool is a bad conductor of heat. Air which is also a bad conductor of heat is trapped inside wool fibres, which prevents the escape of heat from our body to the surroundings. So we feel warm wearing woollen clothes.

Similarly we feel warmer if we use two thin blankets instead of one thick blanket. Air trapped inside the two thin blankets prevents the escape of heat from our body.

KEYWORDS

- Heat
- Temperature
- Thermometer
- Celsius scale
- Conductors
- Insulators
- Conduction
- Convection
- Radiation
- Sea breeze
- Land breeze
- Fahrenheit Scale

Points to Remember

- Sense of touch is not a very reliable method to determine if an object is hot or cold
- Temperature is a measure of degree of hotness or coldness of an object.
- Thermometer is a device used to measure temperature .
- Clinical thermometer is used to measure temperature of human body. Its range is from 35°C to 42°C.
- Laboratory thermometer is used to measure temperature of objects other than human or living bodies. Its range is usually from-10°C to 110°C.
- The normal temperature of human body is 37°C or 98.6°F.
- Heat always flows from a body at higher temperature to a body at lower temperature
- There are three modes of heat transfer called conduction, convection and radiation.
- The process by which heat is transferred from hotter end to the colder end of object without actual movements of heated particles is called conduction. Solids generally get heated by the process of conduction.
- The process of heat transfer due to actual movement of heated parts is called convection. Liquids and gases gets heated by convection.

- The movement of air from sea to land during daytime in coastal areas is due to convection and is called sea breeze.
- The movement of air from land to sea during night in coastal areas due to convection is called land breeze.
- The materials which allow heat to pass through them easily are called conductors.
- The materials which do not allow heat to pass through them easily are called insulators.
- Dark coloured objects are better absorbers of heat than the light coloured objects. That is why we wear dark clothes in winters and light clothes in summers.
- Woollen clothes keep us warm in winters because wool is bad conductor of heat and it has air trapped inside wool fibres.

Exercise

1. Fill in the blanks:

(i) The hotness of an object is a measured by its ..... .

(ii) The mode of heat transfer without any medium is called..... .

(iii) Air is ..... conductor of heat.

(iv) The normal temperature of human body is ..... °C.

2. Write True or false :

(i) Metals are insulators of heat .

(ii) Sea breeze arises due to conduction .

(iii) We get heat from the sun by radiation .

(iv) Wool is good conductor of heat .

(v) Range of clinical thermometer is 35°C to 42°C .

3. Match the column

(i) land breeze blows during	(i) winter
(ii) sea breeze blows during	(ii) night
(iii) We prefer light coloured clothes in	(iii) daytime
(iv) We prefer dark coloured clothes in	(iv) summer

4. Very Short answer type questions:

(i) Temperature of human body is:

(a) 100°C ☐ (b) 0°C ☐

(c) 37°C ☐ (d) 98°C ☐

(ii) Which is bad conductor of heat

(a) Aluminium ☐ (b) Iron ☐

(c) Copper ☐ (d) Wood ☐

(iii) One litre of water at 30°C is mixed with one litre of water at 50°C. Then temperature of mixture will be:

(a) 80°C ☐ (b) More than 50°C but less than 80°C ☐

(c) 20°C ☐ (d) Between 30°C and 50°C ☐

(iv) A wooden spoon is dipped in a cup of ice cream. Its other end

(a) becomes cold by the process of conduction ☐

(b) becomes cold by the process of convection ☐

(c) becomes cold by the process of radiation ☐

(d) does not become cold ☐

(v) Land breeze is:

(a) cool air from land to sea ☐

(b) cool air from sea to land ☐

(c) hot air from land to sea ☐

(d) hot air from sea to land ☐

5. Short answer type questions:

(i) State the condition which determine the direction of flow of heat.

(ii) What is clinical thermometer? Write its range.

(iii) What is the use of kink in a clinical thermometer ?

(iv) What is lab thermometer? Write its range.

(v) Why do we prefer dark clothes in winters and light one in summers ?

(vi) Why do we wear woollen clothes in winters?

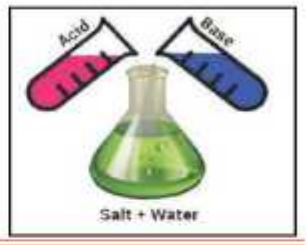
6. Long answers type question :

(i) What are various modes of heat transfer? Explain.

(ii) Explain the formation of sea breeze and land breeze in coastal areas.

5 ACIDS, BASES AND SALTS

P2U1Y3



In our day-to-day life we use several substances. We take number of substances in food such as salt, sugar, lemon, amla and vinegar etc. These substances are sweet, salty, bitter, sour or having some other taste. Some commonly used substances and their tastes are given table 5.1

Table 5.1 Substance and their tastes

SUBSTANCE	TASTE
Sugar	Sweet
Common Salt	Salty
Amla	Sour
Lemon Juice	Sour
Baking Powder	Bitter
Vinegar	Sour
Orange Juice	Sour
Jaggery	Sweet
Curd	Sour
Tamarind	Sour
Bitter Guard	Bitter

Caution

Do not try to touch or taste any substance in lab unless you know or asked to do so.

From Table 5.1 we find that some substances taste sweet, some taste sour, some taste salty and some taste bitter.

5.1 Acids and Bases :

Acids : As given in table 5.1 Amla, lemon juice, vinegar, orange juice, tamarind and curd taste sour because they contain acids. The word acid is derived from latin word "**acere**" which means sour. The acids in these substances are natural acids . The chemical nature of such substances is acidic.

Table 5.2 Natural acids present in few substances

SUBSTANCE	ACID PRESENT
Amla	Ascorbic acid
Lemon, Orange	Citric Acid
Curd, Milk	Lactic Acid
Vinegar	Acetic Acid
Tamarind	Tartaric acid

Natural substances have weak acids as shown in table 5.2. Mineral acids such as sulphuric acid, hydrochloric acid and nitric acid are strong acids and are dangerous. They can cause harm when comes in contact. These acids are used in industries and science labs with precautions.

Bases : As given in table 5.1. baking powder is bitter in taste. If you rub its solution between fingers, it feels soapy. The substances which are bitter in taste and feels soapy to touch are called bases. The nature of such substances is said to be basic. Common bases are baking powder, lime water, sodium hydroxide and potassium hydroxide etc.

Table 5.3 Common bases with their sources

Bases	Found In
Calcium Hydroxide	Lime Water
Magnesium Hydroxide	Milk of Magnesia
Ammonia hydroxide	Window Cleaner
Sodium Hydroxide	Soap
Potassium Hydroxide	Soap

5.2 Indicators

As we cannot taste every substance, how do we find its nature? Let us know about it. Special type of substance are used to test wheather a substance is actdic or basic. These substance are called **Indicaotors.** An indicator is a substance that changes its colour when added to acidic or basic substance.

Examples	Acids	Bases
Litmus	Turns blue litmus red	Turns red litmus blue
Phenolphthalein	No change in colour	Turns pink

There are two types of indicators :

1. Natural Indicators : They are extracted from plants such as litmus, turmeric, china rose petals (Gudhal Petals) and extract of red cabbage leaves etc.

2. Synthetic Indicators : They are organic compounds prepared in laboratory such as phenolphthalein and methyl orange.

Natural Indicatiors Around Us :

1. Litmus : The natural indicator which is most commonly used is litmus which is extracted from Lichens (figure 5.1). It is a purple coloured dye. Purple color of litmus changes to red on adding acidic solution and to blue on adding

a basic solution. It is available in the form of solution or paper strips. Paper strips are known as **Litmus Papers (Fig 5.2)** and solution form is called Litmus solution. Generally it is available as red and blue litmus.

Fig 5.1 : Lichen

Fig 5.2: (a) Red Litmus Paper
(b) Blue Litmus Paper

Effect of substances on litmus :

Activity 1 : To see the effect of litmus on some substances.

Material Required : Beaker, test tubes, tap water, lemon juice, vinegar, common salt, baking Soda and Milk of magnesia.

Method : Prepare the solutions of lime (tap water), lemon juice, vinegar, common salt, baking soda and milk of magnesia seperatly in water in different beakers. Take blue and red litmus papers and put one drop of each solution on both blue and red litmus paper and observe.

Observation : You will observe that lemon juice and vinegar changes blue litmus to red. Thats why they are acids. Whereas, baking soda and solution of milk of magnesia changes red litmus to blue and therefore they are bases.

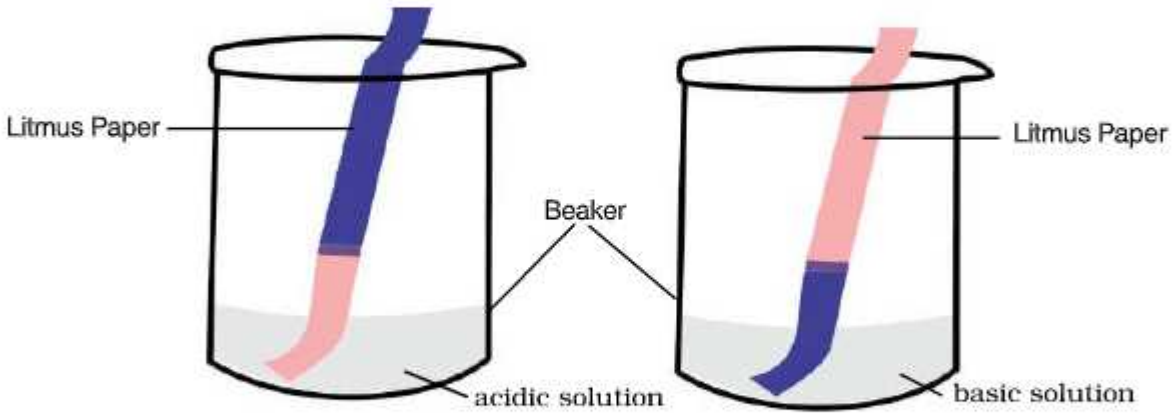


Fig 5.3 (a): *Fig 5.3 (b) :*

Conclusion : Colour change of litmus paper from blue to red indicates the presens of acid in lemon juice and vinegar.
The colour change of litmus paper from red to blue indicats the presence of base in baking soda & milk of magnesia.

Now, what about tap water and common salt solution ? They have no effect either on blue or red litmus paper; such substances are called neutral substances,they are neither acidic nor basic. Table 5.4 summarise the effect of different solutions on litmus paper.

Table 5.4 : Effect of different solution on litmus paper

Sr. No.	Solution	Effect on red litmus paper	Effect on blue litmus paper	Result
1	Lime-water	Blue	No effect	Base
2	Lemon-juice	No effect	Red	Acid
3	Vinegar	No effect	Red	Acid
4	Common salt	No effect	No effect	Neutral
5	Tap water	No effect	No effect	Neutral
6	Baking soda	Blue	No effect	Base
7	Milk of magnesia	Blue	No effect	Base

Are you familiar with the term Acid Rain? Have you ever heard about damaging effect of Acid Rain ? As the name indicates the rain containing excess of acids is called an **Acid Rain**. Where do these acids come from? The rain becomes acidic because carbon dioxide. sulphur dioxide and nitrogen dioxide which are present in the air as pollutants get dissolved in rain drops to form carbonic acid, sulphuric acid and nitric acid respectively. Acid rain can cause damage to buildings, historical monuments, plants and animals.

2. Turmeric : The extract of turmeric (Haldi) is yellow coloured. It changes to reddish brown color in basic solution. *Now you must have understand why a turmeric stain on your white shirt is turned to red when it is washed with soap. It is because the soap solution is basic in nature.*

Turmeric-extract---basic solution----->Reddish brown colour

HOW TO PREPARE TURMERIC-PAPER : Take a teaspoon full of turmeric powder; Make a paste of it by adding little water. Put this paste on filter paper. After drying, the paper will turn yellow. Now cut this paper into strips. These are called Turmeric Papers.

You can prepare a card for your mother on her birthday. Apply turmeric paste on a sheet of plane white paper and dry it. Draw a beautiful flower with soap solution with the help of a cotton bud. You will get a beautiful greeting card.

Fig 5.4

3. China Rose as an indicator : Take some china rose (Gudhal) petals and place them in a beaker. Add some hot water. Keep the beaker for sometime till water becomes coloured. Use the coloured water as an indicator. Add five drops of the china rose extract to each of the solutions given in table 5.5. and record your observations in the table China rose indicator turns acidic solution to dark pink (Magenta) and basic solution to green.

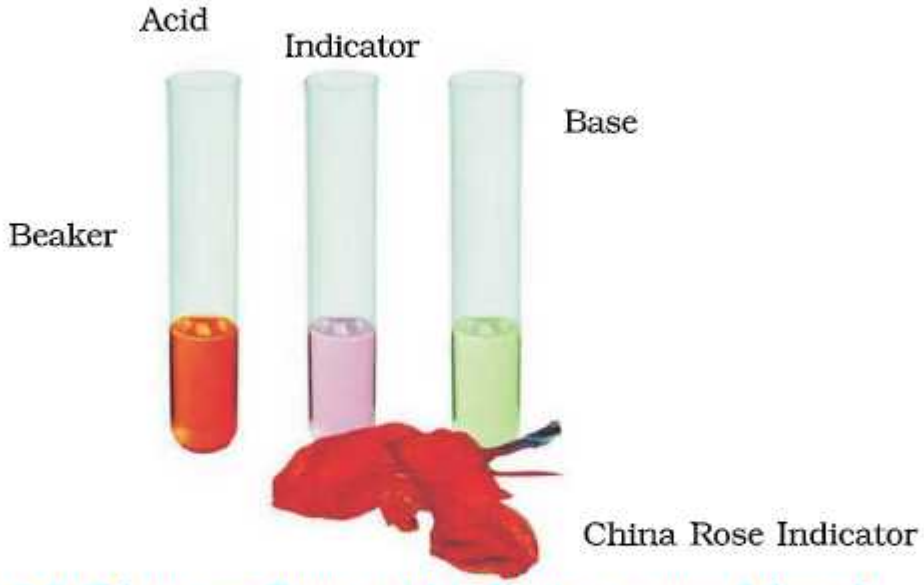


Fig 5.5 China rose flower and indicator prepared from it

Table 5.5 Effect of China Rose

S.No.	Test Solution	Initial Colour	Final Colour
1.	Shampoo		
2.	Lemon Juice		
3.	Soda Water		
4.	Sodium hydrogen carbonate solution		
5.	Vinegar		
6.	Sugar Solution		
7.	Common salt solution		

(4) Synthetic indicator-phenolphthalein :

Phenolphthalein is another commonly used indicator. Its solution is colorless and remains colorless in acidic and neutral solution but, it gives pink color in basic solution. Therefore it is considered as base indicator.

Neutralization :

The reaction between an acid and a base is known as **neutralization reaction.** Salt and water are produced in this process with evolution of heat. In neutraliation reaction, new substance is formed. This is called salt. Salt may be acdic, basic or neutral is nature. Thus neutralisation reaction can be defined as

Acid + Base---------→ Salt +Water +Heat

e.g. $HCl + NaOH \rightarrow NaCl + H_2O$ + Heat

Activity 2 : To understand the process of neutralization.

Material Required : Beakers, test tubes, dilute hydrchloric acid, Phenolphthalein, Sodium hydroxide, dropper etc.

Method: Take 2-3 ml of dilute hydrochloric acid in a test tube. Add 2-3 drops of phenolphthalein solution. No colour is formed because phenolphthalein remain colorless in acidic and neutral solutions. Now take sodium hydroxide solution in another test tube and add 2-3 drops of phenolphthalein. The formation of pink colour indicates the basic nature of sodium hydroxide.Now add few drops of dilute hydrochloric acid to it.

Observation : The pink colour of the solution disappears.

Conclusion: Above activity shows that adding suitable amount of a base to acidic solution, makes it neutral.

Acid + Base → Salt + Water + Heat

Example :

$NaOH + HCl \rightarrow NaCl + H_2O + Heat$

Think and Answer:

1. What will be the colour of basic solution after the addition of phenolphthalein?
2. Name the products of neutralisation.

5.3 Properties of Acids, Bases and Salts

On the basis of our knowledge, we can summaries the properties of acids, bases and salts as given below.

Acids :

i. They are sour in taste.
ii. They change blue litmus into red.
iii. They give no colour change with phenolphathalein indicator.
iv. They are corrosive in nature and can destroy clothes, wood, metals. They are harmful for to human body and also to historical buildings etc.
v. They neutralize bases to produce salt, water and heat.

Bases :

i. They are bitter in taste and soapy to touch.
ii. They change red litmus to blue.
iii. They produce pink colour with phenolphthalein indicator.
iv. They neutralize acids to produce salt, water and heat.

Salt :

i. They are formed as a result of neutralization reaction between acids and bases.
ii. Salts as mostly soluble in water.

5.4 Neutralizations in Day to Day life.

(i) Antacids : We know that gastric juice secreted by stomach contains hydrochloric acid which helps in the digestion of food. But too much of acid in stomach causes indigestion, causes pain and irritation in stomach. This problem is called **acidity**.

To neutralize excess acid, some mild base is used which neautralize the excess acid and relieves pain. Such substances are called antacid such as milk of magnesia (magnesium hydroxide), baking soda, etc.

(ii) Ant bite : Insects such as honeybees, wasps, bettles and ants when sting us, they inject formic acid into our body. The effect of the acid can be decreased by neutralizing formic acid with some mild base such as baking soda or calamine solution (having zinc carbonate). These substances are called **Ant bites.**

(iii) Soil treatment : Due to presence of certain substances, the soil may become acidic or basic. Excessive use of chemical fertilizers, also makes the soil acidic. For the proper growth and development of plants, soil should be neutral. So soil is tested and if it is found to be acidic, it is treated with bases such as quick lime (calcium oxide), slaked lime (calcium hydroxide), etc. If the soil is formed to be basic, it is added with organic matter which releases acids and neutralizes the bases present in the soil.

(iv) Treatment of wastes from Industrial plants and factories : Wastes from industrial plants and factories may be acidic in nature. If they are disposed off as such they can damage aquatic life. So, it is essential to neutralize the acidic wastes. The wastes are mixed with suitable bases to neutralize them by making it more fertile.

KEYWORDS

Acid	Basic	Neutralisation
Acidic	Indicator	Salt
Base	Neutral	

- Acids are sour in taste. Bases are bitter in taste and soapy to touch.
- Acid turns blue litmus to red. Base turns red litmus to blue.
- Substances which are neither acidic nor basic are called neutral.
- Solutions of substances that show different colour in acidic, basic and neutral solutions are called indicators.
- Litmus paper, China Rose and turmeric are commonly used indicators.
- An acid and a base neutralise each other and form a salt. A salt may be acidic, basic or neutral in nature.
- Litmus, turmeric and China rose petals are natural indicators. Phenolphthalein and methyl orange are synthetic indicators.
- In basic solutions, phenolphthalein produces pink color.
- Acids and bases are used in our daily life.

Exercise

1. Fill in Blanks.

(i) Acids are ..... in taste.

(ii) Litmus and turmeric extract are ..... indicators.

(iii) Phenolphthalein is ..... in acidic solution.

(iv) Reaction between an acid and a ..... is called neutralization reaction.

(v) Ant's sting has ..... acid.

(vi) Excess secretion of hydrochloric acid in stomach, is called ..... .

(vii) Milk of magnesia is used in case of ..... .

2. Match the words of Columns :

Column 'A'	Column 'B'
(i) Red litmus changes to blue in	(i) Neutralisation
(ii) Blue litmus changes to red in	(ii) Zinc Carbonate
(iii) Reaction between an acid and a base	(iii) Basic solution
(iv) Formic acid	(iv) Antbite
(v) Calamine	(v) Acidic Solution

3. Choose the Correct Answer:

(i) Vinegar contains :

a) acetic acid ☐ b) lactic acid ☐

c) citric acid ☐ d) tartaric acid ☐

(ii) Tamarind contains :

a) acetic acid ☐ b) lactic acid ☐

c) citric acid ☐ d) tartaric acid ☐

(iii) The example of natural indictor is :

a) Litmus ☐ b) Turmeric extract ☐

c) China rose petals ☐ d) all the above ☐

(iv) The colour of blue litmus in acidic solution is :

a) purple ☐ b) blue ☐

c) red ☐ d) pink ☐

(v) Amla Contains :

a) Ascorbic Acid ☐ b) quick lime ☐

c) calamine ☐ d) all the above ☐

4. Write True and False :

(i) Citric acid is found in tamarind.

(ii) Ant's sting has oxalic acid.

(iii) Turmeric extract gives reddish brown colours in basic solution.

(iv) Sodium hydroxide turns blue litmus red.

(v) Organic matter is used to treat acidic soil.

5. Very Short Answer Questions:

(i) Which acid is secreted in our Stomach ?

(ii) Name any two ant acids.

(iii) What type of substances are used as ant bites ?

(iv) Name any two citrus fruits.

(v) Why is it essential to treat acidic products ?

6. Short Answer Questions:

(i) Name the source from which litmus solution is obtained. What is the use of this solution?

(ii) Is the distilled water acidic/basic/neutral? How would you verify it?

(iii) Describe the process of neutralisation with the help of an example.

(iv) Name any two common acids and two common bases.

(v) What are indictors ? Write their types and two examples of each.

7. Long Answer Type Questions:

(i) State differences between acids and bases.

(ii) Name the acid present in (i) Vinegar (ii) tamarind (iii) citrus fruits and (iv) curd.

(iii) You are given hydrochloric acid solution, sodium hydroxide solution and water in three different bottles. How would you check which bottle has which compound ?

6 PHYSICAL AND CHEMICAL CHANGES

P4X4C9

In your day to day life you come across many changes in your surroundings. These changes may involve one or more substances or may of be various kinds. For example, melting of ice represents a change in state of a substance. You may be asked to dissolve salt in water to make a drink or making a sugar solution also repersents a change. Similarly, obtaining curd from milk is a change which involves formation of a new substance. Sometimes milk becomes sour. Souring of milk is a chemical change. Stretched spring band also represents a change (change in length). Going to school and coming back from school represents a change in position, colour of sky is blue during day and dark during night (change in colour), a sponge is deformed on pressing (change in shape). Thus we observe change in state of a substance involves change in physical state of substance for e.g. change in length, position, colour, shape. We also observe change in the chemical composition of substance where due to change a new substance is formed for e.g. setting of curd, making of butter, burning of paper etc.

Thus these changes can be categorized broadly into two kinds, physical change and chemical change. Now In this chapter we shall perform some activities and study the nature of these two types of changes.

6.1 Physical Change :

The change in length, position, colour, shape and size or we can say a change in **physical properties** of a substance, is a **physical change**. Thus a change due to which a substance undergoes a change in its physical properties is called a **physical change**. In a physical change no new substance is formed. Most of the physical changes are reversible, this means we can get the substance back even after the change e.g. change in length, position, shape etc.

Activity 1 : Cutting of paper is a physical change

Material Required : Paper (A-4 Sizes), cutter.

Method: Cut a piece of paper in four square pieces. Cut each square piece further into four square pieces. Arrange these pieces on the floor or on a table so that the pieces acquire the shape of the original piece of paper. Try to join the pieces of paper.

Fig 6.1 (Pieces of A-4 Size Paper)

Observation: You can not join the pieces of paper to make the original piece of paper. By cutting paper we have obtain small pieces of paper i.e. there is a physical change of shape although no new substance is obtained due to this change.

Conclusion: From above activity, we can conclude that cutting of paper is a physical change because of change in shape and size.

Think and Answer:

1. Mention whether the cutting of paper is reversible or irreversible change.
2. Is the cutting of paper a physical or a chemical change?

Activity 2 : Crushing of chalk is physical change

Material Required : A piece of chalk, Water.

Method: Collect chalk dust lying on the floor near the blackboard in your classroom or, crush a small piece of chalk into dust. Add a little water to the dust to make its paste. Roll it into the shape of a piece of chalk. Let it dry.

Observation : Once the pieces of chalk are dried you could get back chalk from its powder i.e you could get back the original substance.

Conclusion : Crushing of chalk is a physical change of shape and the original substance can be obtained due to this change.

Think and Answer:

1. Can you recover chalk from dust?
2. Does chalk powder dissolve in water?
3. What is the nature of above change. Is it physical or chemical?

Activity 3 : Change in a state of water in a Physical change

Material Required : Glass beaker, ice.

Method: Take some ice in a beaker and place it on a table at room temperature. Wait for some time. Once ice melts into water, put the beaker into the freezer.

Observation: You will observe that there is a change in state of water with increase and decrease of temperature. With the increase of temperature, the solid state of water i.e. ice changes into liquid state and with the decrease of temperature liquid state of water changes into its solid state i.e. ice.

Conclusion : From above activity we can conclude that with the increase of temperature, ice melts into water and with the decrease of temperature, water freezes into ice. Water changes its physical state with the increase and decrease of temperature.

Fig 6.2 (a) Ice in Beaker

Fig 6.2 (b) Water in Beaker

Think and Answer:

1. Ice melts into water with ..... in temperature.
2. Water changes to ice with ..... in temperature.

Activity 4 : Change in state of water is a physical change.

Material Required : Water, burner, pan.

Method: Boil some water in a container. You will see the steam rising from the surface of water (this process is called **evaporation**). Hold an inverted pan by its handle over the steam carefully as shown in figure 6.3. You will see water droplets at the inner surface of pan (conversion of water vapours into water droplets is called **condensation**):

Observation : With the rise of temperature water changes from liquid form

to gaseous form (water vapours) and with decrease of temperature water changes its state from gaseous (Wate vapour) to liquid state (water droplets).

Conclusion : Change in state of water in a physical change.

Caution
Be Careful while handling a flame

Fig 6.3 Evaporation and Condensation

Think and Answer

1. What is Evaporation?
2. Define Condensation.
3. Water changes into gaseous form with ..... in temperature.
4. Water changes from gaseous state to liquid state with ..... of temperature.

Activity 5 : Colour change is a physical change.

Material Required : Hack saw-blade, pair of tongs, flame of lamp.

Method: Hold a used hack-saw blade with a pair of tongs. Keep the tip of the free end on the flame of a lamp. Wait for a few minutes. Remove the blade from the flame. Observe the tip once again after some time.

Observation : You will notice that the colour of tip changes to orange/red when it is hot and it get back to its original colour when removed from flame.

Conclusion : Change in colour of blade is a physical change.

Fig 6.4

Think and Answer:

1. Which colour do you notice on heating the free end of hacksaw blade?
2. Is the physical change reversible or irreversible ?

SOME OTHER EXAMPLES OF PHYSICAL CHANGES ARE :-

- Melting of wax
- Beating of metals to form thin wires,sheets, foils etc.
- Magnetization of iron.
- Wetting a paper and drying it.

Hence, a physical change can be defined as:-

The change in physical properties like state, length, position, colour, shape etc. for a short period of time is called **Physical change**. On reversing the process or the course of change the substance may or may not regains its original form." Therefore physical change may be reversible such a melting of ice and freezing of water or it may be irreversible such as cutting of trees etc.

Characteristics of Physical Change

The characteristic of Physical Change is that:-

- Only physical properties of substances change.
- No new substance is formed during this change.
- Most of the Physical changes are reversible.

Think and Answer:

1. Define a physical change.
2. Is a new substance formed during a physical change?
3. Explain any two examples of physical change from your surroundings.

6.2 Chemical Change :

Changes due to which chemical properties of a substance changes and a new substance is formed are called **chemical changes**. Most of the chemical changes are irreversible. Even in case of reversible chemical change, the change cannot be reversed by simple physical processes. For examples : Burning of paper/wood/fuel into ashes, setting of curd, rusting of iron etc. Lets perform some activities to demonstrate these.

Activity 6 : Burning of Magnesium ribbon is a chemical change

Part-I

Material Required : Magnesium ribbon, sand paper, a pair of tong, spirit lamp, watch glass, blue and red litmus papers.

Method:- Take a magnesium ribbon strip of about 10cm in length and clean its surface with the help of a sand paper. Hold it with the help of tongs. Burn it over a spirit lamp as shown in fig. 6.5 (b). Observe immediately the colour of flame produced and collect the ash so formed on watch glass.

Caution : 1. To be performed by Teacher. 2. It is dengerous to look for long time at the burning of Magnesium Ribbon

Fig 6.5 (a) Magnesium ribbon

Fig 6.5 (b) Burning of Magnesium ribbon

The change can be represented by the following equation:

Magnesium (Mg) + Oxygen (O_2) → Magnesium oxide (MgO)

Observation:- Magnesium ribbon burns with a white flame. A white ash powder is also formed. The ash so formed is not similar to that of magnesium ribbon.

Conclusion:- It is a chemical change as there is a formation of a new substance. i.e. Magnesium oxide in the form of ash.

PART-II

Method : Collect the ash and mix it with a small amount of water. Stir the mixture (aqueous solution) well. On dissolving the ash in water, a new substance is formed . This change can be written in the form of the following equation:

$$(MgO) + (H_2O) \rightarrow [Mg(OH)_2$$

Magnesium oxide + Water → Magnesium hydroxide $[Mg(OH)_2]$

Test this mixture with blue and red litmus papers by putting few drop of mixture on them.

Observation :- (i) There is no change in colour of blue litmus paper when we put drops of mixture.

(ii) The colour of Red litmus paper changes to blue.

Conclusion:- The solution of magnesium hydroxide formed above is basic in nature.

1. What type of metal oxide is formed on burning of magnesium ribbon?
2. What is the colour of magnesium oxide formed on heating magnesiam?

Activity 7 : Reaction of copper sulphate with iron is a chemical change.

Material Required : Test-tube, Copper sulphate, water, beaker or glass tumbler, dil sulphuric acid (H_2SO_4), a small glass bottle, nails or shaving blade.

Method: - Dissolve about a teaspoon of copper sulphate (blue vitriol) in about half cup of water in a glass tumbler or a beaker. Add a few drops of dilute sulphuric acid to the solution. You will get a blue coloured solution. Take a little of this solution in a test tube and save the rest in a glass bottle. Drop a nail or a used shaving blade into the the test tube. Wait for half an hour or so. Observe the colour of the solution. Compare the colour of the solution in a test tube with that in glass bottle.

Fig. 6.6 (a)

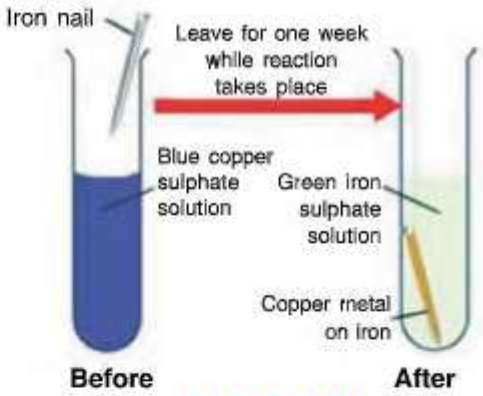


Fig. 6.6 (b)

Observation:- The colour of the solution of test tube turns green due to formation of a new substance i.e. iron sulphate. The brown colour of iron nail or shaving blade is due to formation of another new substance which is copper. The colour of solution of glass bottle is blue.

This activity shows the reaction of copper sulphate solution with iron nail or blade. The following reaction have taken place:-

$CuSO_4$ (blue)	+	Fe	→	$FeSO_4$ (green)	+	Cu
Copper Sulphate		Iron		Iron sulphate		Copper

Conclusion : The reaction of copper sulphate with iron produces iron sulphate and copper. Both of these are new substance. Copper was also deposited on shaving blade. It is a irreversible process and therefore it is a chemical change.

Precaution : Copper sulphate is toxic in nature so you must wash hands after the activity.

Think and Answer:

1. What is the common name of copper sulphate?
2. Write the colour and chemical formula of ferrous sulphate.

Activity 8 : Evolution of a Gas is a chemical change.

Material Required : Two test tube, cork, delivery tube, vinegar, baking soda, lime water.

Method:- Take about a teaspoonful of vinegar in a test tube. Add a pinch of baking soda to it. You would hear a hissing sound and would also see bubbles of a gas coming out. Pass this gas through freshly prepared lime water as shown in Figure 6.7.

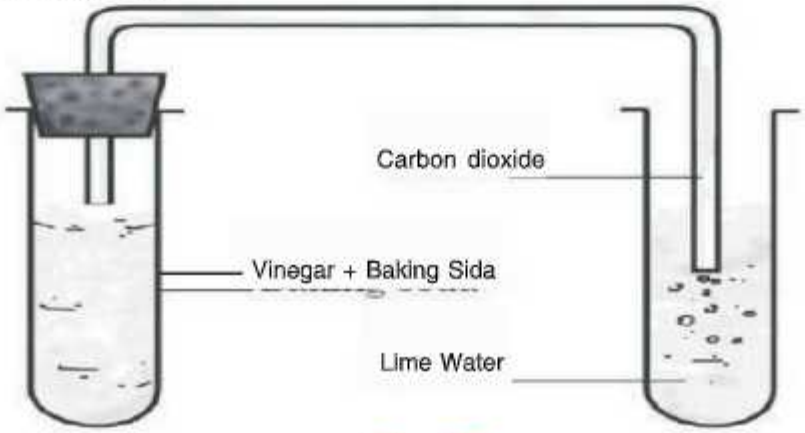


Fig 6.7

Observation:- 1. On passing the produced gas through the lime water, lime water turns milky. This means carbon dioxide gas is produced when vinegar (acetic acid) reacts with baking soda (sodium bicarbonate).

Vinegar + Baking Soda ⟶ Carbon Dioxide (gas) + other substance

2. When carbon dioxide gas produced is passed through lime water $\{Ca(OH)_2\}$, the lime water turns milky due to the formation of calcium carbonate.

$$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$$

Calcium Hydroxide Carbon dioxide Calcium Carbonate Water

Lime Water + Carbon Dioxide ⟶ Calcium Carbonate (Milkiness)

Conclusion : Vinegar and baking soda react to produced new Carbon dioxide and others, Substances. New substances are formed during this reactions and that's why it is a chemical change.

Think and Answer:

1. What is the formula of lime water?
2. How the presence of CO_2 gas can be detected?

Therefore A change in which one or more new substances are formed is called **a chemical change.** A chemical change is also called a **chemical reaction**.

Chemical changes are very important in our lives. New substances are formed as a result of chemical changes. For example for extraction of iron from iron ore, we need to carry out a series of chemical changes, Daily used medicine are also the end product of a chain of chemical reactions. Useful new materials, such as plastics and detergents, are also produced by chemical reactions. Indeed, every new material is discovered by studying chemical changes.

We have seen that one or more new substances are produced in a chemical change. In addition to new products, the following may accompany a chemical change:

- Heat, light or any other radiation (ultraviolet, for example) may be given off or absorbed during chemical change.
- Sound may be produced.
- A change in smell may take place or a new smell may be given off.
- A colour change may take place .
- A gas may be formed.

Some other examples of chemical change

1. You saw that burning of magnesium ribbon is a chemical change. Burning of coal, wood or leaves is also a chemical change. In fact, burning of any substance is a chemical change. Burning is always accompanied by production of heat, light and carbon dioxide.

2. Explosion of a firework is a chemical change. You know that such an explosion produces heat, light, sound and unpleasant gases that pollute the atmosphere. That is why you are advised not to play with fireworks.

3. When food gets spoiled, it produces a foul smell. This is also a chemical change.

4. You must have noticed that a slice of an apple acquires a brown colour if it is not consumed immediately. If you have not seen this change in colour,

cut a fresh slice of apple and keep it away for some time. Repeat the same activity with a slice of potato or brinjal. The change of colour in these cases is due to the formation of new substances.

Difference between physical and chemical change:-

S. No.	Physical change	Chemical change
1.	There is a change in physical state or properties of the substances.	Chemical properties and chemical composition of a substance is changed.
2 .	No new substance is formed.	New substance is formed.
3.	It is mostly reversible.	It is mostly irreversible.

Think and Answer:

1. What is a chemical change?
2. Write two observation to see chemical change.
3. What is lime water?
4. What happens when carbon dioxide is passed through lime water?
5. Name the gas evolved when acetic acid (vinegar) reacts with baking soda.
6. What is the colour and formula of copper sulphate.
7. Name some compounds formed as a result of chemical reactions.
8. In Chapter 5, you neutralised an acid with a base. Is neutralisation a chemical change?

6.3 Rusting of Iron:-

Fig 6.8

Rusting : This chemical change occurs in iron and articles made of iron when exposed to atmosphere. A reddish brown or orange coloured layer is formed on the surface of the iron objects due to their reaction with oxygen and

water present in the atmospher. It is called rust and this process is called **rusting of iron**. If the content of moisture in air is high, rusting becomes faster. The process of rusting can be represented by the following equation:

$$Fe + O_2 + xH_2O \rightarrow Fe_2O_3.xH_2O$$

(Iron) + (Oxygen) + (Water) → (Iron oxide)

Conditions necessary for rusting of iron :

- Open surface of the iron object
- Presence of air (oxygen)
- Presence of moisture or humidity (water)

Harmful effects of rusting :

The iron article becomes weak in due course of time as all the iron slowly turns into rust. In this way iron objects gets rough surfaces, cavities and hole. Iron is used in making bridges, ships, trucks, cars and other machines. If rusting is not prevented, it can cause huge monetary loss to the country.

Prevention of rusting:

We can control rusting by preventing iron articles coming in contact with oxygen and water.

The following methods may be used to prevent rusting:-

- **By greasing or oiling:-** By coating the surface of iron objects with a thin film of oil or grease. In fact these coats should be applied regularly to prevent rusting.
- **By painting :-** By coating the surface with paint evenly and frequently.
- **By the process of galvanization :-** A layer of non reactive metal such as aluminium or zinc is deposited over the surface of iron objects. This process of depositing a layer of non reactive metal over the surface of iron is called **galvanization**. The layer of non-reactive metal prevents the iron articles from coming in contact with moisture and oxygen directly. Thus it prevents rusting.

6.4 Crystallisation :

In Class VI you have learnt that salt can be obtained by the process of evaporation of sea water. The salt obtained in this manner is not pure and its crystals are small. The shape of the crystals cannot be seen clearly. However, large crystals of pure substances can be formed from their solutions. The process is called **crystallisation**. It is an example of a physical change.

Activity 9 : Preparation of crystals of copper sulphate (blue vitrol)

Material Required : Beaker, water, dil H_2SO_4, burner, copper sulphate, funnel, filter paper, etc.

Method:- Take 200ml water in a beaker and add a few drops of dilute sulphuric acid. Heat the water. When it starts boiling add copper sulphate powder slowly while stirring continuously. Continue adding copper sulphate powder till no more powder can be dissolved. Filter the solution with the help of funnel and filter paper. Allow it to cool. Do not disturb the solution while it is cooling. Look at the solution after some time.

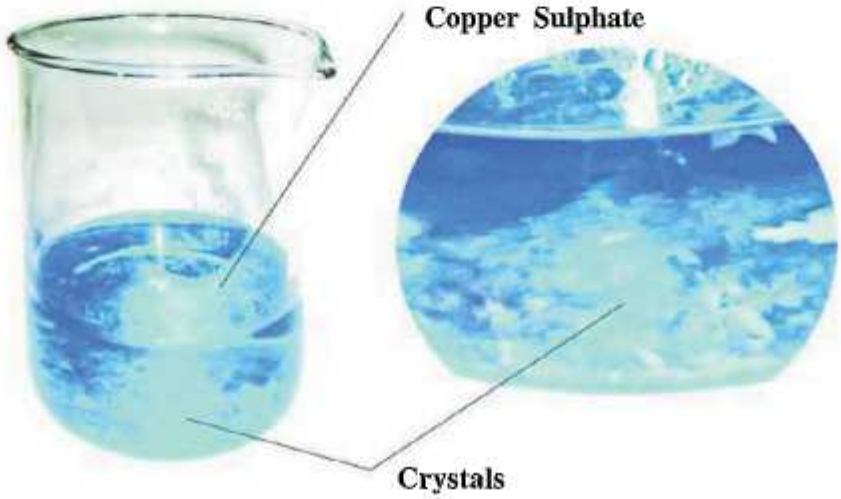


Fig 6.9:- Crystallisation

Observation:- After some time you will get clear and pure crystals of the copper sulphate. When we heat saturated solution upto the point of crystallisation, then after cooling it, we will get blue coloured pure and clear crystals of copper sulphate.

