SCIENCE

For Class VIII

G4C4B2

ਪੜ੍ਹੋ ਸਾਰੇ ਵਧੋ ਸਾਰੇ

ਸਿੱਖਿਆ ਅਤੇ ਭਲਾਈ ਵਿਭਾਗ, ਪੰਜਾਬ ਦਾ ਸਾਂਝਾ ਉਪਰਾਲਾ

PUNJAB SCHOOL EDUCATION BOARD

Sahibzada Ajit Singh Nagar

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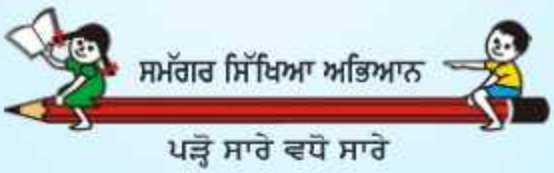

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FOREWORD

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.

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 Science for the class VIII has been so arranged so as to develop reasoning power of the students and to enhance their understanding of the subject. Graded questions and exercises have been included to suit the mental level of students. While preparing the textbook, CBSE syllabus has been followed. This step has been taken to maintain the uniformity in the Science subject so that Science student will have no problem while facing 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.

Chairman

Punjab School Education Board

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CONTENTS

CHAPTER - 1

Crop Production And Management

You might have noticed that whenever we go out of a city or town, we see same kind of plants growing in a large area of land. But when season changes, we see some other kind of plants growing in the same fields. Just think why is this so ? Do these plants grow naturally by their own or some special efforts are made to grow these ? Yes, farmers make efforts to grow these plants in their fields according to seasonal changes as all plants cannot grow properly in all weathers. Moreover, plant cultivation is done according to human requirement and consumption. When plants of same kind are grown at a large scale in a large area of land, this is known as **crop**. In this chapter we will study about crop production & management in detail.

Activity 1 : Germination of seeds.

Take a few gram seeds and sow them in the soil and moisten the soil with little water and observe them daily. After about three or four days, you will notice saplings coming out of the soil.

Ancient man might have observed any such event and an idea of sowing seeds might have come to his mind. This lead slowly to agricultural practice. Thus we see that agriculture was the first step towards civilizations.

Fig 1.1 Germination of seeds

Think and Answer :

Q.1. Give any one factor responsible for sprouting of seeds.

Q.2. Which occupation was the first step towards civilization?

1.1 CROPS IN ACCORDANCE WITH SEASON

According to their needs for different climatic conditions different plants grow in different seasons. Similarly, Crop plants are also grown

according to the weather most suitable for them. There are two main seasons of crop production. Depending upon the time of sowing and harvesting, these crops are :-**A. Rabi Crops B. Kharif Crops**

A. Rabi Crops : These crops are also called **winter crops**. These are grown just in the beginning of winter season (October to November) and harvested after winter season.ie, March-April. Wheat, barley, oats are main cereals, mustard, linseed are oil crops and pea, gram, lentils are pulses. Many vegetables like carrot, radish, turnip, cabbage, cauliflower, beet root, potatoes are also grown during this season.

1.2 Rabi Crop (Wheat)

B. Kharif Crops : These are also called **summer crops**. The crops which are grown during summer and rainy season, are called Kharif crops. These are grown in the months of May and June and are harvested in September and October. Rice, maize, jawar, sorghum are main Kharif cereals. Beans, pigeon peas, soybean, pulses, sunflower, cotton seed, ground nut, sesame (Til) are oil seed crops of

Fig. 1.3 Kharif Crop (Maize)

Kharif season. Lady finger, bitter gourd and pumpkin are the main vegetables of Kharif season.

Besides these crops, some crops take long time for example, sugarcane is sown in February and harvested in November.

1.2 BASIC PRACTICES FOR CROP PRODUCTION

Production of crops is not limited to sowing and harvesting, but it involves many other activities that include :-

A) Preparation of soil
B) Sowing seeds
C) Addition of manure and fertilizers
D) Irrigation
E) Removal of weeds
F) Protection from pests
G) Harvesting and threshing
H) Storage.

A. Prepration of Soil

The preparation of soil is very necessary before growing a crop. All crops grow well in the soil which is porous and contains water and have

microorganisms in it. In a loose soil, air can enter as the germinating seeds require air for respiration. Micro-organisms can also multiply in a porous and moist soil. The roots of plants can penetrate in the loose soil. Loosened soil also helps in growth and reproduction of earthworms. They can breathe in air from porous soil and help to make the soil fertile and porous by turning it.

Soil contains water, air, minerals, living organisms and dead organisms. Decomposition of dead bodies of organisms by microorganisms also release nutrients in the soil. These nutrients are absorbed by plants through roots.

The top layer of soil up to a few centimetres depth 25-30 cm on 9-12 inches is very useful for crops. It contains all the nutrients required for plants. It supports plant growth. Only this layer of soil is to be loosened or turned. From the loose soil plants can easily absorb nutrients. The process of turning of the soil, by using tiller or ploughs is called **tilling** or **ploughing**. Earlier the ploughs were made purely from wood. It had a long wooden shaft, wooden heavy plough share and a back handle. The plough share had an iron file which could be sharpened again and again because it becomes blunt on using for tilling.

With the advancement of technology wooden ploughs all replaced by iron ploughs. Now a days **tractor**driven tillers are invented and are being used in agriculture.

The dry soil may need water before ploughing. When Plough turns the soil, some lumps of soil or clay are formed. Sometimes big lumps are very hard and need to be broken into small pieces. These lumps are crushed with the help of a **plank** or **leveller**. A **leveller** is also used for the levelling of the field.

If the soil is not rich in nutrients then manure or fertilizers are also added during preparation of soil so that manure mixes well in the soil.

Agricultural Implements : The soil is prepared by using various agricultural tools. These tools are plough, hoe, leveller and cultivator.

(i) Plough : Plough is used for tilling, ploughing, turning over the soil and mixing the manure into it. Time to time, it is also used for uprooting the weeds. In the ancient times purely wooden ploughs were used. Later an iron file fitted to the hoe was used.

Fig. 1.4 Plough

Fig. 1.5 Tiller discs

This lasted longer than wooden plough.

(ii) Hoe :A hoe is plough-like iron implement which has shaft of wood and an iron plate to turn over the soil. It is used to till deep and turn over the soil.

Fig. 1.6 Iron plough

Fig. 1.7 Wooden plough

(iii) Cultivator : With the advancement of technology, now-a-days ploughing is done by using a set of 10-12 iron ploughs called cultivator. It is driven by tractor.

Fig. 1.8 Cultivator

B. Sowing of Seeds

Seeds are sown with different methods in field. Nature also disperses and sows seeds which germinate to give rise to plants. Crops are sown in fields by following methods.

(i) Broadcasting : Seeds of crops like, wheat, maize, turnip, radish, sorghum, pearl millet, oats, oil seeds like mustard sesame may be scattered by hand. This method is called broadcasting. Broadcasting has two disadvantages, seeds are not evenly distributed secondly seeds are not buried properly in the soil.

Fig. 1.9 Broadcasting

(ii) Sowing by hand : After ploughing the field, a person drops seeds in furrows with hand. Potatoes are sown in furrows by hand.

Fig. 1.10 Sowing by hand

(iii) Seed drill : It is a tool used for sowing seeds into a specific depth and at proper distances in a field so that seeds should germinate properly.

A seed drill has wide mouth like a funnel and a long pipe. Earlier it was made up of wood and later iron sheet replaced wood. The seed drill is tied to the handle of plough in such a way that the seeds dropped in it fall just in the furrow made by plough and then soil covers the seeds. Seed drill is also used with tractor. Seeds are put in a trolley like box in which a broad pipe is fitted. This broad pipe is attached to 10-12 narrow metal or rubber pipes which sow seeds just behind each plough in the furrow. Even fertilizers are also dropped by using seed drill.

Before sowing, the seeds must be checked for their health and capacity to sprout. This can be checked by following activity.

Fig. 1.11 Seed drill

Activity 2 : Activity for testing health and sprouting capacity of seeds.

Material Required : A bowl, water, a handful of seeds.

Procedure : Take some water in a bowl. Now put a handful of seeds in it and stir properly, and let them rest for some time.

Observation : Some seeds float on water end others get settled at the bottom of the bowl.

Conclusion : Healthy seeds with good sprouting capacity settled at the bottom.

If some powder like substance appears in water then seeds are infested. Insects make holes in seeds and seeds become hollow. Such seeds float on water and powdery substance is formed.

Tink and Answer :

Q.1. Are floating seeds fit for sowing?

Q.2. Which seeds get settled at the bottom ?

Nursery

A nursery is a small plant bed or a small area of field. Here the plants are grown in bulk and after few days transplanted in fields. For example paddy is grown in small beds and after 20-30 days it is transplanted in the fields. Growing sapling in a nursery saves manure, water and also gives time to keep the field without crops. During this period if the field is being ploughed properly, its weeds are removed and soil gets replenished with nutrients.

Nursery

For many crops like paddy, brinjal, capsicum, tomato, onion, garlic and many other flowering plants, the seeds are grown in a small area called **nursery** and then transplanted in the fields.

C. Adding Manure & Fertilizers

For proper growth and better yield, the crops require some nutrients, which they absorb from soil with water.

When we grow crops in the same field year after year, the soil gets depleted of nutrients. In order to replenish the soil, the nutrients need to be added to the soil as per the requirement of crop. Crops need some elements in large quantity. These are called **macronutrients**. Carbon, hydrogen, oxygen, nitrogen phosphorus, potassium, sulphur, calcium are macronutrients. Out of these hydrogen and oxygen are obtained from water and carbon is obtained from carbon dioxide. But other**macronutrients**are to be added in the soil in the form of manure or fertilizers.

Some elements are required in small quantity by plants. These are called **micronutrients**. Iron, zinc, manganese, chlorine, molybdenum, cobalt, magnesium, copper are called micronutrients. Their requirement can be fulfilled by adding manure or fertilizer. Manure is organic in nature and is prepared by decaying residue of plants and animal dung by decomposition. Therefore it is called as**farmyard manure**. If it is prepared from decaying of sewage, vegetables and residue of kitchen waste then it is called**compost**.*Rhizobium*bacteria in the roots of leguminous plants fix atmospheric nitrogen. If leguminous crops are grown and then left on the fields to wither and decomposed before flowering, it is called **green manure**. Now a days, farmers are also preparing manure or compost from animal dung using special breed of earthworm, this is called **vermicompost**.

(i) Vermicompost

To prepare vermicompost, exotic breed of earthworms (*Eisenia fetida*) is used. These earthworms are 8 to 10 cm long and red in colour. They convert decomposed animal dung into nutrient rich manure called vermicompost. You can make Vermicompost in your school garden with the help of school gardener under your teacher's guidance.

To prepare vermicompost, two adjacent beds (Pits) are made by using bricks and cement. Each pit is about 2 meter long, 50 cm. broad and 60-70 cm. deep. These pits are

Fig. 1.11 Vermicompost

Fig. 1.12 Red Worms

made at ground level and connected to each other by alternate holes. First of all mixture of animal dung and leaves are watered and left to decay in first pit for about 30 days. Then earthworms are released in the pit and animal dung, leaves and water are put in second pit. Animal dung in both the pits is kept moist by sprinkling water over it. After 40-45 days, the compost in first pit is changed to vermicompost. Vermi-compost is then turned and it dries up in few days. Earthworms are now shifted to second pit. The dried vermicompost is sieved and cocoons of earthworms are put in the second pit. Again first pit is filled with animal dung, water and leaves. And this process is repeated again and again. Vermicompost prepared in this way is very rich in nutrients.

(ii) Fertilizers

Fertilizers are chemical substances and are prepared in industries. Fertilizers are nutrient specific for example urea is rich in nitrogen, potash is rich in potassium. NPK is mixed fertilizer which contains nitrogen, phosphorus and potassium.

Fig. 1.13 Manure

Fig. 1.14 Fertilizer

Differences between Manure and Fertilizer

Manure	Fertilizer
1. It is organic in nature and contains carbon in large amount.	1 It is inorganic in nature and does not contain carbon

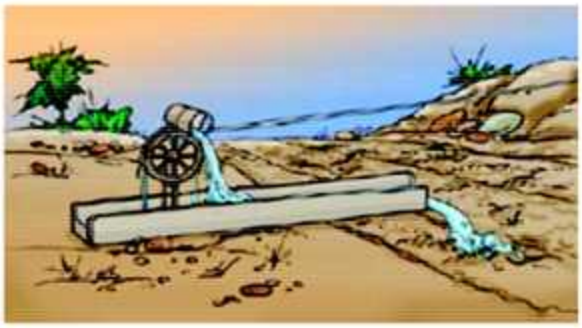
Manure	Fertilizer
2. It is made up of animal dung, plant residues and human waste.	2. It is prepared in factories.
3. It does not contain macro-nutrients like nitrogen, phosphorus, potassium in large quantity.	3. Nutrient specific fertilizer contains the respective nutrient in a large quantity.
4. It does not get spoiled in rain or sun.	4. It gets spoiled in excess heat of sun or in rain.
5. It provides humus to the soil	5. It does not provide humus to the soil.
6. It needs large space to keep it.	6. It can be stored in bags.
7. It enriches the quality of the soil.	7. Its excessive use decreases the quality of soil.
8. It is sparingly soluble in water and slowly absorbed by plants.	8. It is soluble in water and quickly absorbed by plants.
9. It does not require any store and is kept in fields.	9. It requires bags and store - room for storage.

D. Irrigation

All the living organisms need water. Plants also need water as an essential nutrient. Two nutrients namely, oxygen and hydrogen are obtained from water. Plant roots absorb water from soil alongwith minerals. For healthy growth of plants, the soil require adequate amount of water. When it rains, the plants and crops get water through natural process but excessive rain may cause floods. But when rainfall is scanty, the crops need water supply by artificial means. This process of providing water to crops by artificial methods is called **Irrigation**. The amount, time and frequency of irrigation depends upon the nature of the crop, season and soil quality.

(i) Sources of Irrigation : Ponds, wells, tubewells, lakes, rivers and canals all are the sources of irrigation. Now a days, tubewells are mainly used for irrigation but in old times, irrigation was done by Dhekli, Moat (Chhagal), chain pump and Persian wheel (Halt). Moat or Chhagal was a system of drawing water from well by using pully and rope.

(i) Moat (pulley-system)



(ii) Chain pump

(iii) Dhekli

(iv) Halt (Persian Wheel)

Fig. 1.15 Different means of irrigation

(ii) Modern System of Irrigation: Presently underground water is drawn by using a diesel pump or an electric pump and supplied to field through furrows. To save water, the irrigation is also done by using sprinkle system or drip system.

(a) Sprinkle system : It is a system in which irrigation is done as if it is raining. But for this system either a wire net is made over the field on which pipes run with holes or a number of pipes are raised above the ground. When water flows through these pipes with great pressure, then it sprinkles like rain over crop.

(b) Drip Irrigation : In drip irrigation, water from a tube well is brought to field through very narrow pipes. Network of pipes is burried underground and small holes are made in these pipes near the plants. When water flows through these pipes, it is supplied through holes near each plant. This system also checks the wastage of water.

Fig. 1.16 (a) Sprinkle irrigation

Fig. 1.16 (b) Drip Irrigation

E. Protection of Crops

(i) Protection from pests : Any types of micro-organisms or animals that attack crop plants are called **pests**. These may be viruses, bacteria, fungi, insects, birds, rodents or big animals.

To protect crops from micro-organisms, the crops are sprayed by chemicals. During earlier times, ash was sprayed as fungicide.

Diseases caused by worms can be controlled by following steps:

1) Treating seeds by fungicides and antibiotics and then sowing these disease free seeds.
2) Selecting disease-resistant varieties or breeds.
3) Destroying those weeds or plants which act as alternate host for disease causing micro-organisms.
4) By uprooting and destroying the infected plants.
5) Spraying fungicide or bactericide over infected plants.

(ii) Insect control : Crops can be protected from the attack of insects by following methods:

1) Selecting those varieties which are not attacked by insects.
2) Using chemical insecticides.
3) Mixed cropping can also be followed to reduce the chances of insect attacks.

(iii) Control of Birds and Rodents : Rodents like hare, rats, porcupine and birds can be scared by using scare crow and beating drums or use of fire crackers.

(iv) Control of wild animals : Crops can be protected from wild animals such as deer, wild cow, jackals, foxes, wild pigs etc by making hedges or iron wire fencing. Dogs are also kept by farmer to scare these animals.

Fig. 1.17 Scare Crow

(v) Weeds and Weed Control : Weeds are unwanted plants that grow along with the crop. These weeds share water and nutrients with the crop. This results in reduction of crop yield. Some weeds also act as alternate host for micro-organisms or insects and increase the chances of microbial attack or insect attacks. Some weeds are *Amaranthus* (chulai), *Chenopodium*(bathu).

Weeds have to be removed from field. The removal of weeds from the field is called **weeding**. They can be removed by :

1) Uprooting with hands.
2) Uprooting using harrow*(dandral)* or khurpa. Small harrow driven by hand is called**rake**.

3) Weeds can be destroyed by using chemicals called **weedicides**. 2, 4-D chemical is used as weedicide. But, Use of chemical weedicides is now discouraged because they create following problems :-

i Like pesticides and fungicides, weedicides are also poisonous chemicals. They pollute air, water and soil.

ii Pesticides and weedicides are non-biodegradable and enter the food chains.

iii Vegetables, fruits produced by using weedicides are contaminated and cause many health problems.

Fig. 1.18 Spraying Pesticides

4) Fumes of insecticides, weedicides or fungicides may cause allergies as they may attack our ears, nose and eyes. So we must use goggles and cover our nose, mouth and eyes with cloth while these are sprayed.

F. Harvesting

Harvesting is the last step in the life of crops. **Harvesting is the process of cutting and gathering a ripened crop.**Manually harvesting is done with the help of a sickle. But now-a-days, a machine called harvester is used.

Threshing : After harvesting the mature crop, the next step is to separate the grains.

Fig. 1.19 (a) Reaping Manually

Fig. 1.19 (b) Combine Harvester

Separating grains from husk is called**threshing.**Earlier, it was done by crushing the wheat with the help of animals and separating grains and husk from crushed wheat. This is also called **winnowing**. Now harvesting and winnowing is done collectively by

a machine known as **combine**. This machine is a combination of a harvester and a thrasher.