Conclusion:- The process of crystallisation is physical change i.e. a change from liquid state to solid state (crystal form),

Think and Answer:

1. What is end product in the process of crystallisation?
2. When will you stop dissolving copper sulphate powder to hot water?

KEYWORDS

Chemical change	Crystallisation	Physical change
Chemical reaction	Galvanisation	Rusting

Points to Remember

- Changes can be of two types, physical and chemical.
- Physical changes are changes in which only physical properties of the substances such as shape, size, state and temperature, change. No new substances are formed during these changes. These changes may be reversible.
- Chemical changes results in the formation new substances. A chemical change brings change in chemical properties of a substance.
- Some substances can be obtained in pure state from their solutions by crystallisation.
- Rusting, burning and food spoilage are chemical changes.
- Open surface, humidity and oxygen are necessary conditions for rusting.
- Rusting can cause huge financial loss to country.

Exercise

1. Fill in the blanks

(i) A change in which only physical properties of a substance are changed, is a ..... change.

(ii) Changes that lead to formation of new substances are called ..... changes.

(iii) Fossil fuels produce ..... gas on burning.

(iv) When carbon dioxide is passed through lime water, it turns ..... .

(v) ..... is the method for the prevention of rusting of iron objects.

2. Match the Words of coloumn 'A' with words of coloumn 'B' :

Coloumn 'A'	Coloumn 'B'
(i) Physical change	(i) Galvanization
(ii) Chemical change	(ii) Formation of a new substance.
(iii) Prevention from rusting	(iii) Mixing of vinegar and Baking Soda
(iv) Evolution of carbon dioxide	(iv) Reversible change

3. Choose the correct Answer:

(i) The example of chemical change is

(a) erruption of volcano ☐ (b) burning of candle. ☐

(c) cooking of food. ☐ (c) all of the above. ☐

(ii) When acetic acid is mixed with baking soda , the gas evolved is :

(a) hydrogen ☐ (b) oxygen ☐

(c) carbon dioxide ☐ (d) carbon monoxide ☐

(iii) For rusting of iron objects, the essential requirement is :

(a) air (oxygen) ☐ (b) moisture (water) ☐

(c) open surface of object ☐ (d) all of the above. ☐

(iv) For prevention of rust ,we use:

(a) a coat of oil and grease ☐ (b) a coat of paint ☐

(c) galvanization ☐ (d) all of the above ☐

(v) The chemical formula of Rust is :

(a) Fe_2O_3 ☐ (b) $FeCO_3$ ☐

(c) $Fe_2O_3.xH_2O$ ☐ (d) $FeCO_3.xH_2O$ ☐

4. True/False :

(i) Cutting a log of wood into pieces is a chemical change.

(True/False)

(ii) Formation of manure from leaves is a physical change.

(True/False)

(iii) Iron pipes coated with zinc do not get rusted easily. (True/False)

(iv) Iron and rust are the same substances. (True/False)

(v) Condensation of steam is not a chemical change. (True/False)

5. Very Short Answer type Questions:

(i) What is rust? Write its chemical formula.

(ii) Write the conditions necessary for rusting of iron.

(iii) Why are iron objects painted frequently ?

(iv) What is galvanization?

(v) Name two metals which are deposited on the surface of iron objects during the process of galvanization.

(vi) Burning of candle is an example of which type of change- physical or chemical change? Give reasons.

(vii) Why burning of fireworks is harmful?

(viii) What is crystallisation?

6. Short Answer Tyep Questions :

(i) Mixing of baking soda and vinegar is a chemical change or a physical change. Discuss ?

(ii) Explain how cutting and burning of wood are different type of change ?

(iii) What will happen when carbon dioxide is passed through lime water?

(iv) Why does the colour of copper sulphate($CuSO_4$) solution change, when an iron nail is dipped into it? Write chemical equation also.

(v) Magnesium ribbon is burnt and the ash formed is mixed with water. Now answer the following :

(a) Write equation for the burning of magnesium.

(b) What will happen when the mixture of ash and water is added to (a) blue litmus solution and (b) red litmus solution.

(c) Name the substance formed by mixing ash and water .Is it acidic or basic?

7. Long Answer Tyep Questions :

(i) What are physical and chemical changes? Write differences between physical and chemical changes?

(ii) What do you understand by rusting of iron ? Write the necessary conditions required for rusting of iron objects. How rusting of iron and iron objects can be prevented?

(iii) Give detail of process of crystallisation of copper sulphate ($CuSO_4$).

7 WEATHER, CLIMATE AND ADAPTATIONS OF ANIMALS TO CLIMATE

X2D8V8

7.1 Introduction

You might have noticed that the weather keep on changing and does not remain same always. Sometimes, it may be hot and dry. Sometimes, it may be hot and humid. Even at the same time the climate of all the places on earth is not same. At one place it may be winter and at other place it may be summer.

7.2 Weather

Day-to-Day state of atmosphere at a particular place over a short period of time is called weather. Conditions such as heat, cloudiness, dryness, sunshine, wind, rain etc. determine the weather of a place.

We generally see that when there are clouds in the sky during the day, the day is colder and when there are clouds in the sky at night, the night is warmer.

Clouds form a blanket around the earth. During day time they do not allow the heat of the sun to reach the earth and at night these clouds do not allow the heat of earth to escape. That is why cloudy nights are warmer than ordinary nights and cloudy days are colder than ordinary days.

7.2.1 Following Factors affect the weather of a place.

(i) **Sun :** The sun is a prime source in determining the weather of a place.

(ii) **Wind**: Air in motion is called wind. If wind blows it makes weather cooler and if air is still then it is comparatively hot.

(iii) **Water/Rain/Humidity :** The amount of water vapour in the air also influences the weather. If there are no water vapours in the air the air is dry and weather becomes hotter.

(iv) **Temperature:** Too high and too low temperature makes weather hotter or cooler. Moderate temperature range is between 20°C and 30°C.

(v) **Distance from sea/ocean :** Distance of a place from sea or ocean also determine the weather of a place.

(vi) **Altitude :** Temperature decreases with increase in altitude, so weather becomes cooler.

Activity 1 : Collect weather data of your city or nearby city for one week as follows:

Date	Temperature in °C		Relative Humidity in %		Rainfall in mm
	Max.	Min.	Max.	Min.	

7.2.2 Weather Report

We can collect weather report from any of these:

(a) We can collect data by using following

(i) We can use a maximum and minimum temperature themometer to note temperature.

(ii) We can use a wet and dry bulb thermometer to note the humidity of a place.

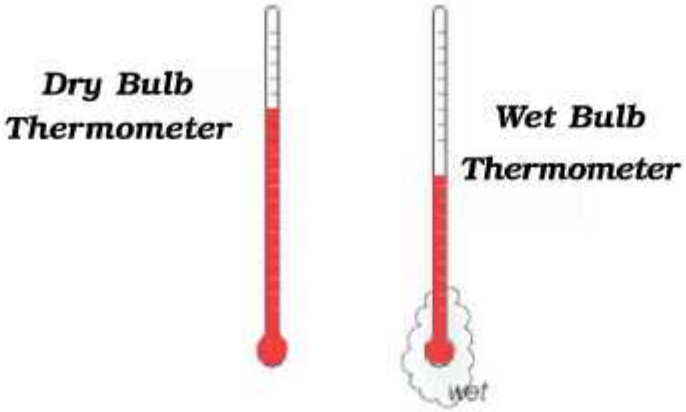


Fig 7.1 (a) Dry Bulb Thermometer (b) Wet Bulb Thermometer

(iii) We can use a rain gauge to measure the rain fall of our place, within 24 hours when it rains. Rain guage is a type of measuring cylinder with a funnel on top. Rainwater is collected in it and then measured.

Fig 7.2: Rain Gauge

(b) We can collect data from a newspaper and can note in our diary.

(c) Data can also be collected from a weather observatory.

Think and Answer:

1. Name the instrument used to measure relative humidity.
2. Which instrument is used for measuring rainfall?
3. Name the source you used to collect weather reports?

7.3 Climate

The average of weather conditions of a place for a period of about 25-30 years is called as the climate. The climate of different places of earth is different. Climate is affected by following factors:

7.3.1 Distance from sea

The places near sea and oceans have moderate climate. During day time the sea breeze and at night, land-breeze makes the temperature moderate.

(a) Sea breeze

During day time, earth become hotter than water. The air near the surface of earth gets hot and light. So It rises above whereas the air over sea is colder and heavier than that over land. So it moves down towards land. The cold air that moves from sea towards land during day-time is called sea breeze.

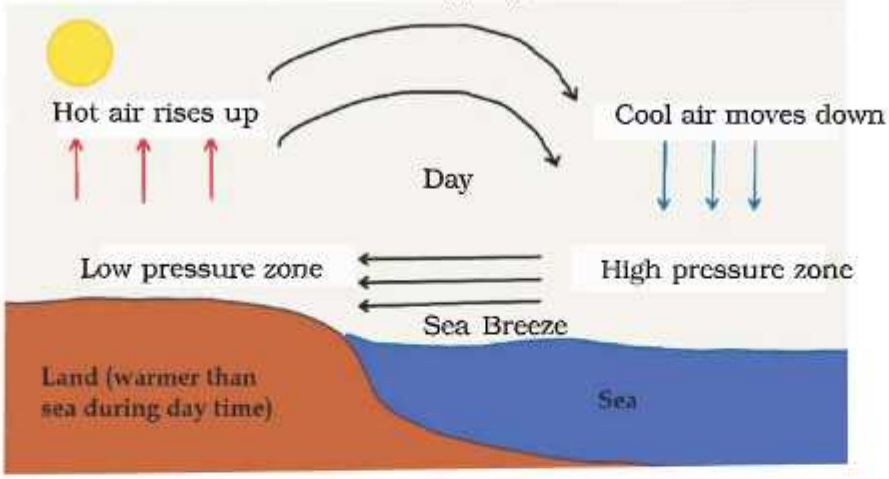


Fig 7.3: Sea breeze

(b) Land breeze

During night time, land looses heat faster than water. But air over ocean is warmer and lighter than the air overland. It rises up. The air from over the land moves towards sea to occupy the empty space. This cold air that moves from land towards sea at night is called land-breeze

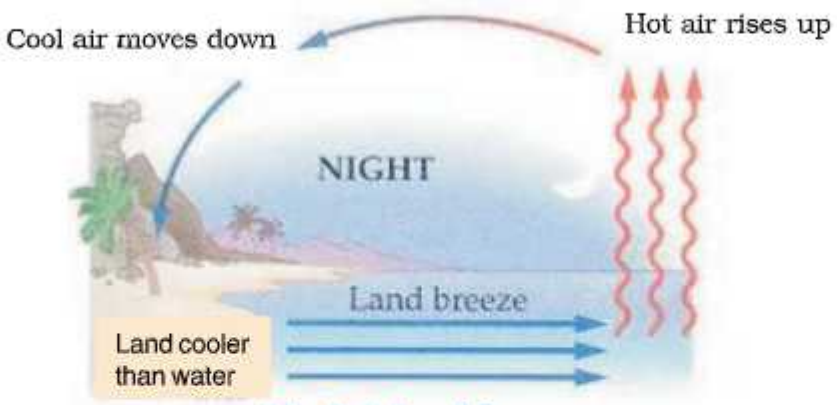


Fig 7.4 Land breeze

7.3.2 Altitude

Altitude refers to height above the sea level. The temperature of locations closer to earth is higher and it decreases with the rise in altitude.

7.3.3 Latitude:

Latitude refers to distance from the equator. The shape of earth is not spherical, It is slightly bulged near the equator. So sun rays fall veritcally near the equator round the year. Latitude of equator is 0° and increases towards poles. The latitude of north pole is 90°N and of south pole is 90°S. The climate near equator is hot and humid throughout the year. With the increase in latitude, the climate keeps on getting colder.

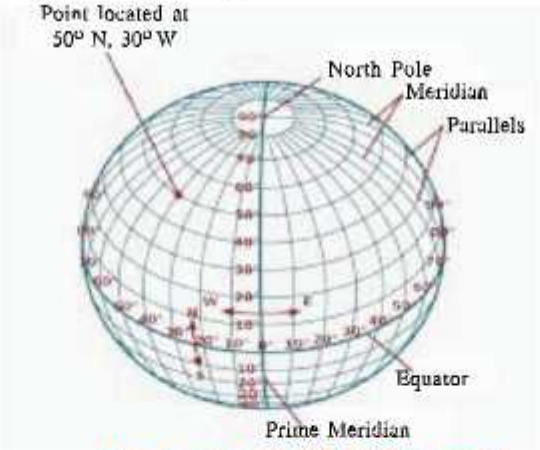


Fig 7.5: Latitude of Earth

7.3.4 Direction of mountains

The direction of mountains also affect the climate of a place. If mountains are parallel to the direction of winds, the winds go unchecked and if the mountains are vertical in front of winds, the winds are blocked and it rains. In India Aravali Hills are parallel to the direction of south-west monsoon, which arise from Arabian Sea. Therefore monsoon go unblocked near Rajasthan and it rains little in Rajasthan. Himalayas are like a wall in the north of India.

These mountain ranges check both monsoons coming from Bay of Bengal and Arabian Sea. So it rains heavily in North-East and northern states in India.

7.4 Climate and Adaptations

Plants, animals and micro-organisms in order to survive better in changing climatic conditions develop some features in their bodies. These features which are developed among organisms to survive in extreme or changing climatic conditions are called adaptations.

7.4.1 The Hot desert region

The climate of desert is hot and dry. There are sand dunes everywhere in desert. Indian Thar desert is a hot desert. It covers many districts of Rajasthan and Gujarat. Camel is the main animal of this region. Other animals are rats, snakes, squirrels, bustard, deer, lizards etc.

Fig 7.6: Sand dune

Camel is known as 'Ship of the desert' as it has adapted its body to survive in the hot and dry climatic conditions of the desert. Camel has following adaptations to survive in desert:

1. Its colour is brown like the colour of sand dune.
2. Its feet are flat and spongy to walk on sand.
3. Its nose is covered by nasal flaps so that sand may not enter nose.
4. It drinks a lot of water when available. This water spreads in the body tissue. This helps camel to survive without water for many days.
5. It store fat in the hump. This fat is consumed when food is not available to it.
6. It excretes very little water as urine and dung is also dry.
7. Its legs are long to keep high above hot sand.

Fig 7.7: An Indian Camel

7.4.2 The Cold desert

The areas where temperature may fall below-20°C and rocks are stony and have little vegetation are called cold deserts. In India cold desert lies between Ladakh region in north to Lahaul and Spiti valley of Himachal Pardesh. Yak, sheep, hilly dogs, goat and cold desert camels are main animals. To survive in cold desert, Yak has following adapations:

1. Body is covered by long hair or fur.
2. The colour of fur is generally black to absorb more and more heat.
3. Its feet have sharp toes which help it to climb in uneven paths.
4. A layer of fat is deposited under its skin. It helps yak to survive in extreme cold during winters.

Fig 7.8: Yak

7.4.3 The Polar Regions

The areas found between 85°N to 90°N and 85°S to 90°S latitude around the poles are called Polar region. Here the climate is very cold and dry. Even the Arctic Ocean (near North Pole) and Antarctic Ocean (around South Pole) remain frozen. Reindeer, Polar bear, Penguins are main animals of Polar region.

Polar bear has following adaptations:

1. Its fur is white to camouflage with snow covered areas.
2. Long fur saves it from extreme cold of surroundings.
3. A layer of fat deposited under the skin helps it keep warm.
4. Its feet are designed to run on snow.

Polar Bear

Penguins

Fig 7.9

7.4.4 Aquatic climate

Some animals and plants live inside the water in aquatic climate. Many animals like whale cannot move or walk on land so they have adapted themselves for an aquatic climate. Fishes, crabs and many invertebrates have following adaptations:

1. Streamlined body helps them in swimming.
2. Presence of gills to take oxygen from water.
3. Presence of fins help in swimming.
4. Body is covered with scales which help them keep moist.

Fig 7.10: Fish

7.4.5 The tropical rain forests

The areas near and around Tropic of Cancer and Tropic of Capricorn are called tropical areas. These areas have hot and wet climate. Even during winters, temperature is about 15°C. During hot summer temperature rises up to 40°C. The region gets plenty of rainfall throughout the year. Important feature of this region is tropical rain forest which form a canopy. The animals living in rain forests are elephants, tigers, leopards, snakes, birds and insects. Special adaptations among the animals found in tropical rain forests are:

1. **Creeping habits:** Snakes, lizards and monitors can creep in thick forests.
2. **Sturdy body:** Force is required to pass through thick and dense forests. So the body of elephant, gorilla, tigers and leopards is sturdy.

3. **Special senses:** Many tropical animals have sharp eyesight, sensitive hearing, thick and colourful skin that camouflage with surroundings.

Fig 7.11Snake

Fig 7.12 Monitor-Lizard

FIg 7.13 Gorilla

Fig 7.14 Leopard

7.5 Climate change

In the recent years many changes are seen in the climate of many countries. Snow fall on certain places shows that climate of whole earth is changing. Certain human activites are responsible for climate change.

1. **Excessive consumption** of fossil fuels due to increase in population and their standard of living.
2. **Deforestation:** To make houses, buildings, industries, roads etc., the forests are cut on a large scale.
3. **Mining:** Unchecked mining has also increased the chances of floods.
4. **Global Warming:** Deforestation and burning of fossil fuel increases the percentage of carbon dioxide in air. Carbon dioxide acts as glass house and absorbs infrared radiations of sunlight and increases the temperature. This is called Green House Effect and continuous rise in temperature causes global warming. This may lead to melting of glaciers.

7.5.1 Effects of climate change

1. Due to global warming snow melts and height of snow caps is decreasing.
2. Many glaciers have melted and melting of glaciers is an alarming bell for polar life.
3. Melting of ice and snow increases the sea level. So there is danger for many coastal cities.

KEYWORDS

- Weather
- Climate
- Global warming
- Green house Effect
- Climate change
- Humidity
- Polar Region
- Tropical
- Aquatic
- Hot desert
- Cold desert
- Tropical rain forest
- Latitude
- Altitude
- Sea breeze
- Land breeze
- Adaptation
- Streamlined body
- Fins
- Gills

- Day-to-Day state of atmosphere at a particular place over a short period of time is called weather.
- The average conditions of humidity, rainfall, snowfall and temperature of a place over a span of 25-30 years is called climate.
- Humidity is the amount of water vapours present in air at a given time.
- The air is humid during rainy seasons and dry in summer or winter.
- The climate of a place is affected by distance from oceans, latitude, altitude and mountains near it.
- The areas of earth around North Pole and South Pole are called as polar regions.
- Animals develop certain characters in their body which help them to survive in extreme climatic conditions. These changes are called adaptations.
- Increase in amount of carbon dioxide due to burning of fossil fuels and loss of forests increase the Green House Effect.
- Green House Effect traps infra red radiations of sunlight and increases temperature of earth.
- Rise in temperature results in global warming.
- Global warming is the main cause behind climate change.

Exercise

1. Fill in the blanks :

(i) ..... of a place may change during a day.

(ii) The areas of Earth near North Pole and South Pole are called ..... .

(iii) The amount of water vapour present in air is called ..... .

(iv) Indian hot desert or Thar Desert spread over states of ..... and ..... .

2. State true and false :

(i) Reindeer is the main animal of tropical forest.

(ii) Weather and climate both terms have same meaning.

(iii) Camel stores fat in its hump which is consumed during the days it does not get food.

(iv) Whale is the largest animal.

3. Match column A with column B:

A	B
(i) It insulate its body and keep the polar beer warm	(a) Sea breeze
(ii) This instrument is used to measure humidty in air	(b) Hot and dry
(iii) Imaginary lines on the earth parallel to the equator	(c) Fat layer under the skin
(iv) Cool air that blows during night towards coastal area	(d) Dry and wet bulb thermometer
(v) The climate of Rajasthan is	(e) Latitude

4. Choose correct answer :

(i) Weather of a place is affected by:

(a) Wind ☐ (b) Temperature ☐

(c) Humidity ☐ (d) All of these ☐

(ii) Climate of coastal areas is:

(a) Hot and dry ☐ (b) Moderate ☐

(c) Cold and dry ☐ (d) Extreme cold ☐

(iii) The coldest desert on earth is:

(a) Arabian desert ☐ (b) Sahara desert ☐

(c) Thar desert ☐ (d) Ladakh ☐

(iv) Arctic region lies at:

(a) 23°N ☐ (b) 23°S ☐

(c) 0° ☐ (d) 85°N to 90°N ☐

5. Very short answer type questions :

(i) Name any two factors that affect the weather of a place.

(ii) Define climate.

(iii) What is sand dune?

(iv) What is a polar region?

6. Short answer type questions :

(v) How does sea breeze occur?

(vi) Write three adaptations found in aquatic animals.

(vii) What is green house effect?

(viii) Write two effects of climate change.

7. Long answer type questions :

(ix) How is camel adapted to survive in hot desert? Explain.

(x) Name various factors that affect the climate of a place. Explain any two of them.

(xi) Write various adaptations found in polar beer.

8 WINDS, STORMS AND CYCLONES

8.1

As you have studied in class 6th that air is present all around us. The layer of air around the earth is called atmosphere. Air is needed for our survival. We inhale air to use oxygen from it for respiration. Plants need air to prepare their food. All the living things need air. So the existence of life on earth is possible due to the presence of air. Air is a mixture of gases. About 99% of air is composed of nitrogen (78%) and oxygen (21%). The remaining part of air contains hydrogen, carbon dioxide, methane, ozone and other gases. The amount of water vapours and dust particles present in air depends upon the temperature, humidity and weather conditions of a place. The atmospheric air exerts pressure called atmospheric pressure. The changes in atmospheric pressure cause many phenomena like winds, storms and cyclones. In this chapter we will study about these phenomena.

8.2 Air Exerts Pressure :

Air around us exerts pressure in different ways. This can be understood by following examples (fig 8.1):

(i) When we fill air in a balloon, it expands. This shows that air exerts pressure on the walls of balloon.

(ii) When we fill air in tube of a bicycle, it gets inflated.

(iii) Moving air also exerts pressure. We can fly kite due to pressure of moving air.

(iv) While moving in a direction opposite to that of fast moving air, we find it difficult to move because of the pressure of air.

(a) Inflated balloon

(b) Inflated vehicle tube

(c) Flying kite

Fig 8.1 Air exerts pressure

Now you can very well understand why it is easier to row a boat in the direction of wind and difficult to ride a bicycle against the direction of wind.

The reason why air exerts pressure is that it has freely moving molecules which collides with each other and also with the walls of the container.

Activity 1 : Air exerts pressure

Materials Required : Tin can, tripod stand, burner/spirit lamp, cold water.

Method : Put some water in a tin can and heat it. Boil water with the help of a burner for some time, so that all the air inside the can gets expeled from the tin can. The whole tin can is now filled with steam. Close the can tightly with a cork. Remove the can from the burner. Pour cold water on the can.

Observation: You will observe that the tin can gets crushed.

Conclusion : On pouring cold water, the steam inside the can gets cooled and changes to water. Due to this there is less pressure of air inside the can than the outside atmospheric pressure. So, the can gets crushed inwards due the pressure of the outside air.

(a) Heating up the can *(b) Crushed can*

Fig 8.2 Air exerts pressure

Think and Answer:

1. The can gets crushed because of the atmospheric pressure. (True/False)
2. Air exerts pressure. (True/False)

Moving air is called **wind**. The moving air exerts pressure. We can see the leaves of the trees, flags and banners fluttering due to moving air. Usually, the banners have holes to avoid the pressure of wind. The fast moving air or high speed wind cannot blow away the banners, if there are holes in them. The air will pass through the holes and will not exert pressure on the banner and there will be no damage to it.

Moving air exerts pressure but very fast moving air creates low pressure. High speed winds are accompanied by reduced air pressure. We can show this by the following activity.

Activity 2 : High speed winds are accompanied by reduced air pressure.

Materials Required: Two balloons of equal size, thread, stick, water.

Method : Take two balloons of equal size. Fill some water in both the balloons and then inflate them by filling air into them. Tie both the balloons with threads and tie each one to a string. Hang the balloons 8-10cm apart on a stick. Blow air in the space between the balloons.

Observation : You will observe that balloons comes closer to each other.

Figure 8.3: High speed air reduces pressure.

Conclusion: This is due to the reason that when we blow air in between the balloons, it creates low air pressure in between the balloons. The higher air pressure on the outer sides of the balloons push the balloons towards each other. So High speed wind reduces air pressure.

Think and Answer:

1. Both balloons shoud be of equal size. (True/ False)
2. The fast moving wind creates _____ pressure.

High speed winds moving above the roofs of huts and kachcha houses may blow away the roofs because of the same reason. High speed wind creates a region of low pressure above the roof. The high pressure below the roof blows it away.

Wind always blows from high pressure region towards the low pressure region. Larger the difference in pressure, higher will be the speed of the wind. The pressure of air at different places may be different due to many reasons. One of the reason is temperature of that particular place.

8.3 Air Expands on Heating :

Air expands on heating. The main reason for the expansion of air on heating is that the molecules of air on heating move away from each other. So the volume of the air increases. We can demonstrate this by doing following activity.

Activity 3 : Air expands on heating.

Materials Required: Boiling tube, beakers, balloon, tripod stand, hot water, ice cold water, cello tape.

Method : Take a boiling tube. Fix a balloon tightly over the neck of the boiling tube with the help of cello tape. Fill a beaker with hot water. Place the boiling tube with balloon in the beaker having hot water so that the balloon remains outside the hot water. Observe for 2-3 minutes for any change in the shape of the balloon. Take the tube out and let it cool down to the room temperature. Take some ice cold water in another beaker and place the tube with the balloon in cold water for 2-3 minutes. Observe the change in the shape of the balloon.

Observation : The balloon gets inflated after some time, when put in hot water and deflated when put in cold water.

(a) (b)

Figure 8.4: Air expands on heating, on cooling it contracts.

Conclusion : When the boiling tube is placed in hot water, the air present in the boiling tube gets heated up and it expands which leads to the inflation of balloon. This shows that air expands on heating. If the boiling tube is cooled, the balloon gets contracted which shows that the air contracts on cooling. Air expands on heating and contracts on cooling.

Think And Answer:

1. The air _____ on heating.
2. On cooling the boiling tube, the balloon expands. (True/ False)

Hot air is lighter than cold air. The hot air expands because its molecules move far away from each other. So the volume of the air increases, as a result the air becomes lighter (when some thing occupies more space, it becomes lighter). Therefore, hot air is lighter than the cold air in which the molecules are nearer to each other.

Activity 4 : Hot air is lighter than Cold air.

Materials Required : Two paper cups, thread, wooden stick, candle, match stic.

Method : Take two paper bags or paper cups of same size. Hang these paper bags or cups in the inverted position on the ends of a stick or rod. Tie a piece of thread in the middle of the rod and hang them like a beam balance. The rod or stick should be horizontal and the bags or cups should be at same level showing that the paper bags or cups have equal air in them. Now burn a candle and put it below one of the paper bags or cups. Observe what happens.

Observation: The paper bag with burning candle below it, is lifted up.

Handle the burning candle carefully.

(a) *(b)*

Figure 8.5: Hot air is lighter than cold air.

Conclusion : This happens because the air above the burning candle gets heated. This hot air becomes lighter and rises up. This hot air fills in the paper bag/ cup and it also becomes lighter. So this paper bag/ cup is lifted up.

Think And Answer:

1. Hot air is _____ than cold air.
2. The paper cup over the burning candle comes down as it becomes heavier. (True/ False)

There are some situations where this phenomenon i.e. hot air is lighter than cold air is used:

(i) Smoke ventilators are built near the roof of the houses as smoke being hot goes up.

(ii) Hot air balloon rises up because of the hot air filled in the balloon.

(iii) Hot air from heat convector, being lighter goes up and the cold air comes down. In this way the whole room gets heated up.

(iv) When lot an rises up, the pressure at that place decreases. The cool air from surrounding moves and takes its place. Hence wind and storm blows.

Fig 8.6: (a) Ventilator

Fig 8.6 : (b) Hot air balloon

8.4 How are winds produced ?

Moving air is called wind. When there is pressure difference in two areas, the air starts moving from area of high pressure to the area of low pressure. This moving air is called wind. The greater the difference in pressures, the greater will be the speed of wind. The difference of pressure of air at different places is due to the temperature difference of these areas which is due to unequal heating of the earth by the sun. This leads to temperature and pressure difference. Hence it causes winds.

8.4.1 Measurement of speed and direction of wind:

The speed of wind can be measured by an instrument called **Anemometer**. It consists of 4 cups mounted on a rod which can rotate freely by the wind. The greater the speed of the wind, faster is the rotation of cups. The direction of a wind can be measured by an instrument called **Wind vane**. The arrow of the wind vane rotates freely. The direction of arrow gives an idea about the direction of flow of wind.

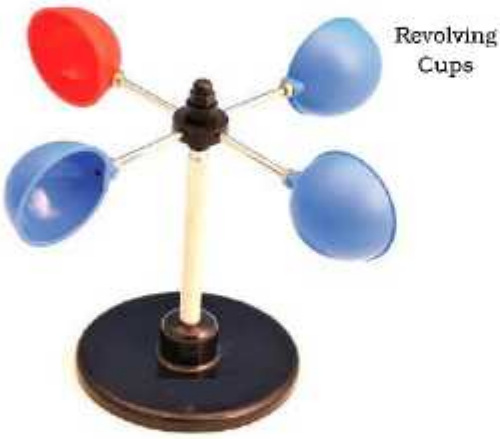


Fig 8.7: (a) Anemometer

Fig 8.7 : (b) Wind Vane

8.4.2 Wind currents are generated due to uneven heating of the earth.

Wind is produced due to uneven heating of the earth. It happens due to following reasons:

(i) Uneven heating between the equator and the poles.

(ii) Uneven heating of land and water.

(i) Uneven heating between the equator and the poles:

Equator is an imaginary line passing through the centre of the earth's surface which divides earth in two equal hemispheres. The equator and the regions around it get direct sun rays for most of the time. So the regions near the equator gets more heat than the region near the poles, which do not get direct sun rays. This lead to the difference in temperature of the equator and the polar region. The air near the equator gets heated and rises up. The colder air from the poles, which is at greater pressure moves to take its place.

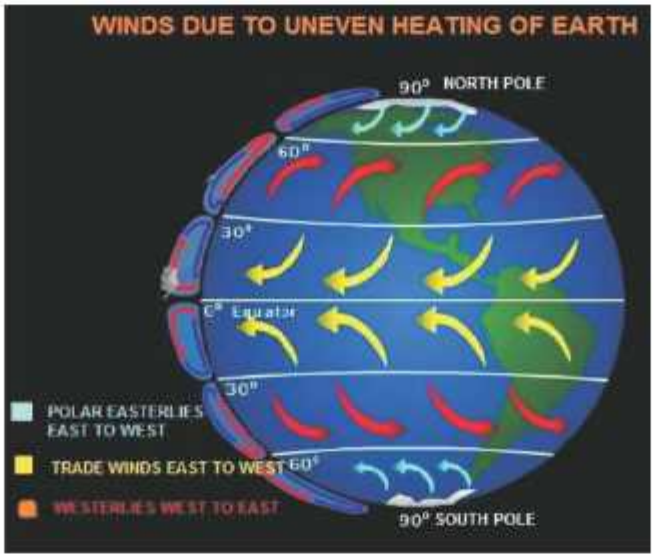


Figure 8.8 : Wind blowing from north and south poles towards equator.

This makes the wind blow from the north and south poles towards the warmer equator regions of the earth. But the direction of wind is not exactly the north-south direction. The change in direction of wind is due to the rotation of earth.

(ii) Uneven heating of the land and water :

During summers, the temperature of land remains higher than that of water. The air above the land gets heated and rises up. This creates an area of low pressure over the land. This causes the air to flow from the ocean towards the land. This is a reason that the air laden with moisture move towards the land from Arabian sea and Bay of Bengal. These are called **Monsoon winds**. The monsoon wind carries lot of water with them from the oceans which bring

rains in India during rainy seasons. The agriculture in India mainly depends on these monsoon winds.

After the rainy season, the wind loses their water content and while passing over the Bay of Bengal, they pick up moisture. This brings rains in coastal areas of Tamilnadu, Andhra Pradesh and Telangana. These are called retreating monsoons.

During winters, the direction of wind flow gets reversed and it flows from land to ocean. In winter the land cools faster than the water in the ocean. The temperature of water in oceans is higher than that of the earth. The warm air over the ocean rises up and creates an area of low pressure above the sea water. The cooler air from the land blows towards the oceans. The winds from land towards oceans carry a little water vapour in them. So there is little rain in winter.

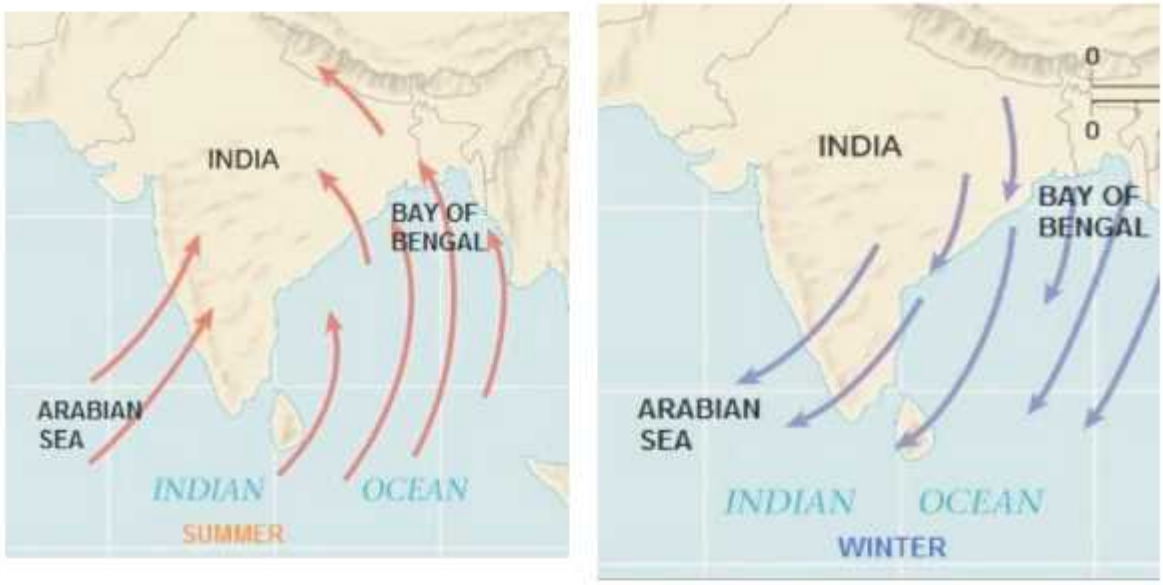


Figure 8.9 : Winds in India due to uneven heating of land and water in summer and winter.

Rain brings happiness and prosperity. But, this is not always true. Sometimes the natural phenomena related to rain can also be destructive. High speed winds like thunder storms and cyclones may bring disaster and can cause a threat to human and animal life. Let us discuss these natural phenomena in detail.

8.5 Thunderstorms and Cyclones :

Thunder is a loud sound produced by lightening. Lightening heats the air to very a high temperature. On heating, the air expands quickly producing a loud sound. This loud sound is called **thunder**.

Storm is a strong wind blowing with heavy rainfall. A storm is highly disturbed state of atmosphere.

(a) Storm in Punjab

(b) Thunder and Lightening

Figure 8.10 Thunderstorms

Sometimes the thunder and storm both occur together. This is called **thunderstorm**. Thunderstorm is a loud sound with flashes of light accompanied by heavy rains. In India the thunderstorms are very frequent as the climate in India is usually hot and humid. The hot weather heats the air. The air becomes lighter and rises up creating a low pressure region near the earth's surface. The cool air moves fast to take its place. So, strong wind or storm is formed. Humidity provides water vapours for the formation of clouds. So, heavy rainfall is also associated with storm. The friction of water vapours in the clouds produces opposite charges in the clouds. These opposite charges produce lightening. So, a thunderstorm is associated with strong winds, heavy rainfall, thundering and lightening. We should take the following precautions during a thunderstorm to escape from its harmful effects:

(i) Do not stand under a tall isolated tree. We should stand under the roof of a building or a small tree.

(ii) Do not stand in open area.

(iii) Do not use an umbrella with metallic stick or wires or any metallic thing. It may act as conductor of electricity during lightening and can cause electric shock.

(iv) Do not sit near open doors or windows. Always close windows during thunder storms.

(v) A car or bus is a safe place to take shelter.

(vi) If you are in swimming pool, come out of it quickly. Take shelter in a building.

8.5.1 How is a cyclone formed?

When water changes to water vapours to form clouds, it absorbs heat from the surroundings. When water vapours cool down and condense to form water drops (rain), they lose the absorbed heat. This is called heat of condensation of water vapours. This heat released by the condensation of water vapours, warms the surrounding air. The warm air being lighter rises up, creating a low pressure area. Fast wind starts blowing towards the centre of the low pressure area. This process repeats again and again forming a low pressure area at the centre and fast blowing winds around this area with thick clouds. The chain of events ends up in the formation of a very low-pressure system with very high speed winds revolving around it. It is this weather condition that we call cyclone.

A cyclone is a huge revolving storm, in which strong winds blow around a central area of low pressure. The centre of a cyclone is a calm low pressure area called the EYE of the cyclone. The diameter of the eye of cyclone is about 10 to 30 km. The area of eye is free from clouds and has light winds. Around this calm and clear eye there is an area with clouds and thunder storms. This area extends about 150 km and strong winds blow at speeds of 150 km/h to 250 km/h. Away from this area, the speed of the winds decreases gradually. The cyclone ends quickly when it moves over land as it does not receive heat energy from warm sea water.

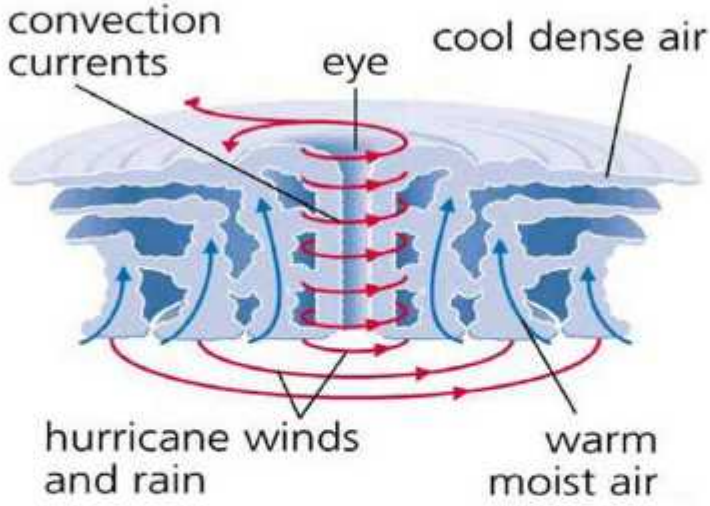


Figure 8.11: Formation of Cyclone

8.5.2 Destruction caused by Cyclones:

Cyclones can be very destructive as they are the strongest storms on earth. Strong winds of cyclone pushes the sea water outwards with a great force. The extremely low pressure in the eye of cyclone lifts the sea water upwards. Sea water can rise up to a height of 3 to 12 meters. The sea water enters the low coastal areas and causes widespread destruction of life and property. The sea water also reduces the fertility of the soil.

Figure 8.12: Destruction by cyclone in Orrisa in 1999

The whole coastline of India is very vulnerable to the cyclones. The eastern coastal regions like Odisha (Orissa), Chennai, Mangalore and Puri are most likely to be effected by the cyclones. The regions far away from the oceans like Punjab, Haryana and Delhi are not vulnerable to cyclones. In India, Odisha was affected by a cyclone on 18th October 1999. The speed of the wind was over 200 km/h and it destroyed 45,000 houses making 70,000 people homeless. Another cyclone hit Odisha on 29th October 1999 with the speed of wind 260 km/h accompanied by 9 meter high waves. Many people lost their lives and property worth of crores was destroyed.

Effective Safety Measures :

There are some effective safety measures which should be taken in cyclone vulnerable areas.

(i) Effective Safety Measures to be taken by the Government :

The following safety measures should be taken by the government:

(a) Coastal areas should be thickly planted with tall and indigenous species of plants, which checks the speed of wind.

(b) In coastal areas, ponds should be built to absorb excess of water.

(c) Cyclone shelters should be constructed in cyclone vulnerable areas.

(d) An efficient forecast measure should be adopted and the warnings should be communicated to the people of the affected area well in advance

(i) Effective safety measures to be taken by the people :

The following safety measures should be taken by the people of the area:

(i) Do not ignore cyclone warnings.

(ii) If the area is regularly affected by the cyclone, it should be evacuated.

(iii) Make necessary arrangements to shift the valuable material, animals and people to safer places.

Advanced technology used in safety measures :

By using the information given by satellites, we can get advance alerts about the cyclone, even 48 hours before it would hit the area. This gives the people enough time to make proper security arrangements and evacuate the area.

8.5.3 Tornado :

A tornado is a violent storm, with strong rotating winds in funnel shaped cloud. Its diameter can be from 1m to 1 Km. Due to very low pressure at the centre of the funnel, it pulls the dust, debris and even people and vehicles towards its centre.

Figure 8.13 (a) : Tornado

Figure 8.13(b) : Safety measures from a tornado.

Safety measures from tornado:

(i) Take shelter inside a room in the house without windows.

(ii) If a room without windows is not available then shut all the doors and windows.

(iii) If a person is in the vehicle, he should get out of it and lie in a low-lying area.

(iv) Whenever you face tornado you can save yourself by bending your knees and putting your arms around your head and neck.

KEYWORDS

Low Pressure	Wind	Expands
Anemometer	Wind vane	Monsoon Winds
Thunderstorm	Lightening	Cyclone
Tornado		

Points to Remember

- Air around us, exerts pressure.
- Moving air is called wind.
- The high speed air reduces pressure.
- The air expands on heating and contracts on cooling .
- Hot air is lighter than cold air.
- The air moves from area of high pressure to the area of low pressure.
- The speed of wind can be measured by an instrument called Anemometer.
- The direction of a wind can be measured by an instrument called Wind vane.
- Wind is produced due to uneven heating of the earth.
- Thunder is a loud sound produced by lightening.
- Storm is a strong wind blowing with heavy rainfall.
- A cyclone is a huge revolving storm, in which strong winds blow around a central area of low pressure.
- A tornado is a violent storm, with strong rotating winds in funnel shaped cloud.

Exercise

1. Fill in the blanks :

(a) Air exerts ..... .

(b) Moving air is called ..... .

(c) Near earth the ..... air rises up and ..... air comes down.

(d) Winds are generated due to ..... heating of earth.

(e) The centre of a cyclone is called its ..... .

2. Write True or False :

(a) A bicycle tube expands when we fill air in it.

(b) Air moves from a region of low pressure to high pressure.

(c) The speed of wind can be measured by an instrument called Anemometer.

(d) Thunder is a loud sound produced by lightening.

(e) We should ignore the cyclone warnings.

3. Multiple Choice Questions :

(a) Which of the following is not an example of air exerting pressure?

i) Flying a kite ☐ ii) Filling air in bicycle tube ☐

iii) Filling air in balloon ☐ iv) Hot air balloon. ☐

(b) Moving air is called _____

i) Wind ☐ ii) Cyclone ☐

iii) Lightening ☐ iv) Storm ☐

(c) Which is the property of air?

i) Expands on cooling ☐ ii) Contracts on heating ☐

iii) Expands on heating ☐ iv) None of the above ☐

(d) Winds are produced due to _____

i) Heating of air ☐ ii) Cooling of land ☐

iii) Heating of water ☐

iv) Uneven heating of land and water ☐

(e) High speed winds can cause _____

i) Thunderstorms ☐ ii) Cyclones ☐

iii) Tornado ☐ iv) All of the above ☐

4. Match the Columns :

Column I		Column II
(a)		(a) Air exerts pressure
(b)		(b) Fast moving wind reduces pressure
(c)		(c) Cyclone
(d)		(d) Tornado

5. Very Short Answer Questions :

(i) Which property of air is described by the inflated balloon?

(ii) Which is lighter, Cold air or hot air ?

(iii) Which region of earth gets maximum heat from the sun?

(iv) Which winds bring rain in India?

(v) Name the instrument used for measuring the speed of wind?

6. Short Answer type Questions :

(i) Why are the holes made in hanging banners and hoardings?

(ii) In which situation does the uneven heating of the earth produces winds?

(iii) Which winds blow from ocean to land in summer? What is their significance?

(iv) What is the difference between a thunderstorm and a cyclone?

(v) State effective measures to be taken in areas vulnerable to cyclones?

(vi) What is a Tornado? Give two safety measures.

7. Long Answer type Questions :

(i) Explain why does a tin can get containing boiled coats gets crushed when cold water is poured over it.

(ii) Explain with an activity that air expands on heating.

(iii) How is a cyclone formed? Describe how a cyclone caused widespread destruction in Odisha in 1999.

9 SOIL

N5P9H9

World Soil day is celebrated on 5th December Every Year

The top most layer of earth where crops/plants can grow is called Soil. It comprises of weathered rocks, organic matter from animals, plants and micro-organisms. Various horizontal layers of soil profile are :

(i) Humus (Organic layer)
(ii) Topsoil
(iii) Subsoil
(iv) Rock fragments
(v) Solid bedrock

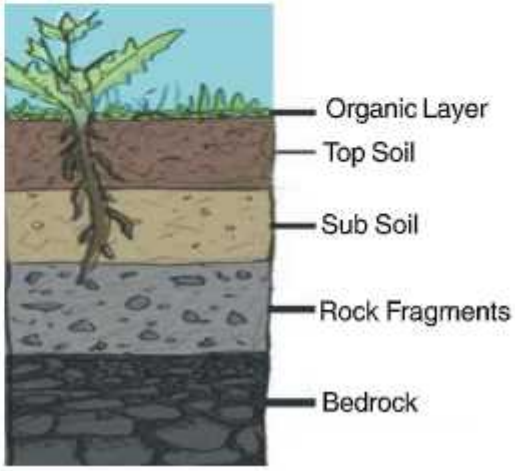


Figure 9.1: Section through soil showing five horizons

9.1 Composition of Soil

The soil is made up of both organic and inorganic components. Dead and decaying leaves or plants, dead bodies of insects or other animals buried in soil, cow dung etc. make the organic matter of soil. This is called **humus.** Sand, gravel, clay, stones and minerals are the inorganic constituents of soil. A soil having a mixture of various types of particles and containing organic and inorganic matter is good for crops. Neither clay nor sandy soil or gravel is suitable for growing crops.

9.2 Types of Soil

Soil may be classified according to the size of particles, colour and chemical nature.

(A) Types of soil according to the size of particles

According to the size of particles the soil may be clayey, sandy, gravel or loamy.

(i) **Clay:** Soil in which particles are very fine like dust particles is clayey soil, when powdered properly its particles may pass through muslin cloth. This type of soil is used for making earthen pots and

porcelain pots. On adding water it changes to mud and on drying it becomes hard.

Fig 9.2 Clay

(ii) Sand : The particles of sand are bigger than clay. These particles can not pass through muslin cloth. Generally, the desert soil is sandy. It does not retain water.

Fig 9.3 Sand

(iii) Gravel : This type of soil has very large particles which can be picked by hand. They do not pass even through a sieve.

Fig 9.4 Gravel

(iv) Loamy Soil : Its particles are of the size between clay and sand. It is the best soil for crops.

Fig 9.5 Loamy Soil

(B) Types of soil according to its Chemical Nature :

Chemically a soil may be acidic, alkaline or neutral.

(i) **Acidic Soil :** Sometimes the soil contains salts which, when mixed with water turns into acid. Such soil is acidic. If crops are to be sown in acidic soil then fertilizers or minerals containing bases are added in such a soil. pH of acidic soil is between 1-6.

(ii) **Alkaline Soil:** This type of soil contains salts of sodium, potassium, magnesium and calcium, which on dissolving in water give alkaline solution. When crops are to be sown in such a soil, then such fertilizers are added in the soil which form acids in water and neutralize the alkaline solution. pH of alkaline soil is 8-14.

(iii) **Neutral Soil:** The soil which is neither acidic nor alkaline is called neutral soil. This soil is good for growing crops. Manure or mixed fertilizers (fertilizers which have both acidic and alkaline salts) are used. pH of neutral soil is 7.

Activity 1 : To identify pH of soil.

Material Required: Test tubes, water, different soil samples, pH paper.

Method : Collect samples of soil from your school ground, kitchen garden, flower bed, field and road side. Now dissolve these samples in water in different test tubes labelled as A,B,C,D and E.

Fig 9.6 Testing the pH of soil

Now test the chemical nature of these solutions with the help of stripes of pH papers.

Observation : Observe the change of colour in pH papers in all the test tubes.

Conclusion : Different colour of pH paper with different solutions will tell the chemical nature of soil i.e. acidic or alkaline or neutral nature of soil. Match the colour of pH paper with pH scale and note its respective number. If it is less than 7 soil is acidic. If it is greater than 7, soul is basic and if it is equal to 7 soil is netural.

Think And Answer:

1. What is the chemical nature of the soil having pH is 3?
2. What is the chemical nature of soil having pH 10?
3. Write down the pH of neutral soil?

(C) Types of soil according to colour :

When we visit different areas or fields we see that soil is also of many colours. These colours are due to the presence of some minerals and organic matter in the soil. The soil may be of following types :

(i) **White Soil :** This soil is generally sandy in texture and does not contain organic matter and minerals. It is not very fertile.

Fig 9.7 (White Soil)

(ii) **Red Soil :** This soil contains salts of copper and iron.

Fig 9.8 (Red Soil)

(iii) **Black Soil :** This soil contains salts of iron, aluminium and humus. The colour may be due to presence of decayed organic matter in it. This soil is best for growing cotton. The south west districts of Punjab like Bathinda, Mansa, Sangrur and Barnala have black soil.

Fig 9.9 (Black Soil)

Activity 2 : To find the rate of percolation of water:

Material Required : 4 pieces of plastic pipe, different types of soil, stop watch, water.

Method : Take four pieces of plastic pipes of about 10 cm. diameter and fix these in holes dug in the ground. Now fill these pipes with different types of soil such as sand, clay, gravel, loamy soil.

Take some water in a bottle and a stop watch. Now put 500 ml of water from bottle in the first pipe and note the time with the help of stop watch, till the water is not visible in the pipe above the soil.

Repeat this with all the samples.

Observation: Find out the time for percolation in each pipe. i.e. (time in which water is fully absorbed by the soil).

Conclusion :- Rate of percolation = $\frac{\text{Amount of water in ml}}{\text{Total time for percolation in minutes}}$

After Calculation, you will find out that different types of soils have different percolation rate.

Think And Answer:

1. In which type of soil rate of percolation is highest?
2. Which soil has maximum water retention capacity?

9.3 Presence of water in soil

Soil not only contains minerals and organic matter but it also contains water. Clay can retain more water but sand has least water retaining capacity.

The presence of water in the soil can also be checked by heating a known amount of soil.

Activity 3 : To show the presence of water in the soil.

Material Required: Soil, test tube, Clamp stand, a burner, a weighing scale.

Method: Take a known mass (let W_1) of soil in a test tube and fit it in a stand with the help of a clamp. Now heat the test tube with a burner.

Observation: You will see that steam or water vapours come out of test tube. When soil has completely dried, Weigh the soil again. Let it be W_2.

Conclusion:

Weight of soil = W_1

Weight of soil (Dry) = W_2

Weight of water present = $(W_1 - W_2)$

$$\%\text{age of water in soil} = \frac{(W_1 - W_2)}{W_1} \times 100$$

W_2 or weight of dried soil is less than the original weight (W_1).

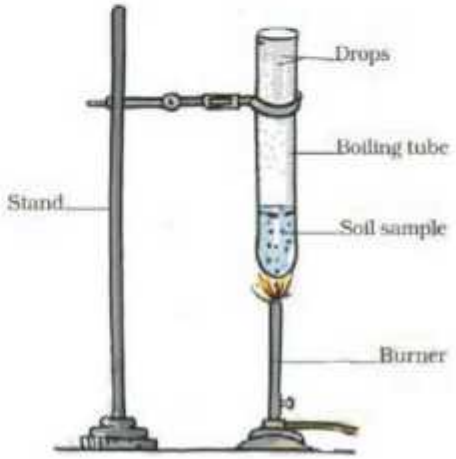


Fig 9.10 Testing the pressence of water in soil

9.4 Presence of air in soil

The air present in the soil is used by roots of plants. The soil is ploughed or tilled to make it porous. Porous soil contains more air in it.

Activity 4 : To show the presence of air in soil :

Material Required : Beaker, Soil, Water.

Method: Take a beaker and half fill it with garden soil. Put this beaker on the table. Now pour water in this soil so that the soil is covered with water.

Observation: You will see the bubbles of air coming out of soil through water.

Conclusion : Soil contains air.

Fig 9.11 Testing the presence of air in soil

Think And Answer:

1. Why is soil tilled or ploughed?
2. What is the use of air present in soil?

9.5 Soil and Crops

In India different crops are grown in different parts of the country. Plants get nutrients from the soil in the dissolved form along with water. Some crops grow better in loamy soil, some in clayey and some crops grow in sandy soil.

Western states of India like Rajasthan and Gujarat have sandy soil, rich in nutrients. So, the crops like millet (*bajra*), groundnut and oil crops grow better in such soil.

Fig 9.12 (Bajra)

Fig 9.13 (Ground Nut)

Punjab, Haryana have clayey and loamy soil. So the crops like wheat, maize and paddy grow better.

Soil of Uttar Pradesh and Madhya Pradesh is suitable for growing pulses.

Tea is grown in Assam, West Bengal and Himachal Pradesh where soil is suitable for it and water does not remain standing.

Fig 9.14 (Tea Plantations)

In coastal areas like Kerala, Karnataka, West Bengal, Orissa and Telangana, the soil is suitable for growing rice. This soil has lower rate of percolation.

Black soil of Gujarat, Maharashtra and few districts of Punjab and Haryana is suitable for growing cotton. Onions grow better in eastern districts of Maharashtra, where soil is rich in sulphur.

9.6 Formation of fertile Soil

It takes many years for the formation of fertile soil. The top layer of earth upto a depth of 30 to 40 cm where crops can grow is called Top soil. This fertile soil is formed by following factors:

(i) **Addition of Manure** Cow dung and manure increases organic matter in the soil. This makes the soil rich in nutrients and suitable for growing crops.

Fig.9.15 (Cow dung and organic matter)

(ii) **Deposition of soil along river beds** River bring many minerals, organic master and sand along with them and deposit them in plains along the river beds. This helps in making soil fertile.

(iii) **Natural vegetation** also makes the soil fertile. Decaying of leaves, dry wood and nitrification by bacteria enriches the soil.

(iv) **Alteration of crops** When crops are sown alternatively in the fields like leguminous crops (Pulses) are sown in between two main crops. The practice is called alteration of crops. This also helps in maintaining the fertility of soil.

9.7 Uses of Soil

Soil is not only used for growing crops but also for many other purposes. Soil is used for the following purposes:

(i) Soil holds the roots of trees firmly.

(ii) Agricultural crops are grown in fields where soil is rich in nutrients.

(iii) Soil is used for making bricks.

(iv) Clay is used for making cement.

(v) Sand is mixed with cement for construction of houses, roads, bridges, factories etc.

(v) Very fine clayey soil is used for making earthen pots. Flower pots, flower vases etc. are also made from soil.

(vi) Soil is also used for building dams across the rivers or ravines.

9.8 Soil Erosion

Sometimes we see that the top layer of soil is washed away by heavy rains, floods, strong winds or other factors. This is called soil erosion.

9.8.1 Causes of soil erosion

Soil erosion is caused by the following factors:

(i) **Floods** : Floods wash away the top layer of the earth called soil. Sometimes the crops are also washed away.

(ii) **Wind or Storm** : Fast blowing air, wind or storm carry away the top layer of the soil and the soil gets eroded.

(iii) **Deforestation** : When forests are cut or uprooted the soil becomes loose and is easily washed away.

(iv) **Over grazing** : When a pasture or grassland is grazed by cattle again and again, the soil becomes bare and loose and is easily eroded.

(v) **Mining** : Mining for stones and minerals is also a major factor for soil erosion.

9.8.2. Checking soil erosion :

To check the soil erosion following steps are to be taken:

1. **Afforestation** : More and more plants should be planted on barren hills and grass be grown on plain grasslands. Bamboo plants are very useful in checking soil erosion. So, more and more bamboo plants should be grown on hills and semi hilly areas.

2. **Controlled Mining** : Mining should be controlled. It should be done in such a way that the mining area does not become prone to soil erosion.

3. **Alternate Grazing :** The cattle should not be allowed to graze in the same pasture regularly. After some days the pasture should be left undisturbed and cattle should be grazed in other pasture.

4. **Making check dams :** In hilly areas check dams should be built across small streams or ravines. This helps in preventing soil erosion.

Fig. 9.16 Dams

5. **Growing grass on embankments of fields :** Fields should be surrounded by soil embankments and grass should be grown on these embankments, so that the water from the fields do not run out.

Fig. 9.17 Embankments of fields

6. **Concrete banks of rivers and canals :** The banks of rivers, canals and streams be made with, bricks, stones and concrete. The stones in iron nets be placed at curves. This reduces the chances of erosion of the banks of river canals.

Fig. 9.18 Concrete banks of rivers

9.9 Soil Pollution

Addition of unwanted and harmful substances in the soil is called soil pollution. Soil gets polluted by following human activities:

(i) **Excessive use of insecticides and chemical fertilizers :** Most of the chemical fertilizers and insecticides are non-biodegradable. They remain in the soil permanently and pollute the soil.

(ii) **Industrial Wastes :** Many chemical industries throw residual waste in the surrounding areas. This also pollutes the soil.

(iii) **Throwing of polythene and plastic wastes :** Throwing of polythene and plastic wastes also pollutes the soil. Many chemicals are used in the manufacture of plastics and polythene. When waste polythene or plastic is thrown in the soil, these chemicals enter the soil and pollute it.

KEYWORDS

- Clay
- Humus
- Soil profile
- Weathering
- Top soil
- Acidic soil
- Alkaline soil
- Soil water
- Percolation
- Black soil
- Desert
- Coastal area
- Water holding capacity
- Soil formation
- Deposition
- Alteration of crops
- Soil erosion
- Grazing
- Pasture
- Mining
- Flood
- Wind
- Storm
- Check dam
- Embankment
- River bed
- Natural vegetation

Points to Remember

- The top layer of earth upto a depth of 30 to 40 cm. where crops can grow is called soil.
- Soil has different layers which can be seen in its soil profile.
- pH paper is used to test the acidic or alkaline nature of soil.
- Soil may be classified according to the size of particles, colour and chemical nature.
- Black soil contains salts of iron and this soil is best for growing cotton.
- The soil containing sulphur is good for growing onions.
- Different types of soil are needed for growing various crops.
- It takes many years to form top soil.
- The washing away of the top layer of the soil by the action of floods, winds, storms and mining etc. is called soil erosion.
- Soil erosion can be checked by afforestation, building check dams, growing grass on embankments of fields and making concrete walls on the sides of rivers.
- Soil is used for making bricks, earthen pots, cement and in all types of constructions.
- Soil becomes loose by mining and over grazing of animals and can easily be eroded by wind or water.
- Growing bamboo plants is best for checking soil erosion.

Exercise

1. Fill in the blanks :

(i) The top layer of earth upto a depth of 30-40 cm where crops can grow is called ..... .

(ii) A cut section of earth shows ..... of soil.

(iii) Acidic nature or alkaline nature of soil can be tested by using a ..... .

(iv) ..... has the finest particles which can even pass through muslin cloth.

(v) ..... soil has least water retention capacity.

(vi) ..... soil is best for growing crops.

(vii) In western states of India like Gujarat and Maharashtra, the soil is of ..... colour.

(viii) ..... is used by potter for making earthen pots.

(ix) The soil which is used for making cement is ..... .

(x) Bricks are made from ..... .

2. State True and False :

(i) pH paper is used to test the acidic or alkaline nature of soil.

(ii) Below a depth of 100 cm, the layer of earth is called soil.

(iii) All crops grow better in sandy soil.

(iv) Overgrazing of pasture lands is also responsible for soil erosion.

(v) Mining can check soil erosion.

(vi) Water can easily percolate through clayey soil.

3. Match column A with column B:

Column A	Column B
(i) Water can easily percolate through	(a) Pollution of soil
(ii) This soil is best for growing cotton	(b) Soil erosion
(iii) Polythene, plastic and use of insecticides cause	(c) Clay
(iv) Mining, overgrazing and deforestation cause	(d) Black soil
(v) This soil is used in the manufacture of cement	(e) Sandy soil

4. Choose correct answer:

(i) Which of these does not cause soil erosion?

(a) Deforestation ☐ (b) Building of check dams ☐

(c) Grazing cattle ☐ (d) mining ☐

(ii) Soil is polluted by

(a) Rotation of crops ☐ (b) Use of manure ☐

(c) Use of insecticides and chemical fertilizers ☐

(d) Using green manure. ☐

(iii) Soil is not used for

(a) Making insecticides ☐ (b) Making check dams ☐

(c) Making cement ☐ (d) Making earthen pots. ☐

(iv) Which of the following can check soil erosion

(a) Deforestation ☐ (b) Afforestation ☐

(c) Grazing of cattle ☐ (d) Mining. ☐

(v) Soil is used for

(a) Making cement ☐ (b) Growing crops ☐

(c) Making Dams ☐ (d) All of these. ☐

5. Very short answer type questions :

(i) What is humus?

(ii) Name the orgainc constituents of soil?

(iii) Name the inorganic constituents of soil?

(iv) What do you mean by loamy soil?

(v) Define soil erosion?

6. Short answer type questions :

(i) What is a soil profile?

(ii) Draw a labelled diagram of soil profile.

(iii) How does soil get polluted?

(iv) Why should we plant more Bamboo plants ?

(v) List the difference between clay soil and sandy soil?

(vi) What is check- dam? Why is it built?

7. Long answer type questions :

(i) Explain how is soil formed?

(ii) Explain the various factors responsible for soil erosion?

(iii) How is soil erosion checked? Explain.

(iv) Classify the soil on the basis of size of particles?

10 RESPIRATION IN ORGANISMS

While doing physical activities, such as running, swimming, cycling or climbing, our breathing rate increases rapidly. Have you ever thought why these activities make a person breathe faster? The answer to this question lies in understanding why we breathe. Breathing is a part of respiration. Do you want to know what is respiration and why do we respire? Let us learn about respiration.

10.1 Why do we respire ?

We already know that all organisms are made up of cells. **A cell is the smallest structural and functional unit of an organism.** Each cell individually performs certain biological activities such as nutrition, excretion, transport and reproduction. To perform all these activities, the cell requires energy. We require energy even when we are sleeping, sitting or reading. From where does this energy come from? Do you know why your parents insist that you should eat properly and regularly. Energy is obtained from the food we eat. This energy is released during respiration. Therefore, all living organisms respire to get energy from food. We already know that air contains oxygen. During the process of breathing, we breathe in air rich in oxygen and breathe out air which is rich in carbon dioxide. The air that we breathe in (contains sufficient amount of oxygen), is transported to different parts of body of an organism and ultimately to each cell. Inside the cells oxygen helps in the breakdown of food. The process of chemical breakdown of food in the cell with the release of energy is called **cellular respiration**. Cellular respiration takes place in the cells of all organisms. The body gets its usable energy through the process of breathing and cellular respiration.

In the cells, the food (glucose) is broken down into carbon dioxide and water in the presence of oxygen. When the breakdown of glucose occurs by using oxygen, it is called **aerobic respiration**. An organism is described as aerobic if it needs oxygen in order to survive.

$$\underset{C_6H_{12}O_6}{\text{Glucose}} + \underset{O_2}{\text{oxygen}} \xrightarrow[\text{Enzymes}]{\text{Aerobic Respiration}} \underset{Co_2}{\text{Carbon dioxide}} + \underset{H_2O}{\text{Water}} + \text{Energy}$$

However, glucose can also be broken down without using oxygen. This is called **anaerobic respiration**. The organisms which do not require oxygen to

produce energy inside the cells are called as **anaerobic organisms** or **anaerobes**. In the absence of oxygen, glucose breaks down into ethyl alcohol and carbon dioxide. Anaerobic respiration takes place in yeast.

$$\underset{C_6H_{12}O_6}{\text{Glucose}} \xrightarrow[\text{Enzymes}]{\text{Anaerobic Respiration}} \underset{2C_2H_5OH}{\text{Alcohol}} + \underset{2CO_2}{\text{Carbondioxide}} + \text{Energy}$$

Yeast is a single celled organism that respires anaerobically. Yeast is used to produce alcoholic beverages and also for making bread, idli and dosa etc.

Anaerobic respiration also takes place in our muscles when enough oxygen is not available. During heavy exercise like running, cycling, brisk walking or heavy weight lifting, the demand for energy increases. But the supply of oxygen to produce energy is not sufficient. Then the anaerobic respiration takes place in the muscle cells to fulfil the demand of energy. Lactic acid is produced during this process.

You might have experienced muscle cramps after heavy exercise. Have you ever thought why you get muscle cramps after a race ? It happens because of the anaerobic respiration of muscle cells. The partial breakdown of glucose in the absence of oxygen produces lactic acid. The accumulation of lactic acid causes muscle cramps (Fig 10.1).

$$\underset{\text{(in muscle cells)}}{\text{Glucose}} \xrightarrow{\text{in the absence of oxygen}} \text{Lactic acid} + \text{Energy}$$

We can get relief from cramps after a hot bath or a gentle massage. Massage or hot bath improves the circulation of blood and this increases the supply of oxygen. This increased supply of oxygen, results in further breakdown of lactic acid into carbon dioxide and water.

Fig.10.1 Muscle cramps after a race

10.2 Breathing

Now, we know that breathing is a part of respiration. Breathing is a mechanism by which organisms take in the air rich in oxygen and release air rich in carbon dioxide with the help of respiratory organs. The taking in of air rich

in oxygen into the body is called **inhalation** and giving out of air rich in carbon dioxide is known as **exhalation**. Both of these processes occur continuously throughout the life spam of an organism.

Activity 1 : Do you want to know that how long can you hold your breath? Perform this activity in your teacher's presence.

Perform this activity under the supervision of your teacher.

Method: Close your nostrils and mouth and hold the breath (Fig10.2). What did you feel after some time? How long were you able to keep both nostrils closed? Note down the time for which you could hold your breath.

Observation:- You will find that it is very easy to hold breath for 35 seconds and after that it becomes very difficult.

Conclusion:- We can not hold breath for long.

Now you can easily understand that one cannot live without breathing. It is because we need oxygen for breathing at every moment of our life and the carbon dioxide produced needs to be removed immediately. High levels of carbon dioxide in the body can be toxic.

Think and Answer:

1. How long were you able to hold your breath?
2. Why can we not hold our breath for a long time?

Fig.10.2 Holding breath

The number of times a person breathes in a minute is termed as **breathing rate**. One breath is one inhalation plus one exhalation. For a normal person, the breathing rate at rest is 12-20 times per minute. A child's breathing rate, at rest, is faster than that of an adult at rest. In general, smaller animals have faster breathing rate as compared to the larger animals. For example, a rat breathes about 90-110 times per minute while an elephant breathes only about 10-15 times per minute.

Amazing facts :

We take 12-20 breaths per minute when sitting and upto 80 during vigorous exercise. If on an average we breath 20 times a minute, we breathe 28,800 times a day.

Generally, we are not aware that we are breathing. We feel it after brisk walking or running. It means breathing rate differs under different conditions. The breathing rate changes according to the oxygen requirement of the body of an organism.

Would you like to find out your breathing rate under different conditions? Do you want to know whether it remains the same throughout the day? Let us find out the answers by doing the following activity.

Activity 2 : To study the rate of breathing under different conditions.

Find out how many times you breathe in and breathe out in a minute. Count your breathing rate (number of breaths per minute) after brisk walking and running. Note down your breathing rate before the event, after the event and and also again after taking complete rest. Tabulate your findings and compare your breathing rates under different conditions with those of your friends. Record your findings in table 10.1.

Table 10.1 Changes in breathing rate under different conditions

S. No.	Name of the Student	Rate of breathing under different conditions			
		Under normal conditions	After brisk walking of 10 minutes	After running a 100 m race	After complete rest

Think and Answer:

1. In which condition the rate of breathing is slowest?
2. What is your normal breathing rate?

Whenever we need extra energy, we need to breathe faster. We need more energy when we work hard. As a result, more oxygen is supplied to your cells to speed up the breakdown of food. Thus more energy is released. Now you can easily understand why we feel hungry after heavy work.

10.3 How do we breathe ?

Let us now learn about the complete process of breathing. We breathe with the help of a pair of lungs which are present in the chest cavity. The lung on

the left side is slightly smaller than the lung on the right side to leave space for the heart to work properly. The chest cavity is also known as **thoracic cavity.**

This cavity is surrounded by ribs. Ribs form a cage like structure called **rib cage**. A large muscular sheet called **diaphragm** forms the floor of the chest cavity (fig 10.3) Breathing involves the movement of both the diaphragm and rib cage. Our lungs are attached to the wind pipe called **trachea** ,which leads to nostrils. When air is inhaled, it passes through the nostrils into the nasal cavity. From nasal cavity, the air reaches our lungs through trachea.

Yawning : When we yawn, we breathe in deeply with our mouth wide open. This ventilates the lungs, fishing out stale air and replacing it with fresh air.

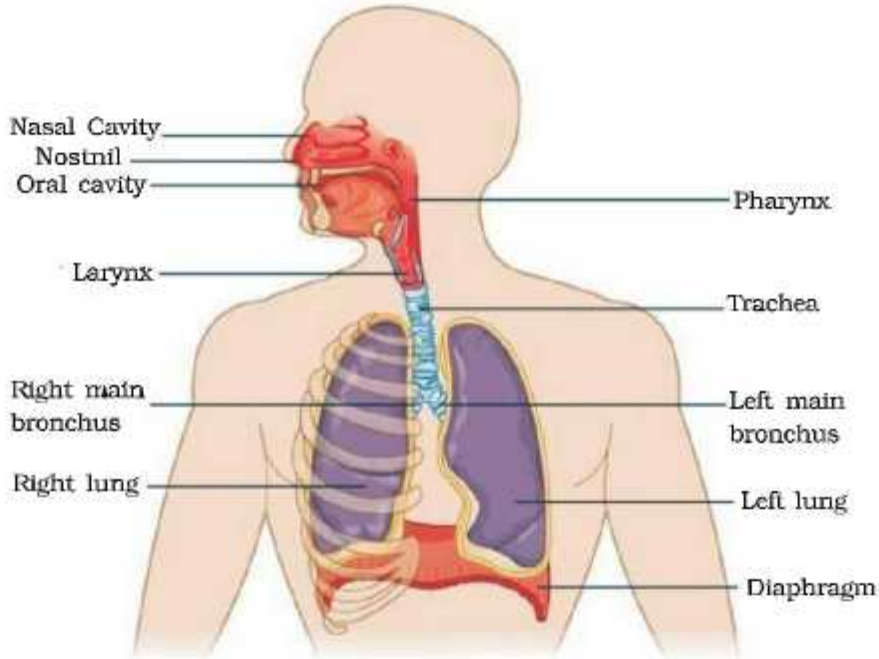


Fig 10.3 Human respiratory system

During inhalation process the ribs move up and outwards while the diaphragm moves down. This movement increases the space in the chest cavity and thus pressure is reduced inside chest cavity. The air outside the nostrils, which is at higher pressure rushes into the lungs and the lungs get filled with air (fig10.4).

During exhalation process, the ribs move down and inwards, while the diaphragm moves upward to its previous position. This reduces the size of the chest cavity and the pressure inside the chest cavity increases.This pushes the air out of lungs.

These movements in the body can be felt by taking a deep breath. Take a deep breath and keep your palm on the abdomen. You can easily feel the

movement of abdomen during expansion and contraction of your chest cavity.

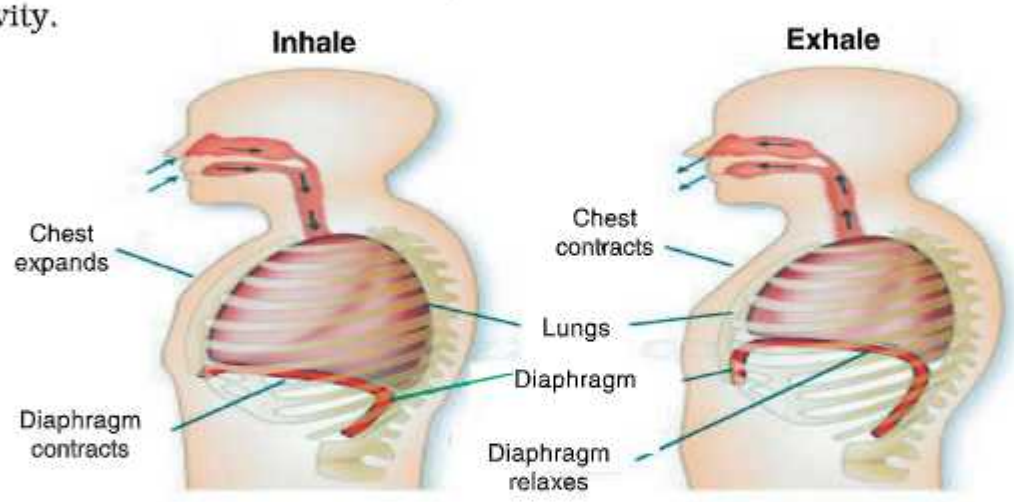


Fig 10.4 Mechanism of breathing In human beings

SNEEZING : There are a lot of unwanted particles in the air around us, such as dust particles, pollens etc. When we inhale, these particles get entrapped in the mucus and hair present in the nasal cavity. However, sometimes these particles may pass through the hair in the nasal cavity. These particles irritate the lining of the cavity, as a result we sneeze. Thus,sneezing expels foreign particles from the inhaled air and a dust free, clean air enters our body.

Activity 3 : Let us perform an activity to know the mechanism of breathing.

Material Required : Plastic bottle, knife, Y shaped tube, 2 balloons, wax or clay, rubber band, rubber sheet.

Method : Take a wide plastic bottle. Cut the bottom of the bottle with a knife or scissors. Get a Y shaped glass or plastic tube. Take two balloons and tie to the two ends of the Y-tube. Make a hole in the lid so that the tube can be passed through it. Introduce the tube into the bottle through the bottom and cap bottle as shown in fig.10.5. Seal the cap with wax or clay. To the open base of the bottle tie a thin rubber sheet or a big balloon with the help of a rubber band.

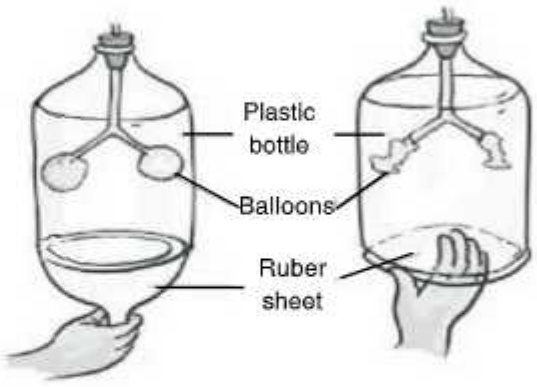


Fig 10.5 Model to show mechanism of breathing

Observation: Pull the rubber sheet downwards from the base of the bottle and observe the balloons tied to the Y-tube. Now push the rubber sheet up and watch the balloons. Did you see any change in the balloons tied to the Y-tube? You will see the balloons tied to the Y-tube get inflated when the bottom sheet is pulled downwards and gets deflated when the rubber sheet is pushed up.

Conclusion : Breathing involves the movement of diaphragm and rib cage. Ribs move up and outwards, while diaphragm moves downwards during inhalation. As a result of increased space in our chest, air enters into lungs and carbon dioxide is exhaled out from lungs and goes out through nostrils.

Think And Answer :

1. What does the rubber sheet represent ?
2. Which organs are represented by balloons?
3. Can you explain the mechanism of breathing with the help of this model ?

HARMFUL EFFECTS OF SMOKING : Smoking is harmful because there are many ingredients in tobacco smoke that can harm tiny air sacs (alveoli) in lungs. It is dangerous because it reduces the area of gaseous exchange in the lungs.These problems can range from an annoying cough to heart failure, emphysema and cancer.

Let us perform an activity to show what we breathe out.

Activity 4 : What do we breathe out ?

Material Required : Container with lid, straw, lime water.

Method : Take a container with a lid. Make a hole in the lid. Fix it on the bottle. Add freshly prepared lime water in the bottle and insert a plastic straw through the lid in such a way that it dips in the lime water. Blow gently through straw into the lime water till the colour changes (fig 10.6). Why is this change observed?

Observation : When you exhale into the bottle, the lime water turns milky.

Conclusion : Air we breath out contains carbondioxide which turns lime water milky.

Think and Answer:

1. Why does lime water turn milky?
2. What is the formula of lime water?

Lime water is calcium hydroxide $Ca(OH)_2$. It reacts with carbon dioxide CO_2 to form calcium carbonate $CaCO_3$, which is white in colour and does not dissolve in water, causing the water to turn milky.

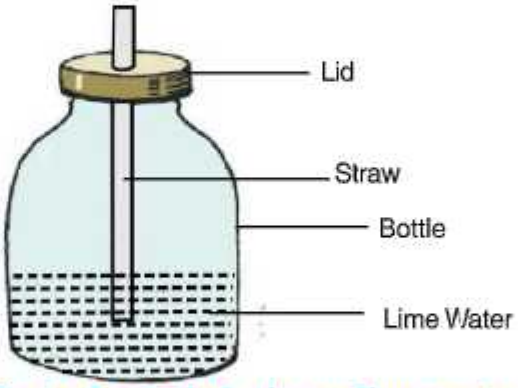
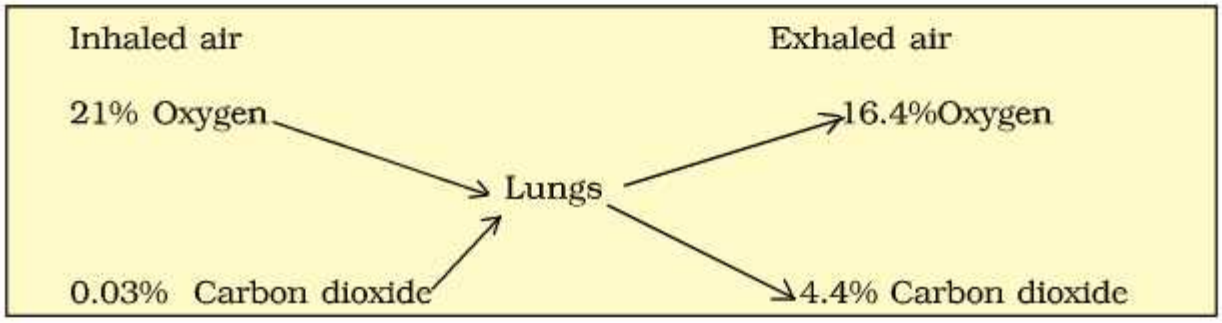


Fig 10.6 Effect of exhaled air on lime water

The percentage of oxygen and carbon dioxide in the inhaled and exhaled air



10.5 Breathing in other animals

Human beings have lungs for breathing. Animals such as lions, elephants, cows, goats, frogs, lizards, snakes, birds also have lungs in their chest cavities like us. However, insects and worms do not have lungs. In these animals breathing takes place through a different system. Let us study the respiratory organs of cockroach and earthworm.