Fig. 1.19 (c) Threshing

Fig. 1.19 (d) Combine

Harvest season : In India, many festivals are related with harvesting seasons of crops e.g. In Punjab, the harvesting of wheat relates to Baisakhi. Similarly, Bihu in Assam, and Pongal in Kerala are harvest festivals. These seasons give pleasure and joy to the farmers and their families.

1.3 STORAGE

Each crop is harvested and winnowed once in a year. But it requires proper storage ; especially cereals and pulses must be stored so that they are available for consumption throughout the year. Even vegetables like potatoes, onions, and tomatoes must be available as they are used in kitchen in all the seasons. To store the grains for longer periods, it is essential to save them from moisture, insects, rodents and micro-organisms. Before storage, seeds are dried and other practices are followed to keep them safe.

Godown/cold storage : Pulses and cereals are stored in dry godown. But before storage it must be checked that moisture content in grains should not be more than 14%. It can even be checked by chewing grain, if grain produces cracking sound then it is ready for storage. Godown must be dry and smoked with fungicides and bactericides. Fruits and vegetables contain more water so they need to be stored in cold storages.

Grains are also stored at home in iron sheet**silos**. But these silos must

be fumigated and neem-leaves should be kept in grains.

1.4 IMPROVEMENT IN CROP PRODUCTION AND GREEN REVOLUTION

To fulfill the needs of growing population, the crop production had to be improved. During seventh decade of 20th century, there was a revolution in agricultural practices. This was named **Green Revolution**. The Aim of this movement was to improve crop yield. For these, following practices were involved.

1) **Selection of seeds :** Good and healthy seeds of traditional crops were selected and sown.
2) **Import of exotic breeds :** Seeds of exotic breeds of crops were imported and sown.
3) **Hybridisation:**Indian agricultural scientists hybridised the Indian varieties with imported ones and new breeds were prepared which give more production.
4) **Use of modern machinery :**Use of tractors and other modern tools was promoted.
5) **Use of fertilizers and insecticides, weedicides** etc. was stressed to increase the crop yield.

DR. M.S Swaminathan

Dr. M. S. Swaminathan *is known as the* ***'father of green revolution'*** *in India. He along with the other scientists developed many breeds of cereals, pulses and vegetables by hybirdisation. With his efforts crop production was increased many times. He also promoted the use of improved agricultural tools especially tractor.*

Food from animals : Many food items are obtained from animals, such as milk, meat, eggs, fish and honey, etc. Keeping cattle as pet in sheds, providing fodder, protecting them from diseases and obtaining useful products from them is called**Animal husbandry**. Rearing of domesticated birds such as chickens, ducks,

Honey-Bee Boxes

turkeys and geese for production of eggs and meat for food is called poultry farming. Keeping fish in artificial ponds is called**Pisciculture**. To obtain Honey, bees are kept in boxes. This practice is called bee-keeping or**Apiculture**.

Cattle in Dairy

Cows and buffaloes are reared for milk. Rearing of cattle for milk is called **dairy farming**.

Marketing : The crop production is always more than the requirement of farmers. Even investment on crops is very high. This can only be compensated if harvested and winnowed crop is sold in the market. The selling of crops is called marketing. Cereals and pulses are stored in grain market. Government and private agencies buy them and store in godowns or granaries. During storage grains must be protected from moisture, birds, rats and micro-organisms.

POINTS TO REMEMBER

- To fulfill the needs of increasing population, the crop yield was increased.
- Crops are cultivated for obtaining cereals, pulses, vegetables, fruits beverages and medicines, etc.
- Animals are reared for obtaining milk, meat, eggs and honey etc.
- Plants of same kind or species are grown in a field known as crop.
- In India there are two seasons of crops, crop sown in winter and harvested before summer are called Rabi crops and crops sown in summer and rainy season and harvested after rainy season (autumn) are called Kharif crops.
- Seeds are sown one by one with hand, broadcasting or by seed drill.
- Some plants are grown in nursery and transplanted.
- Crops must be supplemented with water for proper growth. This is called irrigation.

- Some unwanted plants grow along with the crops, these are called weeds.
- Weeds are removed manually or by using chemicals called weedicides.
- Any organisms like birds, rodents etc which attack on crops and destroy them are called pests.
- Pests can be scared by using scarecrow, fire crackers or beating drums.
- Crop yield is sold in market. This process is called marketing.
- Excess crop production is stored in silos, godown and cold stores.
- Rearing cattle for milk is called dairy farming.

Keywords

- Agricultural practices
- Kharif crops
- Drill
- Compost
- Weed
- Weedicides
- Winnowing
- Silo
- Pisciculture
- Dairy farming
- Tilling
- Broadcasting
- Vermicompost
- Pest
- Pesticides
- Storage
- Animal husbandry
- Marketing
- Rabi crops
- Sowing
- Manure
- Fertilizer
- Rodents
- Harvest
- Granary
- Bee keeping

EXERCISE

A. Fill in the blanks.

1) Any micro-organism or animal that attacks on crops is called a .....

2) Only one type of plants grown in a field is called a.....

3) Crops grown in winter are called ..... crops.

4) Production and management of fish is called.....

5) Selling of crop yield in market is called.....

6) Production and management of honey is called .....

B. Write True (T) or False (F).

1) Pisciculture deals with growing of fruits and vegetables.
2) Excessive use of fertilizers can turn soil acidic or basic.
3) Manure contains more nutrients than fertilizers.
4) A wooden plank is used for digging the soil.
5) A plough is an agricultural tool used for tilling the soil.

C. Match column A with B column :

	Column A		Column B
1	It is an agriculture tool/ machinery which can reap and thresh grains	A	Urea
2	Keeping birds for meat and eggs is called	B	Rabi crops
3	It is nitrogen rich fertilizer	C	Kharif crops
4	Barley and mustard	D	Poultry
5	Maize and paddy	E	Combine

D. Choose the correct answer:

1) Broadcasting is a method of

a Weeding b Sowing

c Irrigation d Reaping

2) The type of irrigation best suited for the place where there is scarcity of water is

a Furrow irrigation b Sprinkle irrigation

c Drip irrigation d Basin irrigation

3) Earthworm is used for preparing:

a Compost b Manure

c Green manure d Vermicompost

4) The process of growing crop without using inorganic fertilizer is called

a Organic farming

b Hybridization

c Mixed cropping

d Crop rotation

5) Three macronutrients are

a Phosphorus, carbon and iron

b Nitrogen, phosphorus and potassium

c Potassium, calcium and magnesium

d Nitrogen, hydrogen and chlorine

6) The process of cleaning grains from chaff is called:

a Harvesting

b Broadcasting

c Thrashing

d Winnowing

E. Very Short Answer type questions.

1) Name any two animals reared for milk.

2) Name any two ancient methods of irrigation.

3) What is a plough?

4) Where are vegetables and fruits stored?

F. Short Answer type Questions.

5) What is a weed ? Name any two weeds, and one method of removing them.

6) What is hybridization ? How is it useful ?

7) What are biofertilizers ?

8) What are different ways of sowing seeds ?

9) What do you mean by transplantation ?

10) What is a pest. Give examples ?

G. Long Answer type questions.

11) Write differences between manure and fertilizer?

12) What do you mean by crop improvement ? Explain various practices of crop improvement ?

13) Explain how vermicompost is prepared?

14) What are various agricultural practices ? Explain any two?

CHAPTER - 2

Micro-Organisms : Friends And Foe

There are many kinds of living things in and around us. They may be small, large or very tiny. These include millions of organisms which can't be seen with the naked eye. They are visible only with the help of microscope. These organisms are called as micro-organisms or microbes.

2.1 DISCOVERY OF MICRO-ORGANISMS

The invention of a microscope helped in the discovery of micro-organisms.

Fig. 2.1 Anton Van Leeuwenhoek

Anton Van Leeuwenhoek was the first person to observe and describe single celled organisms but now with the help of modern microscope we know more about the micro-organisms.

2.2 TYPES OF MICRO-ORGANISMS

There are four major groups of microorganism. These are as follows :

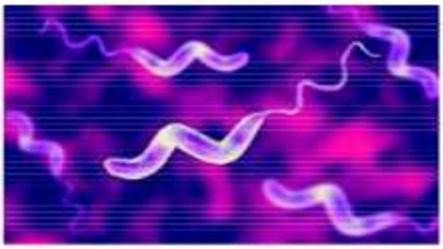
- **Bacteria**
- **Fungi**
- **Protozoa**
- **Algae**

2.2.1 Bacteria

They are found almost everywhere. They may be present in air, water, soil, within or outside the body of plants and animals. They are the most abundant micro-organisms. They can live in soil, in ocean & even in human gut.

On the basis of their shape bacteria are grouped under four categories. The bacteria may be spherical shaped called 'Coccus', rod-shaped called 'bacillus', comma shaped called 'vibrio' or spiral shaped called 'spirilla' (Fig. 2.2).

(a) Rod Shape



(b) Spiral shape

(c) Comma shape

(d) Spherical shape

Fig. 2.2 : Shapes of Bacteria

Activity 1 : To test the presence of bacteria in curd.

Material required : Microscope, glass slide, petri-dish, needle, curd, water.

Procedure : Put a drop of water on a clean glass slide. Now take a drop of curd from the petri-dish and put it on glass slide. Now spread it with the help of needle to dilute it. Place the glass slide under the microscope and observe it carefully.

Observation : You will see very small, rod shaped bacteria in the curd.

Conclusion : They are lactobacillus.

Fig. 2.3 : Lactobacillus

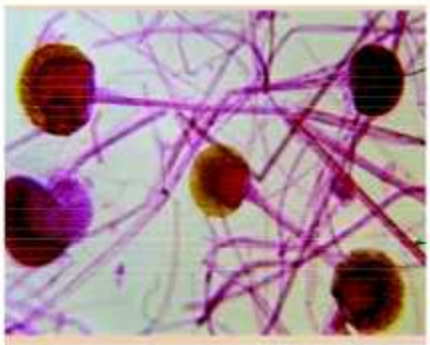
Think and Answer :

Q.1. What is the shape of bacteria seen in the curd ?

Q.2. Name the bacteria which turn milk into curd.

2.2.2 Fungi

They are plant like organisms but do not contain chlorophyll. Therefore, they cannot synthesize there own food. They grow on food, clothes, shoes, fruits or trees. e.g. Bread mould, Penicillium, Aspergillus, Mushrooms etc. (Fig. 2.4).



(a) Bread mould

(b) Penicillium

(c) Aspergillus

(d) Mushrooms

Fig. 2.4 Fungi

Activity 2 : To study growth of fungi on bread.

Material Required : Bread, water, glass slide, needle, microscope.

Procedure : Take a slice of bread. Moist it with water. Now keep it in an open dish and place it in a warm moist place (place where temperature is 25°C to 30°C). Watch it daily, until you see cotton like outgrowths on it. Now, take a pinch of this outgrowth on a clean glass slide and then put a drop of water on it and disperse it with the help of needle. Now watch the glass slide under the microscope.

Observation : You will see some stick like structure bearing ball like outgrowth.

Conclusion : This stick like structure is called as**sporangiophore,** and ball like structure is called as **sporangium.** This fungus is known as**Rhizopus**(Bread mould) (Fig. 2.5).

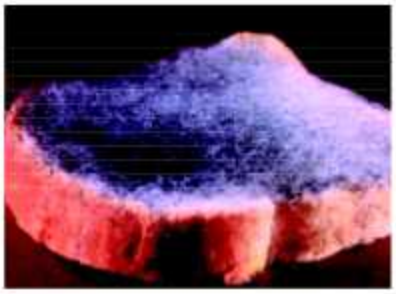


Fig 2. 5 Rhizopus

Think and Answer :

Q.1. What is the scientific name for Bread mould ?

Q.2. In which season most of the things in our house get contaminated with fungus ?

2.2.3 Protozoa

They are usually found in moist habitats such as ditches and ponds. Some of them live in the body of plants and animals. Their sizes range from

2 micron to 200 micron. e.g. Amoeba (Fig. 2.6), Paramecium (Fig. 2.7), Euglena (Fig. 2.8) etc.

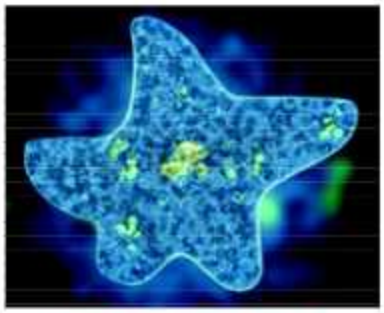


Fig. 2.6 : Amoeba

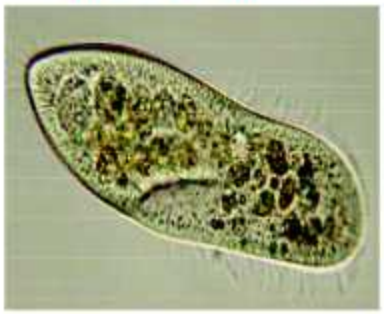


Fig. 2.7 : Paramecium

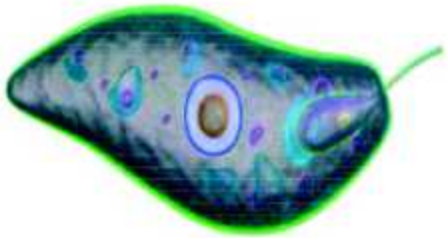


Fig. 2.8 : Euglena

2.2.4 Algae

Algae are simple plant like organisms. They have chlorophyll. So they can synthesize their own food.

Fig. 2.9 : Chlamydomonas

They may be unicellular or multicelluiar ranging from one micron to 50 micron in size.

e.g. Chlamydomonas (Fig. 2.9), Fucus (Fig. 2.10), Diatoms (Fig. 2.11) etc.

Fig. 2.10 : Fucus

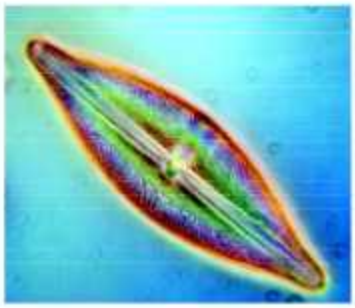


Fig. 2.11 : Diatoms

Activity 3 : To study the structure of Algae through microscope.

Material Required : Microscope, Petri-dish, threads of blanket weed from pond.

Procedure : Put a drop of water on clean slide. Put a piece of silk like thread of blanket weed on slide. Disperse it with the help of needle. Place it under the microscope and observe carefully.

Observation : You will see green block like cells of spirogyra (Fig. 2.12)

which contain nucleus, chloroplast and other cell organelles.

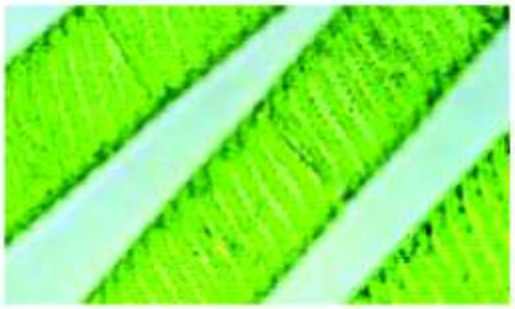


Fig. 2.12 : Spirogyra

Think and Answer :

Q.1. What gives green colour to algae ?

Q.2. Where is spirogyra found ?

2.2.5 Viruses

Some scientists consider viruses as non-living as they cannot reproduce on their own and some other scientists consider them as dividing line of living and non living.

The first virus was discovered by Dr. Wendell Stanley in 1935 on tobacco plant which is known as Tabacco Mosaic Virus (TMV). He was awarded Nobel Prize for his work. He found that viruses can be crystallized and stored in laboratory and when these crystals were injected into healthy plants, they developed disease.

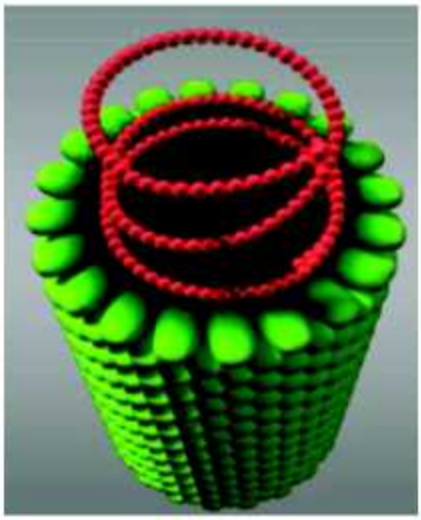


Fig. 2.13 : TMV

They are much smaller and range from 0.15 micron to 0.2 micron in size e.g. Tobacco Mosaic Virus (TMV) (Fig. 2.13), Influenza Virus, Corona Viruses (Fig. 2.14) and HIV Virus (Fig. 2.15) etc.

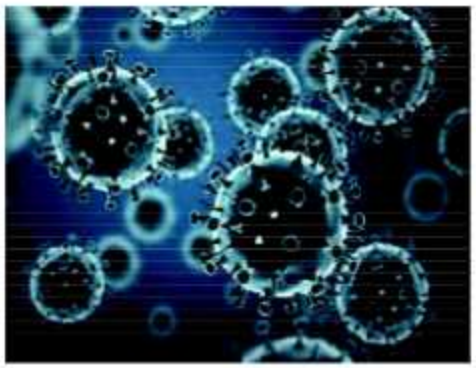


Fig. 2.14 : Corona Virus

Fig. 2.15 : HIV Virus

2.3 MICRO-ORGANISMS IN OUR LIFE

Micro-organisms play an important role in our lives. Most of micro-organisms are helpful to us,

some are harmful and cause diseases. Such micro-organisms are called as **pathogens**.

2.4 MICRO-ORGANISMS AS OUR FRIENDS

Although micro-organisms cause a large number of diseases in animals & plants but this does not mean that all microorganisms are harmful. Several micro-organisms are useful in many ways. Here we will discuss some important contributions of micro-organisms to human beings.

2.4.1 Role of Micro-organisms in Food Industry

Lactobacillus is the bacterium that helps in the formation of curd. Some bacteria and fungi also help in making of cheese. Fungi like yeast cells break down sugar in fruit juice, as a result of this, juice is converted into alcohol, and is used in alcoholic beverages. This process is known as **fermentation**. Carbon dioxide is produced during fermentation.

Fig. 2.16 : Bakery

Similarly, when yeast cells are mixed with wheat flour (Atta) or Maida CO_2 is produced which helps in raising the flour to make bread, pastry, idly etc.