10.5.1 Cockroach

A cockroach has small openings on both sides of its body called **spiracles**. It has a dense network of air tubes called **trachea** which are connected to the spiracles. As the oxygen rich air from the atmosphere enters into the body of cockroach through the spiracles into the tracheal tube, it penetrates into the different cells, where it is utilized to produce energy. Similarly, the air rich in

carbon dioxide, goes into the tracheal tubes and moves out through the spiracles (Fig 10.7).

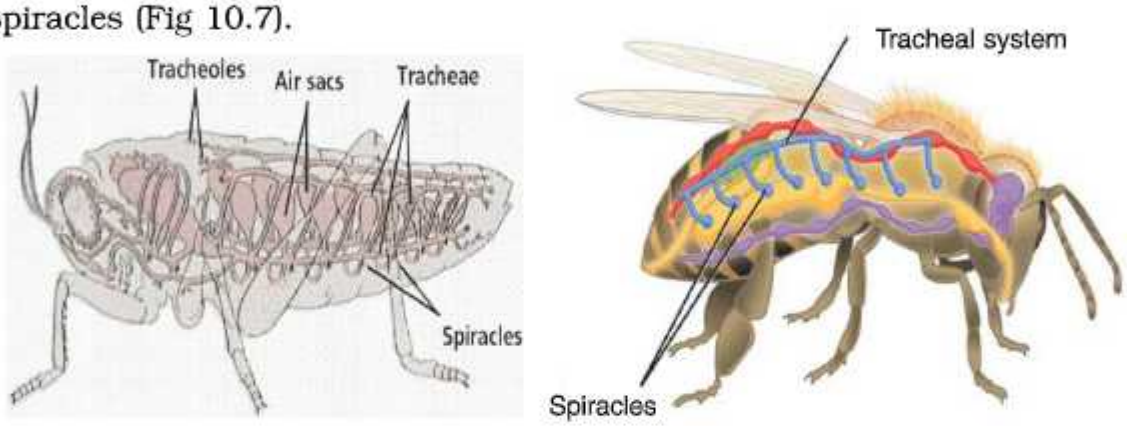


Fig 10.7 Tracheal system in insects

The blood of cockroach is colourless and in the absence of a respiratory pigment, it cannot carry oxygen to different tissues. Therefore, a tracheal system is developed to carry air directly to the cells.

10.5.2 Earthworm

Earthworm's skin is moist to touch. Earthworms breathe through the skin. Gases are exchanged through its moist skin and capillaries, where the oxygen is picked up by the haemoglobin present in the blood and carbon dioxide is released (Fig 10.8).

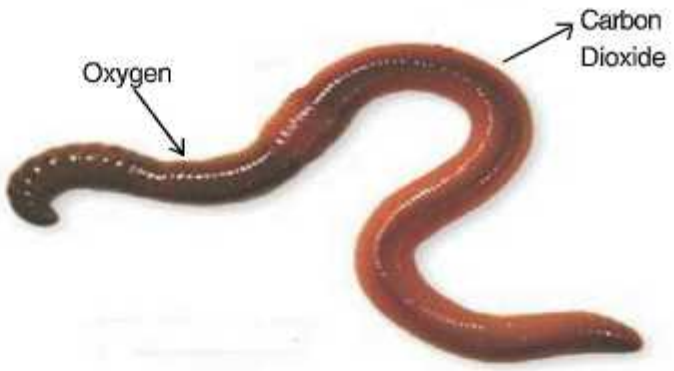


Fig 10.8 Respiration in earthworm

Although frogs have a pair of lungs like human beings to perform respiration yet they often breathe through their skin which is also moist and slippery like earthworms.

10.6 Breathing under water

We cannot breathe in water. There are many organisms which live in water. They may breathe in water through specialised organs called gills or through skin. Fishes have gills for respiration. Gills are feathery organs full of

blood vessels. Fishes take in water through their mouth and force it out through the gills (Fig.10.9). In gills water and blood flows in opposite direction to maximize the diffusion of oxygen.

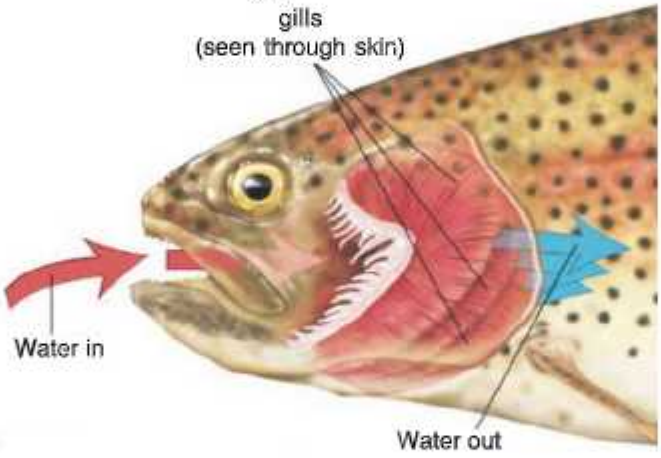


Fig 10.9 Breathing organs of fish

Why do dolphins and whales, come to the surface of water to breathe?

Dolphins and whales are not fishes, they are mammals. They use lungs for breathing. Like other mammals they are warm blooded and give birth to young ones.

Aquatic animals use oxygen dissolved in water. Since the amount of oxygen in water is very low as compared to the air, the rate of breathing is much faster in aquatic animals as campared to the terrestrial animals.

10.7 Respiration in Plants

Plants also respire like other organisms for their survival. Respiration in plants also involve exchange of oxygen and carbon dioxide. Plants prepare glucose by the process of photosynthesis. This glucose is used to produce energy. In cells break down of glucose takes place in the presence of oxygen. As a result carbon dioxide and water are produced, accompanied by the release of energy. The process takes place as follows:

Glucose + Oxygen $\longrightarrow$ Carbon dioxide + Water + Energy (ATP)

All parts of plants such as root, stem and leaf perform respiration individually. The leaves of plants have tiny pores called **stomata** for exchange of gases. The stomata generally open up during the day time and remain

closed at night. Young green stems also possess stomata. Old woody stems have lenticels for gaseous exchange.

The cells in the roots of the plants, also need oxygen to generate energy. Roots take air from the air spaces present between the soil particles (fig10.10).

Do you know why plants die when we overwater them?

This happens because the air spaces in the soil get occupied by water. Plant roots cannot get sufficient oxygen that is needed and plant dies.

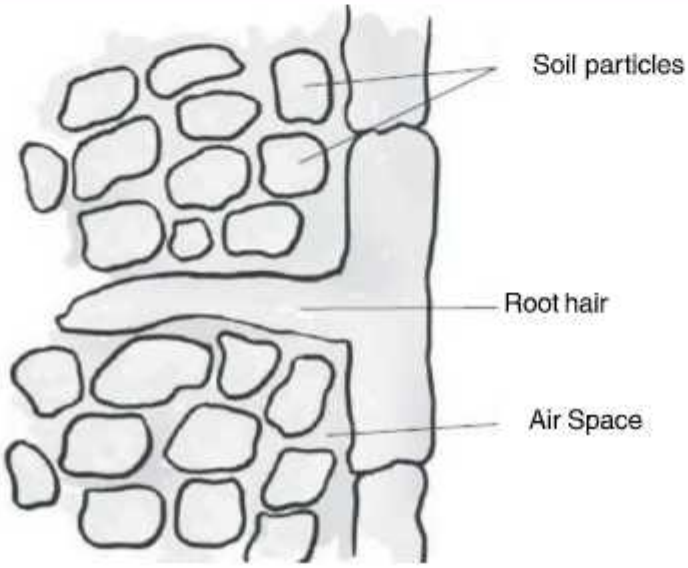


Fig.10.10 Roots absorb air from soil

We have learnt that respiration is a vital biological process. All living organisms respire to get energy to perform different biological activities.

KEYWORDS

Breathing	Inhalation	Breathing Rate
Respiration	Exhalation	Diaphragm
Aerobic Respiration	Anaerobic Respiration	Ribs
Cellular Respiration	Lungs	Gills
Aerobes	Muscle Cramps	Spiracles
Aquatic Animals	Lactic Acid	Trachea

Points to Remember

- Breathing is a part of the process of respiration in which an organism takes oxygen rich air and gives out carbon dioxide rich air.
- Respiration is a process by which energy is released from food after its breakdown. It is essential for the survival of living organisms.
- During cellular respiration breakdown of glucose occurs in the cells of an organism.
- Aerobic respiration is a process by which breakdown of food takes place in the presence of oxygen.
- Anaerobic respiration is a process by which breakdown of food takes place in the absence of oxygen.
- Haemoglobin is a pigment in the blood which transports oxygen to the different parts of the body.
- During heavy exercise when there is insufficient supply of oxygen, food breakdown takes place by anaerobic respiration.
- Increased physical activities enhance the breathing rate.
- During inhalation, our lungs expand and come back to the original position as air moves out during exhalation.
- In animals like cow, buffalo, dog, and cat the respiratory organs and the process of breathing are similar to those of humans.
- The breakdown of glucose in plants is similar to that in other organisms.
- Exchange of gases in earthworms takes place through the moist skin. In fishes, it takes place through the gills and in insects by the trachea.
- In plants roots take in air present in the soil. Leaves have tiny pores called stomata through which exchange of gases takes place.

Exercise

1. Fill in the blanks :

(i) Lactic acid is produced during ..... respiration.

(ii) Taking in of air rich in oxygen is called ..... .

(iii) The number of times a person breathes in a minute is termed as .....

(iv) Exchange of gases in leaves of plants takes place through .....

(v) The skin of an earthworm is ..... to touch.

2. Write true or false :

(i) Frogs breathe through their skin as well as lungs.

(ii) We cannot feel breathing movements in our body.

(iii) Aerobic respiration produces more energy than anaerobic respiration.

(iv) During heavy exercise the breathing rate of a person slows down.

(v) Insects have organ, called trachea for respiration.

3. Match the column A with B :

A	B
(i) Lenticels	(a) Gills
(ii) Yeast	(b) Old stem
(iii) Fish	(c) Skin
(iv) Stomata	(d) Alcohol
(v) Earthworm	(e) Leaves

4. Choose the correct answer:

(i) The earthworms respire through

(a) Trachea ☐ (b) Gills ☐

(c) Lungs ☐ (d) Skin ☐

(ii) Respiration helps in

(a) Digestion ☐ (b) Energy production ☐

(c) Locomotion ☐ (d) Chromosomes ☐

(iii) In cockroaches, air enters the body through:

(a) Skin ☐ (b) Lungs ☐

(c) Spiracles ☐ (d) Gills ☐

(iv) In old and woody stem gaseous exchange take place through:

(a) Stomata ☐ (b) Lenticels ☐

(c) Root hair ☐ (d) Do not respire ☐

(v) During heavy exercise we get cramps due to:

(a) Glucose ☐ (b) Oxygen ☐

(c) Lactic acid ☐ (d) Alcohol ☐

5. Very Short Answer Type Questions :

(i) Define the term breathing rate.

(ii) What is respiration? Name two types of respiration.

6. Short Answer Type Questions :

(i) Why do we get muscle cramps after heavy exercise?

(ii) Why does an over watered potted plant die?

(iii) Why do we often sneeze when we inhale a lot of dust- laden air?

7. Long Answer Type Questions :

(i) How respiration is different from breathing?

(ii) Draw a labelled diagram of human respiratory system.

(iii) List similarities and differences between aerobic and anaerobic respiration.

11 TRANSPORTATION IN ANIMALS AND PLANTS

We have already learnt that all living organisms require energy for various metabolic activities. This energy is obtained from the food they consume. We know that leaves need water to prepare their food through photosynthesis. Likewise, the food produced in the leaves has to be transported to the other parts of the plant. Similarly, in animals, the food, oxygen and water has to be transported to every cell of the body and wastes produced there have to be transported from the cells to the organs that excrete them.

In unicellular organisms, transportation is simple. Here, **diffusion** and **osmosis** helps in the movement of substances. Gases move in and out of the cell by diffusion. Other substances move by osmosis. The process of movement of substances, from one location to another, in an organism is known as **transportation**. Let us learn about the transportation of substances in animals and plants.

11.1 Transportation in Animals

(A) Circulatory System

The circulatory system in higher animals, consists of heart, blood vessels and blood. It helps in the transportation of oxygen, carbon dioxide, food, hormones and enzymes etc. from one part of the body to another. Let us learn about them in detail.

(a) Blood

Blood is a connective tissue that circulates throughout the body. It is a fluid medium for transportation. It flows in the blood vessels. It carries oxygen from lungs to the cells and carbon dioxide from the cells to lungs. It also transports digested food from small intestine to all parts of the body and nitrogenous wastes from the body cells to kidneys for removal from the body. It consists of a liquid called plasma in which three types of blood cells are suspended.

(i) Plasma : It is the liquid part of blood. It is yellowish in colour. Its major component is water. It makes up to about 55 per cent of the body's total blood volume.

(ii) Red Blood Cells (RBC's): Red blood cells are disc-shaped cells. Nucleus is absent in the RBCs. [Fig11.1 (a)] These contain a red coloured pigment

called **haemoglobin**. It is this pigment due to which the colour of the blood is red. Haemoglobin binds with oxygen to form oxyhaemoglobin and transports it to the cells of the body.

(iii) White Blood Cells (WBC's): They are colourless and irregular in shape. Their main job is to fight against germs and other foreign materials that enter our body [Fig 11.1 (b)].

(iv) Platelets: These are smallest cells present in the blood. They help in clotting of blood. So, they prevent excessive loss of blood during injuries [Fig11.1 (c)].

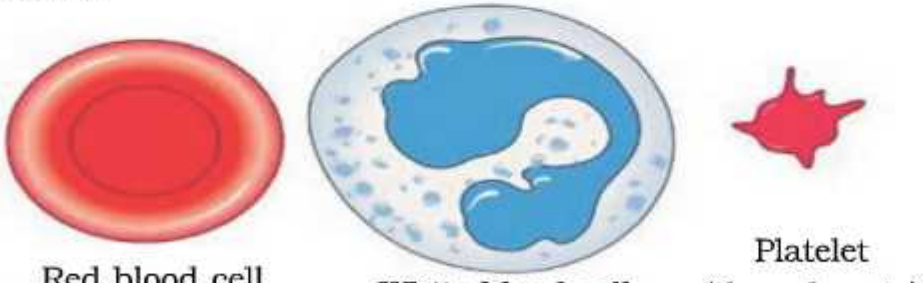


Fig 11.1 (a) Red blood cell, (b) White blood cell (c) and platelet

(b) Blood Vessels

Blood vessels are a network of tubes present throughout the body (Fig 11.2). They supply blood to all parts of the body. They are of three kinds:

(i) Arteries
(ii) Veins
(iii) Capillaries

(i) Arteries: Arteries carry oxygen rich blood from heart to all parts of the body (except the pulmonary arteries). Blood is pumped by heart with force through the arteries. So, we feel the pulse. A pulse is a rhythmic expansion and contraction of the arteries as blood is pumped through them by the heart. As the blood flows at high pressure in arteries, so they have thick and elastic walls which do not have valves.

(ii) Veins : Veins carry carbondioxide rich blood from all parts of the body to heart (except the pulmonary veins). The veins have thin walls as compared to arteries. There are valves present in veins, which allows blood to flow only towards the heart.

(iii) Capillaries: The arteries branch out into very thin tubes called capillaries. The capillaries join up to form veins. The exchange of

nutrients, gases and waste products between the blood and tissue fluids take place through capillaries.

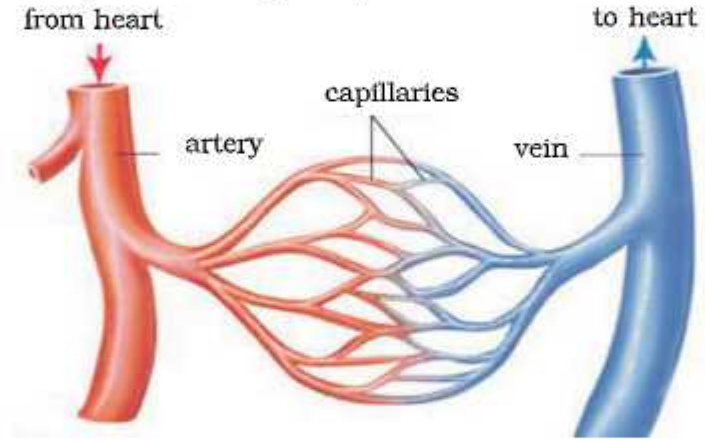


Fig 11.2 Schematic diagram of blood circulation

Let us perform an activity to study the flow of blood through arteries.

Activity 1 : To study the flow of blood through arteries.

Place the index and middle finger of your right hand on the inner side of your left wrist, towards the thumb side (as shown in the fig 11.3). You will feel the pulse.

Now count the number of beats in one minute. The number of beats per minute is called the pulse rate. A person at rest usually has a pulse rate between 72 to 80 beats per minute. You can also feel the pulse at neck, behind the knee, near the ankle joint etc.

Think and Answer :

1. What is pulse rate?
2. Where can we feel the pulse?

Fig 11.3 Feeling the pulse

Record the pulse rate of your friends in the table below.

Table 11.1 Pulse rate

S. No.	Name of student	Pulse rate

(c) Heart

The heart is a muscular organ which beats continuously to act as a pump for the transport of blood. It is located in the centre of chest cavity, with its lower tip slightly tilted towards left. Human heart has four chambers. Two upper chambers are called **right and left auricles** and two lower chambers are called **right and left ventricles** (fig. 11.4). The partition between left and right chambers helps to avoid mixing up of oxygenated blood with deoxygenated blood. Your heart is roughly the size of your fist.

Heart receives oxygen-rich blood from the lungs in the left auricle. Then the left auricle contracts and blood enters left ventricle. When the left ventricle contracts, the blood is pumped out to the body. Deoxygenated blood from the body comes to the right auricle. When the right auricle contracts, it transfers blood to the right ventricle. Right ventricle pumps blood to the lungs through pulmonery arteries for oxygenation. A number of valves in heart allow the blood to flow in one direction only and thus prevent blood from flowing back.

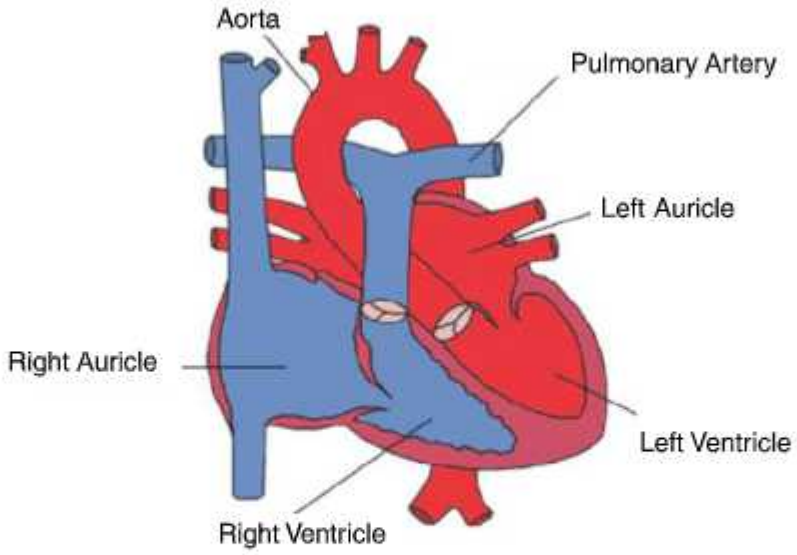


Fig. 11.4 The Human heart

Heart Beat

The walls of chambers of heart are made up of specialised muscles, called cardiac muscles which continue to contract and relax all the time without getting tired. The contraction and relaxation follows a rhythm called **heart beat**. One heart beat indicates one cycle of pumping action by all the four chambers. We can feel the heart beat by placing our hand on the left side of our chest. Doctors check heart beat with the help of an instrument called **stethoscope** (fig.11.5).

Fig.11.5 Stethoscope

A doctor use stethoscope to listen to the amplified sound of heart and lungs. It consists of a chest piece that carries a diaphragm, two ear pieces and a joining tube. Doctors get clues about the condition of patient by listening internal sounds of the body.

Let us make a simple model of stethoscope.

Activity 2 : To make a model of Stethoscope.

Material Required : Two funnels of different sizes, a rubber or plastic tube, rubbersheet or balloon, tape.

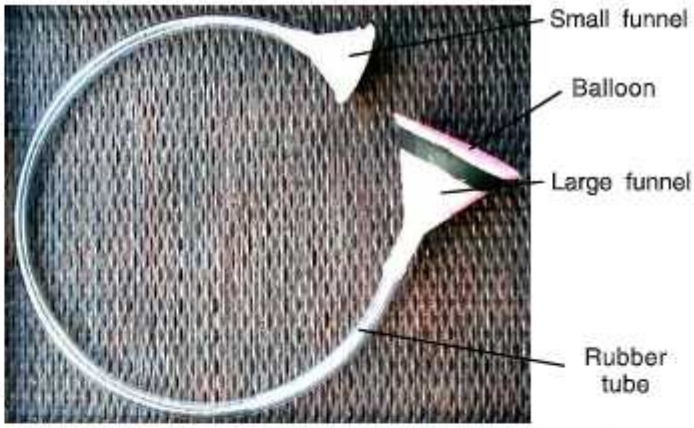


Fig 11.6 Model of stethoscope

Method : Take two funnels of different sizes and a rubber/ plastic tube which can fit either over or inside the funnel spouts. Fix both ends of the rubber tube to the funnels as shown in fig.11.6. Tape them to secure the ends if needed. Stretch a balloon or rubber sheet on the mouth of larger funnel and fix it with tape or rubber band. The balloon should be flat and pulled tightly. Use the smaller funnel as listening end, it helps to hear sound better. Place the balloon end over your heart and listen through the other end. Do you hear a regular thumping sound. This is your heart beat. Count the beats per minute.

Observation : Record your pulse rate and heart beat and that of your friends at rest and after running for five minutes. Note down your observations in the table11.2.

Table 11.2 Heart beat and pulse rate

S. No.	Name of Student	While at rest		After running for 5 minutes	
		Heart beat	Pulse rate	Heart beat	Pulse rate
1					
2					
3					
4					

Conclusion : At rest the human heart beats 60 to 80 times per minute. Heart beat does not remain the same at all instances. It may increase or decrease according to the situation. It increases during physical activity, excitement, mental stress etc. and decreases at the time of rest. The pulse rate is same as the rate of heart beat.

Unicellular organisms use their cell surface as a point of exchange with the outside environment. Aquatic animals like sponges and hydra do not have circulatory system. Their simple structure helps them in circulation. Since their body wall is very thin and they are always surrounded by water, substances can easily diffuse in and out of the body. Thus, these animals do not need a circulatory fluid like blood.

Think and Answer :

1. What is a stethoscope?
2. Is there any relationship between heart beat and pulse rate?

B. Excretion in Animals

We have already discussed that carbon dioxide is removed from the body during respiration. Other metabolic activities in the body generate nitrogenous wastes. These wastes are toxic and can act as poison, hence need to be removed from the body. The organs which remove unwanted waste materials from the body are called **excretory organs** and the process of removal of these substances is called **excretion**.

Excretory System in Humans: The excretory system of human beings consist of a pair of **kidneys**, a pair of **ureters**, a

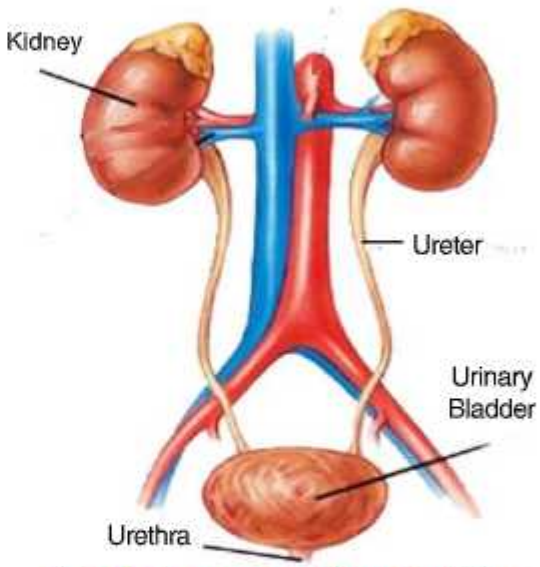


Fig. 11.7 Human excretory system

urinary bladder and **urethra** (fig.11.7). Kidneys are bean shaped organs located on either side of the backbone. Filteration of blood is done by the blood capillaries present in the kidneys. The blood contains both harmful and useful substances. The useful substances are absorbed back into the blood and the unwanted harmful wastes are dissolved in water and removed as **urine**. This urine passes from kidneys to ureters and gets collected in urinary bladder and from here it is excreted out through the urethra.

In hot weather or due to heavy exercise, we sweat. Sweating is the production of fluids secreted by sweat glands present in the skin of mammals. It consists of water and mineral salts. You must have seen white patches on your clothes in summer. These patches are due to salts which are left behind after evaporation of water. Sweating helps in cooling our body.

DIALYSIS : Normally, the kidneys filter blood and remove harmful wastes from the body. If one kidney is not working properly the other kidney is sufficient for removal of wastes. If both kidneys of a person are damaged, the blood cannot be cleaned properly. Waste products and fluids start accumulating in the body. Such person cannot survive longer unless the blood is filtered periodically through an artificial kidney. The process of removing waste products and excess fluids from the blood with the help of a machine is called **dialysis**.

11.2 Transportation in plants

Plants prepare their food with the help of chlorophyll by taking water from soil and carbon dioxide from the atmosphere in the presence of sunlight. Water and minerals are absorbed by the roots and then transported to the leaves where photosynthesis takes place. The food prepared in the leaves also need to be transported to all parts of the plant.

11.2.1 Transportaion of water and minerals

Plants obtain water and minerals from the soil through roots. Roots have root hair, which increase the surface area of roots and helps in the absorption of water and minerals dissolved in water. Root hair are in close contact with water between soil particles.

A suction pull is developed due to the loss of water through leaves during transpiration. It helps in the movement of water and nutrients to the top parts of

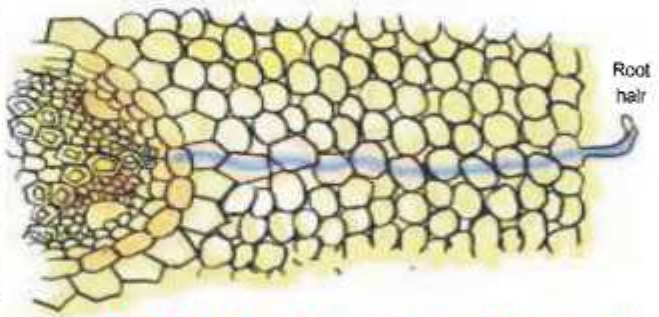


Fig 11.8 Transportation of water and minerals in a cut section of root

the plant. Plants have pipe like vessels to transport water and nutrients from the soil. The vessels are made of specialized dead cells known as **vascular tissue**.

The vascular tissue which transports water and nutrients from roots to all parts of the plant is called **xylem**. The cells of xylem are joined to form long tubes which extend from the tip of roots to the top of plant.

11.2.2. Transportation of food

Plants prepare their food in the leaves by photosynthesis. This food has to be transported to all parts of the plant. The vascular tissue responsible for transport of food in the plants is known as **phloem**. Phloem transports the food from leaves to all parts of the plant. Transportation of food material from leaves to other parts of the plant is called **translocation**.

11.2.3 Osmosis

It is the process by which the movement of solvents take place from lower concentration to higher concentration through a semi-permeable membrane to keep concentration equal. Transportation of substances by this method takes place only for very short distances. Root hair of plant uptake water from soil via osmosis.

Activity 3 : To Study Osmosis using potato osmometer.

Material Required : A large sized potato, a knife, sugar solution, a pin, a container.

Method: Take a large sized potato. Peel off its outer skin. Cut its one end to make it flat. Make a deep and hollow cavity in the middle of the potato almost upto the bottom. Fill half of the cavity with sugar solution and mark the level by inserting a pin. Place the potato in a container having water. (fig 11.9a)

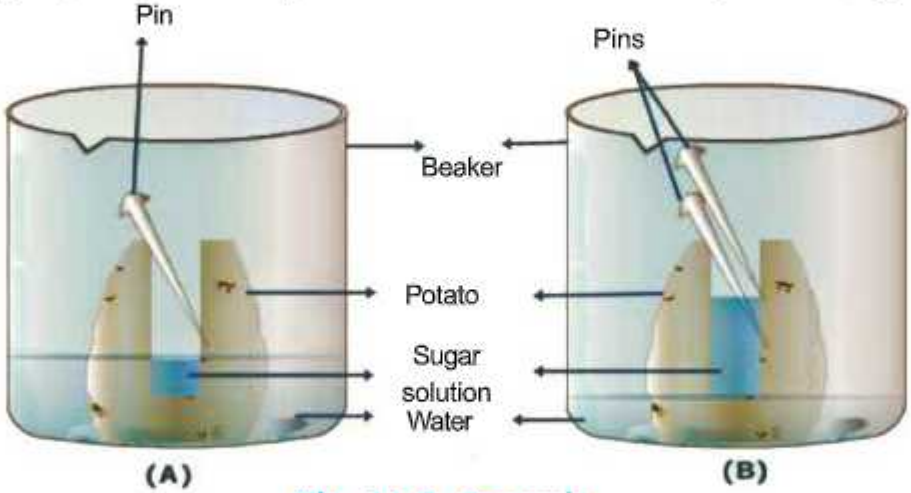


Fig. 11.9 Osmosis

Observation: After some time the level of the sugar solution in the potato cavity will rise(fig.11.9b). Mark this new level by inserting another pin. This happens due to the phenomenon of osmosis. The water from outside moves into the potato cavity filled with sugar solution.

Conclusion: The potato walls act as semi-permeable membrane.

Think and Answer :

1. Define osmosis?
2. Define semi-permeable membrane.

KEYWORDS

Artery	Heart Beat	Capillaries
Vein	Red Blood Cells	White Blood Cells
Stethoscope	Plasma	Haemoglobin
Pulse Rate	Xylem	Phloem
Excretion	Kidney	Root Hair
Excretory System	Dialysis	Osmosis
Translocation	Transpiration	

1. The circulatory system in higher animals consists of heart, blood vessels and blood.
2. Water and mineral nutrients are absorbed by plants through roots from the soil.
3. Blood consists of red blood cells, white blood cells, platelets and plasma. The colour of blood is red due to haemoglobin.
4. The heart is a muscular organ which beats continuously to act as a pump for the transportation of blood.
5. The number of beats per minute is called pulse rate.
6. Arteries carry oxygenated blood and veins carry deoxygenated blood.
7. The exchange of nutrients, gases and waste products between the blood and tissue fluids take place through capillaries.
8. Kidneys, lungs and skin are the main excretory organs in the higher animals.
9. Kidneys remove waste in the form of urine, lungs remove carbon dioxide and skin removes waste in the form of sweat.

10. The excretory system of human beings consists of a pair of kidneys, a pair of ureters, a urinary bladder and urethra.
11. The process of removing waste products and excess fluids from the blood with the help of a machine is called dialysis.
12. Osmosis is the process by which the movement of solvent takes place from lower concentration to higher concentration through a semi-permeable membrane.
13. Transpiration is the process in which water evaporates as water vapours from the plant surface, especially from the stomata.
14. Transportation of food material from leaves to other parts of the plant is called translocation.

Exercise

1. Fill in the blanks :

(i) In plants, water and minerals are transported by ..... .

(ii) Doctors use ..... to listen the internal sounds of the body.

(iii) Sweat contains water and ..... .

(iv) The blood vessels having thick elastic walls are called ..... .

(v) The rhythmic contraction and expansion of heart is called .....

2. Write true or false :

(i) Phloem vessels transport food materials in plants.

(ii) Deoxygenated blood is carried back to heart by veins.

(iii) The veins have thick walls.

(iv) Blood plasma is the solid component of blood.

(v) The red colour of blood is due to the presence of plasma.

3. Match the column A with column B:

A	B
(i) Transport of water	(a) Stomata
(ii) Red in colour	(b) Xylem
(iii) Exchange of gases	(c) Haemoglobin
(iv) Blood clotting	(d) Phloem
(v) Transport of food	(e) Platelets

4. Choose the correct answer :

(i) Blood cells responsible for clotting are

(a) Plasma ☐ (b) WBC's ☐

(c) RBC's ☐ (d) Platelets ☐

(ii) The lower chambers of heart are called

(a) Atria ☐ (b) Valves ☐

(c) Veins ☐ (d) Ventricles ☐

(iii) The excretory system consists of

(a) Kidney ☐ (b) Bladder ☐

(c) Urethra ☐ (d) All of these ☐

(iv) The muscular organ which beats continuously to act as a pump

(a) Auricles ☐ (b) Kidney ☐

(c) Heart ☐ (d) Veins ☐

(v) Blood contains :

(a) Plasma ☐ (b) WBC's ☐

(c) RBC's ☐ (d) All of these ☐

5. Very Short Answer Type Questions :

(i) Why is blood red in colour?

(ii) Define translocation.

(iii) What is dialysis?

6. Short Answer Type Questions :

(i) State three functions of blood.

(ii) Name the excretory organs in humans.

(iii) Why do veins have valves ?

7. Long Answer Type Questions :

(i) Write and explain the components of blood.

(ii) Describe the functions of Heart.

(iii) Draw a labelled diagram of excretory system.

(iv) Differentiate between artries and veins.

(v) Explain the transportation of substances in plants.

12 REPRODUCTION IN PLANTS

A characteristic feature of all living organisms is that they give birth to young ones of their own kind. What would happen, if new generations of species were not produced ? The earth would turn out to be a barren place with no life. Since the life span of an organism is limited, they have devised ways and means to multiply their number. This ability of all living organisms to produce new individuals of their own kind is called **reproduction**. However, reproduction is not essential for an organism's survival but it ensures that the organism leaves behind more individuals of its own kind, so that the species does not vanish from earth.

How do plants reproduce? We will deal with this aspect in the following section.

12.1 Modes of Reproduction in Plants

Plants exhibit two modes of reproduction, namely asexual and sexual reproduction. Some plants multiply by vegetative propagation.

A. Asexual Reproduction:- In this type of reproduction seeds are not required to grow new plants. Only one parent is involved.

Types of Asexual Reproduction :-

(a) Binary fission (b) Budding (c) Fragmentation
(d) Spore formation (e) Regeneration

(i) Binary fission :

It is the most common method of asexual reproduction in which an organism divides into two. It is common among plants and in some unicellular organisms like algae and fungi [Fig.12.1]. In this method, the organism divides itself into two equal halves. Nucleus also divides into two parts. Each of the two parts then grows into full adult.

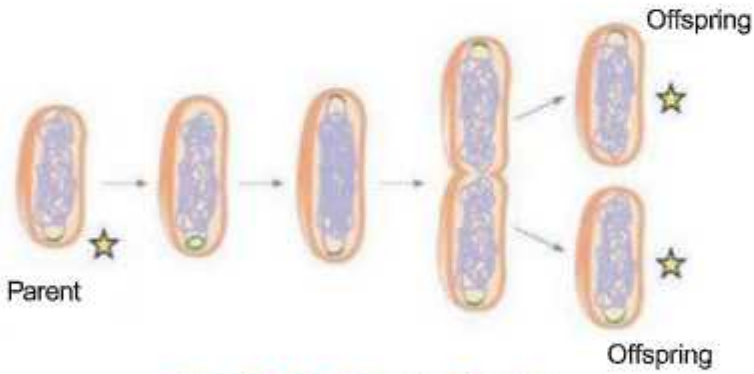


Fig 12.1: Binary Fission

(ii) Budding :

Budding is commonly observed in Hydra. A bulb like projection called the bud is formed on the plant body. The bud grows into full organism and detaches itself from the parent body. It grows to full size and becomes a new individual [Fig.12.2].

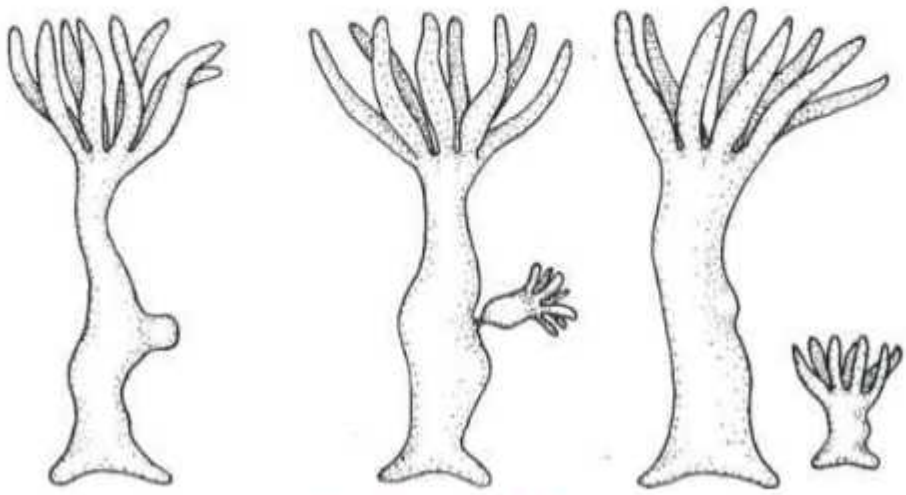


Fig 12.2 Budding

(iii) Fragmentation :

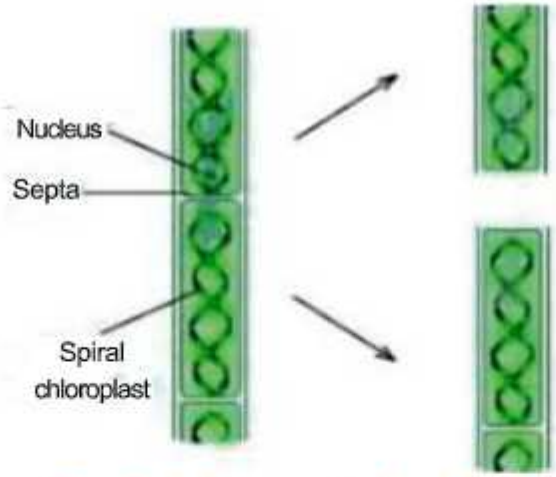


Fig 12.3 Fragmentation in Spirogyra

Have you ever seen a pond or a lake showing a greenish tinge of color? It is due to the presence of algae which can be seen in the form of green patches mostly in ponds or in other stagnant water bodies. When water and nutrients are available then this algae grow and multiply rapidly by **fragmentation**. An algae breaks up into two or more fragments upon maturation. These fragments or pieces grow into new individuals [Fig 12.3]. This process is repeated many times and very soon algae cover a large area in a short period of time.

(iv) Spore Formation :

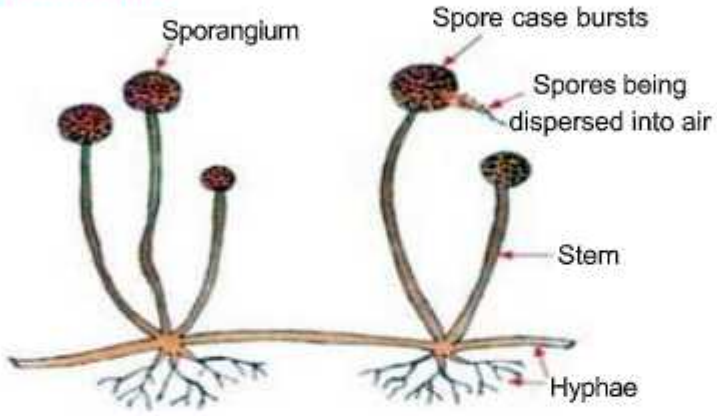


Fig 12.4 Spore Formation in bread mould (Rhizopus)

Spores are tiny spherical asexual reproductive bodies. They have a thick wall. Mature spores keep floating in the air. They can remain in the air for a long time [Fig 12.4]. Under favourable conditions, each spore germinates and develops into a new organism. Bread mould (Rhizopus) reproduces asexually by spore formation. Plants like mosses and ferns also reproduce by means of spores.

(v) Regeneration :

In your garden, you mow the grass, and next week, it again needs mowing. Each organism can repair itself in some or the other way. New cells grow to replace damaged or lost cells. The ability of living things to repair themselves or grow lost parts is called regeneration. Plants generally have greater power of regeneration than animals do.

(B) Vegetative propagation :

This is also a type of asexual mode of reproduction in plants where vegetative parts namely, roots, stem and leaf give rise to new plants. No reproductive organs take part in this method of reproduction and therefore, no seeds are produced. It is of following types :

(i) **Vegetative propagation by Roots** – In sweet potato (Fig 12.5), Dahlia or Asparagus, the swollen roots are present. New plants arise from these swollen roots when burried in the soil.

Fig 12.5 Vegetative propagation through roots

(ii) Vegetative propagation by Stems – A number of plants like Sugarcane, Rose and *Gladiolus* multiply by stems.

The potato which you eat is in fact an underground swollen stem [tuber] which contains stored food material. If you observe a potato with a magnifying glass, you will find 'scars'. These scars are called **'eyes'**. The eyes on the potato tuber sprout [germinate] and give rise to new plants [Fig.12.6].

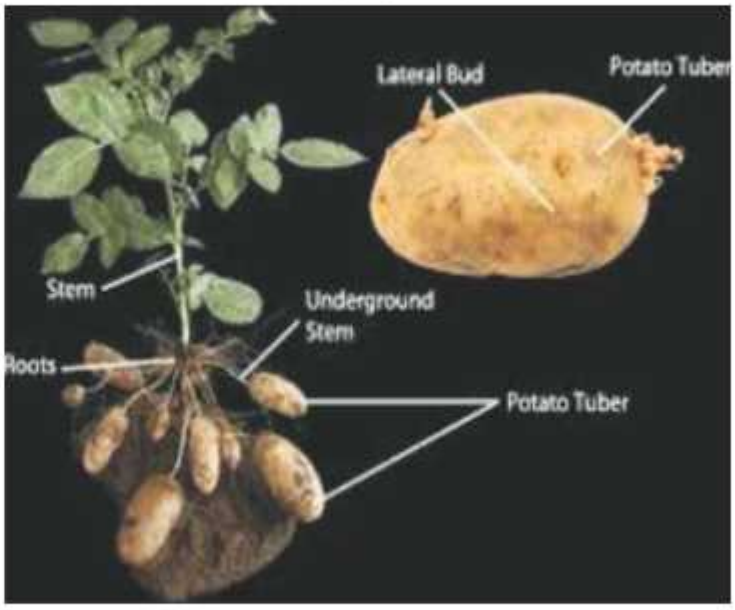


Fig 12.6 A sprouted potato tuber.

Activity 1 : To study vegetative propagation through roots.

Material Required: Roots of sweet potato or Asparagus, flower pot with soil.

Method: Take swollen roots of sweet potato or Asparagus. Place some of these roots in a flower pot containing moist soil. See after few days.

What do you observe?

Observation : New plants grow from the roots burried in the soil.

Conclusion : New plants can grow from roots.

Activity 2 : To study vegetative propagation in stem.

Material Required: Potato, a pot with soil, a hand lens, a knife.

Method : Take a potato tuber and observe it with a hand lens. You will be able to see 'eyes' on it. Now cut a piece of it and plant the cut piece with eyes in a pot containing soil.

Observation: After few days. observe the new plant [roots, stem and leaves] developing from the cut potato piece.

Conclusion: New plants can grow from stem.

Likewise, ginger is a modified swollen underground stem [rhizome] with stored food. Under favorable conditions, the buds on the stem give rise to new plants. In strawberry, long stems grow over the soil surface and are called runners (Fig. 12.7)

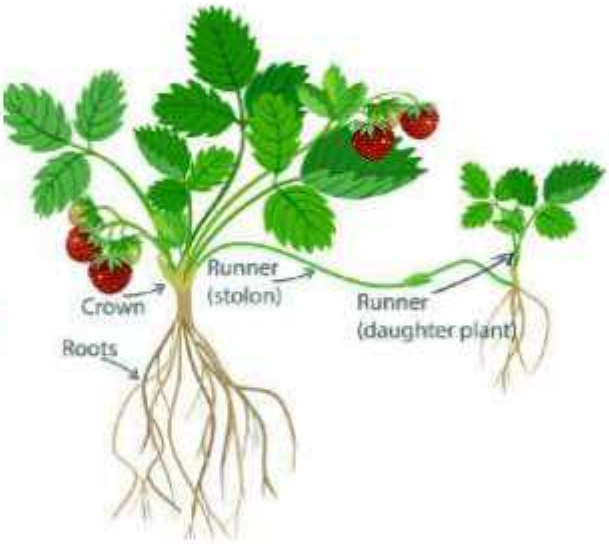


Figure 12.7 (Strawberry runners)

(iii) **Vegetative propagation by leaves** – Some plants like Bryophyllum and Begonia can be propagated by leaves. In Bryophyllum, plantlets develop from the margins of intact leaves. These plantlets after some growth get detached and develop into independent plant [Fig.12.8].

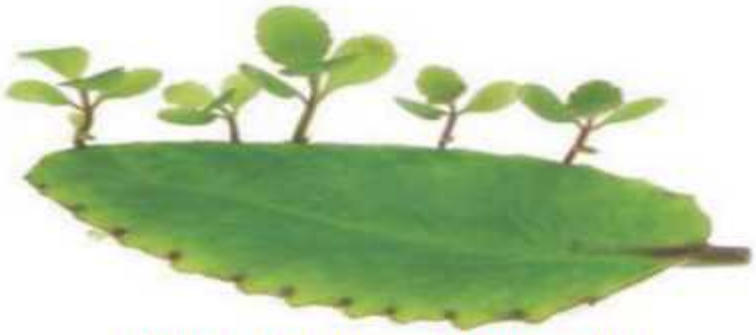


Figure 12.8 (Bryophyllum leaf)

Activity 3 : To study vegetative propagation by leaves.

Material Required : A bryophyllum leaf, a pot filled with soil.

Method : Take a Bryophyllum leaf with plantlets. Place it on the moist soil in a pot containing soil. Take care that the plantlets and margins of the leaf remain in touch with the moist soil.

Observe after two three days.

Observation : Some small plants with fine roots and shoots will come out from the notches of the leaf. Now separate a small plant from the leaf notch and plant it in another pot. Observe what happens.

In a few days, you will find that a mature plant develops.

Conclusion : New plants can grow from leaves also.

Advantages of Vegetative Reproduction

1. It is an easier, rapid and less expensive method of propagation. Plants can grow in much less time.
2. Plants can be raised without seeds.
3. Plants produced by this method are identical copies of the parent plant and show no variations.
4. Plants like banana, sugarcane, sweet potato, rose and jasmine do not produce viable seeds. Such plants can be easily grown by this method.

Artificial methods of Vegetative Propagation:

Because of the advantages offered by vegetative propagation, humans have used this method for artificial multiplication of useful plants. For this reason, such multiplication methods are called artificial methods of vegetative propagation.

Some of these methods are as follows :

(a) Cutting

(i) Stem Cutting : Cuttings are short lengths of the plant with nodes which, when removed and placed in soil, with suitable conditions develop roots and leaves and grow into independent plants [Fig.12.9]. Rose, bougainvillea, sugarcane and cactus are grown by stem cuttings.

Figure 12.9 cutting in rose

(ii) Root cuttings : In certain plants like lemon, tamarind, etc., root cuttings when put in the damp soil give rise to roots and shoots and form new plants.

(b) Layering : The lower branch of the stem is bent so that a part of the stem is buried under the soil. The growing tip remains above the soil surface. After sometimes, roots grow from the node of stem part buried in the soil. Now this new plant can be cut from the parent plant and

planted as a new independent plant. This method is used in plants like jasmine, strawberry, and bougainvillea.

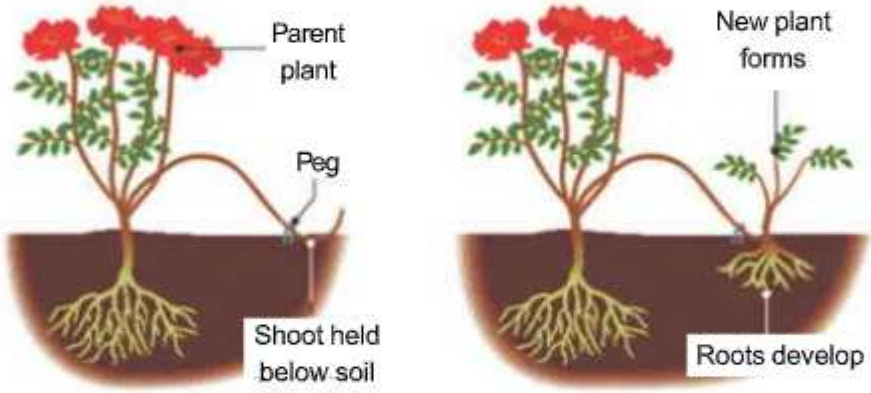


Fig.12.10 Layering

c. **Grafting :** In grafting, the desired plant is derived from two different individuals. The root portion taken from one plant is called the **stock** while the stem portion from the other is called the **scion**. Scion is from the plant which one wants to propagate and so it is grafted on to the stock. The grafting ends of the stock and scion are obliquely cut and placed face to face. Then the two ends are tied tightly and are wrapped.

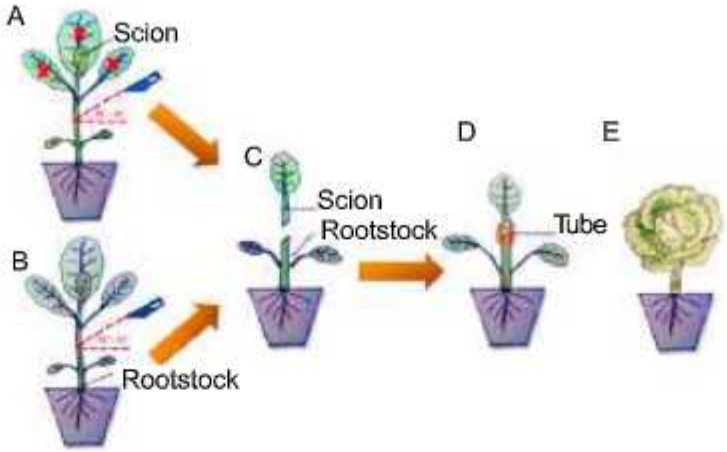


Fig.12.11 Grafting

d. **Tissue Culture:** In this method, a tissue is taken from the tip of a plant as it is composed of undifferentiated and immature rapidly dividing cells. The tissue is grown in a suitable medium containing necessary nutrients and hormones. The tissue grows into an unorganized mass. Small parts of this tissue are put in another medium which induces the formation of plantlets. The plantlets can be transplanted in the soil or in the pots. This technique is also called micro propagation. [12.12].

Since in a very short time, unlimited number of plants can be produced, this technique is being used for the propagation of disease-free orchids, carnation, gladiolus, chrysanthemum, potato, sugarcane and other plants.

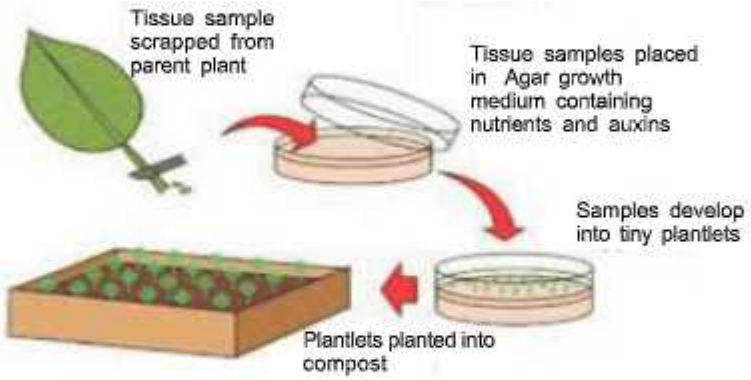


Figure 12.12 Tissue culture

Activity 4 :

Visit a nearby nursery and note down the names of plants growing there. With the help of a gardener find out the method of multiplication followed in case of these plants.

Think and Answer:

1. What happens in regeneration method of reproduction?
2. Give two examples of organisms reproducing through binary fission.

C. Sexual Reproduction in Plants

As we know that the flowers are the reproductive parts of a plant. The **stamens** are the male reproductive part and the **pistil** is the female reproductive part of a flower.

The flowers which contain either only the pistil or only the stamens are called **unisexual flowers**. The flowers which contain both stamens and pistil are called **bisexual flowers**. Corn, papaya and cucumber produce unisexual flowers, whereas mustard, rose and petunia have bisexual flowers. (both the male and the female) unisexual flowers may be present in the same plant or in different plants.

Activity 5 : To study the different parts of a flower.

Material required: China rose flower, forceps, magnifying glass, dissecting blades, dissecting microscope and needle.

Procedure : Take a fresh flower of China rose. With the help of forceps, remove the outer whorls of the flower one by one and then the inner ones.

Observe the arrangement of these parts. Take another flower. With the help of a blade, cut a longitudinal section passing through the flower from bottom to top.

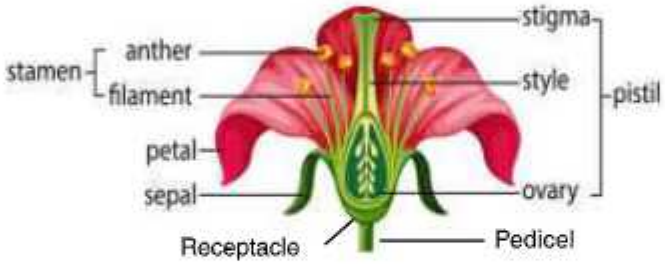


Fig 12.13 : Parts of flower

Observation : The parts of flowers are arranged in circles on the swollen tip. This swollen tip is the **receptacle**. Flower is attached to the plant with **pedicel**. The **sepals** and **petals** form the outer ring whereas the **stamens** and **carpels** form the inner ring seated on the receptacle.

Conclusion : The sepals and petals form the accessory whorls. Stamens and carpels form the reproductive whorl.

Each **stamen** consists of **filament** and **anther**. The anther has two anther lobes containing pollen grains. Pollen grains are very minute in size like particles of dust.

Each pistil is made up of three parts – the terminal knob like part which may be lobed is called **stigma**, the tubular stalk connecting the stigma and ovary called **style** and swollen basal portion called **ovary**. The ovary contains one or more **ovules**.

Pollination

Pollination is the transfer of pollen grains from the ripened anther to the stigma. When the anthers are mature, they rupture and burst open, releasing the pollen grains. The pollen grains being light are carried away by agents such as wind, water, insects and animals. They land on the stigma of same flower or on another flower. This transfer of pollen grains from an anther to a stigma is called pollination.

Pollination is of two types :

(i) **Self-pollination :** In this process, the transfer of pollen grains takes place from the anther of a flower to the stigma of the same flower (bisexual).

(ii) **Cross-pollination :** In this process, the pollen grains are transferred

from anther of one flower to stigma of another flower. Cross-pollination may take place between two flowers on the same plant or between flowers on different plants of the same species.

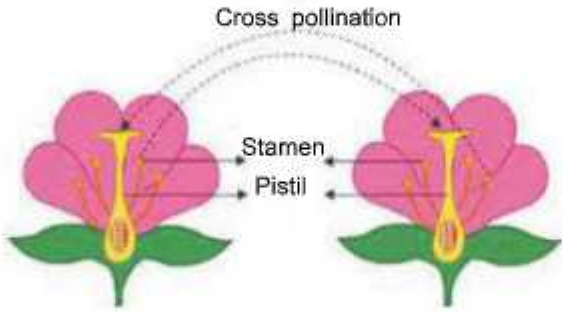


Fig 12.14

Fertilization

On reaching the stigma, a thin pollen tube grows out from the pollen grain. It extends through the style, reaches the ovary and enters the ovule.

Here the fusion of male and female gemetes take place. **The process of fusion of a male gamete and a female gamete is called fertilization.**

Fruit and Seed Formation

- After fertilization the ovary grows into a fruit and other parts of the flower fall off. The ovules develop into seeds.
- A seed is a mature ovule that contains the embryo and the stored food. It is enclosed by a protective covering called **seed coat**.

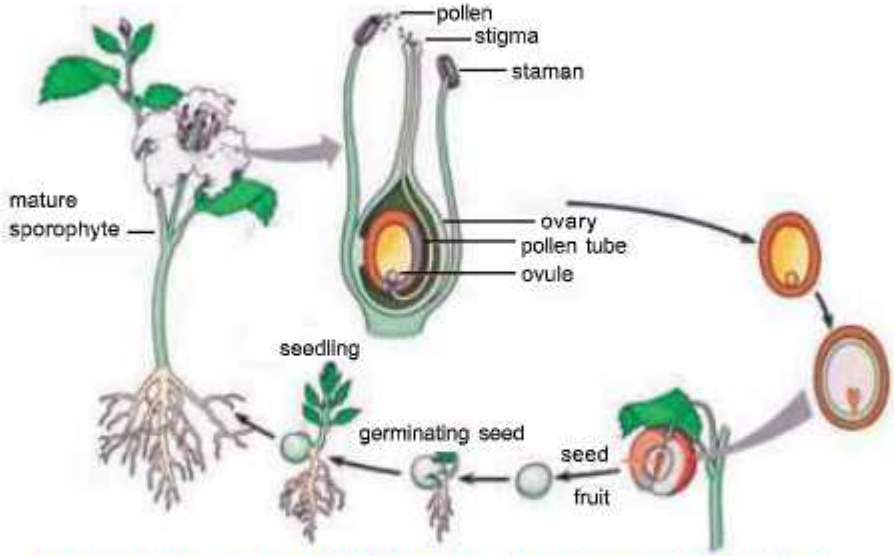


Fig 12.15 (Stages in life history of a flowering plant)

Fruits may be fleshy and juicy or dry and hard. Mango, apple, orange are fleshy and juicy fruits whereas almonds and walnuts are dry and hard fruits.

Need for Dispersal of Seeds

Dispersal of seeds to different places is essential because it increases the chances of survival of seedlings and prevents competition between them.

Advantages of Seed and Fruit Dispersal

Dispersal of seeds and fruits

- Ensures that the plants are dispersed over wide areas.
- Avoids overcrowding.
- Prevents competition among the plants for space, sunlight, water and minerals.
- Fruits and seeds are dispersed by wind, water, animals and explosive mechanism.

Disadvantage of Fruits and Seeds Dispersal

Disadvantage of dispersal of fruits and seeds is that seeds may be carried to unsuitable places where they may fail to germinate due to unfavourable conditions.

Methods of seed dispersal :-

(i) Dispersal by Wind

Fruits and seeds which are small and light are generally scattered by wind. Seeds of maple and drumsticks have wings for floating in the air to long distances. Light seeds of grass, hairy seeds of *Akk*, dandelion and cotton, and hairy fruits of sunflower are blown to far away places by wind.

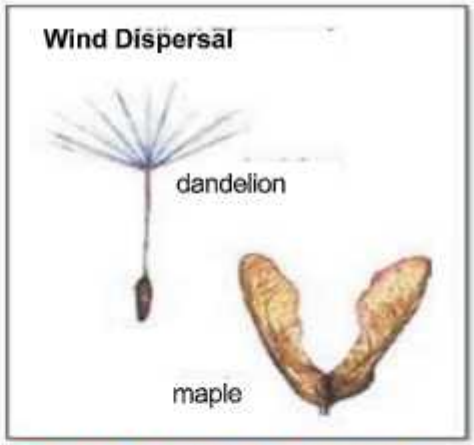


Fig 12.16 Wind dispersal

(ii) Dispersal by Water

The fruits and seeds of plants like those of water lily, lotus and coconut float on water surface and are carried to far off places by water currents. Coconut has a fibrous coat with hard covering. It is carried away to long distances by water currents without being damaged.

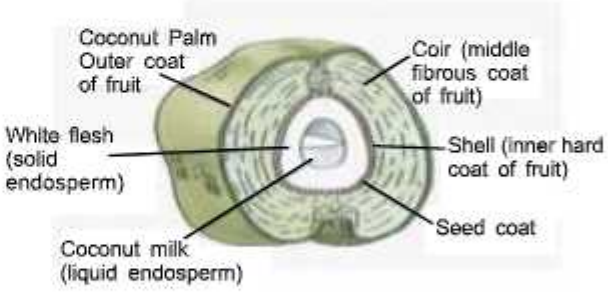


Fig 12.17 (Disperal by water)

(iii) Dispersal by Animals

Seeds dispersed by animals have spines or hooks which cling to the bodies of animals and are carried to long distances as in *Xanthium* and *Urena*.

Man, animals and also birds eat the pulp or the edible part of fleshy fruits and throw their seeds. This helps in their dispersal. The small and undigested seeds are excreted out of their body and get dispersed. The seeds of guava and raspberries are dispersed by this method.

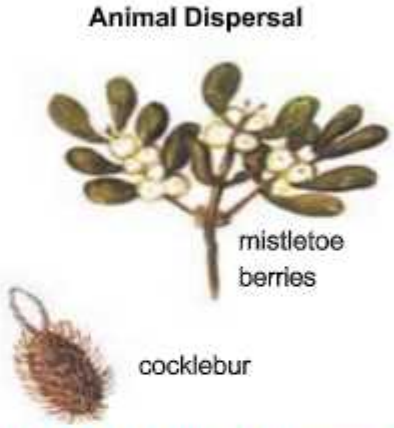


Fig 12.18 : Animal dispersal

(iv) Explosive Mechanism

Fruits and seeds of Balsam, wild Pea, Geranium and Castor burst with sudden jerks and get scattered away from their parent plant.

Fig 12.19

Germination of Seed

On reaching the moist soil, the seed swells up by imbibing water. The embryo starts germinating. Its radical grows down into the soil and forms the root. The plumule grows upward in the air, develops leaves and forms the shoot of the young plant.

Fig 12.20 : Diagram of germination of seed

KEYWORDS

- Asexual Reproduction
- Binary fission
- Bisexual
- Embryo
- Gamete
- Grafting
- Layering
- Pollination
- Regeneration
- Sexual reproduction
- Tissue culture
- Unisexual
- Vegetative reproduction
- Fertilization
- Zygote

Points to Remember

- Reproduction in plants is of two types : asexual and sexual.
- Asexual reproduction is the process in which new plants are produced by involving only one parent.
- Flowerless plants such as algae reproduce by fragmentation; yeast reproduce by budding, while moulds and mosses reproduce through spores.
- Vegetative reproduction in plants takes place with the help of roots, bulbs, rhizomes, tubers and adventitious buds.
- There are many artificial methods by which plants multiply. These include cutting, grafting and layering.
- In sexual reproduction male and female organs produce male and female gametes, which fuse to form zygote. This zygote develops into a new individual.
- Sexual reproduction is carried out only in flowering plants.
- After fertilization of the egg, ovary matures into a fruit and ovules mature into seeds.
- Seed dispersal is necessary to separate the seed from the parent plant so that the seed can grow into a new plant.

Exercise

1. Fill in the blanks :

(i) Anther and filament form the ..... of a flower.

(ii) In ..... reproduction seeds are formed.

(iii) Flowers having, both stamens and pistil are called ..... .

(iv) ..... is an asexual mode of reproduction.

2. Write True or false :

(i) Yeast reproduces by asexual and sexual means. ☐

(ii) Pollen grains are the male gametes of a flower. ☐

(iii) Ginger is a stem which bears nodes and internodes. ☐

(iv) Cutting and grafting are natural means of reproduction. ☐

3. Match column A with column B :

Column A	Column B
i) Sweet potato	a) micropropagation
ii) Potato	b) Bryophyllum
iii) Leaf buds	c) artificial propagation
iv) Grafting	d) yeast
v) Tissue culture	e) hybridization
vi) Cross pollination of different species	f) spirogyra
vii) Bud	g) adventitious root
viii) Fragmentation	h) stem tuber.

4. Very short answer type questions :

(i) In which mode of reproduction new plants are formed from only one parent ?

(ii) Which part of the flower develops into fruit?

(iii) How does yeast multiply?

(iv) Give one example where air helps in pollination.

(v) Name the reproductive parts of a flower.

5. Short answer type questions :

(i) Name different methods of asexual reproduction in plants.

(ii) What do you mean by artificial propagation in plants?

(iii) What is tissue culture technique or micro propagation?

(iv) Describe advantages of seed dispersal.

(v) What is germination? What are the conditions needed for germination?

6. Long answer type questions :

(i) Describe different kinds of asexual reproduction with examples.

(ii) Explain different ways with examples in which plants can be reproduced vegetatively by artificial means.

(iii) What is pollination? What are the two types of pollination? Discuss the different agents of pollination with examples.

(iv) Explain the process of fertilization.

(v) List the different steps in the formation of seeds and fruits.

(vi) What is dispersal? Explain with examples the different ways in which seeds get dispersed.

13 MOTION AND TIME

X6T9P8

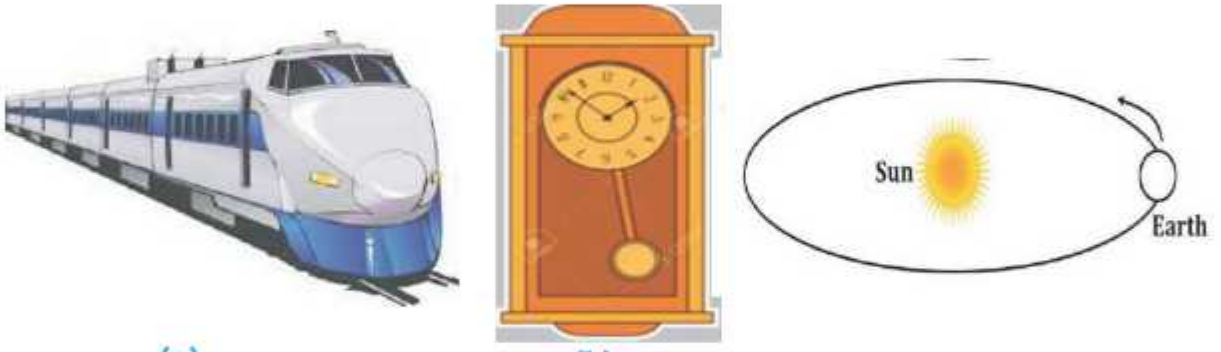
13.1 Introduction :

As you have studied in class 6th that some objects are at rest and some have movement. If an object does not change its position with respect to time and the surroundings, it is said to be at rest. If the object changes its position with respect to time and the surroundings, it is said to be in motion. There are many types of motion, like linear motion, circular motion, perioidc motion and oscillatory motion.

Linear Motion is the motion of an object in a straight line. **Circular motion** is the motion of an object in circular path and **oscilatory motion** is to and fro motion of an object about its mean position. Figure 13.1 gives us an idea of different types of motion. With this knowledge complete table 13.1

Table 13.1 Common examples of different types of motion

Example of motion	Type of motion Linear/Circular/Osulatory
Motion of a train on straight railway Track	
Motion of Simple pendulum of a clock	
Motion of earth around the sun	
Motion of wheel of a moving cycle	
Motion of see Saw	



(a) (b) (c)

Fig 13.1 Different types of motion

13.2 Slow or Fast Motion :

Motion of some objects is slow, but some objects move very fast. Try to list the activities shown in figure13.2 in slow or fast motion. Make a list of some objects or animals, which move very fast like racing car or cheetah and slow moving objects or animals like needle of clock or snail and tortoise etc.

(a) racing car ***(b) cheetah*** ***(c) snail*** ***(d) tortoise***

Fig 13.2 Slow and Fast Motion

Slow motion : An object is said to be in slow motion, if it takes long time to cover a certain distance

Fast motion: An object is said to be in fast motion, if it takes shorter time to cover the same certain distance. A motorcycle can move slow or fast depending upon the traffic on the road. A motorcycle can move faster than a bicycle but an aeroplane moves faster than the motorcycle.

On a road we can easily spot the difference in speed of different moving objects by simply looking at them. If we look at the position of vehicles at one instance of time and then again at the same vehicles after few seconds, we can spot which vehicle moves faster and which vehicle moves slower.

The distance moved by an object in a given interval of time will help us to decide its speed. For example during race, we can say who has the highest speed by noting the time taken by them to cover the same distance. The object which takes the least time to cover a certain distance has the highest speed. If we have an idea of time and distance we can easily determine the speed.

13.3 Speed :

We are familiar with different moving objects and their speeds, higher speed means that a given distance has been covered in a shorter time, or longer distance is covered in given time. The best way to compare speed of objects is to compare the distance covered by them in unit time or to have uniform measuring units.

Let us take the example of 3 vehicles as follows which covers certain distance in 1 hrs.

(a) (b) (c)

Fig 13.3

A bicycle can travel a distance of 8 km in 1 hour. A motorcycle can travel 40 km in 1 hour. An aeroplane can travel 1200 km in 1 hour. From the above example it is clear that an aeroplane has greater speed, because it covered more distance in 1 hour. We can denote the speed of the aeroplane to be 1200 km/hr but it doesn't mean that the aeroplane travels at a constant speed all the time. The speed may or may not vary during the flight. Generally, the aeroplane starts moving at much lower speed and increases its speed after some time, but the aeroplane has travelled a distance of 1200 km in an hour. So, the average speed at which the aeroplane has travelled is 1200 km/hr. We shall use the term speed to determine average speed. Speed can be calculated by dividing the total distance travelled by the total time taken as follows :

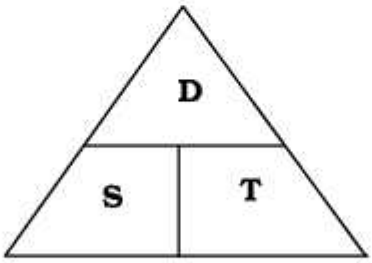
$$\textbf{Speed} = \frac{\text{Total Distance travelled}}{\text{Total Time taken}}$$

From this relation, we can also find the relation for calculating distance travelled and time taken:

Distance travelled = Speed × Time taken

Time taken = Distance travelled / Speed

We can easily remember above formula by the following figure.



13.3.1 Units of Speed :

The SI unit for the measurement of distance is **meter** and the SI unit for measurement of time is **second**.

We know that Speed = Distance/ Time.

So, the SI unit for measurement of speed is **meter/second**. In short, this is written as **m/s or ms^{-1}.**

For measuring larger interval of time we have bigger units like minutes and hours. Similarly, we use Kilometers and Miles for larger distances. Depending on the usage, we use bigger units for speed as: kilometers per hour (km/h).

Solved Numericals :

1. **A man on a scooter travels a distance of 50 meters in 10 seconds. What is the speed of the scooter?**

   Solution :

   Speed of the scooter= Distance travelled/ Time taken

   = 50m/10s = 5 m/s

2. **A car moves with a speed of 80 km/h for 15 minutes. Find the total distance covered by the car.**

   Solution :

   Time taken = 15 minutes = 15/60 hours = ¼ hours

   Distance covered by the car with a speed of 80 km/h in 15 minutes = Speed ×Time

   = (80 Km/h) × ¼ hours

   = 20 Km

13.4 Uniform and Non-uniform Motion :

Objects moving in a straight line at a constant speed are said to have uniform motion, whereas an object that moves in a straight line with varying speed is said to be in Non-uniform motion.

But, in everyday life we rarely find objects moving long distances at a constant speed. So, it is difficult to have uniform speed in real life, but we can measure average speed. Some examples of uniform motion are given as follows:

1. The hour hand of a clock moves with uniform speed.
2. The earth moves round the sun, is an example of uniform motion.
3. A pendulum having equal amplitudes on both sides has uniform motion.

13.5 Measurement of Time:

Time is a moment or duration in which an event occurs.

In our day to day life, we need to measure time for doing all our activities. We need to measure the time as we get up. We need to know the time, when we have to reach the school or workplace. We should also know the time, when we are going to sleep. So, we need to measure the time the whole day. Now a days we measure time with the help of wall clocks, table clocks, digital clocks, wrist watches, even by our mobile phone.

Fig 13.4: Different Types of Clocks used

In ancient times, people used the natural events that occurred after certain regular interval, to measure time. For example, The earth takes one year to revolve around the Sun. Also, the earth takes one day or 24 hours for one rotation about its own axis. Our ancestors measured time by the movement of stars and the earth. They found that some natural events repeat themselves after regular intervals of time. The sun rises everyday in the morning and sets in the evening. The time interval from one sun rise to next sun rise was called to be **one day**. The time interval from one new moon to the other new moon was called to be **one lunar month**. The time interval for the earth to complete one revolution around the sun was called to be **one solar year**. To measure shorter time periods, many time measuring devices were discovered by them like sundials, sand clocks, water clocks etc. There were different designs of these time measuring devices in different parts of the world.

Sundial at Jaipur *(a)*

Sundial at New Delhi *(b)*

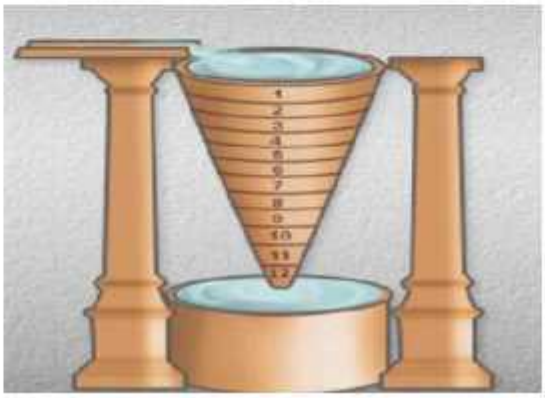
Fig 13.5 Sundials

SUNDIAL: A sundial measures the time of the day by the change in position of shadow due to the change in the sun's position. The sun rises in the morning and changes its position throughout the day, due to the rotation of the earth. At many places, huge sundials have been constructed. In India, famous sundials have been constructed at Jantar Mantar in Delhi and world's largest sundial at Jaipur, Rajasthan.

SAND CLOCK: Sand clock (fig. 13.6 (a)) also known as hour glass uses flow of sand from one bulb to the other to measure time.

WATER CLOCK: Water clock (fig. 13.6 (b)) uses the time taken by water to drip from the upper vessel to the lower vessel in certain interval of time.

Sand clock
(a)



Water clock
(b)

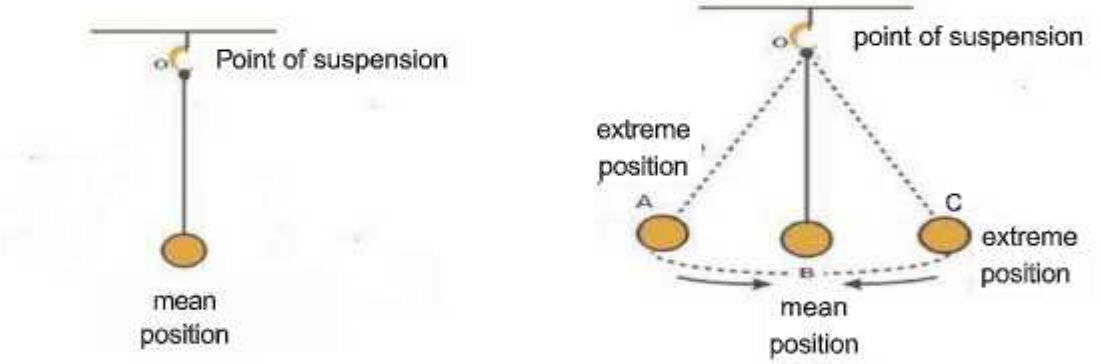
Fig 13.6 Some Ancient time measuring devices

The ancient devices for measuring time were not suitable for measuring shorter time periods like minutes and seconds. So, modern clocks and watches were discovered to measure shorter time intervals. These clocks and watches have electronic devices to operate them and are based on the principle of periodic motion. **A motion which repeats itself at regular intervals of time is called periodic motion.** The modern clocks are very much accurate than the earlier clocks. A simple pendulum is the most important device used for periodic motion.

13.6 Simple Pendulum :

A simple pendulum is a heavy mass suspended by a thread from a rigid support, say a stand. The point of suspension is O in figure 13.7.. The heavy mass, say a bob should be free to move to and fro about its mean position. The heavy mass or bob is a metallic ball and is suspended by a thin elastic thread from a rigid support. When it is at rest, its position is called the mean position (position B in figure). The to and fro motion of the simple pendulum is called periodic or oscillatory motion. It has two extreme positions (Position A and C). The to and fro motion of bob of simple pendulum from mean position B to extreme position C and back to extreme position A then back to mean position

B is called One Oscillation. Similarly, the motion from mean position B to one extreme position A, back to mean position B, then to other extreme position C and again back to mean position B is also called one oscillation. The simple pendulum takes exactly the same time for every oscillation. The time taken by pendulum to complete one oscillation is called **Time period of Simple pendulum**.



(a) Simple Pendulum at rest *(b) Oscillating Simple Pendulum*

FIg 13.7 Simple Pendulum

Activity 4 : Measuring the time period of a simple pendulum.

Material Required: A thread, a heavy metallic bob, stop watch.

Method: Set up a simple pendulum as shown in figure 13.7 with a thread or string of length nearly one meter. Switch off any fans nearby. Let the bob of the pendulum come to rest at its mean position. Mark the mean position of the bob on the floor below it with a chalk. To measure the time period of the pendulum we will need a stopwatch. If a stopwatch is not available, a table clock or a wristwatch can be used. You can also use stopwatch or clock in your mobile phone. To set the pendulum in motion, gently hold the bob and move it slightly to one side. Make sure that the string attached to the bob is stretched, while you displace it. Now release the bob from its displaced position. Remember that the bob is not to be pushed when it is released. Switch on the stopwatch or note the time on the clock, when the bob is at one of the extreme positions. Keep on counting the oscillations. Measure the time taken by the pendulum to complete 20 oscillations. Record your observations in the table given below. Divide the time taken for 20 oscillations by the number of oscillations that is 20. This will give you the time taken for one oscillation. Time taken for one oscillation of the pendulum is called its **Time Period**. Number of oscillations per unit time is called its **frequency**. It is measured in hertz (Hz). Repeat the activity for 2-3 times. Record your observation in the given table.

Observation :

S.No.	Time Taken for 20 Oscillations	Time Period
1.		
2.		
3.		

Conclusion : The time period in all the three cases will almost be same.

Think and Answer :

1. What is simple pendulum?
2. What is the to and fro motion of a simple pendulum called?
3. The time taken for one oscillation of the pendulum is called its _____ .
4. _____ is the number of oscillations per unit time.

13.7 Measuring Speed :

To measure speed we need distance covered by an object and the time taken by it to cover that distance. In class 6th, we have studied the method to measure the distance by using scale or measuring tape. In this chapter, We have also studied the method to measure time by clock and watch. We can now calculate the speed of an object by dividing the measured distance covered by it with the time taken to cover that distance.

Activity 2 : Measuring the speed of a ball.

Material Required : A ball, a stop watch, a measuring tape and a marker (chalk).

Method : Mark a point 'O' on the floor with a chalk or marker. Mark a line 'AB', (say 5 meters) away from the point 'O' as shown in figure 13.8. Put the ball on the point O. Now push the ball towards line AB and start the stopwatch at the same time. Note the time on the stop watch, when the ball crosses the line AB. Divide the distance covered (5m) by the time taken for the ball to cover the distance between point O and line AB (say 10 seconds).

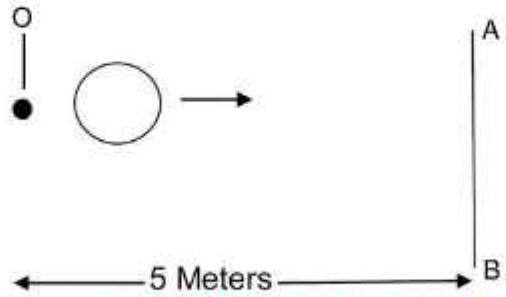


Fig 13.8 To measure the distance travelled by a ball.

Observation :

Speed = Distance/ Time = 5 meters/10 seconds = 0.5 m/s

Conlusion : Speed of the ball is 0.5 m/s.

Think and Answer:

1. What do we measure by using a stop clock?
2. What is the unit of measuring distance ?
   Or Name the S.I. unit of distance.