2.4.2 Role of Micro-organisms in Sewage disposal

Raw sewage like faeces and urine are health hazards. Some bacteria are used in the biological treatment of sewage and industrial waste. Bacteria helps in breakdown of organic content present in sewage. They, thus clean our environment.

Fig. 2.17 : Sewage Treatment Plant

2.4.3 Role of Micro-organisms in Recycling of matter in nature

Bacteria and fungi decompose dead organisms like plants and animals, and thus enable nutrients (like phosphorus, nitrogen etc) to go back to the soil. Therefore these microbes are called as**decomposers**.

Fig. 2.18 : Toad-Stools (decomposer)

2.4.4 Role of Micro-organisms in medicine industry

Many micro-organisms present in the alimentary canal of some animals like cow, help in digestion and absorption of food. Micro-organisms are also used in production of antibiotics. **Antibiotics are the chemicals that inhibit the growth of other harmful micro-organisms by affecting their life processes**e.g. *Penicillium notatum*produce penicillin. Streptomycin, Tetracycline and erythromycin are forms of antibiotics which are obtained from fungi and bacteria.

It is important to remember that antibiotics should be taken only on the advice of a qualified doctor. Also you must complete the course prescribed by the doctor. If you take antibiotics when not needed or in wrong doses, it may make the durg less effective when you might need it in future. Also antibiotics taken unnecessarily may kill the beneficial bacteria in the body. Atibiotics, however, are not effective against cold and flu as these are caused by viruses.

2.4.5 Role in Retting of Fibers

Linen is made from the fibers obtained from flax plant. These plants are tied in bundles and kept in water, bacteria enter into the stem and destroy stem tissue and loosen the supporting fibers. This is known as **retting**. These fibers are used to make linen thread.

Fig 2.19 : Jute Preparing (Retting)

2.4.6 Role in Tanning of Leather

The bacteria attack the skin of animals and make them soft and pliable. (This process is long and complex)

Fig. 2.20 : Tanning Of Leather

2.4.7 Nitrogen Fixation in Nature

Atmosphere has 78% nitrogen gas. It is one of the essential constituent of all living organisms as a part of proteins. Nitrogen cannot be taken directly by plants and animals. Certain bacteria Rhizobium and blue green algae convert it into compounds of nitrogen and then it is utilized by plants.

Fig 2.21 : Rhizobium Bacteria in Nodules of Roots

2.5 HARMFUL MICRO-ORGANISMS

Some micro-organisms are harmful and cause diseases in plants and animals, such micro-organisms are called as **pathogens**. They even spoil the food and adversely affect the quality of leather and clothes.

Some micro-organisms enter in our body by air, water or any contact. They multiply inside the body and release harmful materials, which are called **toxins**. These toxins cause diseases. Such diseases spread from an infected person to healthy person through air, water, food, physical contact or by insects and are called as**communicable diseases**.

Vaccine : When disease carrying microbes enters in our body, the body produces antibodies to fight with these

Table 2.1 : Diseases caused by Microorganism

Micro-organisms	Diseases
1. Bacteria	Tuberculosis, Tetanus, Typhoid, Cholera
2. Fungi	Ringworm, Athlete's foot
3. Protozoa	Malaria, Amoebic dysentery
4. Viruses	Common cold, influenza, Mumps, Polio, AIDS, Covid-19

Table 2.2 : Modes of transmission of micro-organisms

Modes of Transmission	Diseases
1. Air (action like sneezing and coughing)	Tuberculosis, Common cold, influenza, swine flu, Covid-19
2. Water (using contaminated water)	Cholera, Amoebic dysentery, Typhoid.
3. Soil	Tetanus
4. Animals (being bitten by rabid dogs, vectors that spread diseases)	Rabies, Malaria

microbes and body also remembers to fight these microbes if they enter again.

So if dead or weakened microbes are introduced in healthy individual, body produces specific types of antibodies and when such individual get infected by same type of microbes, they are killed by antibodies already present in the body of that individual. This is called as **vaccine** and this process is known as**vaccination**.

Now a day's various types of vaccines are available to protect ourselves from diseases, such as small pox, Chicken pox, Tetanus, Rabies etc.

Table 2.3 : Prevention of Diseases

Methods of Prevention	Diseases that may be Prevented
1. Vaccination	Tuberculosis, Polio, Mumps, Tetanus etc.
2. Using mosquito net and Mosquito repellants	Malaria, Dengue etc.
3. Proper disposal of sewage and Using disinfected water	Cholera, Typhoid etc.
4. Maintain good personal Hygiene	Ringworm and Athlete's foot

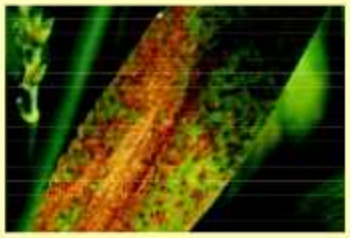
Table 2.4 : Disease causing micro-organisms in animals

Name of Disease	Micro-organisms that cause Disease	Animal infected
Anthrax	Bacteria	Cattle
Tuberculosis	Bacteria	Cattle, Poultry
Foot and Mouth Disease	Virus	Cattle
Rabies	Virus	Dogs, Monkey
Aspergillosis	Fungi	Poultry

2.6 DISEASE CAUSING MICRO-ORGANISMS IN PLANTS

Most of diseases in plants are caused by fungi, bacteria and viruses. They reduce crop yield and some time cause total destruction of crops.

Table 2.5 : Disease causing micro-organisms in plants

Micro-organism	Disease	Image
Virus	Tobacco Mosaic Virus (appearance of uneven spots and discoloration of leaves)	
Bacteria	Citrus Canker (lesions on leaves, stems, and fruits with raised, brown, water soaked margins)	
Fungus	Smut of wheat and rice (Smut balls of grains that become greenish black, burst and infect other grains)	
Fungus	Rust of Wheat (rust colored patches on the infected plant parts)	
Fungus	Red Rot of Sugarcane (the infected stems have red color, occasional white patches across the stalk elongated red lesions on the mid ribs of leaves)	

2.6.1 Food Poisoning

Food poisoning occurs due to the presence of harmful bacteria or other microbes in food. They produce toxins in the food which cause food poisoning.

Some bacteria like Clostridium and Staphylococci, fungi like Aspergillus cause food poisoning. Food must be properly stored to prevent food poisoning.

2.7 FOOD PRESERVATION

Processing of food to prevent the spoilage and retain their nutritive value for long periods is called as**food preservation.**

Preservation usually means preventing the growth of bacteria, fungi and other micro-organisms, as well as retarding the oxidation of fats, which cause rancidity. **Rancidity** means having disagreeable odour or taste due to decomposition of oil and fats. Let us discuss commonly used method of preserving food in our homes.

2.7.1 Drying

In this method water content is sufficiently reduced to prevent and to delay the bacterial growth. e.g. wheat, maize, oat, barley, rice etc. are dried.

Fig 2.23 Sun Drying

2.7.2 Preservation using sugar and salt

Sugar and salt withdraw water content from micro-organisms and food therefore reduce the growth of microorganisms. Meat, fish and dried vegetables are covered with salt, jams and jelly are usually preserved by sugar.

Fig. 2.24 Food Preserved as Pickle and Jams

2.7.3 Preservation using Acetic acid

Acetic acid (vinegar) is used in manufacturing of several pickled products. It also stops the growth of micro-organisms.

Fig. 2.25 Preservation By Acetic Acid

2.7.4 Heat and cold treatment

Food items are usually boiled before use or storage, while some other food stuffs are stored in refrigerator because low temperature

Fig. 2.26 : Pasteurized Milk

reduces the growth of micro-organisms.**Pasteurization**is another method to check the growth of microbes in milk. In this method milk is heated about 70°c to 100°c for 15 to 30 seconds and then suddenly chilled and stored. This process is known as pasteurization.

2.7.5 Vacuum packing

Vacuum packing is a method in which air is removed from package prior to sealing. It is commonly used for storing nuts.

Fig 2.27 : Vacuum Packing

2.7.6 Freezing

When food is kept below freezing temperature, some micro-organisms are killed while growth of others slow down.

Fig. 2.28 : Freezed food items

POINTS TO REMEMBER

- Micro-organisms are very small and not visible to naked eye.
- Most of micro-organisms are harmless to human being. Some are harmful and cause diseases, and are called pathogens.
- Four major groups of microorganisms are bacteria, algae, fungi and protozoa.
- Viruses are linkage between living and non living.
- Micro-organisms survive well in moderate temperature 25°C to 38°C.
- Bacteria are single celled organisms with no nucleus.
- The main uses of bacteria are making medicine, decomposition of dead organisms.
- Viruses are smaller than bacteria and do not have a cellular structure.
- Viruses cause disease such as polio, measles, mumps, rabies, AIDS (Acquired Immune Deficiency Syndrome) and Covid-19 etc.
- Fungi are plant like organism that do not contain chlorophyll.
- Algae are also plant like organisms and have chlorophyll, so they can synthesize food on their own.
- Some disease can be prevented by vaccination.
- Food preservation can be done by drying using sugar and salt, heat and cold treatment, vacuum packing, freezing etc.

Keywords

- Microbes
- Protozoa
- Rancidity
- Sporangium
- Tobacco mosaic virus
- HIV
- Fermentation
- Antibiotics
- Rabies
- Citrus canker
- Bacteria
- Algae
- Bacilli
- Sporangiophore
- Influenza
- AIDS
- Smut of rice
- Retting
- Vaccination
- Red rot of sugarcane
- Fungi
- Streptococcus
- Rust of wheat
- Spirogyra
- Bacteriophage
- Pathogens
- Decomposer
- Communicable diseases
- Athlete's foot

EXERCISE

A. Fill in the blanks :

(a) ..... can be seen with the help of microscope.

(b) ..... is the bacterium that helps in the formation of curd.

(c) Fungi like ..... cause food poisoning.

(d) During pasteurization, milk is heated about ..... to ..... and then suddenly chilled and stored.

B. Write true (T) or false (F) :

(a) All living organisms can be seen with naked eye.

(b) Anton van Leeuwenhoek was the first person to observe and describe single celled organism.

(c) Penicillin is produced from *Penicillium notatum.*

(d) Micro-organisms which are helpful to plants and animals are called as pathogens.

C. Match column A with column B :

A		B
1. Streptococus	A	Algae
2. Penicillium	B	Virus
3. Chlamydomonas	C	Bacteria
4. HIV	D	Fungi

D. Choose the correct answer :

(a) Which one of following is not a bacterial disease ?

(i) Typhoid (ii) Tetanus

(iii) Cholera (iv) Malaria

(b) Which one of following cannot definitely be called living or non living.

(i) Virus (ii) Algae

(iii) Bacteria (iv) Fungi

(c) Which one of these can make its own food ?

(i) Algae (ii) Bread mould

(iii) Diatom (iv) Amoeba

(d) Which one of these diseases is prevented by vaccination.

(i) Malaria (ii) Polio

(iii) Ring worm (iv) Cholera

E. Very Short Answer type questions.

1. Name the major groups of micro-organisms ?
2. What is food poisoning ?
3. Name three diseases caused by fungi in plants.
4. Name two diseases caused by bacteria in cattle ?

F. Short Answer type Questions.

5. What are viruses, name three disease caused by viruses ?
6. Define vaccination, name three disease which can be prevented through vaccination ?

G. Long Answer type questions.

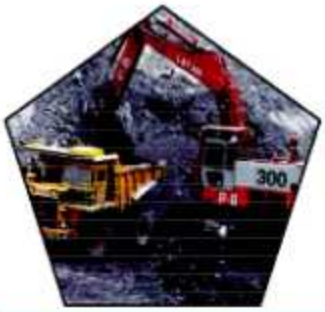
7. How micro-organisms help in the following :

1 Food industry 2 Sewage disposal

3 Recycling of matter 4 Making of medicine

5 Retting of fibers 6 Tanning of leather

8. Describe various methods to preserve food ?
9. Draw shapes for various types of bacteria ?



CHAPTER - 3 Coal And Petroleum

For basic day to day needs, human beings are dependent on different materials. These materials are essential for our life. Some of materials used are avialable in nature and are used in natural form. These materials are called natural materials. For example :- Sunlight, Wood, etc. Some materials are manufactured in factories & industries and are called **man-made materials**. For example :- plastic, glass etc.

Can you make a list of various materials used in our daily life and classify them as natural and man - made. On the basis of your knowledge complete table 3.1.

Table 3.1 Natural and Man - made material.

S.No.	Natural	Man - made
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

You can include toys, different metals, paper, grains etc in your list.

Can we use all our natural resources forever?

Can natural materials or resources be exhausted by human activities? you have already studied about water in class VII. Is water a limitless resource?

In the light of the availability of various resources in nature, natural resources can be broadly classified into two kinds :-

(i) Inexhaustible Natural Resources

(ii) Exhaustible Natural Resources

Let us discuss them in detail :

(i) Inexhaustible Natural Resources : These resources are present in unlimited quantity in nature and are not likely to be exhausted by human activities. For example : sunlight, air.

(ii) Exhaustible Natural Resources : The amount of these resources in nature is limited. They can be exhausted by human activites. Examples of these resources are forests, wildlife, mineral, coal, petroleum, natural gas etc.

Activity 3.1 : To understand exhaustible natural resources.

Material Required : Group of students, container, grains, chocolate and Popcorn

Procedure : Take some Containers. Fill them with grains/ Chocolate/ Popcorn. Divide Students into groups of seven each. Further divide each group into three subgroups containing 1, 2 and 4 students. Label them as first, second and third generation respectively

These sub- groups represent the consumers. As population grows, Second and third generation will have larger number of consumers.

Put one full container for each group on a table. Ask Consumers of the first generation from each group to consume eatables from the container of their group. Now, ask the second Consumers from each group to do the same. Ask students to observe carefully the availability of eatables in each container. If some thing is left in the containers, ask third generation from each group to consume it. Now, finally observe whether all the consumers of the third generation got the eatables or not. Also observe if anything is still left in any of the containers.

Assume that the eatables in the container represent the total availability of an exhausible natural resources like coal, petroleum or natural gas.

Observation : Moving from one generation to another, the availability of exhaustable natural resources will decrease.

Conclusion : If exhaustible natural resources are not used judiciously, these will not be available for next generations.

Questions :

Q.1. What would have been the right approach of student groups (generations) towards consumption of eatables (natural resources)

Q.2. Define Natural and Man - made resources.

Q.3. Define exhaustible and inexhaustible natural resources. Give example.

In this Chapter we will learn about some exhaustible natural resources like coal, petroleum and natural gas. These were formed from the dead remains of living organisms (fossils). So, these are all known as**fossil fuels**.

3.1 COAL

Coal is one of the cheapest fuel available. You may have seen coal or heard about it (Fig. 5.1). It is as hard as stone and is black in colour. In India large deposits of coal are found in Jharkhand, West Bengal, Orissa, and Madhya Pradesh.

Coal is one of the fuel used to cook food. Earlier, it was used in railway engines to produce steam to run engine. It is also used in thermal power plants to produce electricity. Coal is also used as a fuel in various industries.

Fig. 3.1 : Coal

3.1.1 Formation of Coal

Where do we get coal from and how is it formed ?

Formation of coal : The formation of coal took millions of years. Coal was formed by the bacterial decomposition of ancient trees & forests buried under successive layers of the earth. Under the action of high temperature and pressure, and in the absence of air, the decayed plant matter was converted into coal through a series of steps. With each successive layer of coal formation, the amount of carbon present in the deposits increased and the level of impurities decreased. This process is know as**carbonization**and the most active episode of carbonization took place in the carboniferous era. i.e 270 million year ago.

When heated in air, coal burns and produces mainly carbon dioxide gas.

Coal is processed in industry to get some useful products such as coke, coal tar and coal gas. coal mine is shown in Fig 3.2.

Fig 3.2 Coal mine

3.1.2 Coke

It is a tough, porous and black substance. It is an almost pure form of carbon. Coke is used in the manufacture of steel and in the extraction of many metals.

3.1.3 Coal Tar

Coal tar is a foul smellling, dark brown liquid. On fractional distillation it furnishes large number of useful organic compounds. It is a mixture of about 200 substances (Fig. 3.3). Products obtained from coal tar are used as starting material for manufacturing of various substances used in everyday life and in industry,

Fig 3.3 Coal Tar

like synthetic dyes, drugs, explosives, perfumes, plastics, paints, photographic materials, roofing materials, etc. Interestingly, naphthalene balls used to repel moths and other insects are also obtained from coal tar.

Do You Know ?

These days bitumen, a petroleum product, is used in place of coal - tar for metalling the roads.

3.1.4 Coal Gas

Purified coal gas is used as an industrial and household fuel. It is obtained during the processing of coal to get coke. It is used as a fuel in many industries situated near the coal processing plants.

Think and Tell :

1. _____ is known as the process of formation of coal.
2. Coke, _____ and _____ are obtained from industrial processing of coal.

3.2 PETROLEUM

The word **'petroleum'** is derived from the latin words *petra* meaning *rock* and *oleum* meaning oil.

Petroleum is a dark coloured, viscous, sticky mixture, with a foul smell. It is found trapped between layers of impervious rock (non-porous rock). The *Crude oil* is a mixture of solid, liquid and gaseous hydrocarbons, alongwith salt, water and earthly impurities.

Petroleum is a versatile form of energy. In fact, the economy of a modern nation depends critically on its petroleum wealth. Hence the term 'black gold' is used for petroleum.

The major oil producing countries are Saudi Arabia, Iran, Iraq, Kuwait, US and Russia. In India crude oil is obtained mainly from Gujarat, Assam and Bombay High.

3.2.1 Formation of Petroleum

Petroleum is formed by the action of pressure and heat on animal matter, most of which was buried under the earth millions of years ago. Petroleum (or rock oil) occurs at moderate depths, i.e. 500 m - 2000 m below the earth's surface, usually between layers of non-porous rocks. Oil deposits are also found under shallow ocean beds. Often there is a layer of natural gas resting under high pressure over the layer of crude oil.

3.2.2 Extraction and refining of Petroleum

Petroleum is obtained by drilling holes into the earth's crust at places where oil deposits are known to be located. At first, natural gas comes out through the rocks with great pressure. Then petroleum comes out by itself. After the pressure subsides petroleum has to be pumped out of the wells. The crude oil so obtained is a mixture of kerosene, petrol, diesel, lubricants and various other substances, each with its own density and boiling point. The crude oil is

then subjected to "refining". The method used for refining crude petroleum oil is called **"fractional distillation"**.

Refining : The process by which different pure . substances are obtained from a crude substance is called refining.