Speed of the following animals can be compared as follows:

Falcon	390 Km/h
Cheetah	120 Km/h
Rabbit	60 Km/h
Human Sprinter	40 Km/h
Squirrel	20 Km/h
Mouse	12 Km/h
Human walk	8 Km/h
Tortoise	0.27 Km/h
Snail	0.0028Km/h

(a) Falcon (fastest animal)

(b) Snail (slowest animal)

Similarly, we can compare the speeds of some vehicles:

Bicycle	20 Km/h max.
Motor cycle	80 Km/h
Car	100 Km/h
Aeroplane	1200 Km/h
Space rocket	40000Km/h or (11.2 Km/sec)

(c)Bicycle (slowest vehicle)

(d) Space rocket (Fastest vehicle)

Fig 3.9: Speed of different Objects

Therefore, by comparing the speed of different animals & birds we can calculate that falcon is the fastest and snail is the slowest among them.

By Comparing the speed of different vehicle we can say that cycle is slowest and rocket is fastest.

The instrument used to measure the speed of running vehicle is called Speedometer. You must have seen a speedometer on the handle of a motorcycle or dashboard of a car. The speedometer measures the speed of the vehicle in Km/h. A needle of the speedometer directly points towards the numbers marked on the dial, which shows the speed of the vehicle.The

instrument used to measure the distance covered by the vehicle is called **Odometer**. This meter can also be seen on motorcycle or car along with the speedometer. These meters can be manual or digital also.

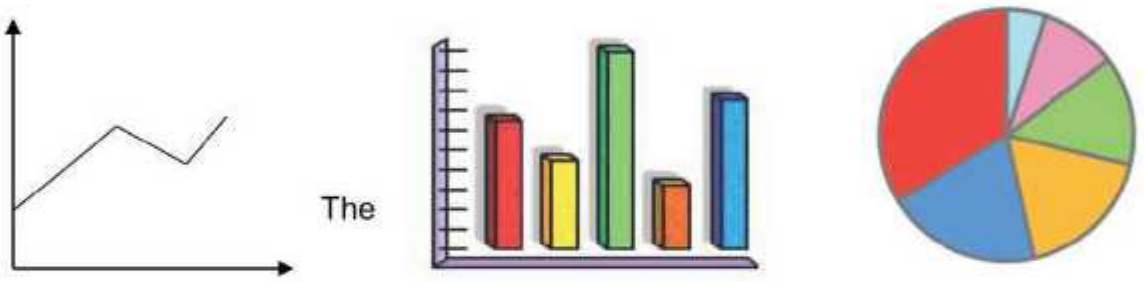
(a) Speedometer **(b) Odometer**

Fig 13.10 : Speedometer and odometer

Once you know the speed of an object, you can find the distance covered by it in a given time. You can also find the time of an object would take to cover certain distance with a given speed.

13.8 Graphical Representation of Speed :

A Graph is a pictorial representation of variation of one quantity with respect to the other quantity. When one quantity is changed, the value of the other quantity also changes by itself. There are many types of graphs like **Line Graph**, **Bar Graph** and **Pie chart** etc. A Line Graph is a set of points joined together which represents the values of the quantities compared with each other. A Bar Graph is a chart that presents data with rectangular bars with heights proportional to the values of the quantity, it represents. A Pie chart is a circular statisatical graph which is divided into sectors to illustrate the values of the quantity, it represents.



(a) Line Graph (b) Bar Graph (c) Pie chart

Fig 13.11: Different types of graphs

Similarly, motion of objects can also be represented by distance-time graph. Distance-Time graph shows the distance travelled by an object in certain interval

of time. Distance-Time graph is a line graph plotted by taking Distance travelled by an object along Y-axis (Vertical) and time taken along X-axis (Horizontal) as shown in fig. 13.12. The point where the two axes meet is called the Origin (O). You can draw the graph by following the steps given below:

Draw two perpendicular lines to represent the two axes and mark them as OX and OY with O as the origin .

Choose a scale to represent the distance (Kilometers) and another to represent the time (minutes) on the graph. Mark values for the time and the distance on the respective axes according to the scale you have chosen. Mark time 1 hour, 2 hour so on, or 9:00 A.M., 10:00 A.M. on the x-axis from the origin O. Similarly, mark the distance 10 km, 20 km and so on, on the y-axis. Now we have to mark the points on the graph paper to represent each set of values for distance and time.

The Distance travelled and the Time taken, are always positive. So, Distance on vertical axis is taken upward and time taken along the horizontal is taken on the Right hand side from the origin (O).

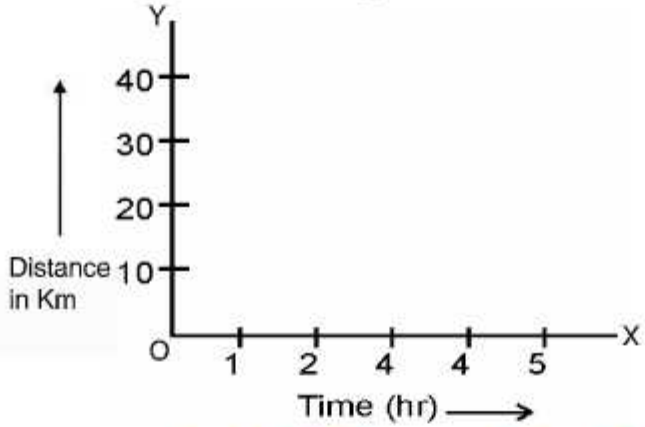


Fig 13.12: Distance - Time Graph

13.8.1 Graph for uniform speed:

When an object travels equal distance in equal interval of time, it is said to have uniform speed. In a real time situation, it is very difficult for any object to have uniform speed for long time. We can assume an ideal situation in which a train travels with Uniform speed.

Time shown by a clock	Distance travelled by train from Station A
9:00 A.M.	0 km
9:10 A.M.	10km
9:20 A.M.	20km
9:30 A.M.	30km
9:40 A.M.	40km
9:50 A.M.	50km
10:00 A.M.	60km

The Distance-Time graph for the uniform speed is drawn by following steps discussed above.

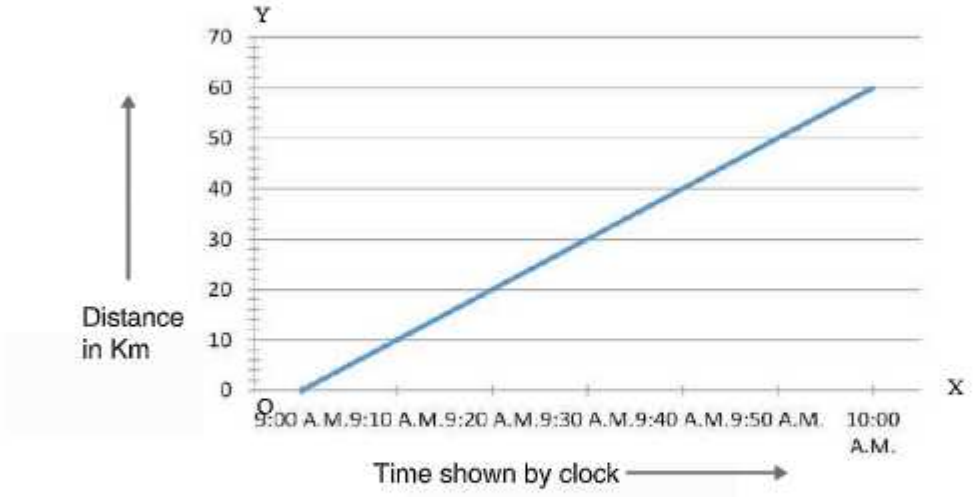


Fig 13.13: Distance - Time Graph for Uniform Speed

So, the train travels a distance of 10 km in every 10 minutes. It is having a uniform speed. The graph plotted between the distance travelled and the time taken by the train for a uniform speed is a straight line sloping upwards as shown in the figure 13.13. The speed of the train can be found at any instant by dividing the distance travelled and the time taken at that instant (by finding the slope of the graph). You will be surprised to see the same value of speed at all the distances.

We can also compare the speed of two objects by plotting Distance-Time graphs for their motion. Greater the slope of the graph, greater will be the speed of the object.

13.8.2 Graph for Non-uniform speed:

When an object travels unequal distance in equal intervals of time or equal distances in unequal intervals of time, it is said to have **non-uniform speed**. In this case, the graph obtained is not a straight line. The speed of the object does not remain the same at all intervals of time. The Distance-Time Graph for non uniform motion is a Curved line. We can again take the example of motion of a train moving with non uniform speed.

Time shown by a clock	Distance travelled by train from Station A
9:00 A.M.	0 km
9:10 A.M.	5km
9:20 A.M.	20km
9:30 A.M.	25km
9:40 A.M.	50km
9:50 A.M.	55km
10:00 A.M.	60km

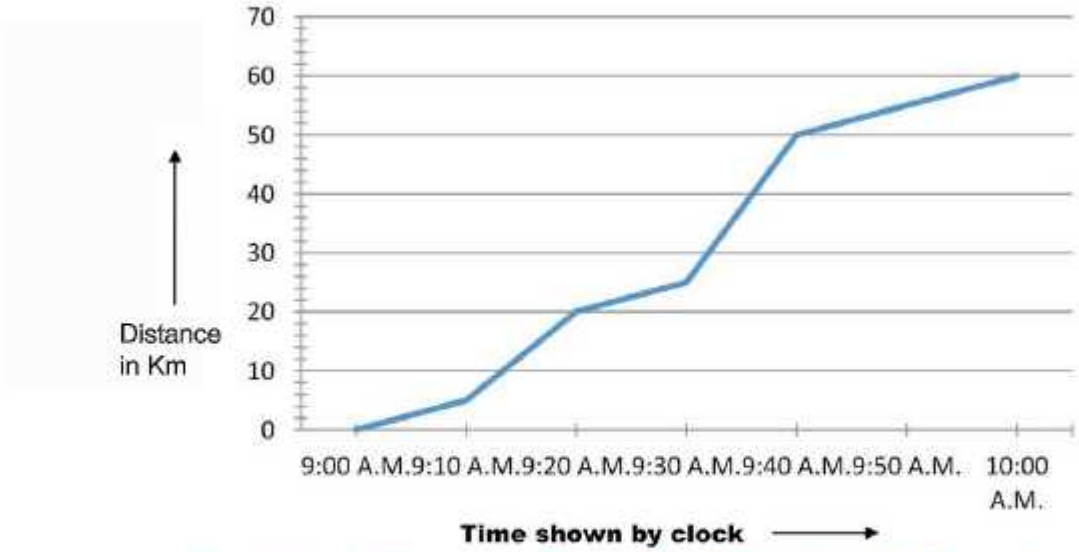


Fig 13.14 : Distance - Time Graph for Non Uniform Speed

The train is not having uniform speed. It is moving unequal distances in equal intervals of time. If we plot a graph between the distance travelled and the time taken by the train, we will find that it is not a straight line as shown in the figure 13.14. The speed of the train can be found at any instant by dividing the distance travelled and the time taken at that instant (or by finding the slope of the graph).

13.8.3 Graph for a stationary object :

Stationary object means, it is not moving and is not changing its position with time. Distance -Time graph in this situation will be a straight line parallel to the X-axis (Time Axis). We can take an example of a train, which has been stopped at a distance of 30 Km from the station A for some time.

Time shown by a clock	Distance travelled by train from Station A
9:00 A.M.	30 km
9:10 A.M.	30km
9:20 A.M.	30km
9:30 A.M.	30km
9:40 A.M.	30km
9:50 A.M.	30km
10:00 A.M.	30km

The train is not moving from its place. So, the distance travelled by the train in any interval of time is zero. If we plot a graph between the distance travelled and the time taken by the train, we find it is a horizontal straight line parallel to X-axis (Time Axis) as shown in the figure 13.15. The speed of the

train is found to be zero at any instant which is calculated by dividing the distance travelled to the time taken (or by finding the slope of the graph).

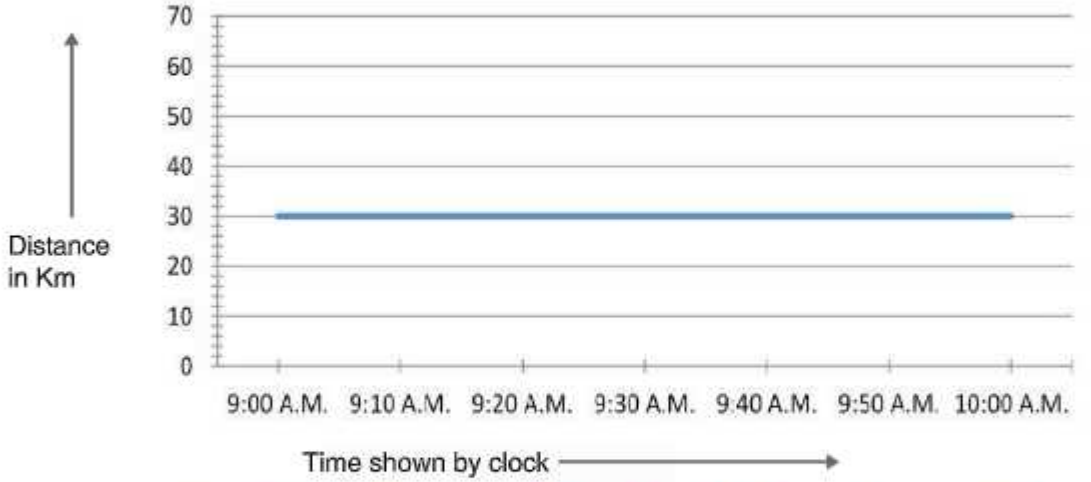


Fig 13.15 : Distance - Time Graph for stationary Object

KEYWORDS

Speed	m/s or ms^{-1}	Uniform motion
Non-Uniform motion	Oscillation	Periodic motion
Mean position	Extreme position	Time period
Frequency	Hertz or Hz	Distance-Time Graph

Points to Remember

- If an object does not change its position with respect to time and the surroundings, it is said to be at rest and if the object changes its position with respect to time and the surroundings, it is said to be in motion.
- **Slow motion :** An object is said to be in slow motion, if it takes more time to cover a certain distance.
- **Fast motion :** An object is said to be in fast motion, if it takes shorter time to cover a certain distance.
- Speed is the distance travelled by an object per unit time.
- Speed can be calculated by dividing the total distance travelled by the total time taken to cover that distance as follows:

$$\text{Speed} = \frac{\text{Total distance travelled}}{\text{Total time taken}}$$

The SI unit for measurement of speed is meter/second. In short, this is written as m/s or ms^{-1}.

- Objects moving in a straight line at a constant speed are said to be in uniform motion, whereas an object that moves in a straight line with varying speed is said to be in non-uniform motion.
- Time is a moment or duration in which an event occurs.
- We measure time with the help of wall clocks, digital clocks,wrist watches, mobile phone.
- In ancient times, people used the natural events that occurred after certain period, to measure time. Many time measuring devices were discovered by them like sundials, sand clocks, water clocks etc.
- A motion which repeats itself at regular intervals of time is called periodic motion.
- A simple pendulum is a heavy mass suspended with a thread from a rigid support about which it can vibrate.
- The to and fro motion of bob of simple pendulum from mean position to one extreme position and back to another extreme position then back to mean position is called One Oscillation.
- Time taken to complete one oscillation of the pendulum is called its Time Period.
- Number of oscillations per unit time is called its frequency. It is measured in hertz (Hz).
- Speedometer is a device used to measure the speed of a running vehicle.
- Odometer is a device used to measure the distance covered by the vehicle.
- The graph plotted between the distance travelled and the time taken for a uniform speed is a straight line.

Exercise

1. Fill in the blanks :

(i) The motion of an object in a straight line is called ..... .

(ii) A clock is used to measure ..... .

(iii) The Distance-Time graph for uniform speed is a ..... line.

(iv) The motion of a simple pendulum is called ..... motion.

2. Write true or false :

(i) Speed is the distance travelled by an object per unit time.

(ii) The S.I. unit of speed is km/s.

(iii) The time taken to complete one oscillation of a pendulum is its time period.

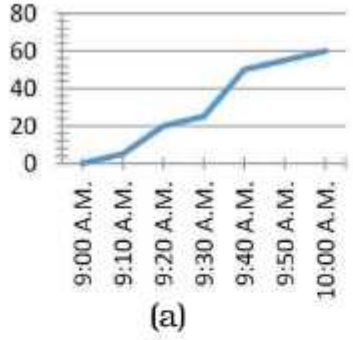
(iv) The instrument used to measure the speed of a vehicle is odometer.

3. Match the Columns :

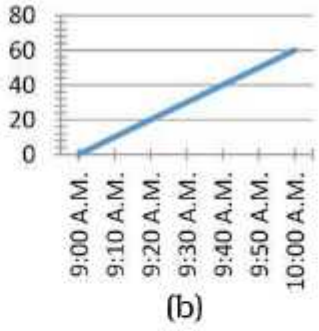
Column I	Column II
(a) Periodic Motion	(a) 
(b) Measure Time	(b) 
(c) Measure Speed	(c) 
(d) Slow motion	(d) 

4. Multiple Choice Questions :

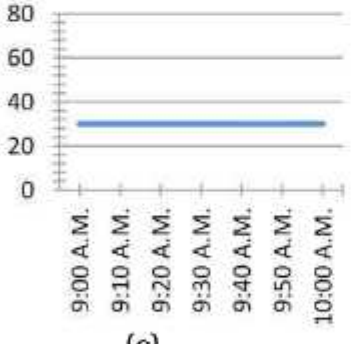
(i) Which of the following is a Distance-Time Graph for an object at rest?



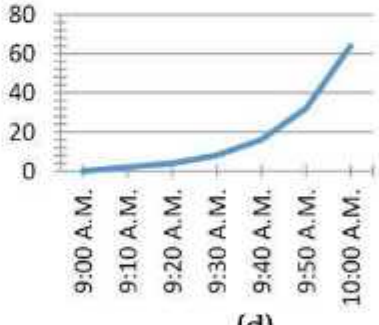
(a)



(b)



(c)



(d)

(ii) Which of the following relation is correct for finding speed of an object?

(a) Speed = Distance x Time (b) Speed = Distance/Time

(c) Speed = Time/Distance (d) Speed = 1/ Distance x Time

(iii) Simple pendulum is an example of ..... motion.

(a) Rectilinear motion (b) Oscillatory motion

(c) Rotational motion (d) none of above

(iv) A car moves with a speed of 40km/h for 15 minutes and then with speed of 60km/h for the next 15 minutes. The total distance covered by the car is:

(a) 100 km (b) 25 km

(c) 15 km (d) 10 km

5. Very Short Answer Questions :

(i) Define speed. Give its S.I. units?

(ii) Which instruments were used for measuring time by the ancient people?

(iii) Name the instruments used for measuring (a) the speed of a moving vehicle (b) the distance moved by a vehicle.

(iv) What is Graph? Give its types.

6. Short Answer Questions :

(i) Differentiate between slow and fast motion. Give examples.

(ii) Differentiate between uniform and non-uniform motion. Give examples.

(iii) Ajay goes to his school 600 meters away from his house. Find the speed in ms^{-1}, with which he must walk to reach his school in 5 minutes.

(iv) The distance between two stations is 216 km. In how many hours will a train reach the destination which is moving at a speed of 20 m/s?

(v) Find the time period of a simple pendulum, which takes 20 s to complete 50 oscillations?

7. Long Answer Questions :

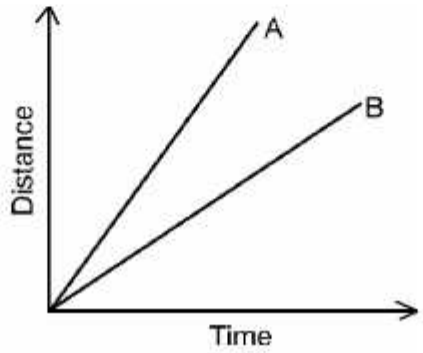
(i) Describe the method to find the time period of a simple pendulum.

(ii) A car moves a distance of 60 km in 1st hour, 75 km in 2nd hour, 55 Km in 3rd hour and 50 km in 4th hour. Plot a distance-time graph for the motion of the car.

(i) Find the speed of the car for the whole journey.

(ii) Find the speed of the car between 1st and 3rd hour.

(iii) Figure shown below represents the distance-time graph for the motion of two vehicles A and B. Which one of them is moving faster?



14 ELECTRIC CURRENT AND ITS EFFECTS

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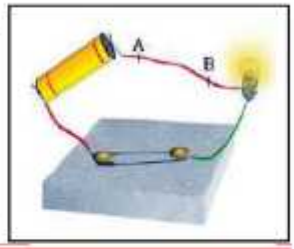
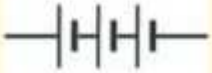


In class VI we have studied about various electrical components like electric wire, electric cell, electric bulb etc and how these can be arranged together to form an electric circuit. We also made neat & clean diagrams depicting the various components of an electric circuit. It is very difficult to draw an electric circuit consisting of many electric components by drawing the pictures of all the electric components. The better and easier way to draw an electric circuit is to draw symbols of its various components. Therefore, we represent common electric components of electric circuit by their symbols as shown in table 14.1

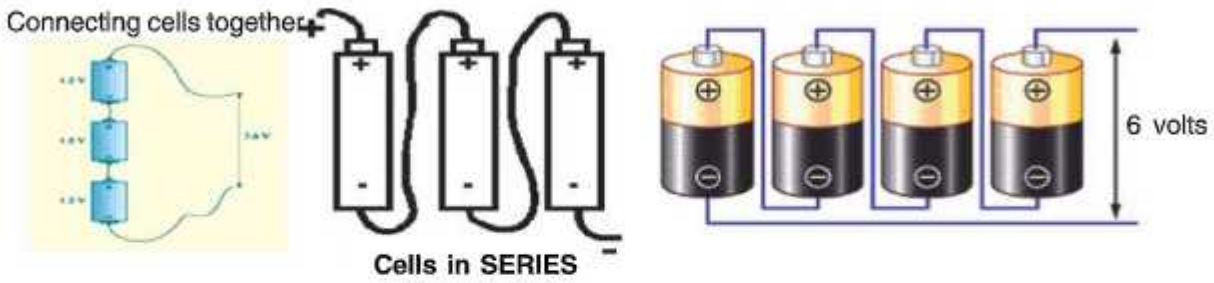
Table 14.1 Symbols of Electric Components :

Electric Components	Picture	Symbol
(i) Electric Cell		
(ii) Electric Bulb		
(iii) Switch in OFF Position		
(iv) Switch in ON Position		
(v) Battery		
(vi) Wire		

14.1 To make an electric circuit

If you look at the symbol for electric cell you will notice two parallel line where one is longer than the other one. Since an electric cell consist of a positive terminal and a negative terminal, therefore, longer line represents the positive terminal of electric circuit and shorter line represents the negative terminal of the cell.

A switch in ON position and OFF position is also represented by symbols as shown in table 14.1. A battery is made by combining two or more number of cells connected back to back such that positive terminal of one cell is connected to the negative terminal of another and vice versa.



(a) (b) (c)

Fig 14.1 (a), (b), (c) shows cells connected together to form battery

Many devices like torches, electric toys, TV remote control, radio etc use batteries. In these devices, cells are not usually placed back to back but are usually placed side by side as shown in fig 14.1(b) and (c). If we look carefully inside the battery compartment of these devices(fig 14.2), we see a thick wire or metallic strip connecting the positive terminal of one cell to the negative terminal of next cell. To help you place the batteries in correct order symbols '+' and '-' are printed there.

Fig 14.2 A battery holder of two cells

We can buy battery holders from market to prepare battery of two or more cells for our activities.

Activity 1 : To make an electric circuit.

Material Required : A cell, A bulb, switch, connecting wires.

Method : Make an electric circuit as shown in fig 14.3. This electric circuit can be depicted by using symbols as shown in figure 14.4 & 14.5.

It is quite easy to draw a diagram of this circuit using symbols. Therefore we represent an electric circuit using a circuit diagram.

A circuit diagram is a graphical representation of an electric circuit.

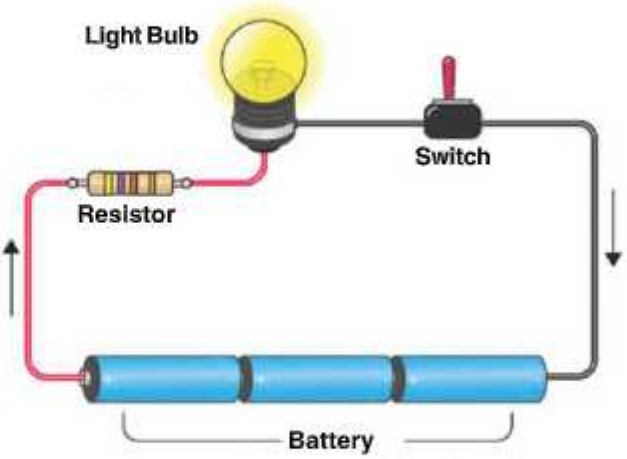


Fig 14.3 An electric circuit

Figure 14.4 shows a circuit diagram for electric circuit in 'ON' position (closed circuit).

A switch or a key can be placed anywhere in the circuit.

Figure 14.5 (below) shows circuit diagram of the same electric circuit in 'OFF' position (open circuit).

There is a thin wire in the bulb called filament which glows when current passes through it. When its filament is broken, the circuit is no longer closed. The bulb does not glow and we say that the bulb gets fused.

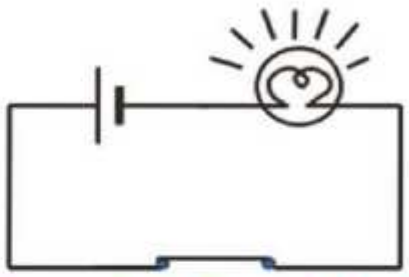


Fig 14.4 circuit diagram of electric circuit in ON position (closed circuit)

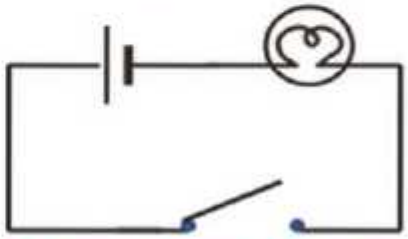


Fig 14.5 Circuit diagram of electric circuit in OFF position(open circuit)

Observation : When the switch is in 'ON' position the circuit is said to be closed and the current flows through the circuit and the bulb glows. When the switch is in 'OFF' position the circuit is said to be open and no current flows through the circuit and the bulb does not glow.

Conclusion : The bulb will glow when Circuit is closed.The bulb will not glow when circuit is not closed.

Think and answer

1. How many terminals are there in an electric cell ? Name them.
2. What is the role of switch in the electric circuit ?

14.2 Heating Effects of Electric Current

Activity 2 : Heating Effects of Current

Material Required : Electric cell, A bulb, Key (switch), connecting wires.

Method : Take an electric cell, a bulb, a key (switch), and connecting wires Make an electric circuit as shown in fig. 14.4 Touch the bulb when the key is in 'OFF' position. Let the key be in 'ON' position for about one minute. Again move the switch to 'OFF' position and touch the bulb.

Observation : You will observe that bulb will become hot when it glows.

Conclusion : Due to heating of current, bulb will feel hot when glows.

Think and answer

1. When switch is in 'ON' position then bulb..... and feels .....

Activity 3 : Heating effects of current in a wire.

Material Required : Nichrome wire, two iron nails, electric cell, switch and connecting wire.

Method : Take about 10cm long nichrome wire. Tie it between two iron nails. Complete the electric circuit using a cell and a switch as shown in figure 14.6

Now switch on the current in the circuit by moving the switch to 'ON' position. After few seconds touch the wire (do not hold it for long time). Switch off the current and again touch the wire after few minutes.

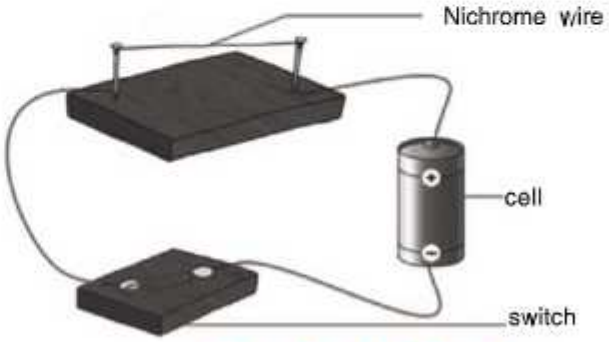


Fig 14.6 Heating effect of current

Observation : The nicrome wire feels hot when the switch is in 'ON' position and feels cold when switch is in 'OFF" position.

Conclusion : The wire becomes hot when the current flows through it due to heating effect of current

Think and Answer

1. When switch is OFF the wire feels hot. (True/False)
2. When switch is ON the wire feels cold. (True/False)
3. If you take any other wire, will you feel the same effect?

We have noticed from these two activities that the bulb and the wire becomes hot when electric current passes through them. This is called the **heating effect of current**.

Fig 14.7 A room heater

An electric heater or room heater (Fig. 14.7) utilises heating effect of current for heating or cooking. It contains a coil of wire called element which becomes red hot when heater is switched on after connecting it to electric supply. Think of those appliances where heating effect of current is utilised and make a list of them in your notebook.

The amount of heat produced in a current carrying wire depends on,

i. Material of the wire
ii. Length of the wire
iii. Thickness of the wire.

The wires used for making electric circuits do not get heated normally whereas elements of some electric devices become red hot (as in case of an electric heater) and may also start glowing (as in case of an electric bulb).

If large current flows through a wire, it may become so hot that it may even melt and break. If in activity 3 we replace the cell with a battery of four cells and a thin strand of steel-wool in place of nichrome wire then on passing the current for few minutes, we will see that the steel wool wire melts and breaks.

Wires made of special materials melt quickly and break when a large current are passed through them. These wires are utilised in making electric fuses, which are used in every electric circuit. There is a maximum limit of the current which can safely flow through a circuit. If by accident the current exceeds its safe limit. the wire of the fuse melts and breaks the circuit thus preventing electric fire. These electric devices can prevent electric fires and accidents when large current accidently passes through the electric supply.

Therefore, electric fuse is a safety device which prevents damages to electric circuits and prevent electric fires.

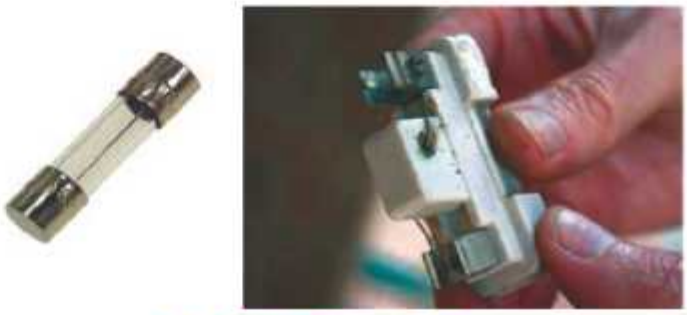


Fig 14.8 Electric fuses

In electric circuits there are different types of fuses used for different purposes. Figure 14.8 shows fuses used in homes and in electric devices.

4.3 Magnetic Effect of Current

We have observed heating effect of electric current. Let us now study one more effect of electric current by doing an activity.

Activity 4 : Magnetic effects of electric current.

Material Required : An electric wire, empty match box tray, compass, bulb, switch, a cell or battery.

Method : Wrap an electric wire around a empty matchbox in which an electric compass needle is placed. Connect the free ends of the wire to an electric cell via a key as shown in figure 14.9

First of all note the direction in which the compass needle is pointing initially when it is at rest. You will find it pointing towards north south

direction, as we already learned in class VI. Now bring a bar magnet near the compass needle. You will see that the needle will get deflected. This is because a compass needle itself is a tiny bar magnet and it gets deflected when it is brought near a magnetic substance. Now move away the bar magnet and switch 'ON' the current in the circuit. You will observe that the magnetic needle again gets deflected. This can happen only if some magnetic substance is near the magnetic needle. But there is no magnetic substance near the tray containing the magnet, except a current carrying wire. Now switch 'OFF' the current. You will again observe that the needle again gets deflected and comes back to its initial position. This indicate that current carrying wire behaves like a magnet.

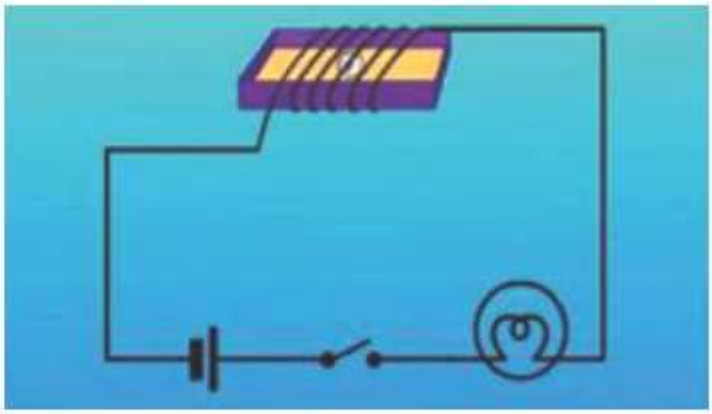


Fig 14.9 Magnetic effect of current

Observation : You will observe the deflection of magnetic needle when the switch is in ON position. The needle comes back to its original position when the switch is in OFF position.

Conclusion : The deflection of needle shows the presence of magnetic substance near the needle. This proves that wire behaves like a magnet when electricity or electric current is passed through it.

Therefore, current carrying wire behaves like a magnet and this is called the magnetic effect of current. This property of current can be used to make electromagnets.

This is what a scientist Hans Christian Oersted noticed first accidentally in year 1820 while he was delivering a lecture in his class.

Think and answer :

1. Why a magnetic needle points in NS direction when there is no magnetic substance near it?
2. Why magnetic needle gets deflected when a bar magnet is brought near it?
3. Why a magnetic needle gets deflected when current is switched on?

14.4 Electromagnet

Activity 5 : To make an electromagnet

Material Required : An iron nail, a cell or battery, a switch, paper pins, connecting wires.

Method : Take 1 m long insulated copper wire and wrap it around a long iron nail. Connect the two ends of the wire to an electric cell (or a battery) and a switch as shown in fig 14.10.

Place some paper pins near the nail. Observe nails carefully by switching ON the current and again observe them while switching OFF the current.

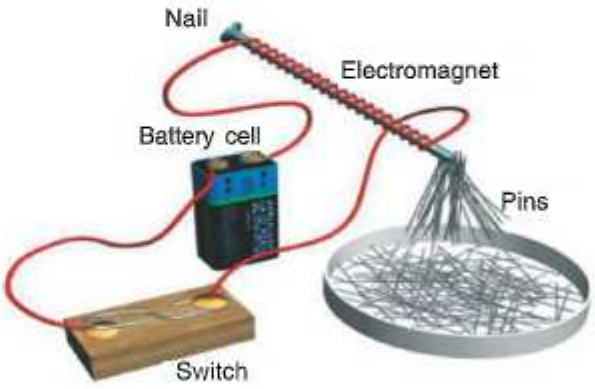


Fig.14.10 Making an electromagnet

Observation : You will see pins clings to the iron nail when the switch is in ON position and current flows through it.

Conclusion : When current flows through the circuit, the coil behaves like a magnet due to magnetic effect of current and losses its magnetic effect when current is switched off.

Think and answer :

1. Why do the pins get stick to the iron nail when current is passed through it?
2. Why the pins fall back after sometime when current is switched off?

Such substances which becomes magnet when current passes through them losses their magnetic effect when current is switched off are called **electromagnets**. By increasing the current in the coil the electromagnets can produce large magnetic effect and can be used to lift heavy loads from one place to another. Such electromagnets are used in cranes. The end of such crane has a strong electromagnet attached to it. The electromagnets are also used to seperate magnetic material from the junk. Doctors use tiny electromagnets to take out small pieces of magnetic material that have accidently fallen in the eye. Can you look for other uses of electromagnets in your daily life? They are also used in loudspeakers ,earphones, electric bells and are also used in many toys. Have you seen any electromagnet in a toy ?

14.5 Electric Bell

An electric bell is a mechanical device that functions by means of an electromagnet. When an electric current is passed, it produces a repetitive buzzing or clanging sound.

Three main parts of a simple electric bell are an electromagnet, a bell (or gong) and a hammer. Figure 14.11 shows the circuit of an electric bell.

Main parts :

Electromagnet : It consists of a coil of insulated wire wounded round iron rod which acts as an electromagnet when current is passed through it.

Hammer : An iron strip with a metal ball at one end is called a hammer. It is kept close to the electromagnet. There is a contact screw near the iron strip of the hammer.

Gong : It is in the shape of a cup or half sphere made of metal. When hammer strikes the gong, sound of bell is heard.

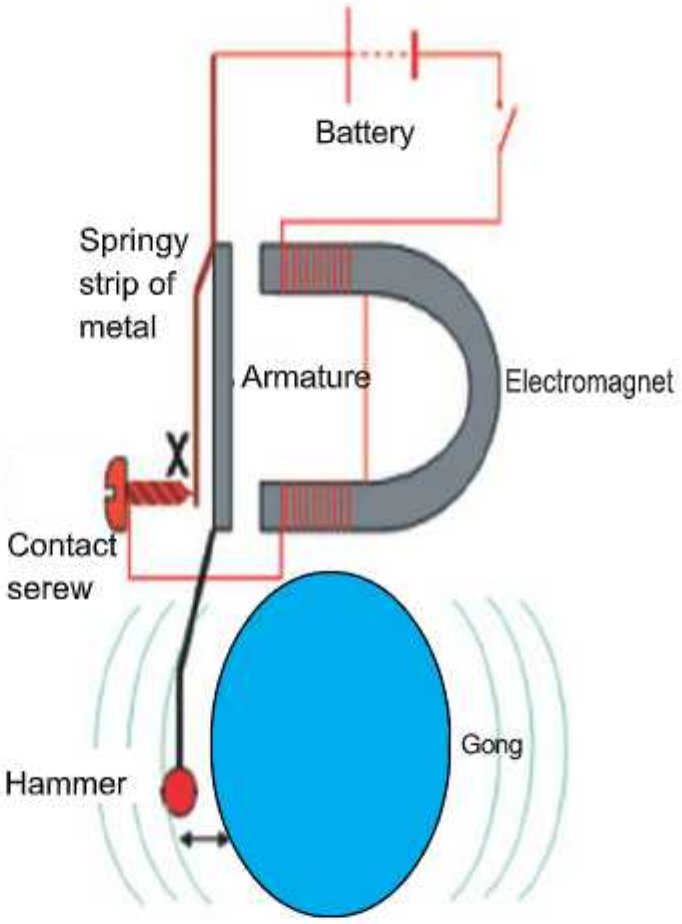


Fig.14.11 An Electric Bell

Working : When we switch on the bell, the contact screw comes in contact with the iron strip of the hammer and the current flows through the coil which becomes an electromagnet. This electromagnet in turns attracts the iron strip towards it. Due to this the metal ball of the hammer strikes the gong to produce sound. But in this process the hammer looses its contact from the contact screw, thus breaking the circuit. Due to this, the coil no longer remains an electromagnet and thus no longer attracts the iron strip of the hammer. The iron strip comes back to its original position and again touches the contact screw. This again makes the coil electromagnet and hammer again strikes the gong. This process continues again and again in quick succession and the bell keeps ringing.

KEYWORDS

- Battery
- Electric circuit
- Electric cell
- Circuit diagram
- Switch or key
- Electric bulb
- Electromagnet
- Electric bell
- Magnetic crane
- Electric fuse

Points to Remember

- It is convenient to represent electric components by their symbols.
- A circuit diagram is a graphical representation of an electric circuit.
- The circuit through which current is not flowing is called an open circuit
- The circuit through which current is flowing is called closed circuit.
- When a current passes through a wire it gets heated. This is called the heating effect of current.
- Wire made from special materials gets so heated that it melts and breaks when large current is passed. These wires are used in electric fuses to prevent fires and damage to electrical appliances.
- Heating effect of current is used in electric heaters, room heaters, toasters etc.
- When a current passes through a wire it behaves like a magnet. This is called magnetic effect of current.
- Substances which becomes magnet when current passes through them and loses its magnetic effect when current is switched off are called electromagnets.
- Electromagnets are used in many appliances.

Exercise

1. Fill in the blanks :

(i) Shorter line in the symbol for cell represents ..... .

(ii) Combination of two or more cells is called ..... .

(iii) When key is in ..... position current flows through the circuit.

(iv) In a battery positive terminal of one cell is connected to ..... terminal of next cell.

(v) Electric heater works on the ..... effect of current.

2. Write True or false :

(i) To make a battery of two cells, positive terminal of one cell is connected to negative terminal of another.

(ii) Electric iron works on the basis of heating effect of current.

(iii) Magnetic crane is based on magnetic effect of current.

(iv) When current flows in the circuit then circuit is called open circuit.

(v) An electric bell works on the principle of electromagnet.

3. Match the column :

Column I	Column II
(i) Electric cell	a. Electric component
(ii) Electric heater	b. Heating effect of current
(iii) Electric fuse	c. Electromagnet
(iv) Magnetic crane	d. Safety device

4. Choose one option for the following :

(i) Which appliance is not based on heating effect of current

a. Electric toaster b. Loudspeaker

c. Heater d. Electric iron

(ii) Which of these devices are not based on magnetic effect of current

a. Room heater b. Magnetic crane

c. Electric bell d. Loudspeaker

(iii) The amount of heat produced in wire depends on

a. Nature of material b. Length

c. Thickness d. All of these

(iv) The wire used in the bulb is called

a. Element b. Spring

c. Filament d. Component

(v) An electric bell consists of

a. Gong b. Hammer

c. Electromagnet d. All of these

5. Very Short Answer Questions :

(i) What is an electromagnet ? How does it work ?

(ii) What is a magnetic crane ? How does it work ?

(iii) Drawn an electric circuit with one battery, one bulb and one switch in open position.

6. Short Answer Type Questions:

a) Define the following terms :

i) An electric cell

ii) A battery

iii) Electric circuit

iv) Open circuit

v) Closed circuit

7. Long Answer Type Questions:

(i) Explain the principle, construction and working of an electric bell using suitable diagram.

(ii) What is an electric fuse? How does it work. Why is it an essential component in an electric supply?

15 LIGHT

Introduction :

You have studied in class 6th that light helps us to see the things around us. We can see the things when light from a luminous object or from any of its source falls on an object and after striking, it reaches our eyes. We also know that light always travels in a straight line as you must have seen in the beam of light from headlamps of cars, torch, laser etc (fig 15.1).

Torch Light *Laser* *Head lights*

Figure 15.1: Light travel in a straight line.

Activity 1 : Light travels in straight lines

Materials Required : A rubber pipe and candle.

Method: Take a piece of pipe of a long rubber tube. Light a candle and fix it on a table. Try to see the candle through one side of the pipe. Now bend the pipe a little and again try to look at the candle through the pipe.

Observation : When we see the light of a burning candle through straight pipe, it is visible. But if the pipe is bent, we cannot see the light of the burning candle.

Conclusion : This shows that light travels in a straight line.

Looking at the candle through the straight pipe

Looking at the candle through the curved pipe

Figure 15.2 Light travels in a straight line.

15.2 Reflection of Light :

You may have seen your reflection on the surface of still water or on a steel plate or on a steel spoon. You must have seen the reflection of your face in a mirror also. It happens when the light coming from a source falls on your face and is reflected towards the mirror and the light is again reflected from the mirror towards your eyes and you can see your face in the mirror. But you can't see your reflection on a wall. It doesn't mean that there is no reflection of light from the wall. Reflection depends on the smoothness of the reflecting surface. For you to see your reflection, the reflection of light has to occur uniformly. For example, if you throw a ball at a rough piece of stone, it will bounce in a random direction. If you throw the same ball on a smooth surface, it will bounce back in a desired direction. Similarly, the reflection of light from a smooth surface like mirror is uniform. Such surfaces reflects almost all the light falling on them and we can clearly see the image of an object through the mirror. The reflection of light on a rough surface is random. The rough and dull surface reflects only a small amount of light, falling on it and therefore, it does not lead to the formation of a clear image. So, you can't see your reflection on a wall (wall being rough surface). For the same reason, you can see your face in a steel plate, but it is not as clear as a mirror.

Fig. 15.3 (a) Reflection in water

Fig. 15.3 (b) Reflection through a Shining surface

Therefore, one way to change the direction of light is to let it fall on a shiny surface. For example, a shining stainless steel plate or a shining spoon can change the direction of light. The surface of water can also act like a mirror and change the path of light as you must have seen the reflection of trees or animals in water figure15.3.

Activity 2 : Reflection through a mirror.

Material Required: Plane mirror, laser light, a chart paper, protractor.

Method : Place a piece of a plane mirror on a chart paper vertically, with the help of a mirror stand. Now take a laser light and place it in such a position that light can be seen along the chart paper and falls on the plane mirror at an angle. The light after striking on the plane mirror, changes its direction. This means that the light gets reflected.

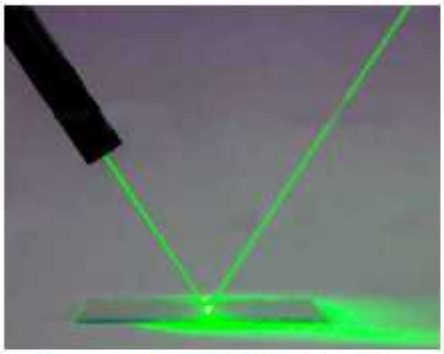


Figure 15.4 (A): Reflection of laser light from plane mirror.

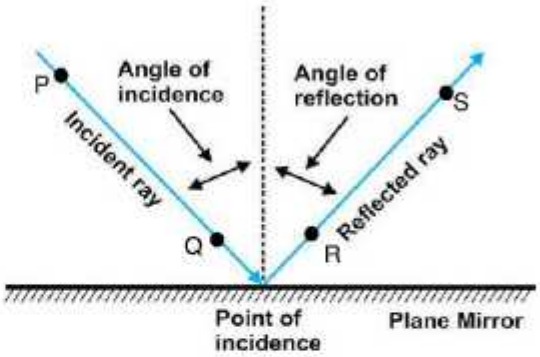


Figure 15.4 (B): Labeled diagram for Reflection of light from plane mirror.

The ray of light coming towards the plane mirror is called **Incident ray** and the ray after striking on the plane mirror changes its direction and is called **the reflected ray**. If you change the position of the torch, the position of the incident ray as well as the reflected ray will also change. This activity shows the reflection of light through plane mirror.

The point on the plane mirror, on which the incident ray and the reflected ray meets, is called the **point of incidence**. The perpendicular drawn on the point of incidence is called the normal. The angle between the normal at point of incidence and the incident ray is called the **Angle of Incidence**. The angle between the normal at point of incidence and the reflected ray is called the **Angle of Reflection**. Measure the angle of incidence and the angle of reflection marked on the chart paper by using a protractor.

Observation: Measure of the angle of incidence found to be same as angle of reflection.

Conclusion: Angle of incidence is equal to the angle of reflection.

Note : *The incidence ray, normal and the reflected ray lies in the same plane, here the plane is chart paper.*

Think and Answer:

1. The process of change in direction of light after falling on a mirror is called ..... of light.
2. Angle of Incidence is equal to angle of reflection. (True/ False)

15.3 Image :

When we look into the mirror, we see the reflection of our face. This reflection is called the 'Image' of our face. Light from our face falls on the mirror and is reflected back towards our eyes. It seems that the light is coming out of the mirror. There are two types of images: **Real and Virtual Images.**

The image which can be obtained on a screen is a real image. A real image is formed when light rays coming from an object actually meet at a point after

reflection. For example, the image on a cinema screen or image formed by a projector on a wall is the real image.

Figure 15.5 (A): The image formed by a projector is real image.

Figure 15.5 (B): The image formed by a plane mirror is virtual image.

The image which cannot be obtained on a screen is a virtual image. A virtual image is formed when light rays coming from an object do not actually meet but appear to meet at a point after reflection. For example, our image formed by a plane mirror is a virtual image.

15.4 Characteristics of images formed by a plane mirror :

Place a lighted candle in front of a plane mirror. This candle is the object. It seems that similar candle is placed behind the mirror. This is the image of the object (candle) formed by the mirror. This image shows the following characteristics:

1. The image of the candle appears behind the mirror. So, we can say that image formed by a plane mirror is always seen behind the mirror.
2. We cannot obtain the image of the candle on a screen placed behind the mirror. It shows that the image formed by a plane mirror is, **virtual**.
3. If we place the candle vertically upwards, the image also appears to be vertically upwards. It shows that the image formed by a plane mirror is **erect**.
4. If we compare the size of the candle with the size of its image formed by the plane mirror, it is found to be the same. It shows that the image formed by a plane mirror is of the **same size** as that of the object.
5. We can measure the distance between the object (candle) and the mirror. It is the same as the distance between the image and the

mirror. So, the image formed by the plane mirror is at the same distance behind the mirror as the distance of the object in front of the mirror. (This is shown in the activity 3).

6. If we stand in front of a plane mirror and raise our right hand then in the image it appears to us that our left hand is raised and vice versa [(fig 15.6 (a)]. If we write alphabets like BCDE, on a paper and see their image in the plane mirror. They also appear inversed sideways as ƎDCB [(fig 15.6 (b)]

   This shows that the image formed by a plane mirror is laterly inverted, i.e left side of the object appears to be the right side of the image. This is called **'Lateral Inversion'**.

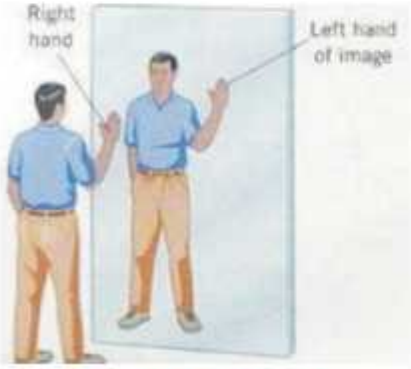


Figure 15.6 (a): Lateral Inversion of hands of a person by plane mirror.

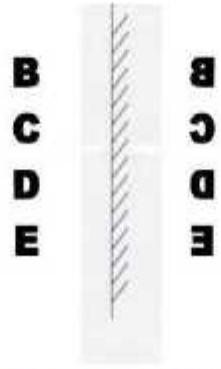


Figure 15.6 (b): Lateral Inversion of alphabets by plane mirror.

Figure 15.6 (c): Lateral Inversion of alphabets by plane mirror.

You must have seen the word AMBULANCE is written as shown in fig 15.6 (c). This is because when driver of a vehicle ahead of ambulance looks through her/his rear view mirror she/he can read AMBULANCE written on it and gives way to it.

Activity 3 : The distance of the object in front of the mirror is same as the distance of the image behind the mirror.

Material Required: A plane mirror, A paper, paper pin or pencil.

Method: Take a paper and fix it on board or table. Draw a thick line in the centre of the paper and put a marks at equal spacing of 1 cm each. Place a plane mirror on the paper vertically, with the help of a mirror stand on this line. Place or fix a paper pin or a pencil in front of the mirror at certain known distance say 3cm. Note the position of the image of the paper pin/pencil in the mirror.

Observation: You will find that the position of image is 3 cm behind the mirror.

Conclusion: This shows that the image of an object, formed by the plane

mirror is at the same distance behind the mirror as the distance of the object in front of the mirror.

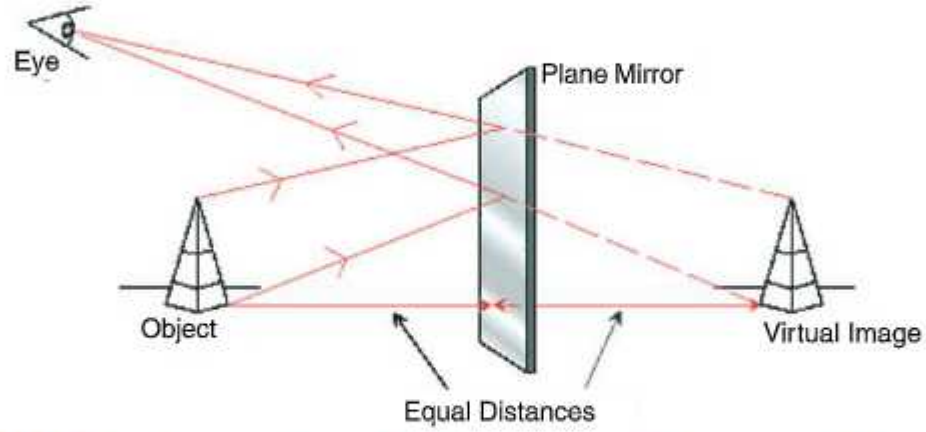


Figure 15.7: The image of an object is seen at the same distance behind the plane mirror as the distance of the object in front of the mirror.

Think and answer :

1. The distance between the object and the mirror is ..... to the distance between the image and the mirror.
2. The plane mirror has to be placed vertically on the graph paper. (True/False)
3. The plane mirror should be vertically upright.

We have discussed the characteristics of the images formed by a plane mirror. But all the mirrors are not plane mirrors. Some mirrors are curved. These are called **Spherical mirrors**.

15.5 Playing with Spherical Mirrors :

You have seen your image in a stainless steel plate. It is similar to the image formed by a plane mirror. The image is erect and of the same size of the object. If you see your image using the back side of a stainless steel spoon, it is not the same as that of the image obtained on a plate or on plane mirror. It is erect and smaller than the size of object. This means that this mirror is different from that seen in plane mirror. Now try to see your image using the front side of the spoon. The image may be erect but it is larger than the object. If you take the spoon away from you, you may get the inverted image of yourself. The curved, shining surface of the stainless steel spoon acts as a convex mirror. The most common example of a curved mirror is a spherical mirror. Thus Spherical mirror is a mirror, whose reflecting surface is the part of a hollow sphere of glass.

Spherical mirrors are of two types: **Concave mirror and Convex mirror**. The front side or inside surface of the spoon is concave. So, it acts as a concave

mirror. The backside or bulging out surface of the spoon is convex. So, it acts as a convex mirror. **A Concave mirror** is a spherical mirror, whose reflecting surface is concave or bent inwards. **A Convex mirror** is a spherical mirror, whose reflecting surface is convex or bulging outside. Therefore, the inner surface of a spoon acts like a concave mirror while its outer surface acts like a convex mirror.

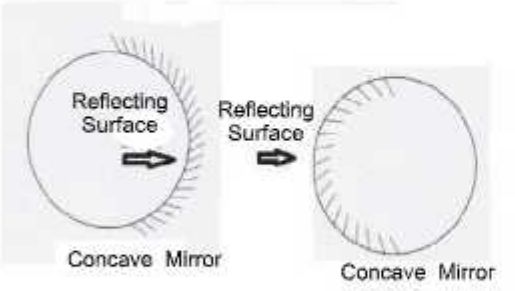


Figure 15.8 (A): The hollow sphere of glass, whose inner or outer reflecting surface makes concave and convex mirrors.

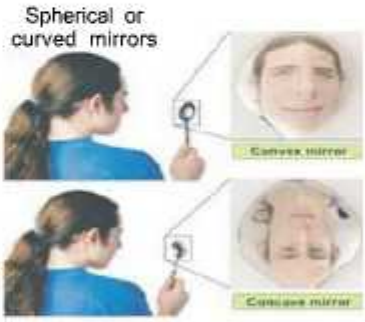


Figure 15.8 (B): Steel spoon as concave and convex mirrors.

These mirrors are called spherical mirrors, because they are a part of a hollow ball of glass painted inside or from outside.

To understand this, take a hollow plastic or rubber ball and cut a small portion of the ball with knife, very carefully. The inner surface of the small part of the ball is concave and the outer surface is Convex.

Fgure15.9: Hollow ball and its concave and convex surface.

You have read earlier that we cannot obtain the image formed by a plane mirror on any screen or wall. Let us try to obtain the image formed by a concave mirror on a wall.

Activity 4 : To obtain the image of sun on a wall using a concave mirror

Material Required: A Concave mirror, wall.

Method: Take a concave mirror. Hold it facing the sun. Try to get the light reflected by the mirror on a wall. Adjust the distance between the mirror and the wall to get a sharp bright spot of light on the wall.

Observation: You will see bright spot of light on the wall.

Conclusion: The image of the sun (object) is formed when the rays of light from the object fall on the mirror and after reflection, they meet at a point on the wall (screen).

This image of the sun is the real image as it is formed on a screen because the rays of light actually meet after reflection from the mirror. The point on which the image is formed on the wall is the focus of the mirror because the rays are coming from a very distant object. The distance between the focus and the mirror is **focal length of the mirror**. Measure this focal length by using a scale.

Figure 15.10 : Image of sun as seen on a wall by concave mirror

Think and answer :

1. The image of the sun formed by the concave mirror on the wall is ..... image. (Real/virtual)
2. Is the image of a candle seen using a concave mirror same as that the image of the Sun seen on the wall?

Activity 5 : To obtain the image of an object on a screen using a concave mirror

Material Required : Concave mirror, mirror stand, candle, match stick, screen.

Method: Place a concave mirror vertically on a leveled table using a mirror stand. Place a cardboard covered with white cloth or chart paper (as screen) at some distance in front of the concave mirror. Now place a lighted candle in between the concave mirror and the screen. Adjust the position of the screen or the candle to obtain a sharp image of the candle flame on the screen. Now try to obtain different images of the candle by moving the candle near and far from mirror.

Obsevration : By adjusting the position of candle or screen we will obtain different images and of different sizes.

Conclusion: We find that when the object is very far away from the mirror, the image formed is inverted and very small. If we bring the object nearer to the mirror the image obtained becomes larger and remains inverted. When we bring the object closer after a point the image becomes virtual, erect and very large than the object. This point is focus of the mirror.

Figure 15.11: Image of an object on screen formed by a concave mirror

Note : *You can repeat the above activity with a convex mirror also. For a convex mirror, you will always obtain a virtual, erect and smaller image for any position of the object. It makes no difference in the nature of the image,*

Think and answer :

1. When the object is very far from the concave mirror, the image formed is ..... and ..... .
2. The image formed on the screen is real. (True/False)

15.6 Uses of Spherical Mirrors :

The image formed by a concave mirror can be real or virtual, smaller or larger than the object. Depending on the nature of the image, concave mirrors are widely used. Concave mirrors are used by dentists to see the larger images of the teeth by placing the mirror very close to the teeth. Concave mirrors are used as shaving mirrors. Concave mirrors are also used as reflectors in search lights, torch lights, automobile **headlights**. Engineers working in mines and doctors use concave mirror as reflectors on their head to produce a parallel beam of light, which helps them in watching small things.

Figure 15.12 (a): Dentist use concave mirror to check the teeth.

Figure 15.12 (b): Concave mirror used as reflectors in torch and search light.

Figure 15.12 (c): Doctors use Concave mirror for checkup of the patients.

The image formed by a convex mirror is virtual, erect and smaller than the object. It is used as a rear view mirror in the vehicles like cars, scooters, buses etc. It helps the drivers to see the traffic on the road coming from backside. The image is smaller and erect. So, it gives a wide view of the backside. Convex mirrors are also used for security purposes in shopping malls, hospitals, road turnings to avoid accidents and are used in banks to keep an eye on customers in a larger area. Convex mirror is also used on the front wall of an A.T.M. which helps the customer to keep watching the happenings at his backside.

Figure 15.13 (a): Convex mirror used as a rear view mirror.

Figure 15.13 (b): Convex mirror used for rear view in bank ATM.

15.7 Images Formed By Lenses :

A piece of transparent glass used to see very small things clearly is called **magnifying glass or a lens**. You must have seen through a magnifying glass. It gives the larger view of the object. It is used for reading very small printing. Lenses are used in spectacles, cameras, binoculars, telescopes and microscopes.

Figure 15.14 (a): Magnifying glass.

Figure 15.14 (b): Camera and binoculars

Mirrors are not transparent because of which there is reflection through the mirrors. But lenses are transparent. Light can pass through them. So, there is refraction through the lenses. **Refraction** is the process of change of path of light, when it passes through a transparent material like lens. Lenses are of two types : **Convex and concave lenses. Convex lens is a piece of glass thicker in the middle than at the edges. Concave lens is a piece of glass thinner in the middle than at the edges.**

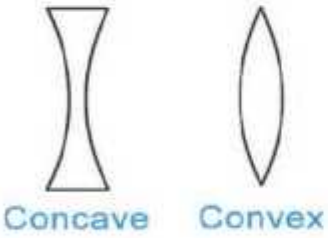


Figure 15.15 (a): Concave lens and Convex lens.

Figure 15.15 (b): Image of Sun by using a convex lens.

Activity 5 : To obtain the image of sun on a paper using a convex lens.

Material Required: Convex lens, lens holder, paper sheet.

Method: Take a convex lens. Place it in the path of rays of sunlight. Place a paper in front of the lens, where the rays after passing through the lens will fall. Adjust the distance between the paper and the lens to obtain a bright spot of light on the paper.

Observation : You can see a bright spot of light on the paper.

Conclusion: This bright spot of light is the image of the sun.

The image of the sun (object) is formed when the rays of light from the object fall on the lens and after refraction, they meet at a point on the paper (screen). This image of the sun is the real image as it is formed on a screen as the rays of light actually meets after refraction from the lens. **The point at which the image is formed is the focus of the lens because the rays are coming from a very distant object. The distance between the focus and the centre of the lens is called focal length of the lens.** Measure this focal length by using a scale.

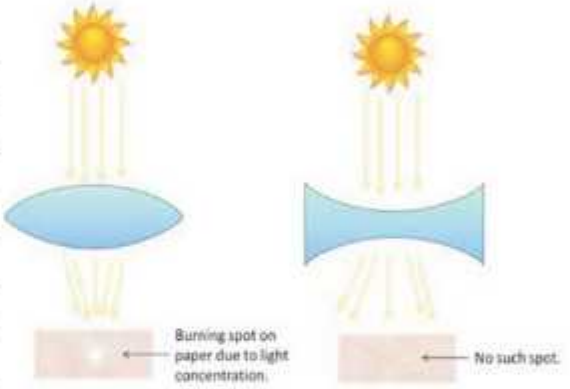


Figure 15.16 : Refraction of sunlight by convex and concave lenses.

If you hold the lens and paper in this position for few minutes, the paper will starts burning. This is due to the fact that the rays of the sun also carry heat. The lens converges thes rays thereby increases the heating effect. Therefore, a convex lens is also called a **Converging lens**.

If you repeat this activity with a concave lens, you will not obtain a sharp, bright image of the sun. This is due to the fact that the concave lens diverges the parallel rays of light passing through it. Therefore, a concave lens is also called a **Diverging lens**.

Think and answer :

1. The bright spot of light obtained on the paper is the image formed due to ..... effect.
2. The image obtained on the paper is the virtual image. (true/false)

Activity 6: To obtain the image of an object on a screen using a convex lens.

Material Required: Convex lens, lens holder, screen, candle, match stick.

Method: Place a convex lens vertically on a levelled table using a lens stand. Place a cardboard covered with white cloth or chart paper (as screen) at some distance in front of the convex lens. Now place a lighted candle between the lens and screen. Adjust the position of the screen or the candle to obtain a sharp image of the candle flame on the screen. Now try to obtain different images of the candle by taking the candle very near to the convex lens and also very far away from the lens.

Observation: We find that when the object is very far away from the lens, the image formed is inverted and very small. If we bring the object nearer to the lens, the image obtained becomes larger and remains inverted. After a certain point, the image becomes virtual, erect and very large. This point is the focus point of the lens.

Figure 15.17 (a) : Images of objects placed at different distances using a convex lens.

Figure 15.17 (b) : Images of objects placed at different distances using a concave lens.

Note : *You can repeat the above activity with a concave lens also. For a concave lens, you will always obtain a virtual, erect and smaller image for any position of the object.*

Think and answer :

1. The convex lens is placed between the object and the screen. (True/False)
2. For a convex lens, the image formed is always real. (True/False)

15.8 Uses of Lenses :

Convex lens:

1. Convex lenses are used as magnifying glasses in simple microscopes.
2. Convex lenses are used in making spectacles.
3. Convex lenses are used in optical instruments like projectors, binoculars, compound microscopes and telescopes etc.

Concave lens:

1. Concave lenses are used in spectacles.
2. Concave lenses are used in doors of the rooms to see the image of the persons outside.
3. Concave lenses are used in peep holes.

15.9 Dispersion of Light :

You must have seen a rainbow in the sky after rain. A rainbow is a beautiful band of seven colours formed by drops of water, when white sunlight passes through them. The process of splitting of white light into seven colours on passing through a prism like transparent material is called **Dispersion of light**. The rain drops present in the sky before or after rain act as prism and disperse the sunlight into a band of seven colours called rainbow.

Figure 15.19 (A) : Rainbow formed after rain.

Figure 15.19(B) Rainbow formed by fountain water.

Figure15.19(B) : Seven colours band on CD.

The same process is seen when we see through a fountain of water in the sunlight. We can also see the formation of seven colour-band on a CD (compact disc), when sunlight is reflected from its surface.

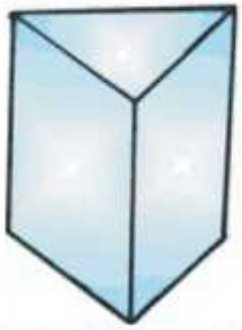


Figure 15.20 (A): Glass prism.

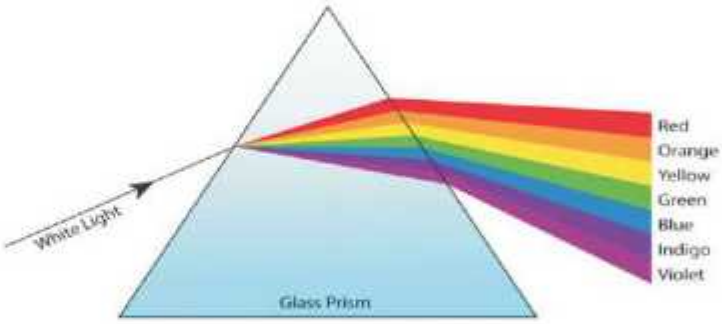


Figure 15.20 (B): Dispersion of white light through a prism.

We can study the dispersion of white light into seven colours by using a glass prism. A prism is a triangular piece of transparent material, having faces at acute angles. If a beam of light is passed through a glass prism, refraction of light takes place and the white colour of the beam splits into a spectrum of seven colours. These seven colours are VIOLET, INDIGO, BLUE, GREEN, YELLOW, ORANGE and RED. Generally we remember these names in series with a word 'VIBGYOR'.

This shows that white light consists of seven colours. We can split white light in to seven colours. These seven colours when mixed give us the white colour.

Activity 7 : To study the formation of white light by mixing seven colours.

Material Required: Cardboard or paper disc, a set of painting colours, a pencil.

Method: Take a circular cardboard or paper disc. Divide this disc into seven equal segments. Paint seven colours VIOLET. INDIGO. BLUE. GREEN.

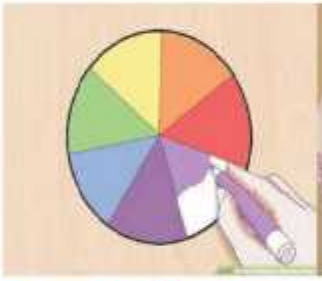


Figure15.21(A) : Paint seven colours on a paper disc.

Figure15.21(B) : Newton's disc.

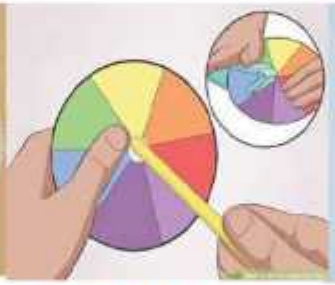


Figure15.21 (C) : Fix the disc on a pencil.

Figure15.21 (D) : Rotate the disc quickly. It will appear white.

YELLOW, ORANGE and RED on these segments. Instead of painting, papers of these colours can also be pasted on the disc. This seven coloured disc is called Newton's disc. Fix this disc on a refill of a ball point pen or a pencil, so that it can be rotated freely. Now rotate the disc quickly in the daylight. You can also make a spinning top by fixing a small coloured disc on a toy top. If you spin this top, disc looks white due to mixing of seven colours.

Observation : You will see the white top of disc while lotating instead of different colours on its top.

Conclusion : White light splits into seven colours due to despersion. We can mix all these seven colour to get white colour.

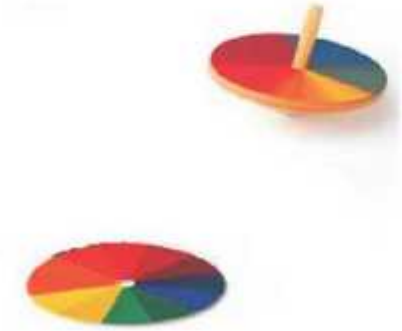


Figure15.22(A) : Fix Newton's disc on a top

Figure15.22(A) : On rotating the top, it appears to be white

Think and answer :

1. White light is composed of ..... Colours.
2. When disc with seven colours is rotated, it appears to be red. (True/False)
3. Name the seven colours of which the white light is made off.

KEYWORDS

Reflection	Incident ray	Reflected ray
Focus	Focal length	Magnifying glass
Lateral Inversion	Angle of incidence	Angle of reflection
Real Image	Virtual Image	Concave Mirror
Convex Mirror	Concave Lens	Convex Lens
Prism		Dispersion

Points to Remember

- The phenomenon of change in direction of light after striking on the surface of an object is called Reflection of light.
- The ray of light which falls on the object is called the Incident ray. The ray of light after striking on the object, which changes its direction is called the reflected ray.
- The angle between the normal at point of incidence and the incident ray is called the angle of Incidence. The angle between the normal and the reflected ray is called the Angle of Reflection.
- Angle of incidence and the angle of reflection are always equal.
- The image which can be obtained on a screen is a real image. The image which can't be obtained on a screen is a virtual image.
- Characteristics of the image formed by a plane mirror are:
  1. The image formed by a plane mirror is always behind the mirror, virtual, erect and of the same size as that of the object.
  2. The image formed by the plane mirror is at the same distance behind the mirror as the distance of the object in front of the mirror.
  3. The image formed by a plane mirror is laterally inverted, that is left side of the object appears to be the right side of the image.
- A Concave mirror is a spherical mirror, whose reflecting surface is bent in. A Convex mirror is a spherical mirror, whose reflecting surface is bulging outside.
- The light rays coming from a very distant object, after reflection meet at a point called Focus of the mirror.
- The distance between the focus and the mirror is focal length of the mirror.
- The process of splitting of white light in seven colours on passing through a prism is called Dispersion of light.

Exercise

1. Fill in the blanks :

1. An image formed by a ..... mirror is always of the same size as that of object.

2. In a plane mirror, the left hand of a person appears to be the ..... hand in the image and ..... hand appears to be the left hand in the image.
3. The image formed by a convex mirror is always ..... and ..... in size.
4. Convex lenses are ..... in the middle and concave lenses are ..... in the middle than at the edges.
5. A prism splits the white light into ..... Colours.

2. Write True or False for the following statements :

1. There is reflection of light through a lens.
2. The ray of light coming towards the plane mirror is called the reflected ray.
3. The image formed by a plane mirror is always in front of the mirror.
4. A concave mirror is a part of hollow sphere of glass, whose outer side is coated with silver layer and reflection takes place from the inside.
5. Concave lens always forms a virtual, erect and smaller image of the object.

3. Multiple Choice Questions :

1. Which of the following does not show reflection of light?

   (a) Plane mirror (b) Concave mirror

   (c) Convex mirror (d) Card board

2. Which is used for rear view in cars and other vehicles?

   (a) Concave mirror (b) Convex Mirror

   (c) Convex lens (d) Concave lens

3. The image of an object formed by a concave lens is always?

   (a) Real and diminished (b) Virtual and larger

   (c) Real and larger (d) Virtual and diminished.

4. The process of splitting of white light in seven colours on passing through a prism is called

   (a) Reflection of light (b) Refraction of light

   (c) Bending of light (d) Dispersion of light.

4. Match the Columns :

Column I	Column II
A) Mirror used by dentists	1. Spectacles
B) Rear view Mirror	2. Microscope
C) Magnifying glass	3. Vehicles
D) Concave Lens	4. Concave

5. Very Short Answer Questions :

(i) Is the image formed by a plane mirror real or virtual?

(ii) Which lens forms a real image of an object?

(iii) Which optical instrument uses convex lens?

(iv) What is the seven rainbow coloured disc called?

6. Short Answer Questions :

(i) Differentiate between Real and Virtual images. Give Examples.

(ii) A person is standing 5m away from a plane mirror. How far will his image be

(i) from the mirror (ii) from the person himself?

(iii) Give two uses of concave mirrors.

(iv) State two differences between convex lens and concave lens.

(v) Of how many colours is white light made of? Name them.

(vi) Ravi is observing his image in a plane mirror. The distance between the mirror and his image is 6m. If he moves 2m towards the mirror, then the distance between Ravi and his image will be :

7. Long Answer Questions :

(i) State and explain the characteristics of the image formed by a plane mirror.

(ii) What is meant by dispersion of light? Explain by using a Prism. Which natural phenomenon is associated with dispersion of light?

16 WATER: A PRECIOUS RESOURCE

H8Y5F7

DO YOU KNOW

Every year 22nd March is celebrated as world water day.

Nihar, a student of class III is brushing teeth with running tap. Her brother Shivam, a student of class VII instructed her not to brush teeth with running tap as it leads to the wastage of water while water is already in shortage. Nihar objects him by saying that they were living on the blue planet where 71% of earth is covered with water and you are saying there could be no scarcity of water. Do you agree with Nihar? Let us find who is right.

Activity 1 :

Make a list of activities by which water is being wasted by you or people around you on blackboard or in your notebook. Discuss these in your classroom.

Think and asnwer :

Q. Name three activities by which water is being wasted ?

Q. Should we check the wastage of water and why?

DO YOU KNOW

The amount of water recommended by the United Nations for drinking, washing, cooking and maintaining proper hygiene is a minimum of 50 litres per person per day.

16.1 Importance of Water

Water is one of the most important natural resources on the earth. All living beings need water to survive. Apart from drinking, human beings need water for various purposes like cooking, bathing, washing clothes, washing utensils, brushing teeth, keeping houses and other places clean, and watering the plants. Water is also used for generation of electricity,

DO YOU KNOW

About 70% of human body is composed of water. We can live without food for many days but cannot live for more than 4 days without water. We need at least 1 litre of water in a day to survive.

agricultural activities, manufacturing of many products in industries, recreational activities like swimming and as means of transport.

16.2 States of Water

Pure water is tasteless, odourless and colourless. Water on earth exists in three different states : solid, liquid and gas.

The solid states of water are ice, snow and hailstones. Snow and ice are present as ice caps at the poles of the earth and glaciers.

Liquid state of water is present in rivers, lakes, oceans and even underground. The water we drink is also in liquid state.

The gaseous state of water is the water vapours present in the air around us.

Water Cycle

The existence of water on the earth has been maintained for millions of years by various processes which form the water cycle.

Study the water cycle in nature and try to answer the following questions:

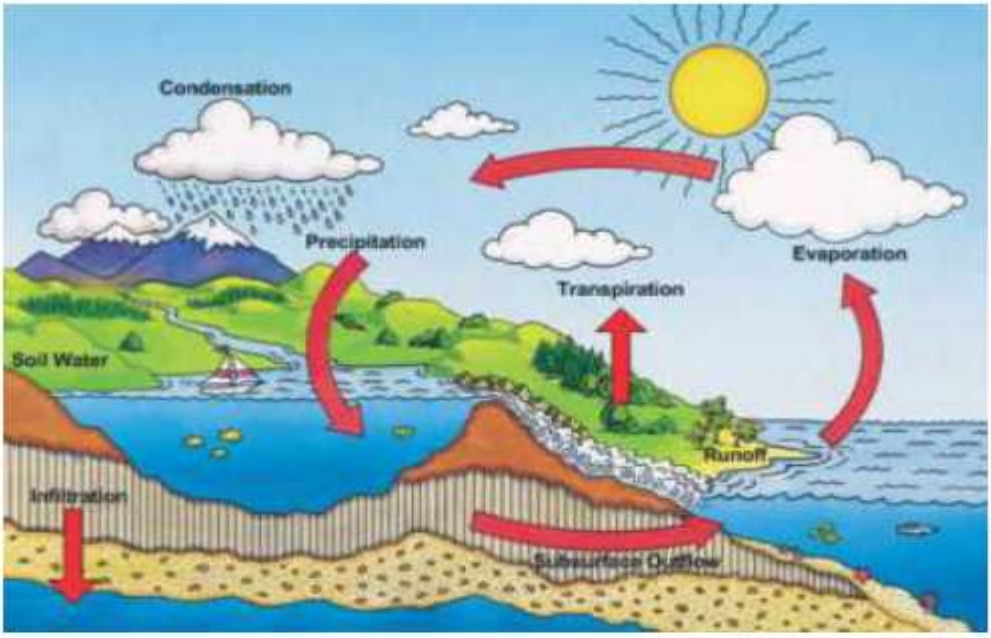


Fig 16.1 Water cycle in nature

Think and Answer

1. _____ is the process by which water is converted from its liquid state to a gaseous state.
2. _____ is the process by which water is converted from its gaseous state to a liquid state.

The continuous cycling of water among its three states keeps the total amount of water on the earth constant even when the whole world is using it.

16.3 How much water is Available?

Like Nihar, most of us assume water to be an unlimited resource. Let us perform an activity to understand the distribution of water on the earth.

Activity 2 :

Take 2200ml. of water in a suitable container and label it as **A**. Assume that this water represents all the water present on the earth. Take 12 spoons of water from it in another breaker and label it as **B**. This water in beaker **B** represents the total freshwater on the earth while the remaining water in container **A** represents the water present in oceans and sea. From breaker **B** transfer 2 spoons of water in one beaker and label it as **C** which represents the total underground water on the earth and half spoon of water in another beaker and label it as D which represents surface water present in lakes and rivers. The water left in beaker B will represent the water which is present in the frozen form as glaciers and icecaps.

Think and asnwer :

Q. Which beaker represents the underground water?

Q. Which beaker represents the surface water?

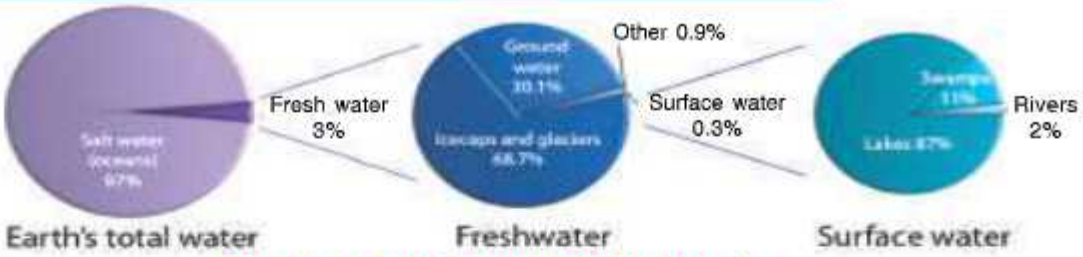


Fig 16.2 Earth's water distribution

About 97% of total water present on the earth is saline water contained in the oceans and seas which have large amounts of dissolved salts (mainly sodium chloride) and is not fit for human consumption. On average, one litre of sea water contains 35 grams of dissolved salts. Drinking sea water can cause excessive dehydration, kidney failure, unconsciousness and death in extreme cases.

The water that is fit for use is **freshwater**. It has generally small amounts of dissolved salts. It is about 3% of total water present on the earth and is present in glaciers, icecaps, rivers, lakes and underground.

Nearly 68.7% of all freshwater on the earth is in frozen form in icecaps and glaciers and hence cannot be used directly for human consumption. However, they melt to form rivers and lakes. Global warming is resulting in the shrinkage

of these sources of freshwater rapidly. Try to gather more information about melting of glaciers and icecaps worldwide.

About 0.3% of all freshwater on the earth is found in rivers, lakes and swamps. This water is fit for human consumption but pollution due to human activities is contaminating these water bodies.