Fractional distillation : The process by which pure fractions of a crude liquid mixture are separated due to the difference in their respective boiling points is known as fractional distillation. In other words, fractional distillation is a particular type of refining.

The process of refining is carried out in a furnace with a long fractionating column. It is done by :

(i) heating the crude oil up to 400°C in the furnace and

(ii) condensing the vapours of the various fractions of the crude oil inside the fractionating column according to their different boiling points.

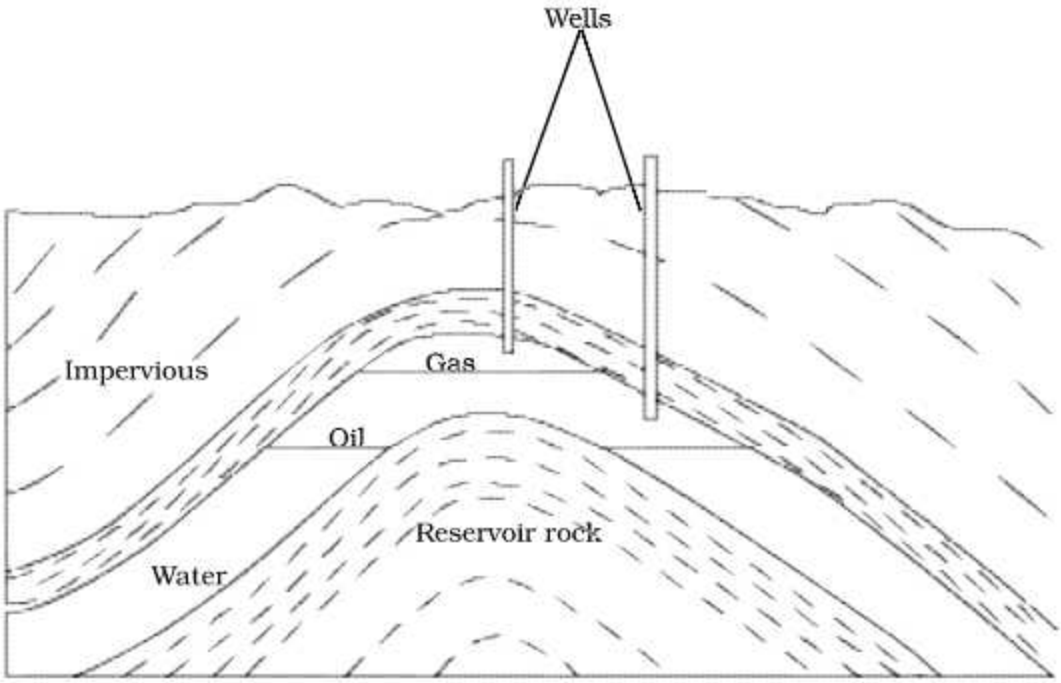


Fig. 3.4 : Petroleum and natural gas resources

Various constituents of petroleum and their uses are given in Table 3.1

Many useful substances are obtained from petroleum and natural gas. These are termed as 'Petrochemicals'. These are used in the manufacture of detergents, fibres (polyester, nylon, acrylic etc.), polythene and other man - made products. Hydrogen gas obtained from natural gas, is used in the production of fertilizers (urea). Due to its great commercial importance, petroluem is also called 'black gold'.

Think and Tell :

Q.1. The word petroleum is derrived from two words. _____

Q.2. 'Black gold' is another name for _____ .

Q.3. Name the fertilizer that is obtained from hydrogen gas.

Fig. 3.5 Crude oil under the earth's surface.

3.3 NATURAL GAS

Natural gas is another fossil fuel obtained from oil wells. It occurs in a layer reserve just above the layer of crude petroleum, trapped between two layers of impervious rock.

Natural gas is a very important fossil fuel because it is easy to transport through pipes. Natural gas is stored under high pressure as compressed natural gas (CNG). CNG is used for power generation. It is now being used as a fuel for transport vehicles because it is less polluting. It is a cleaner fuel.

The great advantages of CNG is that it can be used directly for buring in homes and factories where it can be supplied through pipes. Such a network of pipelines exists in vadodara (Gujarat), Some parts of Delhi and other places.

Natural gas is also used as a starting material for the manufacture of a number of chemicals and fertilisers. India has vast reserves of natural gas. In our country, natural gas has been found in Tripura, Rajasthan, Maharashtra and in the Krishna Godavari delta.

Table 3.2 Various constituent of Petroleum and their uses.

S.No	Constituents of Petroleum	Uses
1.	Petroleum Gas in Liquid fom (LPG)	Fuel form home and industry
2.	Petrol	Motor fuel, aviation fuel, solvent for dry cleaning
3.	Kerosene	Fuel for stoves, lamps and for jet aircrafts
4.	Diesel	Fuel for heavy motor vehicles, electric generators
5.	Lubricating oil	Lubrication
6.	Paraffin wax	Ointment,candles,vaseline etc.
7.	Bitumen	Paints, road surfacing

3.4 SOME NATURAL RESOURCES ARE LIMITED

You have studied in the beginning of the chapter that some natural resources are exhaustible like fossil fuel, forests, mineral etc.

You know that coal and petroleum are fossil fuels. It required the dead organisms millions of years to get converted into these fuels. On the other hand, the known reserves of these will last only a few hundred years. Moreover, buring of these fuels is a major cause of air pollution. Their use is also linked to global warming. It is therefore necessary that we use these fuels only when absolutely necessary. This will result in better environment, smaller risk of global warming and their availability for a longer period of time.

In India, the petroleum Conservation Research Association (PCRA) advises people how to save petrol/diesel while driving. Their tips are :-

- Drive at a constant and moderate speed as far as possible,
- Switch off the engine at traffic lights or at a place where you have to wait,
- Ensure correct tyre pressure.
- Ensure regular maintenance of the vehicle.

Can you suggest some practices to be followed in kitchen while cooking food to save fuel ?

POINTS TO REMEMBER

- Coal, petroleum and natural gas are fossil fuels.
- Fossil fuels were formed from the dead remains of living organisms that are burried inside earth millions of years ago.
- Fossil fuels are exhaustible resources.
- Coke, coal tar and coal gas are the products of coal.
- Petroleum gas, petrol, diesel, kerosene, paraffin wax, lubricating oil are obtained through refining of petroleum.
- Coal and petroleum resources are limited. We should use them judiciously.
- Carbon occurs in all living matter and from substances derived from living matter (food and fuel).
- Graphite, diamond and fullerenes are crystalline allotropes of carbon.
- Diamond is the hardest naturally occuring substance known.
- Fullerenes are discovered only recently.
- Amorphous carbon has different forms: coal, coke, charcoal, lamp black and gas carbon. All are not pure.
- Coal, coke and charcoal are used as fuels.
- Coal, petroleum and natural gas are called fossil fuels because they are derived from the remains of plants and animals.

Keywords

- Coal
- Coal gas
- Coal tar
- Coke
- Fossil Fuel
- Natural gas
- Petroleum
- Petroleum refinery

EXERCISE

I. Fill in the blanks :

(i) Coal and Petroleum are ..... fuels.

(ii) Air, sunlight which can not be totally consumed by human beings are called ..... Natural Resources.

(iii) Conversion of buried dead vegetation into coal is called .....

(iv) Burning of coal in air or oxygen produces ..... gas.

II. Write True (T) or False (F) for the following.

(i) Fossil fuels can be made in the laboratory.

(ii) CNG is more polluting than diesel.

(iii) Coke is almost purest form of carbon.

(iv) Coal and petroleum are in exhaustible natural resources of energy.

(v) Coal-tar is mixture of various substance.

III. Match the correct answers from column with their alternatives in column -I

Column -I	Column - II
(i) Used as fuel in kitchens	(a) CNG
(ii) Least polluting fuel for vehicles	(b) Coal gas
(iii) This gas is produced during heating of coal	(c) L.P.G

IV. Choose the correct answer from the multiple answers (MCQ)

(i) The best quality coal is :

(a) Peat (b) Lignite

(c) Bituminous (d) Anthracite

(ii) It is a renewable energy resource

(a) Coal (b) Petroleum

(c) Wind (d) Natural Gas

(iii) This state does not have any coal mine

(a) Odissa (b) Punjab

(c) Jharkhand (d) West Bengal

(iv) This product of coal is used for

(a) Coaltar (b) Coke

(c) Naphthalene (d) Benzene

V. Very Short answer type questions :

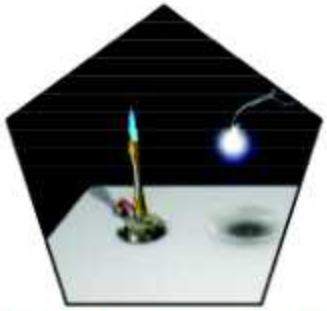
1. Name any two In exhaustible sources of energy.
2. What are petrochemicals ?
3. In which state of India is the largest coal mine located ?
4. Which variety of coal is found in most of the coal-mines in India ?
5. Where is Natural Gas found in India ?

VI. Short answer type questions :

6. What are various varieties of coal ?
7. What are exhaustible Natural Resources ? Give examples.
8. What do you mean by Carbonisation ?
9. How are various products of Coal obtained ?
10. Why is Natural gas called cleaner fuel ?
11. Write some harmful effects of burning of fossil fuels.

VII. Long answer type questions :

12. Write the tips advised by Petroleum conservation Research Association (PMCRA) to save petrol/diesel.
13. Write various constituents obtained from fractional distillation of Petroleum. Also write their uses.
14. Write uses of coke and coal tar.



CHAPTER - 4

Combustion And Flame

Fire has played a very crucial role in the life of human beings. The control of fire by early humans was a turning point in the technological evolution of human beings. Fire provided a source of warmth, protection from predators, a way to create more advanced hunting tools, and a method for cooking food. These cultural advances allowed human geographic dispersal, cultural innovations, and changes in diet and behavior. Additionally, creating fire allowed human activity to continue into the dark and colder hours of the evening.

Have you ever thought where this fire comes from ? The one thing that comes to our mind when we think of fire is match stick box. All of us use match stick in our daily life. Have you ever thought what makes the match stick to burn so easily and produce flame ? When a match stick is rubbed against the side of matchbox, friction heats the head to a temperature at which the chemicals react and generate more heat than can escape into the air, and they burn with a flame. If wind blows away the heat or the chemicals are moist or friction does not raise the temperature sufficiently, the match stick goes off. If properly ignited, the heat from the

flame raises the temperature of a nearby layer of the matchstick and of oxygen in the air adjacent to it, and the match stick and oxygen react in a combustion reaction.

4.1 COMBUSTION

Combustion is a chemical process in which a substance reacts with oxygen to give off heat and light. The substances that burn in air or oxygen to produce heat and light are called **combustible substances**where as the substances that do not burn in air or oxygen are called **non-combustible substances.**

Recall the activity of burning of magnesium ribbon performed in Class VII. We learnt that magnesium burns to form magnesium oxide and produces heat and light (Fig. 4.1). We can perform a similar activity with a piece of charcoal. Hold the piece with a pair of tongs and bring it near the flame of a candle or a Bunsen burner.

What do you observe ? We find that charcoal burns in air producing carbon dioxide, heat and light. A chemical process in which a substance reacts with oxygen to give off heat is called **combustion**. The substances that undergo combustion are said to be **combustible**. It is also called a **fuel**. The fuel may be solid, liquid or gas. Sometimes light is also given off during combustion either as a flame or as a glow.

In the reactions mentioned above, magnesium and charcoal are combustible substances.

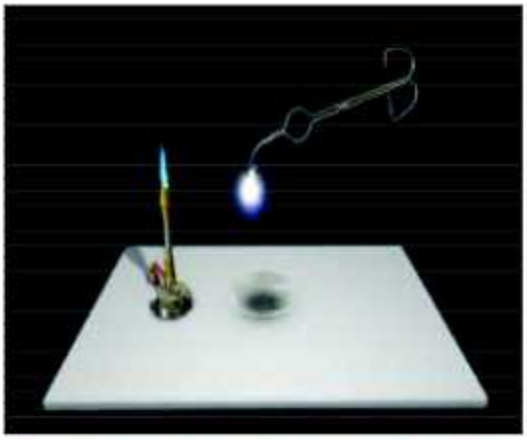


Fig. 4.1 Burning of magnesium ribbon

Activity 4.1 Physical and Chemical Aspects of Combustion

Material required : Piece of wood, match sticks, kerosene oil, newspaper, iron rod, stone pieces, glass, plastic etc.

Procedure : Collect some materials like piece of wood, matchsticks, kerosene oil, newspaper, iron rod, stone pieces, glass, plastic etc. Do under the supervision of your teacher. Try to burn each of these materials one by one. If combustion takes place, mark the material combustible, otherwise mark it as non-combustible (Table 4.1).

Observation : Piece of wood, match sticks, kerosene oil, newspaper start burning.

Conclusion : Piece of wood, match sticks, kerosene oil and newspaper are combustible while iron rod, stone pieces, glass and plastic are non-combustible.

Table 4.1 : Combustible and noncombustible Substances

Materials	Combustible	Noncombustible
Plastics		
Wood		
Newspaper		
Iron rod		
Kerosene oil		
Coconut oil		
Marble piece		
Straw		
Matchstick		
Charcoal		
Glass		

Can you name some more substances which are combustible ?

Activity 4.2 Air is essential for burning.

Material required : A candle, a glass chimney, few wooden blocks, a glass plate, matchbox.

Caution : Be careful while handling burning candle.

Procedure : Fix a lighted candle on a table. Put a glass chimney over the candle and rest it on a few wooden blocks in such a way that air can enter the chimney [Fig. 4.2 (a)]. Observe what happens to the flame. Now remove the blocks and let the chimney rest on the table [Fig. 4.2 (b)]. Again observe the flame. Finally, put a glass plate over the chimney [Fig. 4.2 (c)]. Watch the flame again.

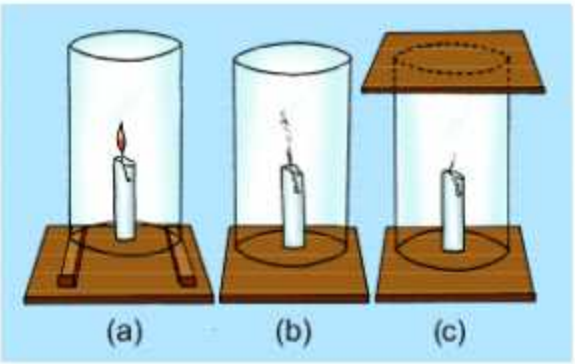


Fig. 4.2 : Experiment to show that air is essential for burning

Observation : The candle with the open glass chiney will keep on burning [Fig 4.2 (a)]. The candle placed on table with open glass chimney will flicker with smoke [Fig. 4.2 (b)]. The candle in the glass chimney covered

with wooden block will go off after some time. [Fig. 4.2 (c)].

Conclusion : You know that for combustion, air is necessary. The candle burns freely in case (a) where air can enter the chimney from below. In case (b), where air does not enter the chimney from below, the flame flickers and produces smoke. In case (c), the flame finally goes off because the air is not available.

Questions :

Q.1. What happens in the three cases ?

Q.2. When does the flame flicker off ?

Q.3. When does it flicker and give smoke ?

Q.4. Does it burn unaffected ?

Q.5. Can you infer anything at all about the role played by air in the process of burning ?

Can you just imagine what kind of combustion takes place in sun ?

In the sun, heat and light are produced by nuclear reactions. You will learn about this process in higher classes.

You might be aware of the fact that when the clothes of a person catch fire, a cloth or a blanket is wrapped around the person to extinguish fire (Fig. 4.3). Can you imagine why ?

Fig. 4.3 Blanket wrapped around a person who has caught fire.

4.1.1 Ignition temperature

Why doesn't a matchstick catch fire by itself ?

Why do we need a paper or kerosene oil to start fire on wood or coal ?

Have you ever seen cooking oil catching fire when a frying pan is kept for long on a burning stove ? Have you ever heard of forest fire ?

So, of course, a matchstick doesn't catch fire by itself. It starts burning on rubbing it on the side of the matchbox as explained at start of the lesson. Of course, we need a paper or kerosene oil to start fire on a piece of wood or coal.

Yes, cooking oil also catches fire when a frying pan is kept for long on fire. And yes if you have heard of forest fire, it happens because due to extreme heat of summer, at some places dry grasses catch fire. From grasses, it spreads to trees, and very soon the whole forest is on fire (Fig. 4.4). It is very difficult to control such fires.

These experiences tell us that different substances catch fire at different temperatures. The lowest minimum temperature at which a substance catches fire is called its **ignition temperature**.

We find that a combustible substance cannot catch fire or burn as long as its temperature is lower than its ignition temperature. Kerosene oil and wood do not catch fire at its own at room temperature. But, if kerosene oil is heated a little, it will catch fire. But if wood is heated a little, it would still not catch fire. Does it mean that ignition temperature of kerosene oil is lower than that of wood ? Does it mean that we need to take special care in storing kerosene oil ?

Fig 4.4 : Forest Fire

Activity 4.3 : Substances with low ignition temperature do not catch fire.

Material Required : a candle, sheet of papers, water, Matchbox.

Procedure : Make two paper cups by folding a sheet of paper. Pour about 60 mL of water in one of the cups. Heat both the cups separately with a candle (Fig. 4.5.)

Observation : The cup containing water will not burn whereas the empty will get burned.

Conclusion : The heat supplied to the paper cup is transferred to water by conduction. The ignition temperature of paper is not reached due to water. Hence, it does not burn.

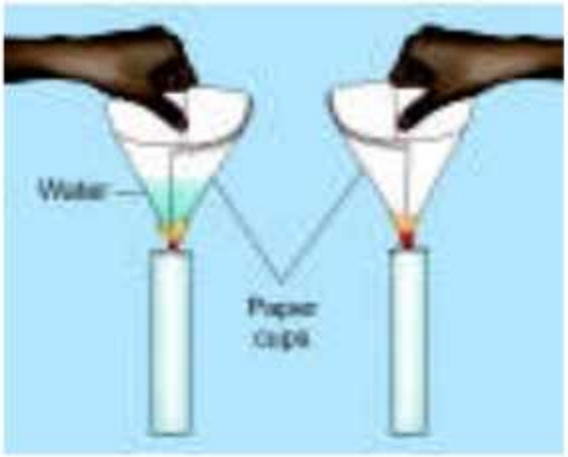


Fig. 4.5 : Heating water in a paper cup

The substances which have very low ignition temperature and can easily catch fire with a flame are called **inflammable substances**. Examples of inflammable substances are petrol, alcohol, liquefied Petroleum Gas (LPG), etc. Can you list some more inflammable substances ?