Discuss about the conditions of nearby rivers, lakes and ponds.

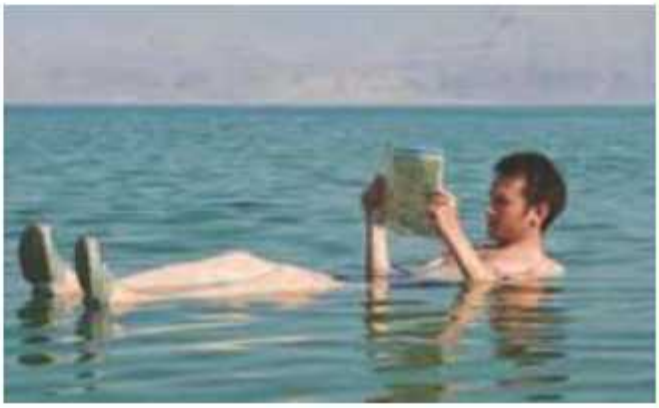
DO YOU KNOW

Glaciers in the Garhwal (Himalaya) in India are shrinking so fast that researchers believe that most central and eastern Himalayan glaciers could virtually disappear by 2035.

The Arctic sea ice has thinned significantly over the past half century and is expected to become ice free in summer before 2050.

DO YOU KNOW

Not all lakes contain freshwater. The Dead **sea** is a very salty lake bordered by Jordan to the east and Israel and Palestine to the west. It is roughly 8.6 times saltier than ocean. The high salinity prevents aquatic plants and animals to live in it. Hence, the name Dead sea. People can easily float in the Dead **sea** due to natural buoyancy. It is also the earth's lowest point.



About 30.1% of total freshwater on the earth is groundwater.

Excessive use of pesticides and fertilizers is polluting groundwater. Less than 1% of the world's fresh water or about 0.003% of all water on the earth is readily available for direct human use.

16.4 Groundwater as an Important Source of Water

If we dig deeper and deeper in the moist soil near a water body, we would reach a level where all the spaces between particles of soil and gaps between rocks are filled with water. This is called **groundwater zone or saturation zone.**

The water found in this saturation zone is called **groundwater**. It is the pure water as it gets filtered through many layers of sand, rock and soil. The upper level of groundwater is called **water table**. The portion of the soil above

the water table is unsaturated zone where both air and water are found in the spaces between soil and rock particles. At many places, groundwater is present between the layers of hard rocks below the water table and is known as an **aquifer**. These are typically made up of gravel, sand, sandstone or fractured rock. Aquifers are huge sources of water from where water is usually pumped out with the help of tube wells or handpumps.

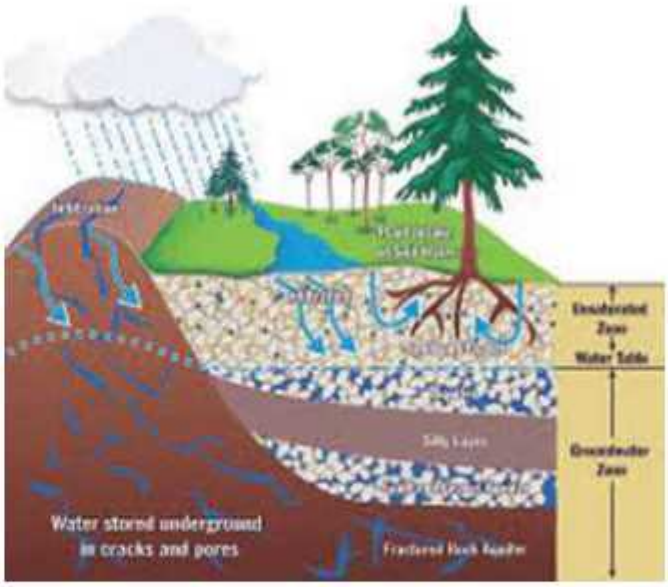


Fig 16.3 Groundwater

The rainwater and water from other sources such as rivers and ponds seeps into the soil due to gravity until the empty spaces and cracks deep below the ground are filled with water. The process of seeping of water into the soil is called **infiltration**. The groundwater gets recharged by this process. Collect information regarding water table in your locality from people who dig borewells, tube wells or for water pumps.

16.5 Depletion of Water Table

The water table varies from place to place. It may be at a depth of less than a metre or may be several metres below the ground. Water table at a place does not change as long as we draw only the amount of water that is recharged by natural processes. However, water table may go down if it is not sufficiently recharged. The major reasons for depletion of water table are:

DO YOU KNOW

It is estimated that by 2030, nearly half of the world's population will be facing acute water shortage. We are quickly moving toward **Global Water Crisis.**

Growing population: Human population is growing at a fast pace. As the number of humans increase, the consumption of water by them increases for their daily activities. Often groundwater is used for construction of houses, shops, offices, roads and pavements. The construction work also decreases the open areas for the seepage of rainwater into the ground. So, we are not only consuming more and more groundwater but also not allowing much water to seep into the ground, ultimately resulting in depletion of water table.

Increasing Industries: To meet the demand of growing population, more and more industries are setting up. These industries mainly use groundwater leading to lowering of water table.

Deforestation: Cutting of trees to fulfill the need of rising population is disturbing the water cycle, which is ultimately reducing the amount of water seeping to the ground and finally leading to depletion of water table.

Agricultural activities: India is country where majority of farmers depend upon rain for growing their crops as only few places have Irrigation system like canals. But rainfall is not certain so farmers use groundwater for irrigation by tubewells which leads to the lowering of water table.

Case Study: Depletion of water table in Punjab

The level of groundwater in Punjab is decreasing very quickly and it is considered critical in many blocks. The major reason of depletion of water table is the cultivation of paddy crop which requires huge amount of water and is grown in peak summer season when the temperature in Punjab is very high and hence the rate of evaportion of water is also high. Moreover, Paddy needs a minimum average annual rainfall of 1150mm. In sharp contrast, the average annual rainfall in Punjab is 650mm-700mm. This, too has declined in the last two decades to 400mm-500mm, putting an additional burden on groundwater, as farmers have to sunk deeper tube wells to irrigate their paddy fields. The number of tube wells have increased from 200,000 in the 1970's to the present 4,00,000. Punjab Government. had passed **'The Punjab preservation of subsoil water act, 2009 '** under which for the first time the date of transplantation of paddy was fixed as june 10. Later on it was pushed to June 15 in 2015.

Fig 16.4 Paddy Cultivation

Experts suggest to reduce the area under paddy cultivation by growing less water demanding crops such as maize, pulses and soyabean.

Rainfall: India is a big country where the availability of water depends mainly upon the rainfall. Some places have good amount of rain and have good water table while some places have very low water table because of scanty rainfall. Rain water is considered to be the purest form of water.

16.6 Water Management

Water management means dealing with water in the best possible ways. This can be done at larger scale by local civic authorities or can be done at a smaller scale by individuals at home. A few ways by which water management can be done are as follows:

- Civic authorities can prevent the wastage of water by checking the leakage of water in supply pipes.
- The rainwater harvesting can be used to recharge the groundwater.
- A farmer can use water economically in the field by **drip irrigation**. It is a technique of watering plants by making use of narrow tubes which deliver water directly at the base of plants drop by drop instead of watering the entire field.

Fig 16.5 Drip irrigation

DO YOU KNOW

An age old practice of storing water at many places in India was **Bawris**. Some are still used at some places. However, Garbage can be seen in many of these water reservoirs because of disuse. These are being revived at certain places.

16.7 Role you can Play in Saving water

You can help in saving water by developing following good habits:

- Make efforts to stop the leakage of water from taps and water pipes.
- Turn off taps while brushing or shaving.

- Mop the floor instead of washing , reuse the waste water to water the plants.
- Water your garden early in the morning and late afternoon.
- Take shorter shower.
- Wash vegetables and fruits in big containers and use this water for cleaning or watering the plants.
- Conserve and use rainwater.
- New Plants should be grown during the rainy season.
- Wash your vehicle wisely with minimum water.
- Make people aware of shortage of water and the ways to save it.
- Support people who are active in conserving water.
- Do not pollute water bodies.

DO YOU KNOW

Every year 22nd March is celebrated as world water day.

16.8 Effects of Water Scarcity on Plants

Have you observed plants wilting and finally drying up if they do not get water for some days? Why does it happen ? Water is important for plant growth. When plants do not get water for some days, they start wilting.

Imagine what could be the consequences if water is not available to plants in environment? All the plants on the earth may die. It may result in no food, no oxygen, no rain, and eventually end of all forms of life on the earth.

Imagine what will happen if there is no water for drinking ? Horrible to think.

Nihar understands the importance of conserving water. Have you understood? Start acting wisely before it is too late.

KEYWORDS

- Aquifer
- Freshwaer
- Drip irrigation
- Infiltration
- Groundwater
- Water table
- Saline water

Points to Remember

- All living beings need water to survive.
- Water exists in three states solid, liquid and gas.
- Less than 1% of the world's fresh water or about 0.003% of all water on the earth is available for direct human use.
- Groundwater is the water present below the earth's surface in the cracks and spaces in soil, sand and rock.
- Quick increase in population is leading to quick decrease in groundwater.
- The availability of water at a place mainly depends upon the availability of rainfall that place.
- We can play an important role in saving water by developing some good water saving habits.
- Plants wilt and dry-up if they are not given water for some days.

Exercise

1. Fill in the blanks:-

(i) The water we drink is in ..... state.

(ii) The process of seeping of water into the soil is called ..... .

(iii) The upper level of groundwater is called ..... .

(iv) ..... means dealing with water in the best possible ways.

(v) A farmer can use water economically in the field, by ..... .

2. Write True or False:-

(i) Water cycle helps in maintaining water on the earth.

(ii) About 97% of total water present on the earth is freshwater.

(iii) Repair leaking taps and pipes at the earliest.

(iv) We are quickly moving towards global water crisis.

(v) Turn on taps while brushing.

3. Match the column A with column B :-

A	B
1. Ice	(a) Oceans and sea
2. Saline water	(b) Rivers and ponds
3. Fresh water	(c) Gaseous state of water
4. Water vapour	(d) Purest form of water
5. Rain water	(e) Solid state of water

4. Choose the correct answer :

(i) Which of the following is responsible for depletion of groundwater?

(a) Increasing population ☐ (b) Increasing industries ☐

(c) Deforestation ☐ (d) All of these ☐

(ii) The Punjab preservation of subsoil water act was passed in the year

(a) 2009 ☐ (b) 2010 ☐

(c) 2008 ☐ (d) 2015 ☐

(iii) The world water day is celebrated every year on

(a) 22 April ☐ (b) 24 March ☐

(c) 22 March ☐ (d) 22 May ☐

(iv) Ocean and seas cover about ..... of the earth surface.

(a) 75% ☐ (b) 71% ☐

(c) 81% ☐ (d) 29% ☐

(v) We should not keep taps running while

(a) Brushing ☐ (b) Shaving ☐

(c) Bathing ☐ (d) All of these ☐

5. Very Short Answer type Questions:-

(i) What do you mean by groundwater?

(ii) Why is sea and ocean water not fit for drinking?

(iii) Define aquifers?

(iv) Name the three states of water?

(v) How is groundwater recharged?

6. Short Answer Type Questions:-

(i) Enlist some activities by which water is being wasted by people.

(ii) How will you minimize the use of water to maintain a garden?

(iii) How is water important to us?

(iv) How increase in human population is leading to depletion of water table?

(v) Why do plants wilt and finally dry up if they do not get water for some days?

7. Long Answer Type Questions:-

(i) What steps will you take to save water?

17 FORESTS: OUR LIFELINE

Y1L3Q8

DO YOU KNOW

International day of forests is celebrated on 21st March.

Forest : *A forest, is an area with a high density of naturally growing trees, shrubs and herbs alongwith other organisms.*

Let us first understand the word 'forest'. The word forest is derived from a Latin word 'foris' which means 'out of doors', that is, it is a land which lies beyond the areas enclosed for agriculture or parkland and is not fenced. Such an area is generally composed of trees and other forms of life. Look at fig. 17.1. it gives you a view of forest. You find trees all over the area. If you visit a forest area, do you find something in addition to the trees? You may find animals like butterflies, birds and monkeys. If you enter the deeper areas of the forest you may find animals like elephant, deer, jackals and lion. The area of forest cover in India is about 21% of the total area.

Figure 17.1 Picture of a forest

17.1 The Profile of a Forest

About one third of world's land surface is covered with forests. Forests are different from one another depending upon where they are located. Climate, topography (physical features) and soil type are some of the main factors that determine the type of trees and animals that grow and thrive in a forest.

Figure 17.2 Layers of a Forest

In a forest, trees form the uppermost layer, followed by shrubs, the herbs form the lowest layer of vegetation. According to height of plants and trees, forests can be divided into three layers (Fig. 17.2) canopy, crown and understory. The uppermost layer of branches which serve as a dense roof of trees over the ground in a forest is called **canopy**. The layer where trees branch off from the tree trunk is called **crown**. The shaded layer of the forest where low light is available, is called **understory**. India has a diverse range of forests and their uses are equally diverse.

17.2 Forest as an Ecosystem

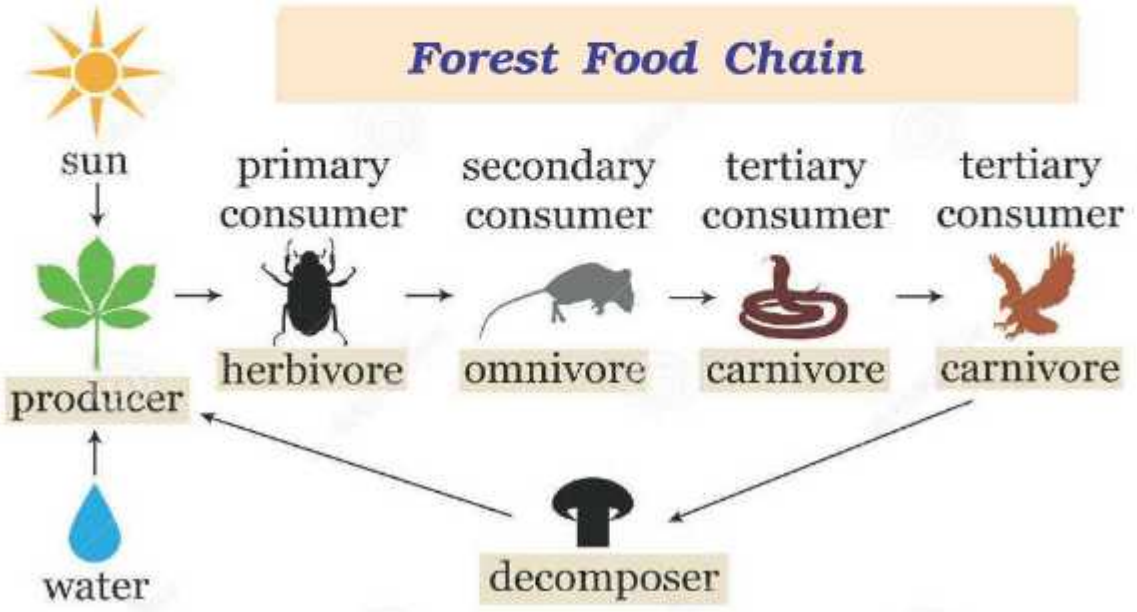
Living beings and their environment together form an **ecosystem**. Plants, animals and microbes are the living components of an ecosystem. They are classified into three categories; Producers, Consumers and Decomposers. (You have already studied in your previous class.)

Food chain and food web in an ecosystem

- **Food Chain** : The producers, consumers and decomposers are connected in the ecosystem where one organism eats another which in turn is eaten by the third one. This sequence in which a producer is eaten by a herbivore and the herbivore is preyed upon by a carnivore is called **food chain**. For example, a Deer eats grass and is eaten by lion, tiger or leopard. Here grass is producer, deer primary consumer (herbivore) and lion or tiger secondary consumers (carnivore). This is an example of simple food chain. In bigger food chains, a carnivore (secondary consumer) is further eaten by another bigger carnivore (tertiary consumer). For example, a grasshopper feeds upon plants which is eaten by a frog (secondary consumer) and the frog is preyed

upon by a hawk (tertiary consumer).

- **Food Web :** A food web is a complex feeding system. In a food web, several food chains are interlinked. In a forest, many interlinked food chains exist. In case one food chain is disturbed, the other food chain is there to support the animals of next feeding level.



17.3 Uses of Forests :

Forests play an important role in our life. Early humans gathered food and were dependent on forests for all their basic needs such as food, clothing and shelter. We too depend on forests for several things directly or indirectly.

- Forests prevent soil erosion and floods. Roots of trees bind the soil particles together and prevent the soil from being washed or blown away.
- We get several nuts and spices from plants growing in forests.
- Trees help to regulate the climate of a place. They absorb water from the ground through their roots and then release it into air as water vapour. In this way, they manage to keep the surrounding air cool.
- By raising the water vapour content in the atmosphere, trees are responsible for bringing the rains too.
- Trees also help in keeping a check on global warming by using carbondioxide (CO_2), the main greenhouse gas for photosynthesis. They utilize carbondioxide during photosyntheis and release oxygen that is used for breathing, burning and other activities.

- We get timber from more than a thousand species of trees such as sal, mahogany, teak and rosewood. Several timber based industries such as plywood, sawmills, paper, pulp and cardboards are all dependent on these trees. We get firewood from trees.

- Plants such as neem, eucalyptus and amla (Indian gooseberry) are used to make several Ayurvedic medicines. Cinchona trees provide quinine, which is an important medicine for treating malaria.
- Many varieties of grasses such as lemon grass, vanilla, kewra and khus are the sources of several kinds of essential oils. Sandalwood, eucalyptus and pine also give us oil, which can be extracted from these trees.
- Forests are a source of resins (used to make varnish and paint), latex (used to make rubber), bamboo (useful as fodder and serves as an important raw material for the manufacture of paper and pulp, basket and other such products) and cane (used to make walking sticks, furniture, baskets, picture frames, mats and screens).
- Some trees, such as coconuts and palms, help to break strong winds in coastal areas. They act as shields or windbreakers against incoming storms or strong tidal waves.

Interdependence of plants and animals

Plants cannot survive without animals and animals cannot survive without plants. They are interdependent on each other through food chain, carbon dioxide cycle and oxygen cycle.

A. Dependence of Plants on Animals.

Plants depend on animals for:

- **Carbon dioxide,** which is released by animals during respiration and is used by plants for photosynthesis.
- **Pollination of flowers**, for seed formation.
- **Dispersal of seeds and fruits**, to new places to avoid overcrowding of seedlings at one place.
- **Nutrients,** animals help in the recycling of nurtrients which are used by plants.

B. Dependence of Animals on Plants

Animals depend on plants for:

- **Food,** which is a source of energy, is obtained by eating leaves, fruits, seeds, nuts or other plant products.
- **Oxygen gas,** which is needed for respiration, is released by plants during photosynthesis.
- **Shade and protection,** is provided by large trees. Animals hide under the trees to protect themselves from bright sun or rains.
- **Shelter,** birds live and make their nests on trees. The nests provide shelter and protection to their eggs and young ones.
- Wild animals hide themselves in dense bushes and tall grasses.

C. Dependence of Human Beings on Plants

Human beings get following things from plants:

- Food, natural fibres like cotton and jute from plants.
- A variety of wood products like firewood, timber, plywood, wood for paper and pulp etc.
- Different medicines and spices like neem, cinnamon, amla, cardamom and cinchona.
- Non wood products from plants, like lac, dyes, cane, bamboo, grasses, fodder, bidi leaves, gum, resin, rubber, etc.
- Oils such as Pine oil, khus and sandalwood oil.

17.4 Threats to forests

With the increase in human population, there have been ever rising demand for converting forests into residential and agricultural areas. As a result, lots of trees are being cut and forests are being cleared, thus destroying the habitat of several species of animals and plants. Deforestation, forest fires and pollution

are the major threats to the forests. The forest cover of India and even of the world is reducing at a fast pace due to various human activities.

(a) Deforestation

The large scale felling of trees is known as **deforestation**. It is the permanent destruction of forests and woodlands. The forests are being destroyed to clear more land for agriculture, industries, housing, roads, railway tracks and places of recreation. About 15-20 hectares of tropical forests are destroyed every year. Trees are also cut for timber and firewood.

Causes of Deforestation

The main causes of deforestation are:

- Increased demand of fuel-wood, wood for paper and timber.
- Increased demand of land for industries, houses, roads, railway tracks and other transport facilities.
- More land for agriculture to provide food for increasing human population.
- Overgrazing by cattle and sheep.
- Increased mining activity.
- Lowering of water table causes plants and trees to wilt and die.

Consequences of Deforestation

Large–scale deforestation is a major threat to our environment because it leads to;

- Increase in overall temperature of the earth leading to **global warming**.
- Lesser rain causes desertification i.e. spread of deserts.
- Increased soil erosion, i.e. loss of humus from soil.
- Unbalanced ecosystem leads to depleted groundwater, and disturbed oxygen (O_2) and carbondioxide (CO_2) ratio in the atmosphere.
- Loss of biodiversity due to extinction of various forest plants and wild animals.
- Loss of forest produce.
- Danger to wildlife.

DO YOU KNOW

July 1 to July 7 is celebrated as 'Van Mahotsav Week' to create awareness about importance of trees and effects of deforestation.

(b) Pollution

Pollution of water by various sources like sewage, industrial wastes etc. changes the quality of water which damages the roots of trees. Higher level of suspended particulate matter in the atmosphere affects the functioning of leaves by closing their stomata.

Forest fire is also responsible for the destruction of forests on a large scale.

17.5 Forest Conservation

Forests have been extensively exploited by human beings during the last few decades. The trees are cut down at much faster pace than their natural replacement. The increase in world's human population has posed serious threat to the forests.

These are being converted into residential, agricultural and industrial locations. Mass scale **deforestation** has led to the destruction of habitats of several plant and animal species. There is, therefore an urgent need for the forests to be managed, conserved and replenished.

Following measures can be prescribed for forest conservation :

(i) Use of wood as fuel should be discouraged. Other alternatives of fuel like biogas could be used for cooking.

(ii) Cutting of trees for timber or other uses should be matched with planting of more trees so that there is no scarcity, in future.

(iii) A forest should have correct population of trees of different ages so that exploitable produce is available at regular intervals.

(iv) Forest fires should be controlled by fire breakers.

(v) Overgrazing and illegal cutting should be controlled.

(vi) The annual deforestation must be followed by annual reforestation of deforested areas. Steps should be taken to plant trees on large scale. This process is called **afforestation** and its rate should be increased three times the existing rate.

KEYWORDS

Afforestation	Deforestation	Food chain
Food web	Canopy	Understory
Bio diversity	Ecosystem	Topography

Points to Remember

- A forest is an ecosystem which is composed of plants, animals and microorganisms.
- Forests protect the soil from soil erosion.
- Soil helps forests to grow and regenerate.
- Humus ensures that the nutrients of the dead plants and animals are released into the soil.
- In a forest, trees form the uppermost layer, followed by shrubs, the herbs form the lowest layer of vegetation.
- Different layers of vegetation provide food and shelter for animals, birds and insects.
- All animals whether herbivores or carnivores depend ultimately on plants for food which comes from the forest.
- The forests keep on growing, changing and can regenerate naturally.
- Forests influence climate, water cycle and air quality.
- In the forest there is interaction between soil, water, air and living organisms.
- Deforestation causes global warming, less rain, increased pollution and soil erosion.
- Afforestation, planned cultivation, prevention of illegal cutting and prevention of overgrazing and forest fires are a few ways to conserve our forests.
- Conservation of forests is essential to maintain balance in nature, to maintain habitats of wild animals and plant species.

Exercise

1. Fill in the blanks :

(i) Animals help plants in the ..... of seeds.

(ii) ..... gas is released by plants during photosynthesis.

(iii) ..... and ..... are the major threats to forests.

(iv) Large scale planting of tree saplings is called ..... .

2. State True and false :

(i) Animals provide nutrients to plants.

(ii) The forest cover in India is only 15% of its total land area.

(iii) Crown is the shape of the trees.

(iv) Deforestation is cutting of trees to clear area for building houses and farming.

(v) Deforestation takes place due to overgrazing.

3. Match Column A with Column B :

A	B
1. Plants	(a) Forest
2. A renewable natural source	(b) Practice of planting trees on a largescale
3. Afforestation	(c) Deforestation
4. Removal of plants	(d) Producers

4. Choose the correct answer :

(i) Which of the following is not a forest product?

(a) Plywood (b) Sealing wax

(c) Kerosene (d) Gum

(ii) A food chain includes

(a) Producers and herbivores

(b) Producers and carnivores

(b) Producers and decomposers

(d) Producers, herbivores and carnivores

(iii) Bacteria and fungi act as

(a) Decomposers (b) Herbivores

(c) Omnivores (d) Carnivores

(iv) Microorganisms act upon the dead organisms to produce

(a) Humus (b) Wood

(c) Sand (d) all of these

5. Very short answer type questions :

(i) How much land area on the earth is covered with forest?

(ii) What is an ecosystem?

(iii) What is afforestation?

(iv) What causes global warming?

6. Short answer type question :

(i) In terms of food chain, discuss the interdependence of plants and animals.

(ii) How do forests help in conservation of soil?

(iii) Give two examples which show that plants depend on animals.

(iv) Explain how forests prevent floods.

(v) List five products we get from forests?

7. Long answer type questions :

(i) What is deforestation? Explain various causes responsible for deforestation.

(ii) Enlist various uses of forests?

(iii) Describe how animals depend on plants.

(iv) What measures can be taken for the conservation of forests?

18 WASTE WATER STORY

F1Q1R4

DO YOU KNOW

In 2013, the United Nation General Assembly officially designated November 19 as World Toilet Day to inspire action to tackle global sanitation crisis.

Nihar on realizing the importance of saving water has started taking several measures to check the wastage of water. She has started pouring the left over water in the glasses served to guests, to the plants grown in her home or in the bowl of her pet dog. This wastewater is clean and can be used for other purposes easily but she wonders, what happens to dirty, black, brown water rich in lather, oil, grease etc. that goes down the drains from industries sinks, showers, toilets and laundries. The sight and smell of open drain is disgusting.

Fig 18.1 Drain

Most unhygienic and unsanitary conditions occur in the rainy season when the drain starts overflowing. Flies, mosquitoes and other insects breed in it resulting in the spread of many diseases like malaria and dengue.

What is sewage? Where it goes and what happens to it? We will study about it in this chapter.

18.1 What is Sewage ?

Sewage is wastewater that contains dissolved and suspended solid impurities. It is produced by homes, offices, industries, fields and hospitals etc. It also includes rainwater that has run down the street during rain or storm. The dissolved and suspended solid impurities in wastewater are known as **contaminants**. A list of contaminants present in sewage are :

Contaminants	Examples
Organic impurities	Human wastes, animal wastes, fruit and vegetable wastes, oils, pesticides and herbicides.
Inorganic impurities	Metals, nitrates and phosphates
Nutrients	Nitrogen and phosphorus
Bacteria	*Vibrio cholera* causing cholera, *Salmonella typhi* causing typhoid.
Other microbes causing water borne diseases	Amoeba causing dysentery

Activity 1 :

Do a contaminant survey at an open drain in your locality or at any place to check the contamination of water by inspecting water flowing through it. Record its colour, odour, contaminants present and any other observations. Fill in the following table and discuss in your classroom.

Location of drain	
Colour of drain	
Odour of drain	
Contaminants in drain	
Any other observation of drain	

Think and answer :

Q. What is the difference in colour of contaminated and clean water?
Q. Name any two organic contaminants present in drain water.

18.2 Water Freshens up-an Eventful Journey

In a home, school, office or in any public building generally one set of pipes bring clean water and another set of pipes take away wastewater. A network of big and small underground pipes for taking wastewater away from home to the point of disposal is called **sewer**. These sewers together form **sewerage**. It is like a transport system that carries sewage from the place of origin to the place of disposal. Domestic sewage flows through cast iron or polyvinyl chloride (PVC) pipes to the main sewer and finally to the wastewater treatment plant. Manholes are provided at every 50m to 60m in the sewerage

Fig 18.2 Manhole

at the junction of two or more sewers or at points where there is a change in direction. These manholes are covered openings through which a person can enter the sewer to check any problem in sewage route.

Activity 2 :

Observe carefully the sewage route in your home or school or any building and do the following :

- Draw a line diagram of the sewage route.
- Find the number of manholes in the street or within the building.
- Follow an open drain to find out which organisms are living in and around it.
- Also find out where an open drain ends.

If sewerage system is not available in your locality then find out how sewage is being disposed off in your area.

Think and answer :

1 Why are manholes built in sewage route?

2 Name any two organisms living in and around an open drain.

18.3 Waste Water Treatment Plant (WWTP)

Nature has an amazing ability to clear the small amounts of pollutants. But it become impossible for nature to get rid of pollutants if billions of gallons of waste water is thrown daily into the environment. Treatment plants reduce pollutants in waste water to a level nature can handle. If waste water is not

properly treated, then the environment and human health can be negatively affected. It may cause harm to aquatic life and wildlife.

Sewage is taken to a waste water treatment plant through closed drains for removing contaminants and is then discharged after treatment into seas or rivers. Waste water treatment plant is the place where contaminants are removed from waste water. The process of removing contaminants from wastewater is called waste water treatment or cleaning of water. It involves physical, chemical and biological processes which remove contaminants from the waste water. The process of waste water treatment is commonly called sewage treatment. It takes place in several stages.

- First of all, waste water is passed through bar screens to remove large objects like cans, rags, napkins, plastics, etc. from it.

Fig 18.3: Bar screen

- Waste water is then passed through grit and sand removal tank where the speed of incoming wastewater is reduced in order to allow sand, grit and pebbles to settle down.

Fig 18.4: Grit and sand removal tank

- Wastewater is then allowed to settle in a large tank called water clarifier. This tank is sloped towards the middle to allow solid materials like faeces to settle at its bottom. The solid materials settle at the bottom of water clarifier are known as **sludge**. The sludge is removed with scrapers. A skimmer is used to remove the floatable solids like oil and grease. Clear water so obtained is called clarified water.

Fig 18.5: Water clarifier

- The sludge is transferred to a separate tank where it is decomposed by anaerobic bacteria to produce biogas. The **biogas** is used as fuel or to produce electricity.
- Air is pumped into the clarified water to promote the growth of aerobic bacteria which consume the remaining wastes. After several hours, the suspended microbes settle at the bottom of the tank as activated sludge. The activated sludge is about 97% water. The water is removed from the top by sand drying beds or machines. Dried sludge is used as manure.

Fig 18.6 Aeration of clarified water

The treated water now has a very low percentage of organic and suspended materials. It is discharged into water bodies like sea/river or into the ground. Nature cleans it up further. Sometimes it is disinfected with chemicals like chlorine and ozone before releasing into the water bodies.

Activity 3 :

The following activity will help you to understand the various processes that take place at the wastewater treatment plant.

- Fill three-fourth of a large glass jar with water. Add some waste materials like some pieces of fruit and vegetable peels, small amount of detergent and a few drops of any colour. Cover the jar and shake it well. Leave the jar undisturbed in the sun for two days. After two days, shake the mixture again and take a small sample into a test tube. Label this test tube as Sample 1-Before treatment. How does it smell?
- Pass air through the mixture in the glass jar with an aerator from an aquarium for several hours. A mechanical stirrer or a mixer can be used for aeration. But you have to stir the mixture several times. When the aeration is complete, take another sample into a second test tube. Label this test tube as Sample 2-After aeration.
- Insert the cone made of filter paper in a funnel. Mount the funnel on a beaker. Place layers of sand, fine gravel and finally medium gravel in the funnel. Pour the remaining aerated liquid through the filter into the beaker. Filter it a few times till you get clear water. Take a sample of the filtered water into a third test tube. Label this test tube as Sample 3-Filtered.
- Take another sample of the filtered water into a fourth test tube. Add a small piece of a chlorine tablet to it and mix well until the water is clear. Label this test tube Sample 4-Chlorinated.
- Carefully observe the samples in all the test tubes and answer the following questions:

Think and answer :

Q What change do you notice in the appearance of liquid after aeration?

Q What was removed by the sand filter?

18.4 Better House Keeping Practices

We must be an active citizen and adopt good sanitation practices at home to keep sewerage system working efficiently.

- Throw cooking oil and fats in the dustbin rather than in drainage because they can harden and block the pipes. Moreover, they can block the soil pores in an open drain reducing its effectiveness in filtering water.

- Do not throw chemicals like paints, medicines, machine oils, grease, insecticides, etc. into the drain as it may kill microorganisms that help to purify water.
- Do not throw wastes like solid food remains, tea leaves, cotton, plastic bags, sanitary towels, soft toys, etc. into the drain as they can block the drain. Moreover, they do not allow free flow of oxygen and also slow down the degradation process.
- Do not waste water. Every time you flush your toilet or leave the water running unnecessarily, it increases the load on your sewer system and also put the burden on sewage treatment plant.
- Avoid using the toilet as a wastebasket.
- Install a water efficient toilet.
- Use only phosphate free soaps and detergents.
- Use washing machine only when you have a full load of clothes.

18.5 Sanitation and Disease

A large number of people in our country are without sewerage facilities. They defecate in open, on railway tracks, on dry riverbeds, near fields and even

Fig 18.7

directly in water. Unavailability of proper toilets, broken or blocked latrines are some of the reasons for open defecation. Open defecation is a health hazard. It results in the spread of a number of diseases including cholera, typhoid, hepatitis-A, polio, meningitis and diarrhoea. Every year, 100,000 children die in India from diseases caused by fecal contamination. Places where open defecation is prevalent, large amounts of faecal pathogens via human and animal faeces are ingested by children. This creates a massive reservoir of bacteria, parasites and viruses within the body that results in diseases. It leads to growth stunting, malnutrition and even death of children.

DO YOU KNOW

In 2013, the United Nation General Assembly officially designated November 19 as World Toilet Day to inspire action to tackle global sanitation crisis.

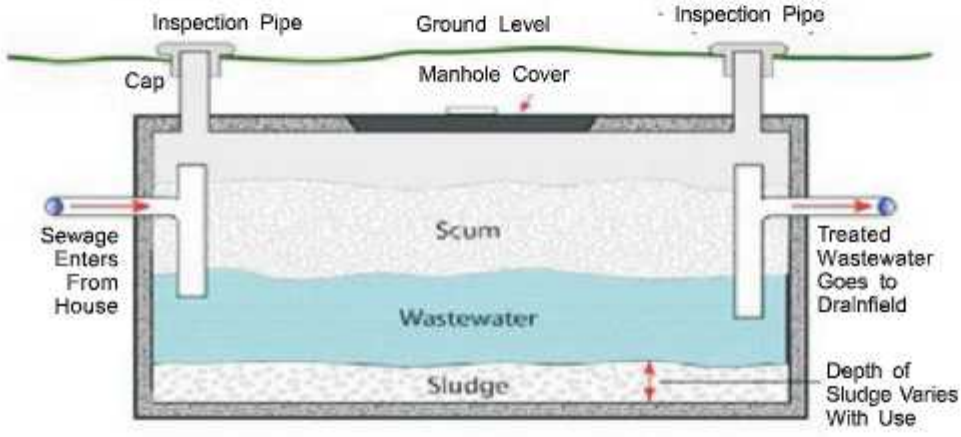


Fig 18.8 : Schematic Representation of a Septic Tank

18.6 Alteranative Arrangement for Sewage Disposal

Low cost onsite sewage disposal system such as septic tanks, chemical tanks, and compost pits can be used at places where there is no sewage system.

A septic tank is small sewage treatment system having anaerobic bacterial environment to decompose the waste matter. It has no connection to main sewage pipes.

On site human waste disposal technology can be used. In which excreta from the toilet seats is sent directly to the biogas plant through covered drain. The biogas so produced is used as a source of energy.

DO YOU KNOW

Vermi processing toilet has been tested in India and found to be a novel, low water use toilet in which human excreta is treated by earthworms.

18.7 Sanitation at Public Places

A large amount of waste is generated at public places like bus depots, railway stations, airports, markets, parks and hospitals etc. It must be disposed off properly to prevent the occurrence of any disease. Approach the municipality or the gram panchayat to insist that the open drains to be covered and proper sewerage system to be built. Do not throw litter anywhere. If there is no dustbin in sight, carry the litter with you and throw it in the dustbin only. We must follow strictly the laws related to sanitation.

DO YOU KNOW

It is suggested to grow eucalyptus trees all along sewage ponds. They absorb all surplus wastewater rapidly and release pure water vapour into the air.

Nihar has decided not only to adopt good sanitation practices but also to motivate others to do so. **Will you join her**? A lot can be done if we work together. Remember **"Cleanliness is next to Godliness"**.

KEYWORDS

Aeration	Sanitation	Sewerage
Contaminants	Sewage	Sludge
Biogas	Sewer	Wastewater

Points to Remember

- Sewage is wastewater that contains dissolved and suspended solid impurities.
- Contaminants are the dissolved and the suspended solid impurities present in sewage.
- A network of big and small underground pipes for taking wastewater away from home to the point of disposal is called sewer. These sewers together form sewerage.
- Manholes are covered openings through which a person can enter the sewer to check any problem.
- Sewage is taken to a wastewater treatment plant through closed drains for removing contaminants and is then discharged after treatment into seas or rivers.

- Wastewater treatment involves physical, chemical and biological processes to remove contaminants from wastewater.
- By products of wastewater treatment are sludge and biogas.
- Sludge is the solid material that settles at the bottom of water clarifier.
- Open drain is the breeding place for flies, mosquitoes and other insects causing many diseases.
- Do not pour fats, oils or grease down the drain.
- Do not defecate in the open.
- Throw litter in the dustbin only.

Exercise

1. Fill in the blanks :

(i) ..... are dissolved and suspended solid impurities present in sewage.

(ii) The activated sludge is about ..... water.

(iii) ..... is the solid material settled at the bottom of water clarifier.

(iv) ..... is the place where contaminants are removed from wastewater.

(v) Adopt ..... sanitation practices.

2. Write True or False:

(i) The sight and smell of open drain is attractive.

(ii) Throw plastic bags in the drain.

(iii) Open drain is the breeding place for flies and mosquitoes.

(iv) Do not defecate in the open.

(v) Solid food remains can block the drain.

3. Match column A with column B :

A	B
(i) Organic impurities	a) Sewage treatment
(ii) Inorganic impurities	b) Typhoid
(iii) Wastewater treatment	c) Manure
(iv) Water borne disease	d) Nitrates and phosphates
(v) Dried sludge	e) Human wastes

4. Choose the correct answer:

(i) Wastewater treatment plant involve

a) Bar screen b) Water clarifier

c) Grit and sand removal tank d) All of these

(ii) Name the by- product of wastewater treatment plant

a) Biogas b) Sludge

c) Both a and b d) None of these

(iii) Which of the following chemicals is used to disinfect water

a) Chlorine b) Ozone

c) both a and b d) None of these

(iv) World Toilet Day is celebrated every year on

a) 29 November b) 19 October

c) 19 November d) 29 October

(v) Which of the following is not a low cost onsite sewage disposal system.

a) Septic tank b) Compost pit

c) Chemical toilets d) Bar screen

5. Very Short Answer Type Questions:

(i) What is sewage?

(ii) What is sludge?

(iii) What is clarified water?

(iv) What is septic tank?

(v) What is waste water treatment plant?

(vi) Which chemicals are used to disinfect water ?

6. Short Answer Type Questions:

(i) Why oil and fats should not be thrown in the drain? Comment.

(ii) What is the function of bar screens in a wastewater treatment plants?

(iii) "Throw litter in the dustbin only". Comment.

(iv) What are the alternative arrangements for sewage disposal?

(v) Why is it harmful to discharge untreated sewage in water bodies?

7. Long Answer Type Questions:

1. Write a brief note on open defecation.
2. What steps will you take at home for efficient working of sewerage system?

Extended Learning-Activities and Projects

1. Be a volunteer to motivate others to adopt good sanitation practices.
2. Visit a sewage treatment plant in your nearby place. Prepare a brief report on information you collected. If not possible to visit then collect more information about sewage treatment plant from internet.