Forest Fire Prevention Tips :

- Obey local laws regarding campfire.
- Keep all flammable objects away from fire.
- Have firefighting tools nearby and handy.
- Carefully dispose of hot charcoal.
- Drown all fires.
- Carefully extinguish smoking materials.

Did you know ?

Combustion, also known as burning, is the basic chemical process of releasing energy from air fuel and air mixture. In an internal combustion engine (ICE), the ignition and combustion of the fuel occurs within the engine itself. The engine then partially converts the energy from the combustion to work.

4.1.2 Breaking the Fire Triangle

A fire triangle is made of three elements namely, heat, oxygen and fuel. Removing anyone of these elements is the basic step to stop fire and will prevent the fire from spreading.

Fig. 4.6 Breaking the fire triangle

Equipments such as fire extinguishers and fire blankets will help to break the fire triangle.

4.2 HOW DO WE CONTROL FIRE ?

You must have seen or heard of fire breaking out in homes, shops and factories. If you have seen such an accident, write a short description in your note book. Also, share the experience with your classmates. Does your city/ town have a fire brigade station ? When a fire brigade arrives, what does it do ? It pours water on the fire (Fig. 4.7). Water cools the combustible material so that its temperature is brought below its ignition temperature. This prevents the fire from spreading. Water vapours also surround the combustible material, helping in cutting off the supply of air. So, the fire is extinguished. You have learnt that there are three essential requirements for producing fire. Can you list these requirements ? These are : fuel, air (to supply oxygen) and heat (to raise the temperature of the fuel beyond

the ignition temperature). Fire can be controlled by removing one or more of these requirements. The job of a fire extinguisher is to cut of the supply of air, or to bring down the temperature of the fuel, or both. Notice that the fuel in most cases cannot be eliminated. If, for instance, a building catches fire, the whole building is the fuel.

Fig. 4.7. Firemen extinguish the fire by throwing water under pressure

The most common fire extinguisher is water. But water works only when things like wood and paper are on fire. If electrical equipment is on fire, water may conduct electricity and harm those trying to douse the fire. Water is also not suitable for fires involving oil and petrol. Do you recall that water is heavier than oil ? So, it sinks below the oil, and oil keeps burning on top.

Fig. 4.8 Fire extinguisher

4.2.1 How does fire extinguisher work ?

For fires involving electrical equipment and inflammable materials like petrol, carbon dioxide CO_2 is the best extinguisher. CO_2 being heavier than oxygen, covers the fire like a blanket. Since the contact between the fuel and oxygen is cut off, the fire is controlled. The added advantage of CO_2 is that in most cases, it does not harm the electrical equipment. How do we get supply of carbon dioxide.

It can be stored at high pressure as a liquid in cylinders. In what form is the LPG stored in cylinders ? When released from the cylinder, CO_2 expands enormously in volume and cools down. So it not only forms a blanket around the fire, it also brings down the temperature of the

fuel. That is why it is an excellent fire extinguisher. Another way to get CO_2 is to release a lot of dry powder of chemicals like sodium bicarbonate (baking soda) or potassium bicarbonate. Near the fire, these chemicals give off CO_2.

4.3 TYPES OF COMBUSTION

Bring a burning matchstick or a gas lighter near a gas stove in the kitchen. Turn on the knob of the gas stove. What do you observe ? We find that the gas burns rapidly and produces heat and light. Such combustion is known as **rapid combustion**. Others examples are burning of CNG and petrol,

There are substances like phosphorus which burn in air at room temperature. The type of combustion in which a material suddenly bursts into flames, without the application of any apparent cause is called **spontaneous combustion.**

4.4 FLAME

Observe the flame of fire chullah, LPG flame, a candle flame. Can you tell the colour of the various flames ?

Recall your experience of burning a magnesium ribbon in class VII. If you do not have any experience of burning the remaining items in table 4.2, you can do now and record your observations.

Spontaneous combustion of coal dust has resulted in many disastrous fires in coal mines. Spontaneous forest fire are sometimes due to the heat of the sun or due to lightning strike. However, most forest fires are due to the carelessness of human beings. It is important to remember that the campfires must be completely extinguished before leaving a forest.

Do You Know ?

A flame (from Latin flamma) is the visible, gaseous part of a fire. It is caused by a highly exothermic reaction taking place in a thin zone. Very hot flames are hot enough to have ionized gaseous components of sufficient density to be considered plasma.

Table 4.2 Materials forming flame on burning

S. No.	Material	Forms Flame	Does not from flame
1.	Magnesium		
2.	Camphor		
3.	Candle		
4.	Burner		
5.	Charcoal		

Fig. 4.9 : Colours of chullah flame, candle flame and LPG flame

4.4.1 Structure of Candle Flame

The substances which vaporize during burning, give flames. For example, kerosene oil and molten wax rise through the wick. They vaporize during burning and form flames. Charcoal, on the other hand, does not vaporize and so does not produce a flame. In Activity 4.4, will the vapours of wax coming out of the glass tube are the cause of the flame produced ?

Activity 4.4 : To observe the zones of a candle flame.

Materials required : a candle, a glass tube, a pair of tongs a thin a copper wire, a matchbox, a glass plate.

Procedure : Light a candle. Hold a glass tube with a pair of tongs and introduce its one end in the dark zone of a non-fickering candle flame [Fig. 4.10. (a)]. Bring a lighted matchstick near the other end of the glass tube Do you see a flame ? If so, what Is it that produces a flame ? Notice that the wax near the heated wick melts quickly.

When the candle flame is steady, introduce a clean glass plate/slide into the luminous zone of the flame [Fig. 4.8 (b)]. Hold it there with a pair of tongs for about 10 seconds. Then remove it. What do you observe ?

Fig. 4.10 (a)

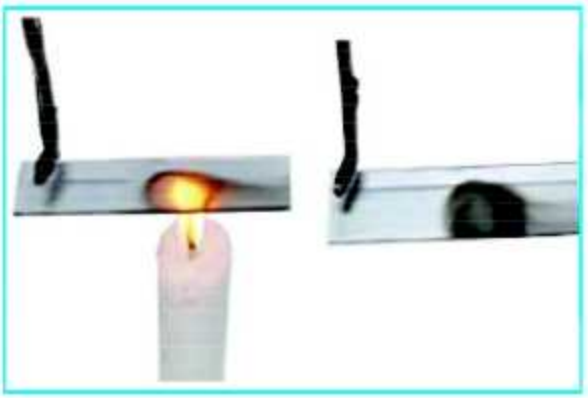


Fig. 4.10 (b)

Fig. 4.10 (c)

A circular blackish ring is formed on the glass plate/slide. It indicates the deposition of unburnt carbon particles present in the luminous zone of the flame. Hold a thin long copper wire just inside the flame for about 30 seconds [Fig. 4.10 (c)].

Notice that the portion of the copper wire just outside the flame gets red hot. Does it indicate that the non-luminous zone of the flame has a high temperature ? In fact, this part of the flame is the hottest part [Fig. 4.11].

Goldsmiths blow the outermost zone of a flame with a metallic blow-pipe for melting gold and silver (Fig. 4.12.) Why do they use the outermost zone of the flame ?

4.4.2 Parts or zones of a flame

Inner Part : This is the part closest to the wick and is the least hot. This is the black part of the flame that contains unburnt particles of the carbon from the unburnt wick.

Middle part : Largest part of the flame with colours in various shades of yellow and orange. This is the luminous flame as it emits light.

This part is also not extremely hot as it gets a limited supply of oxygen (from air) and incomplete combustion takes place here.

Outer Part : This is the hottest part of the flame which burns with blue colour. Being outer part it gets full supply of oxygen so complete **combustion** of fuel takes place. It is non luminous and it does not emit light.

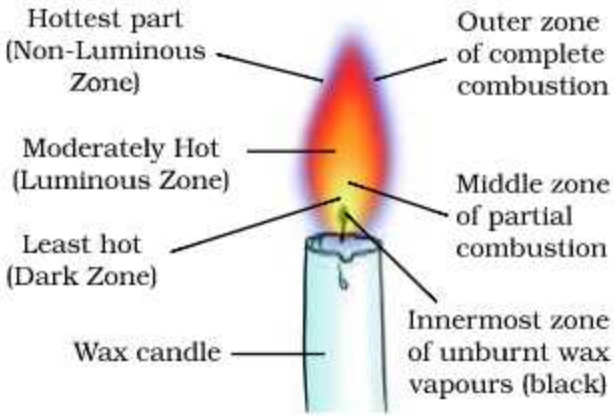


Fig. 4.11 Structure of Candle Flame

Fig. 4.12 Goldsmith blowing through metallic pipe

4.5 WHAT IS A FUEL ?

Fuel is a substance that is burnt to produce nuclear energy, heat or power. Materials like coal, wood, oil, or gas can provide heat when burnt. Methanol, Gasonline, Diesel, Charcoal Wood, Natural gas, Hydrogen are some examples of fuel. Nuclear energy is produced by various processes in nuclear reactors. A good fuel is one which is readily available. It is cheap. It burns easily in air at a moderate rate. It produces a large amount of heat. It does not leave behind any undesirable substances. There is probably no fuel that could be considered as an ideal fuel. We should look for a fuel which fulfills most of the requirements for a particular use. Fuels differ in their cost. Some fuels are cheaper than others. Make a list of fuels familiar to you. Group them as solid, liquid and gaseous fuels as in Table 4.3.

Table 4.3 Types of fuels.

S.No.	Solid Fuels	Liquid fuels	Gaseous fuels
1.	Wood	Kerosene oil	LPG
2.			
3.			
4.			
5.			
6.			

4.5.1 Fuel Efficiency

At its most fundamental, fuel-efficiency refers to the ability of a vehicle to extract energy from fuel. The more energy a vehicle can extract from fuel, the greater fuel-efficiency the vehicle is said to have. Similarly, the less energy a vehicle extracts, the less fuel-efficient the vehicle is. Suppose you were asked to boil a given quantity of water using cow dung, coal and LPG as fuel. Which fuel would you prefer ? Give your reason. You may take the help of your parents. Do these three fuels produce the same amount of heat ? The amount of heat energy produced on complete combustion of 1 kg of a fuel is called its **calorific value**. The calorific value of a fuel is expressed in a unit called kilojoule per kilogram (kJ/kg).

Hence in simple words the amount of heat produced by the complete combustion of unit mass of a fuel is known as fuel or calorific value. Calorific values of some fuels are given in Table 4.4.

Table 4.4 : Calorific Values of Different Fuels

S.No.	Fuel	Calorific Value (kJ/Kg)
1.	Cow dung cake	6000-8000
2.	Wood	17000-22000
3.	Coal	25-33000
4.	Petrol	45000
5.	Kerosene	45000
6.	Diesel	45000
7.	Methane	50000
8.	CNG	50000
9.	LPG	55000
10.	Biogas	35000-40000
11.	hydrogen	150000

4.5.2 Why is burning of Fuels harmful to us ?

The more usage/ consumption of fuels has an extremely bad effect on atmosphere.

1. Carbon fuels like wood, coal petroleum release unburnt carbon particles. These fine particles are dangerous pollutants causing respiratory diseases, such as asthma.
2. Incomplete combustion of these fuels gives carbon monoxide gas. It is a very poisonous gas. It is dangerous to burn coal in a closed room. The carbon monoxide gas produced can kill persons sleeping in that room.
3. Combustion of most fuels releases carbon dioxide in the environment. Increased concentration of carbon dioxide in the air is believed to cause global warming.
4. Burning of coal and diesel releases sulphur dioxide gas. It is an extremely suffocating and corrosive gas. Moreover, petrol engines give off gaseous oxides of nitrogen. Oxides of sulphur and nitrogen dissolve in rain water and form acids. Such rain is called acid rain. It is very harmful for crops, buildings and soil. You have already learnt about it in Class VII. The use of

diesel and petrol as fuels in automobiles is being replaced by CNG (Compressed Natural Gas), because CNG produces the harmful products in very small amounts CNG is a cleaner fuel.

So, that is why we are advised never to sleep in a room with burning or smouldering coal fire in it.

Acid Rain : is a wet deposition that contains acidic components such as sulphuric acid and nitric acid that fall on the ground from the atmosphere.

For centuries, wood was used as domestic and industrial fuel. But now it has been replaced by coal and other fuels like LPG. In many rural parts of our country, people still use wood as a fuel because of its easy availability and low cost. However, burning of wood gives a lot of smoke which is very harmful for human beings. It causes respiratory problem. Also, trees provide us with useful substances which are lost when wood is used as fuel. Moreover cutting of trees leads to deforestation which is quite harmful to the environment, as you learnt in Class VII.

POINTS TO REMEMBER

- The substances which burn in air are called combustible.
- Oxygen (in air) is essential for combustion.
- During the process of combustion, heat and light are given out.
- Ignition temperature is the lowest temperature at which a combustible substance catches fire.
- Inflammable substances have very low ignition temperature.
- Fire can be controlled by removing one or more requirements essential for producing fire.
- Water is commonly used to control fires.
- Water cannot be used to control fires involving electrical equipments or oils.
- There are various types of combustions such as rapid combustion, spontaneous combustion, explosion, etc.,
- There are three different zones of a flame-dark zone, luminous zone and non-luminous zone.

- An ideal fuel is cheap, readily available, readily combustible and easy to transport. It has high calorific value. It does not produce gases or residues that pollute the environment.
- Fuels differ in their efficiency and cost.
- Fuel efficiency is expressed in terms of its calorific value which is expressed in units of kilojoule per kilogram (KJ/kg)
- Unburnt carbon particles in air are dangerous pollutants causing respiratory problems.
- Incomplete combustion of a fuel gives poisonous carbon monoxide gas.
- Increased percentage of carbon dioxide in air has been linked to global warming.
- Oxides of sulphur and nitrogen produced by the burning of coal, diesel and petrol causes acid rain which is harmful for crops, buildings and soil.

Global warming :is the rise in temperature of the atmosphere of the earth. This results in the melting of polar glaciers, which leads to a rise in the sea level, causing floods in the coastal areas. Low lying coastal areas may even be permanently submerged under water.

I. Multiple Choice Questions :

(i) Which of the following gases is used in combustion

(a) Hydrogen

(b) Oxygen

(c) Nitrogen

(d) Carbon dioxide

(ii) The burning of CNG (compressed Natural Gas) is an example of

(a) rapid combustion

(b) spontaneous combustion

(c) slow combustion

(d) none of the above

(iii) Which of the following is an example of spontaneous combustion ?

(a) Burning of petrol

(b) Burning of magnesium ribbon

(c) Burning of camphor

(d) Burning of white phosphorous

(iv) The minimum temperature at which a fuel catches fire is

(a) Melting temperature

(b) Boling temperature

(c) Ignition temperature

(d) None of these

II. Fill in the blanks :

(i) Calorific value of LPG is .....

(ii) ..... part of a flame is the hottest.

(iii) ..... is necessary for combustion.

(iv) Burning of wood and coal causes ..... of air.

(v) A liquid fuel, used in homes is .....

(vi) Fuel must be heated to its ..... before it starts burning.

(vii) Fire produced by oil cannot be controlled by .....

III. True And False :

(i) Burning of camphor is rapid combustion.

(ii) Combustion is a physical change.

(iii) Air is essential for combustion

(iv) Fire caused due to oil can be extinguished by water.

IV. Match the following :

(i)	LPG	(i)	kJ/kg
(ii)	Calorfic value	(ii)	rapid combustion
(iii)	Fire extinguisher	(iii)	Non-combustible
(iv)	Glass	(iv)	CO_2

V. Very short answer type questions :-

(1) List the conditions under which combustion can take place.

(2) Define Ignition temperature

VI. Short answer type question :-

(i) Water is not used to control fires involving electrical equipment. Why ?

(ii) Paper by itself catches fire easily whereas a piece of paper wrapped around an aluminium pipe does not. Why ?

(iii) Name the unit to measure the calorific value of fuel.

(iv) It is difficult to burn leap of green leaf but dry leaves catch fire easily. Explain.

VII. Long Answer type questions :-

(i) What are different parts of a Candle flame ? Explain using labelled diagram.

(ii) Explain how a fire extinguisher works.

(iii) Define calorific value of a fuel ? Give units.

(iv) What is combustion ? Write its types.

CHAPTER - 5

Conservation of Plants And Animals

Plants and animals constitute the most important biotic component of our ecosystem. Presence of different species of organisms increases biodiversity of that area. Forests are generally full of biodiversity. Large number of plants of one or two species, do not make a forest.**A forest is an ecosystem that has varied species of plants, animals and micro-organisms.**It takes thousands of years to evolve a forest. Unchecked human interference causes a great damage to the forests.

5.1 DEFORESTATION AND IT'S CAUSES

A forest rich in different types of organisms is called a mega biodiversity area. The areas where mega biodiversity is found are called hot spots of **biodiversity**. There are seventeen countries of the world where mega biodiversity is found. India is one of those countries. It has three mega biodiversity rich areas or hot spots. But we are losing our plants and animals at an alarming rate. About 150 species of medicinal plants have become extinct. Same is the fate of animals. Indian Cheetah has become extinct. Besides, Tiger, Asiatic lion and one horned Rhinoceros are under threat. Animals require food and shelter (habitat) for their survival. Forests require a wide land area rich in minerals and nutrients. But forests are regularly cleared for making agricultural land, because earlier agricultural land has been engulfed by roads, industries and urbanization. Cutting of forests and using land for other purposes is called **deforestation**. Deforestation may be caused by natural factors or human activities.

Fig. 5.1 Deforestation

5.1.1 Natural Causes of Deforestation

1. Earthquakes bring devastating changes on earth and deforestation is one of them.
2. Draughts also change the forest land into desert area.
3. Heavy rains and snowfall cause landslides. This results in deforestation.
4. Forest fire is the major cause of deforestation.

Figure 5.2 : Forest Fire

5. Exotic breeds of plants or weeds also destroy our forests.

5.1.2 Human Activities Responsible For Deforestation

Various natural factors have not deforested as much forest area as a single human species has deforested by following activities.

1. Forests were cleared for industrialization.
2. Mining for coal, minerals, sand and stones have resulted in loss of forests.

Figure 5.3: Mining

3. Forests have also been cleared for preparing land for agriculture and growing crops.
4. For obtaining fire wood and furniture wood.
5. Forests are destroyed by over grazing of cattle and disturbing food chain by killing Tigers.
6. Clearing of forests for constructing dams, roads and laying railway tracks.

5.2 CONSEQUENCES OF DEFORESTATION

Effects of deforestation can be seen by visiting places where forests were in abundance, a century ago and now they have turned into barren land. Kandi area of Punjab, Himachal and Jammu falling under Shivalik region suffered a great loss of forests after independence. Many forests were cleared. Overhunting of Tigers also disturbed food chains and domestic cattle destroyed grass covered forests by grazing and making top soil porous and prone to be washed away by wind as well as water.

Activity 5.1

Visit any one village near a Kandi area of Punjab. These areas are situated at foot hills in the district of Roopnagar, Shaheed Bhagat Singh Nagar, Hoshiarpur and Pathankot. Meet some villagers of the age 60 to 70 years. Ask them about forests, some causes of deforestation and the consequences of deforestation. Discuss about **reforestation** also.

Figure 5.4 : Desertification

You will know that these areas were rich green and were mega biodiversity areas before sixties of last century. Overgrazing, killing of Tigers, cutting of trees were main causes of deforestation. Deforestation resulted in barren hills that brought floods and draughts. Draughts also turned agricultural land into deserts. **Turning of forest covered land into deserts is called Desertification.** To combat desertification, June 17 is celebrated as, "World Day to combat Desert and Desertification and Draught".

Think and Answer :

Q.1. Name any two districts of Kandi area of Punjab.

Q.2. Write any two causes of deforestation.

5.3 CONSERVATION OF FORESTS AND WILD LIFE

Deforestation resulted in the loss of habitats of many wild animals and many species became extinct or endangered. To save these species from extinction and conserve forests, "Ministry of Environment, Forest and Climate change", Govt. of India has taken many steps. Some of the steps to conserve forests and wildlife are :

1. Conservation Acts : Govrnment of India has passed many acts to save wildlife such as : The Wildlife Protection Act, The Forest Conservation Act and The Biodiversity Act.

2.International Treaties and conventions : India has adopted many International Treaties and Conventions. Ramsar convention on Wetlands (02 Feb, 1972 Ramsar lake, Iran), the convention on International Trade in endangered species of Wild Fauna (animals) and Flora (plants) and the convention of Biological diversity. People are made aware of the importance of wetlands and biodiversity. World wetland day is celebrated on February 2 every year. World forest day is celebrated on March 21 every year. International

biodiversity Day is celebrated on 22 May. These days remind us about our duty to conserve wetlands, forests and biodiversity. In Punjab there are six wetlands of international importance i.e. Ramsar sites. These include Roopnagar wetland, Kanjli wetland (Kapurthala), Harike wetland, Beas conservation reserve, Nangal wildlife sanctuary and Keshopur Miani wetland.

Fig. 5.5 (a) : Roopnagar Wetland

Fig. 5.5 (b) : Kanjli Wetland

Fig. 5.5 (c) : Harike Wetland

3. National Parks and Wildlife sanctuaries : Conservation of local flora and fauna is done by declaring certain forest areas as wildlife sanctuaries and National Parks. A wildlife sanctuary is a forest, from where local people can cut grass for their cattle and collect fallen dry woods to use as firewood. But they are not allowed to cut trees. These sanctuaries provide a natural habitat to the wild animals.

In Punjab there are many wildlife sanctuaries for protection of wildlife. For example Takhni Rehmapur in Hoshiarpur, Keshopur Mehsana (Chhamb) in Gurdaspur, Kathlur near Narot Jaimal Singh in Pathankot, Wildlife sanctuary in Abohar for black buck.

A National Park is completely

Fig. 5.6 (a) : Jim Corbett National Park (Uttara Khand)

Fig. 5.6 (b) : Kanha National Park (M.P.)

Fig. 5.6 (c) : Gir National Park (Gujrat)

Fig. 5.6 (d) : Kaziranga National Park (Assam)

Figure 7.6 : National paks of India

protected area. People are not allowed to enter the National Park without permission of the Forest Department. Both National Parks and Wildlife Sanctuaries are guarded by Forest department. There are 500-551 wildlife sanctuaries in India. Kanha National park in Madhya Pradesh is protected area for Tigers, Kaziranga National Park in Assam for one horned Rhinoceros, Gir forest in Gujrat for Asiatic Lions and Jim Corbett National park for Bengal Tiger in Uttarakhand.

Some facts about National Parks :

- According to 2022 National survey there are 106 National parks in India. These parks are to be increased to 181.
- There are 6500 National parks in the world.
- U.S.A has maximum National parks 1872. The first National park established in the world was Yellowstone National park U.S.A in 1872.
- Largest National park in the world is North East Greenland National park.
- In 1936, Jim Corbett National Park in Uttarakhand was declared as India's first National park.
- India has maximum National parks in M.P. and Andaman and Nicobar (9 each).
- There is no National park in Punjab.
- One horned Rhinoceros is found only in India.
- India has largest number of Elephants. To Save Elephants in India, Project Elephant was launched in 1992.

Fig. 5.7 (a) : Rehmapur, Takhni, Wild Life Sanctuary, Hoshiarpur.

Fig. 5.7 (b) : Black buck in Wild Life Sanctuary, Abhohar

Figure 5.7 : Wild Life sanctuaries in Punjab

Some of India's National symbols are :

National Animal	:	Tiger
National Bird	:	Peacock
National Tree	:	Banyan
National Flower	:	Lotus
National Aquatic animal	:	Dolphin
National River	:	Ganges

Tink and Answer :

Q.1. Name the wild life sanctuary in your district or adjoining district and write its location.

Q.2. Name any two wild animals seen in the sanctuary.

Activity 5.2

With the guidance of your Science teacher, collect more information about wild life sanctuaries in Punjab. Visit a wild life sanctuary in your district or the adjoining district. Collect information about the trees, forests and wild animals in that sanctuary. But do not enter the sanctuary without the permission of forest department and a guide. Some wild animals may attack you.

Conservation Related Projects : Some special projects have been started by the Government of India e.g. Project Tiger, Project Elephant and Project Crocodile. Project Tiger was designed in 1972 and launched in 1973. These projects help to conserve some special species of animals along with other animals.

Setting up of biosphere reserves : Under the world wide network of Biosphere reserves, India has set up 13 Biosphere reserves. These reserves aim to conserve ecosystem as a whole.

National Environment Awareness Campaign : Ministry of Environment, Forests and Climate change, Government of India has launched "National Environment Awareness Campaign" (NEAC) to make people aware of the importance of forests and wildlife. Government institutions and NGOs are also participating actively in this campaign.

Construction of check dams and small projects : Check dams in hilly

areas save forests from erosion. Dams are constructed along small ravines. These dams help to save crops from floods and provide water for irrigation. In Hoshiarpur district such dams are built at Dholbaha, Janauri, Chohal, Saleran and Maili. These dams also have water reservoirs and serve as wetlands and also attract migratory birds. These also save the forests behind the lake.

5.4 CONSERVATION OF FORESTS

If forests are conserved the habitat of many wild animals is conserved and both are saved. Forests can be conserved by following measures :

1. Cutting of trees from a forest must be regulated. More and more saplings must be planted from where trees are cut.
2. Grazing of animals should be discouraged especially before rainy season.
3. More and more Bamboo plants should be planted in forests as their roots check soil erosion.
4. Preventive measures should be adopted against forest fires.
5. Shifting agriculture should be discouraged. (Shifting agriculture is a practice of clearing forests for growing crops after a regular interval of 2 to 3 years).
6. Areas rich in biodiversity must be declared as Forest Reserve.

Fig. 5.8: Bamboo Plantation

Wildlife week is annually celebrated across India between 2nd to 8th October with an aim to protect and preserve the flora and fauna of India.

5.5 FLORA AND FAUNA

Flora and fauna refers to the living organisms found in a forest, field, park, garden or a village. Different species of plants found in a given area constitute the flora of that place. It includes herbs, hard wood bushes or shrubs like wild rose, thorny plants. Trees include Khair, Dalbergia, Neem etc. All animals including small insects, worms, reptiles, birds and mammals found in a given area consitute the fauna of that place.

5.6 ENDEMIC SPECIES

Those species of plants and animals which are found in a particular area and not found all over the world are called **Endemic species**. Many species of plants and animals are found in a forest. But if we visit different forests and observe properly, we will find that some of the species are found in all the forests but some species are confined to a particular area. Many species of bamboo are confined to North-East. Coniferous forests are found in hilly areas.

Wild Bison, Giant Squirrel and Flying Squirrel are found only in Madhya Pradesh. Barking Deer (Kakkar) is found in forests of Kandi area of Punjab and lower Himachal Pradesh. One Horned Rhinoceros is found in forests of Assam and Meghalaya. Yak is found in upper Himachal and Ladakh region. Kashmiri Stag is found in Kashmir. Panda is found in North East of India. Wild Ass is found in Gujrat.

Activity 5.3

Visit a forest and note various species of plants and animals found in that forest. Try to find such plants and animals which you have not seen anywhere else. These are endemic species. Also note their habitat.

5.9 (a) : Barking Deer

5.9 (b) : Panda

5.8 (c) : Flying Squirrel

5.8 (d) : Bison

5.8 (e) : Yak

5.8 (f) : Wild Ass

5.9 (g) : Bamboo

5.8 (h) : Mango

Fig. 5.9 : Endemic species

Think and Answer :

Q.1. Name one endemic species of plant and one of animal found in the forests of Kandi area of Punjab.

Q.2. Write habitat of the endemic species of plants and animals.

5.7 ENDANGERED ANIMALS AND EXTINCT SPECIES

The number of organisms of certain species is decreasing day by day. Some animals which were found in abundance a few years ago are now in very small numbers. Some animals which were very common are not seen now. Animals which were found earlier in our surroundings or in forests but are not found now are called**extinct species**. Cheetah has become extinct from India. Even the small birds like house sparrow are not seen in Punjab for more than ten years.

To bring awareness about small birds. World Sparrow day is celebrated on 20th March every year since 2010.

Number of some animals has fallen rapidly and they are at the verge of extinction. For example : Wild buffalo, one horned Rhinocerous, Tiger, Vulture and Stag (Bara Singha) Animals whose numbers are diminishing to a level that they might face extinction are called**endangered species**. Black Buck, the state mammal of Punjab is also an endangered species. Black bucks are conserved in Sito Gunno wild life sanctuary in Abohar district. Bishnoi community also contributed to save black bucks.

5.10 (a) Wild Buffalo

5.10 (b) : Stag

5.10 (c) : Vulture

5.10 (d) : Tiger

Fig. 5.10 : Endangered Animals

5.8 CAUSES OF EXTINCTION

An Animal is said to become extinct if it is not seen in given area for more than 5-10 years. Animals become extinct due to :

1. **Habitat :**Loss of natural habitat of organisms has resulted in extinction of such organisms.
2. **Overhunting :** If animals are hunted during breeding season then within few years they become extinct.
3. **Lack of adaptations :** Adaptations are the changes developed in the body of an organism in changing habitat. If an animal does not adopt according to the changing habitat, it becomes extinct.

To make people aware of wild animals, first week of October is celebrated as wild life protection week. Entry to zoo is free for students during this week. In Punjab Chhatbir zoo near Zirakpur (Patiala) has many wild animals.

5.9 RED DATA BOOK

International Union for conservation of nature and natural resources (IUCN) has prepared a book called RED DATA BOOK in which the record of endangered species is kept. Different red data books are prepared for plants and animals. From this book you can know about the species found in your area which are endangered and what you can contribute to save such species.

5.10 ECOSYSTEM

An ecosystem is a large area comprising Biotic (Plants, animals and micro-organism) and Abiotic (Air, water, soil and energy) components.

5.11 MIGRATION

Animals migrate during some extreme climatic conditions. Aquatic animals like fish and polar birds migrate when the temperature is very low. Birds from Arctic area migrate to south east Asian countries during the months of winter. They migrate to lakes in these countries. In India there are many lakes and wetlands where we can see these migratory birds.

Fig. 5.11: Migratory Birds

Activity 5.4

Visit a wetland or lake near your village or city in the months of December to February and watch migratory birds there. Note how many species of birds have migrated to that lake or wetland.

Think and Answer :

Q.1. Name two migratory birds that you have watched at a lake or wetland.

Q.2. ..... to ..... months are suitable for watching migratory birds.

5.12 RECYCLING OF PAPER FOR CONSERVATION OF FORESTS

Paper is used for writing books, preparing note books, ledgers, newspapers, packing material etc. Cardboard is made from straw and hard grass and paper is made from soft grass or soft wood. For making one tonne of paper seventeen fully grown trees are cut down. Many chemicals are also used in paper industry to decolourise the pulp which enter the soil and underground water and pollute them. Crushed wood and grass mixed with sodium hydroxide and other chemicals in the form of paste is called pulp. Paper is made from pulp by decolouring it and drying into thin sheets.

If we waste paper, we must remember that we are destroying forests. So we must use paper judiciously and follow the following practices :

1. Write on both sides of the paper and make sure that no blank paper is thrown as waste paper.
2. Do not throw used paper in garbage. Keep them separate and sell them for recycling.
3. To save forests from cutting down for paper industry, follow the Principle of 3R's that is Reduce, Reuse and Recycle. Reduce the use of papers, Reuse printed or written papers for making paper bags and ornamental designs of paper.

5.13 REFORESTATION AND AFORESTATION

Cutting or felling of trees from forests for various uses is called deforestation. While cutting of forests, we should be careful. Trees should not be uprooted. Trees should be cut down by leaving 10-15 cm stalk or stem above the ground. New branches will sprout from these stalks. In place of cut down trees and uprooted dry and old trees new saplings should be planted. Planting new saplings in place of cut or uprooted forests is called**Reforestation**. New plants can also be planted in barren land. Planting of trees in barren land is called **Aforestation**. Forest Department also plants such saplings. We should take care that these saplings are not grazed by animals. Only dry and old trees should be uprooted. Trees cut for other purposes should have a stem/stalk left.

POINTS TO REMEMBER

- Wildlife sanctuaries, National parks, Biosphere reserves and wetlands are the places meant for conservation of forests and wildlife.
- Cutting or felling of trees and clearing forests for building of houses, firewood and agricultural purposes is called deforestation.
- Deforestation results in loss of habitat of many wild animals.
- Plants absorb carbon dioxide from air and reduce pollution and green house effect.
- Different types of species of plants, animals and micro-organisms found in a given area constitute Biodiversity of that place.
- Conversion of a fertile land into deserts is called desertification.
- June 17 is celebrated as International day to combat draughts and Desertification.
- In a wild life sanctuary animals live in their natural habitat but local people can collect firewood and grass from a sanctuary.
- There are 106 National parks in India. India's first National park was declared in 1936, i.e. " Jim Corbett National park" now in Uttarakhand. There is no National park in Punjab.
- There are 6500 National parks in the world. The first National park of the world established in 1872 is The Yellowstone National park, U.S.A.
- A large area meant for conservation of Biodiversity is called a Biosphere reserve.
- To save Tigers and other wild animals, Project Tiger was launched in India in 1973.
- Air, water, Soil and energy are the Abiotic components of an ecosystem. Plants, animals and micro-organisms are the Biotic components of the ecosystem.
- In winter migratory birds come to India and other countries of South Asia covering a distance of six thousand kilometers.
- India has half of worlds Tigers, 65% of Asian Elephants, 85% of one horned Rhinos and 100% of Asian Lions.
- Loss of habitat is the major loss to wild animals.

Keywords

- Forest
- Shrubs
- Nursery
- National Park
- Endemic Species
- Wetlands
- Flora
- Deforestation
- Adaption
- Red Data Book
- Reduce
- Felling
- Grazing
- Conservation
- Trees
- Wild Life Sanctuary
- Forest Reserve
- Endangered Animals
- Biodiversity
- Check Dams
- Aforestation
- Breeding Season
- Migratory Birds
- Reuse
- Uprooting
- Stalk
- Herbs
- Saplings
- Wild
- Rare Species
- Extinct Species
- Fauna
- Bamboo
- Habitat
- Hunting
- Migration
- Recycle
- Pulp
- Sprout

EXERCISE

I. Fill in the blanks :

1. Migratory birds come to India in ..... season.
2. ..... species are found only in a particular area.
3. ..... the state mammal of Punjab is also an endangered animal.
4. First week of ..... is celebrated as wild life protection week.
5. Kanjli wetland is situated in ..... district of Punjab.
6. The process of converting fertile land into a ..... is called desertification.

II. Write True (T) or False (F) :

1. Cutting of trees is a natural cause of deforestation.
2. Wetlands of International level are called Ramsar wetlands.
3. Rehmapur Takhni wild life sanctuary is situated in Hoshiarpur district in Punjab.
4. Panda is endemic animal of Rajasthan.
5. Camel is the state animal of Punjab.
6. Fauna of a place include Herbs, Shrubs and trees.

III. Match Column A with Column B

	A		B
(i)	State mammal of Punjab	(a)	Red Data Book
(ii)	Goat like wild deer found in Kandi Area of Punjab and lower Himachal	(b)	Biodiversity
(iii)	A book having record of endangered species of organisms	(c)	Extinct
(iv)	Presence of so many species of plants, Animals and micro-organims	(d)	Barking deer
(v)	Species which have totally vanished	(e)	Black Buck

IV. Choose the correct answer :

1. International Biodiversity day is celebrated on

   a) 22 February b) 22 March

   c) 22 April d) 22 May

2. 100% of this species of animals is found in India.

   a) Elephants b) Tigers

   c) Asian Lions d) Wild Buffaloes

3. Flying Squirrel is an endemic species of

   a) Gir Forest Gujrat

   (b) Panchmarhi Biosphere Reserve

   c) Kaziranga National park

   d) Jim Corbett National Park

4. This species has become extinct from India

   a) Cheetah

   b) Bengal Tiger

   c) Wild dog

   d) Wild Ass

5. This species is endemic to Gujrat

   a) Wild Ass

   b) Bengal Tiger

   c) Rhinoceros

   d) Elephant

V. Very Short Answer Type Questions :

1. Name any two natural causes of deforestation.
2. Which plant is considered best for checking soil erosion ?
3. In which district are these wild life sanctuaries situated ?

   (i) Sito Gunno wild life sanctuary

   (ii) Kathlour wild life sanctuary

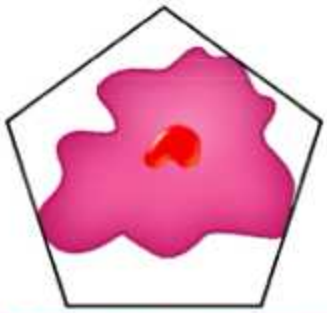
4. Name any two endangered species in India.

VI. Short Answer Type Questions :

5. What do you mean by Deforestation and Reforestation ?
6. What is the difference between endangered species and extinct species?
7. What is Red Data Book ?
8. How does a wild life sanctuary help in conservation of wild life ?
9. Write three causes of extinction of animals.

VII. Long answer type questions in about 40-50 words :

10. What do you mean by shifting agriculture ?
11. What is the purpose of celebrating these days :
    a) World Sparrow day
    b) Forest day
    c) International Biodiversity day
    d) World Wetland day
12. How is paper made ? How does the manufacturing of paper cause deforestation ? What can you do to save paper ?
13. Write various causes of deforestation.
14. What is an ecosystem ? Explain its Biotic and Abiotic components.
15. What are the consequences of deforestation ?



CHAPTER - 6

Reproduction in Animals

Reproduction : All the living organisms have the ability to produce young ones of their own kind. This ability is known as reproduction. The young ones produced are called the offsprings and the adults (male and female) are called parents.

We have learnt in our previous class about the process of reproduction in plants. In this lesson, we shall learn how reproduction takes place in animals.

6.1 MODES OF REPRODUCTION

There are two basic modes of reproduction by which animals reproduce. These are,

a) **Asexual reproduction**

b) **Sexual reproduction**

6.2 ASEXUAL REPRODUCTION

In asexual reproduction, a single organism (parent) produces genetically identical individuals of its own kind. The second parent is not needed.

For example, Amoeba, Yeast, Hydra etc. reproduce by asexual reproduction. The offsprings produced by asexual reproduction are identical to each other and to the parent. They are called clones.Asexual reproduction is carried out in many ways :

6.2.1 Binary fission

Binary fission refers to the division of a cell into two parts. This is the simplest type of asexual reproduction and is seen in single celled

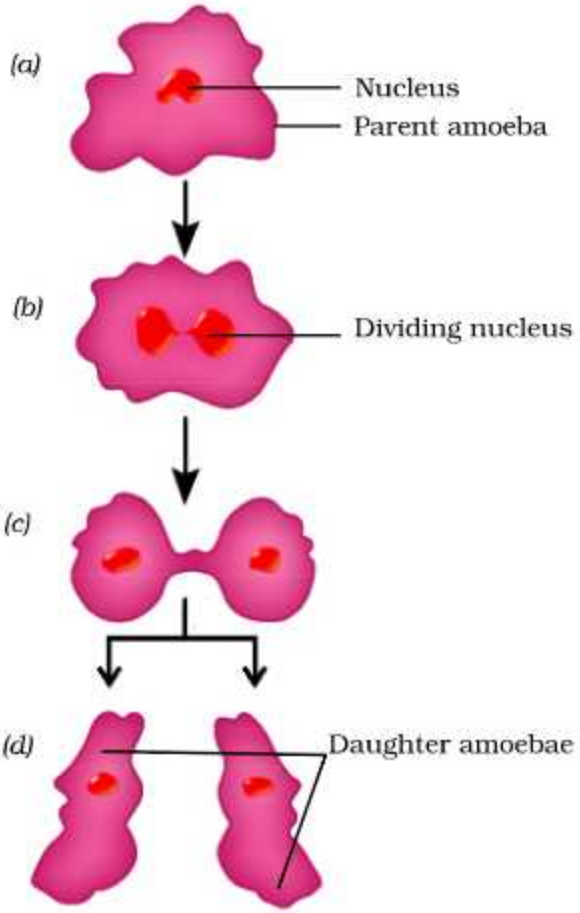


Fig. 6.1 Figure of binary fission in amoeba.

(unicellular) organisms such as bacteria, amoeba and paramecium.

In binary fission, the fully grown parent cell splits into two halves, producing two new cells. Each half receives one daughter nucleus and forms two daughter organism. Thus two daughter organisms are formed from one organism (parent).

In amoeba, the nucleus first divides into two parts. This is followed by division of cytoplasm so that two amoebae are produced from a single parent. The two daughter amoebae thus formed grow and attain full size before splitting again.

Think and Answer

1. Binary fission is common in unicellular organisms.
   True / False
2. Amoeba reproduces by budding.
   True / False
3. Asexual reproduction is seen only in single celled organisms.
   True / False

6.2.2 Budding

In budding, a new organism grows in the form of a bulb-like projection called bud from the parent organism. It grows and may eventually break away from the parent.

Yeast and Hydra reproduce by budding.

In Hydra a small bulge appears from the lower part of the body. This grows into a bud, detaches from the parent body and develops into a young hydra.

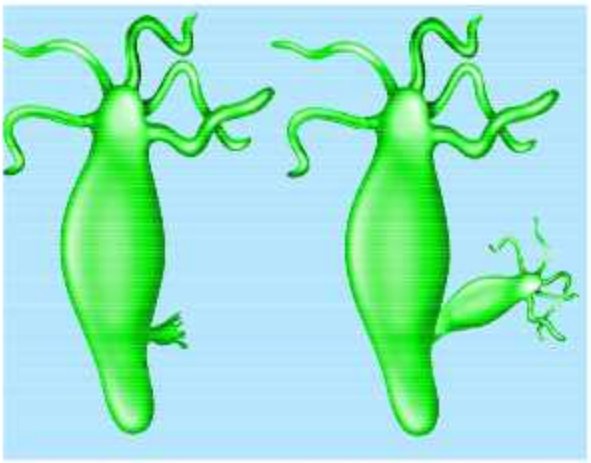


Fig. 6.2 Figure of budding in Hydra.

In coral and sponges buds do not separate out but remain attached to the parent organism. They grow to full size and reproduce themselves again and again producing a colony.

6.3 SEXUAL REPRODUCTION

Most animals and plants reproduce by the method of sexual reproduction. For sexual reproduction to occur, two parents, one male and the other female are required. Males and females have different reproductive organs. Each parent produces one **reproductive cell** or **gamete**. The male parent produces the **sperm** and the female parent produces the**egg or ovum**. When the sperm and ovum fuse together they form a new cell called **zygote**. This process of fusion of the sperm and the ovum is called **fertilization**. The zygote is the first cell of the new organism.

In animals such as frogs, fishes, birds, reptiles and humans, an individual carries only one kind of

gamete-either sperm (in the male) or the ovum (in the female). However in some organisms, both male and female gametes are present in the same individual. Such organisms are called **hermaphrodites**. Earthworms and Leeches are**hermaphrodite**. This means that each earthworm or leech is both male and female.

6.3.1 Types of Fertilization

There are mainly two types of fertilization :

(i) External fertilization

(ii) Internal fertilization.

(i) External Fertilization : In many aquatic animals like fishes, starfishs and frogs fertilization is external. The male and female gametes are released into the water and fusion takes place inside water by chance.

"The type of fertilization in which the fusion of a male and a female gamete takes place outside the body of the female is called **external fertilization**". Animals living in or near ponds, sea and lakes also have external fertilization.

(ii) Internal Fertilization : *"Fertilization which takes place inside the female body is called* ***internal fertilization***".This type of fertilization occurs in insects, birds, reptiles and mammals (humans, cats, dogs etc). This is an efficient form of reproduction as compared to external fertilisation.

6.3.2 Viviparous And Oviparous Animals

(i) Viviparous Animals : The animals which give birth to young ones, are called Viviparous animals. Fertilized egg or zygote develop into a young one inside the uterus of female animal e.g. cat, dog, cow, human beings. You may find it surprising that a small fertilized egg grows into a fully grown individual. You will study about it further in this chapter.

(ii) Oviparous Animals : The animals which lay eggs and these eggs hatch outside the body of female to produce young ones are called oviparous animals e.g. hen, lizards, frog, fish etc.

6.4 HUMAN MALE REPRODUCTIVE SYSTEM

Now Let's study about the male reproductive parts of humans and study the process of reproduction in them. Human male reproductive system include the following parts :

(i) A pair of testes

(ii) Two sperm ducts

(iii) A penis

i) **Tests :** A pair of testes are enclosed in a scrotal sac (or scortum) outside the body. Millions of sperms are produced by the testes.

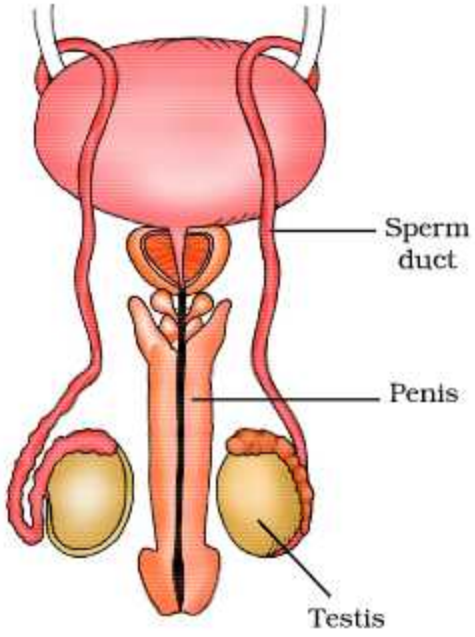


Fig. 6.3 Human Male Reproductive Organs

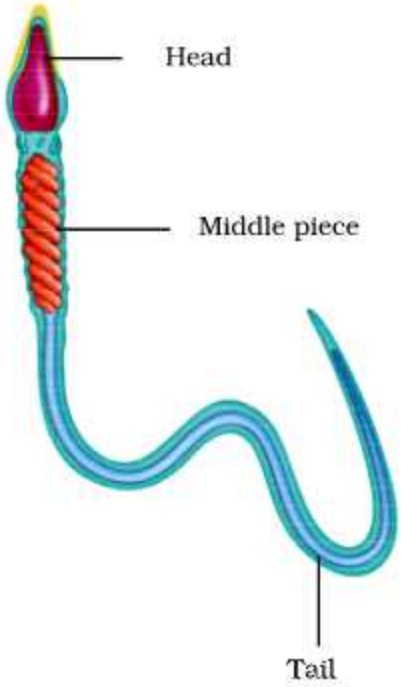


Fig. 6.4 Human Sperm

ii) **Sperm ducts :** Each testis have a sperm duct. The sperms from the testes leave through the sperm ducts and reach the penis.

iii) **Penis :** This is a common structure for the passage of urine and injecting sperms into the body of the female.

Structure of a sperm : A sperm is very small in size in comparison to an ovum.

It is single-celled and consists of three parts, a head with a nucleus, a middle piece and a long tail (Fig. 6.7)

The tail helps the sperm in movement and allows it to reach the egg cell.

6.5 HUMAN FEMALE REPRODUCTIVE SYSTEM

The female reproductive system (Fig. 6.8) include the following organs :

(i) A pair of ovaries

(ii) A pair of oviducts

(iii) Uterus

(iv) Vagina

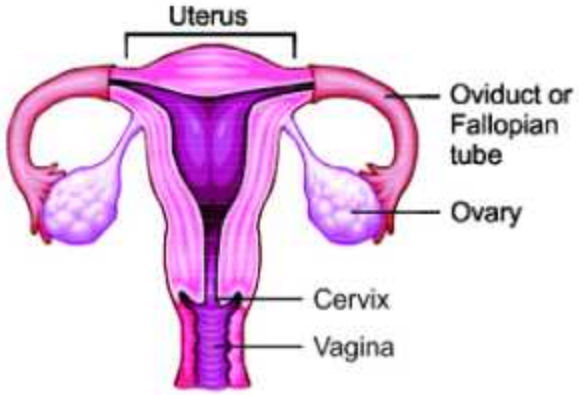


Fig. 6.5 : Female Reproductive System

i) **Ovaries :** The ovaries produce eggs or ova. The egg is much bigger than the sperm. In females, a single ovum is produced by one of the ovaries every month.

ii) **Oviducts :** (also called fallopian tubes). An oviduct is a muscular tube which joins the ovary to uterus. It, thus, carries the ovum from the ovary to the uterus.

(iii) **Uterus :** (called womb), Development of the fertilized egg and foetus takes place here.

iv) **Vagina :**The uterus opens into a muscular tube called vagina.

6.5.1 Structure of Ovum

An ovum, like the sperm, is a single-celled structure. It is spherical in shape. Ovum has large centrally located nucleus surrounded by Cytoplasm. The ovum is enclosed in one or two egg envelops.

It contains large quantities of food to provide nutrition to the developing embryo until it starts receiving nutrition from the mother.

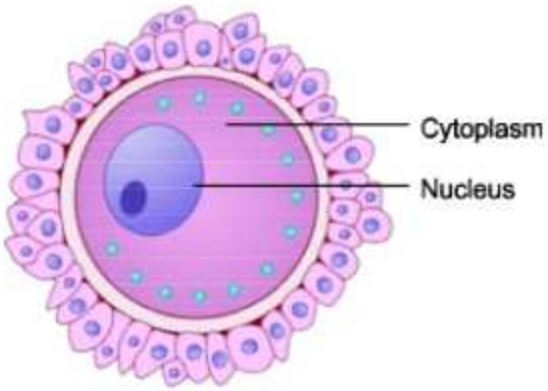


Fig. 6.6. Structure of an egg

Development of Embryo : During this development, the fertilized egg moves from the oviduct to the uterus and gets attached to its walls.

Table 6.1 Differences between Asexual and Sexual Reproduction

A sexual Reproduction	Sexual Reproduction
1. Daughter individuals are produced from a single parent.	1. Two parents of opposite sex (male and female) are needed in sexual reproduction.
2. Sex cells or male and female gametes are not formed.	2. Two types of sex cells (i.e. male and female gametes) are formed.
3. Fertilization does not occur.	3. Male gamete fertilizes the female gamete.
4. Zygote is not formed.	4. A male and female gamete fuse to form zygote.
5. New individuals are identical to each other and to their parent and are called clone.	5. New individuals share characters of both the parents. They are called offsprings. No two offsprings are identical except identical twins.

A new structure called **placenta** grows at the place where the developing embryo fixes to the uterus wall. By 8th week, all the major organs such as hands, legs, head, eyes, ears etc. are formed in the embryo. The embryo at this stage, when most of the body parts can be identified is called a**foetus**. By the 16th week, all the organs are formed and the mother starts feeling the kicks of the foetus. After about 36 weeks of development, the foetus is ready to be born. At the time of birth, foetus weighs about 3 kg.

You have learnt how the development of a baby takes place in humans. Let us briefly study the life cycle of a butterfly and a frog to know about the different stages starting from an egg to the adult stage.

Metamorphosis : During development from a fertilized egg to an adult, considerable changes occur in the body structure. In most animals, the fertilized egg develops into an embryo which increases in size and volume and grows into an adult. This process is called metamorphosis. In some animals like the frog, silkworm, and butterfly, the young ones look very different from the adults.

6.6 LIFE CYCLE OF A BUTTERFLY

The life cycle of a butterfly undergoes the following stages (Fig. 6.7). Egg changes to larva (caterpillar), larva turns to pupa and pupa gives rise to adult butterfly.

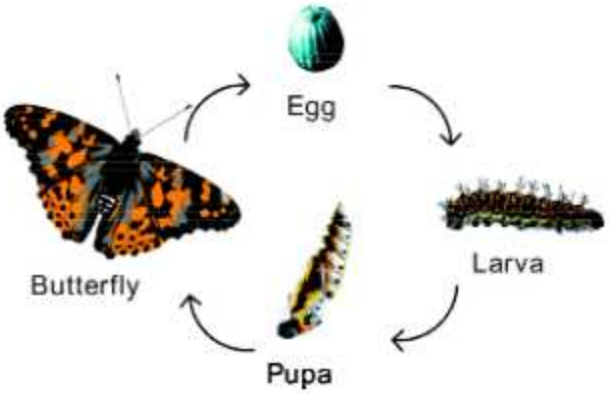


Fig 6.7 Different stages of life cycle of butterfly.

In this case, the larva and pupa look very different from the adult butterfly. The features that are present in the adult are not found in the earlier stages of its life cycle.

6.7 LIFE CYCLE OF FROG

Three distinct stages are seen in the life cycle of frog (Fig. 9.8). Egg turns into tadpole (larva) and tadpole develops into an adult.

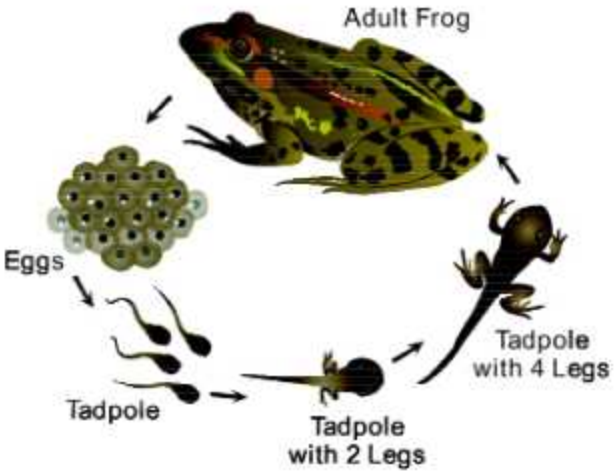


Fig. 6.8 Different stages of life cycle of frog.

A tadpole looks very different from an adult frog. The process of drastic changes by which a tadpole (or a caterpillar) changes into an adult is

called ***metamorphosis***.(meta – after, morphe – form).

Activity 6.1

Explore the pictures of eggs of the following animals – butterfly, frog, hen, sparrow, and pigeon from internet.

1. Draw the pictures of eggs of different types.
2. Compare the sizes of different eggs.

THE STORY OF CLONING

On 27 February 1997, a research article published in the science magazine *Nature*. It talked about the remarkable success achieved by Dr. Ian Wilmut and his colleagues at the Roslin Institute in Edinburg, Scotland, in producing a baby sheep without involving the male sperm. They successfully cloned a sheep named Dolly.

Dolly was born on 5 July 1996 and was the first mammal to be cloned.

The baby sheep Dolly was developed from a cell taken from the mammary gland of a female sheep and an unfertilized egg taken from another female sheep. The nucleus of an unfertilized egg was removed from it. Therefore no chromosome (and hence no genes) remained in egg shell.

The two cells were then fused together. The egg cell accepted the nucleus of the mammary gland cell and was 'fooled' into thinking that fertilization has been taken place. It started developing into an embryo. The embryo was then put inside the uterus of a third sheep. It developed into a baby sheep in the uterus and was born in the usual way on 5 July 1996. It took Dr. Wilmut 277 attempts to clone Dolly.

Dolly inherited all its genes from the female sheep from whose mammary glands the cells were taken. It was, therefore, an exact copy, or a 'clone' of that sheep. Dolly lived an healthy life for more than six and a half years and produced several offspring through the normal sexual method. She died on 14 February 2003.

Since Dolly, several attempts have been made to produce cloned mammals. However success have been limited. Many die before birth or die soon after birth. The cloned animals are found to be born with severe abnormalities many-a-times.

POINTS TO REMEMBER

- Reproduction is the process of producing new individuals of the same kind.
- Animals reproduce by two methods – (i) Sexual reproduction, and (ii) Asexual reproduction.

- Asexual reproduction involves the production of new organisms by just one parent.
- Amoeba reproduces by binary fission, in which the fully grown parent cell splits into two halves, producing two new cells.
- Hydra reproduces by budding in which a bud appears on the body wall which grows into a full hydra and separates from the parent.
- Fertilization in humans occurs in the fallopian tube of the female. The zygote develops into a baby in the uterus before its birth.
- External fertilization occurs outside the body of the organism.
- Internal fertilization occurs inside the body of the organism.
- Sexual reproduction involves two parents one male which produces the sperm and one female which produces the ovum. The process of fusion of sperm and ovum to form a zygote is called *fertilization*.
- Gametes are formed in reproductive (sex) organs of males and females.
- Fertilization is the process of union of male and female gametes.
- In humans, the male reproductive organs are the testes which produce sperms. The female reproductive organs are the ovaries which produce the ovum.
- In multicellular organisms, development of the embryo occurs by cell division and cell differentiation.
- In human beings and all other viviparous animals, metamorphosis does not occur because the young ones resemble the adult at the time of birth.
- The process of transformation of larva into an adult through drastic changes is called metamorphosis.

Keywords

- Binary Fission
- Budding
- Sperm
- Testes
- Ovary
- Gamete
- Placenta
- Uterus
- Zygote
- Internal Fertlization
- External Fertilisation

EXERCISE

A. Fill in the blanks.

1. The process of fusion of sperm and ovum is known as .....
2. Union of gametes does not take place during .....reproduction.
3. Binary fission occurs in .....
4. In human, fertilization is .....
5. The zygote after repeated division gives rise to .....

B. Write True (T) or False (F)

1. The animals which lay eggs are called oviparous.
2. Each sperm is a single cell.
3. Hydra reproduces by binary fission.
4. A zygote is formed as a result of fertilization.
5. In human external fertilization takes place.

C. Match Column A with Column B :

A		B	
1.	The process of producing young ones of own kind.	a.	Oviparous animals
2.	A method of asexual reproduction in Hydra.	b.	Zygote
3.	Its fertilization takes place inside water.	c.	Reproduction
4.	Egg-laying animals.	d.	Frog
5.	Sperm and egg/ovum fuse to form.	e.	Budding

D. Choose the correct answer :

1. Which of these are the male reproductive organs in humans.

   (a) Sperms (b) Ova

   (c) Testes (d) Ovaries

2. Which of the following is a hermaphrodite animal.
   (a) Frog (b) Cow
   (c) Dog (d) Earthworm
3. In humans, fertilization occurs in
   (a) Oviduct (b) Uterus
   (c) Ovary (d) Vagina
4. In a mosquito, the eggs hatch to produce.
   (a) Pupa (b) Embryo
   (c) Larva (d) Adult mosquito
5. The fusion of sperm and egg proudces
   (a) Zygote (b) Gamete
   (c) Embryo (d) Oviduct

E. Very Short answers type questions :

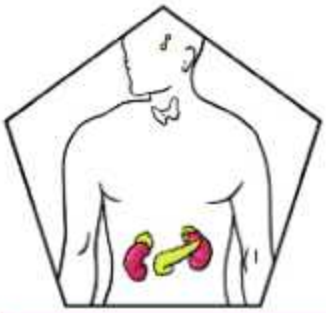
1. Define the following :
   (a) Fertilization (b) Metamorphosis
   (c) Hermaphrodite animals (d) Reproduction
2. What is male gamete in human called ?
3. Name various stages in the life cycle of a butterfly.
4. What is a zygote.

F. Short answer type questions :

5. What is cell division ?
6. What is the difference between asexual reproduction and sexual reproduction ?
7. Why is reproduction important ?
8. What is binary fission ?
9. How does Hydra reproduce ?
10. Explain the difference between viviparous and oviparous animals ?
11. How does fertilization occurs in frogs?

G. Long answer type questions :

12. Explain the importance of reproduction in organisms. Give two differences between zygote and foetus.
13. Explain fertilization. What is the difference between external fertilization and internal fertilization?
14. Describe the process of fertilization in human beings.
15. Explain the life cycle of frog with the help of a labelled diagram.



CHAPTER - 7

Reaching the Age of Adolescence

The journey of human life starts with a single cell. Living organisms reproduce to increase in number and maintain their species in the nature. Human beings can reproduce after attaining a certain age. In chapter 9 we have learnt about reproductive organs.

In this chapter, we will learn about the process of adolescence, what it means, what changes occur in this age and the role of hormones in bringing about these changes which enable a person for reproduction.

7.1 ADOLESCENCE AND PUBERTY

You might have noticed sudden increase in the height of your classmates and some boys of your class develop a hair line above their lips. This indicates that they are growing up and their body is undergoing some changes.

Growth is a natural process and starts from the day a person is born. But after attaining the age of 10 or 11, sudden changes in body become noticeable. Those changes in the body indicate the growth towards adulthood.

There are several stages of development in human beings. These are childhood, adulthood and old age. From the childhood to adulthood, the body undergoes many changes. The period of life, when the body undergoes some changes, leading to reproductive maturity is called adolescence. It is a transitional stage of physical and mental development that occurs between childhood and adulthood. Adolescence beings at the age of 10 or 11 and lasts up to 18 or 19 years of age.

Since, this period is associated with the "teen" years of a child (viz. thirteen to nineteen years of age), thus, adolescents may also be called "teenagers". In girls, the onset of adolescence may occur earlier than the boys by an year or two. Moreover, the period of adolescence may vary from person to person.

The human body undergoes several physical and mental changes during this period. The adolescents become aware of the physical changes they are going through. These changes mark the onset of puberty. The age at which a boy or a girl becomes sexually mature to reproduce is called **puberty**.

The most important change which marks puberty is that the individual becomes capable of reproduction.

Now we have realized that sudden increase in height and hairy line above the lips in boys are signs of adolescence. There are several other changes that take place during this period.

7.2 CHANGES AT PUBERTY

7.2.1 Increase in height

The sudden increase in height is the most dramatic and visible change that takes place at the onset of puberty period. At this stage the bones of arms and legs elongate and the child grows tall.

Refer to the table 10.1 which gives the average rate of growth in height with age. The figures given in column II and III give the percentage of height of an individual at the age given in the column I. For example when a boy reaches the age of 14, then he has reached 92% of his full height, while at the same age the girl has reached 98% of her full height. These figures may show some variations. You may use the table to find out the height of your friends in near future.

Table 7.1

Age in years	% of full height	
	Girls	Boys
Column I	Column II	Column III
8	77%	72%
9	81%	75%
10	84%	78%
11	88%	81%
12	91%	84%
13	95%	88%
14	98%	92%
15	99%	95%
16	99.5%	98%
17	100%	99%
18	100%	100%

Calculation of full height (cm)

$$\frac{\text{Present height (cm)}}{\text{\% of full height at this age}} \times 100$$

(as given in the table)

For example a girl at the age of 11 is 110 cm tall. At the end of growth period she is likely to be :

$$\frac{110}{88} \times 100 = 125 \text{ cm tall}$$

Think and Answer

Q.1. Using the above table find out who will be the tallest and who might be the shortest in your class.

Q.2. In which rate of growth is more during adolescent age, Boys or girls ?

1. The rate of increase of height is different for different individuals. Initially, the height of girls increase more rapidly than the boys, but by the age of 18 years, both boys and girls attain their maximum height.

2. We often notice that the height of an individual is more or less similar to their parents. There are many factors which decide the height of a person, the inheritance of genes from the parents play vital role. Also, taking a balanced diet during these years of growth helps the bones, muscles and other parts of the body to grow adequately.

7.2.2 Change in body shape

When a child is still young, it becomes difficult for us to differentiate between boys and girls from their outer appearance. But when puberty sets in, several changes occur in body shape and appearance of boys and girls, which make them look different from each other. Some of these changes are given in Table 10.2.

7.2.3 Change in Voice

The voice or sound is produced by the voice box which is present in our throat. The voice box is called

Table 7.2

Physical changes in boys	Physical changes in girls
1. Shoulders become broader.	1. The region below the waist becomes wider.
2. Body muscles grow more prominently than in girls.	2. Muscles grow lesser as compared to boys.
3. Chest becomes wider.	3. Breasts develop and increase in size. Mammary glands develop inside the breasts.
4. Facial and Pubic hair grow.	4. Pubic hair grow.
5. Voice becomes coarse.	5. High pitched voice.

Larynx. Before puberty, it is small and the vocal cords are short and thin. This is the reason that the voice of a child is high pitched than that of an adult. At puberty the larynx begins to grow. Boys develop larger voice boxes which can be seen as protruding part of the throat. This protruding part is called Adam's apple (fig. 7.1). Larynx grows more in boys as compared to girls. The bigger voice box in boys gives them deeper (or low pitched) voice.

Fig. 7.1 Adam's apple in a grown up boy

How the voice is produced ?

There are small bands of muscle inside the larynx. These are called vocal cords. The lungs pass a current of air between the two vocal cords. The air makes them vibrate, producing the sound. The sound changes into speech with the help of tongue, teeth, lips and nasal cavity. The vocal cords of females are shorter than that of males. Due to the shorter vocal cords, the frequency of a female's voice is higher than that of a male.

7.2.4 Increased activity of sweat and sebaceous glands

During Puberty, there is an increase in the activity of sweat glands and sebaceous glands (oil glands). This causes the sebaceous glands to secrete more 'oil' and sweat glands to secrete more sweat.

Adolescents get acne and pimples on the face due to the increased secretions of these glands.

7.2.5 Development of sex organs

At puberty, the sex organs of boys and girls start developing. Male sex organs like testes and penis develop completely. The testes also begin to produce sperms. In girls, the ovaries enlarge and start to produce eggs.

7.2.6 Mental, intellectual and emotional maturity

There is a change in person's way of thinking during adolescence period. Adolescents are more independent than before and also become self conscious. Intellectual development takes place and they tend to spend considerable time in thinking. At this stage, the brain has the greatest capacity for learning. During this period, the adolescents may feel insecure while trying to adjust to the changes in the body and mind.

But we should know that there is no reason to feel insecure. These changes are natural part of growth.

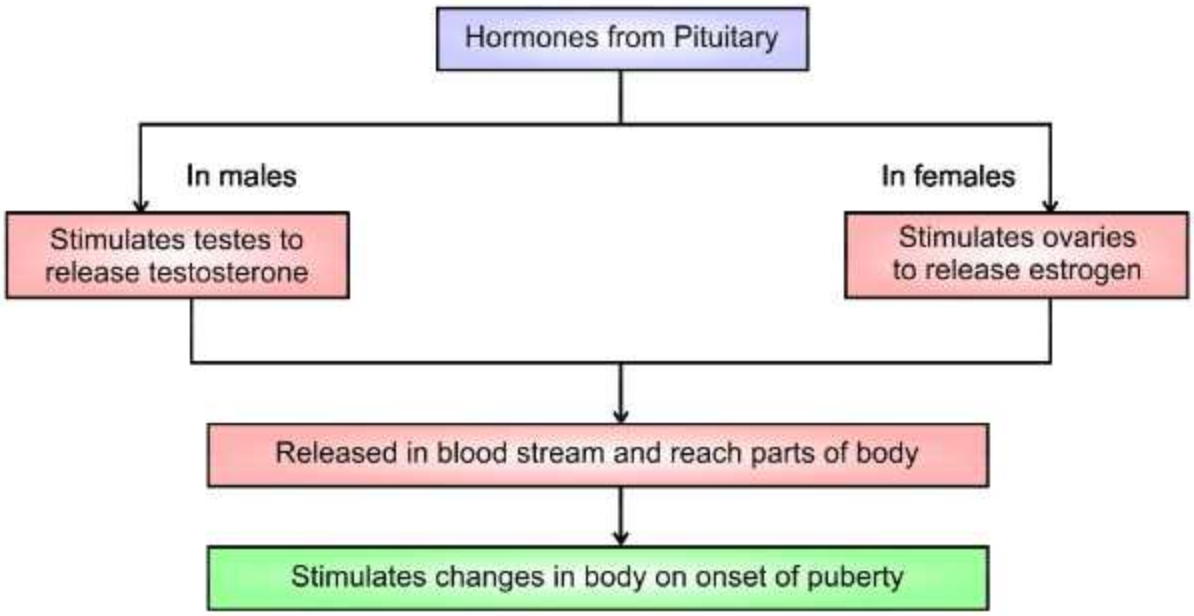
7.3 SECONDARY SEXUAL CHARACTERS

The development of secondary sexual characters starts in boys with the appearance of pubic and facial hair. Boys also develop hair on chest. In girls, the breasts start developing and the appearance of pubic hair takes place. As these features help to distinguish the male from female, they are called secondary sexual characters.

The changes that occur in adolescents are controlled by hormones. **Hormones** are the chemical substances secreted by **endocrine glands**. The production of these hormones is controlled by **pituitary gland**. The male hormone or**testosterone**begins to be released by the testes at the onset of puberty. In girls, ovaries begin to produce the female hormone or **estrogen** which makes the breasts develop. Milk secreting glands or mammary glands develop inside the breasts.

7.4 ROLE OF HORMONES IN INITIATING REPRODUCTIVE FUNCTION

Endocrine glands release hormones directly into the blood. The body part in which the hormone is targeted is called target organ or target site. The target site responds to the hormone. All hormones in the body are under the control of the master gland called pituitary gland. The release of sex hormone in boys and girls are controlled by the pituitary gland. The secretions of pituitary gland triggers the testes to produce testosterone in male and ovaries to produce estrogen in females. These sex hormones are responsible for the pubertal changes in adolescents.



Flow chart showing role of Hormones

7.5 REPRODUCTIVE PHASE OF LIFE IN HUMANS

Humans become capable of reproduction when their testes and ovaries begin to produce gametes sperms and ova. The males produce gametes for a longer duration in their life as compared to females.

In females, the ovaries become active when the girl reaches puberty (10-12 years of age). One ovum matures and is released by one of the ovaries in about 28 to 30 days. During this period the uterus prepares itself to receive the egg by forming thick lining of blood vessels. The mature ovum enters the oviduct where it may get fertilized. If it is fertilized, zygote undergoes cleavage and get implanted into wall of uterus. This results in pregnancy. If fertilization does not occur, the egg and the thickened walls of the uterus along with its blood vessels are shed off. This causes bleeding in women which is called **menstruation**. The series of events between one menstruation and next in female body is called **menstrual cycle**. This happens once in about 28 to 30 days. The first menstrual flow begins at puberty and is termed as **menarche**. The menstruation cycle stops at about 45 to 50 years of age. Stoppage of this cycle is termed as **menopause**. Initially menstruation cycle may be in female body irregular but after sometime it becomes regular.

7.6 HOW IS SEX OF BABY DETERMINED

Human beings have 23 pairs of chromosomes in the nuclei of their cells. Out of these 22 pairs controls all character of body rather then sex and are known as **autosomes** and the last 23rd pair which determines the sex is termed as **sex chromosomes**. This last pair is different in males and females. In males, it is XY and in females it is XX. The gametes (sperm and egg) have only one set of chromosomes. The unfertilized egg has only one type i.e. X chromosomes in the set while sperms have 2 types of chromoses in the set. One has X chromosome and the other has Y chromosome.

During fertilization, if an egg fuses with a sperm having Y chromosome, the zygote will develop into a male child and if an egg fuses with sperm having X chromosome, the resultant zygote will be a female child (Fig. 7.2)

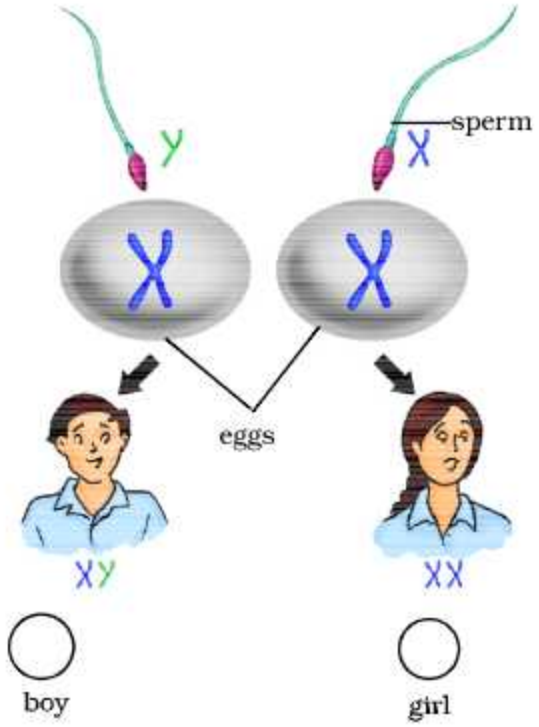


Fig. 7.2 Sex determination in humans

Now you know that the sex of the child is determined by the sex chromosomes of the father. So we can say that the myth about holding the mother responsible for determining the sex of the child is completely wrong.

7.7 HORMONES OTHER THAN SEX HORMONES

A few glands e.g. sweat glands, oil glands and salivary glands release their secretions in the ducts. However, there are certain glands which release hormones directly into the blood stream hence are known as endocrine glands. Endocrine glands are also called**ductless glands**as they do not have any ducts. They release their secretions or hormones directly into the blood stream. The endocrine system regulates metabolism, growth, development, sexual functions, reproduction, sleep and mood etc.

The major glands that make up the human endocrine system are pituitary, thyroid, pancreas, adrenals, ovaries and testes (fig. 7.3).

One of the hormones released by the **pituitary gland** is the growth hormone that regulates the growth and development of the body. The **thyroid gland** secretes **thyroxine**, which influences the physical and mental development after birth by controlling the rate of chemical reactions in all body cells. Less secretions of throxine by thyroid gland results in a very big and bulging throat. This disease is called **goitre**. It usually occurs due to the deficiency

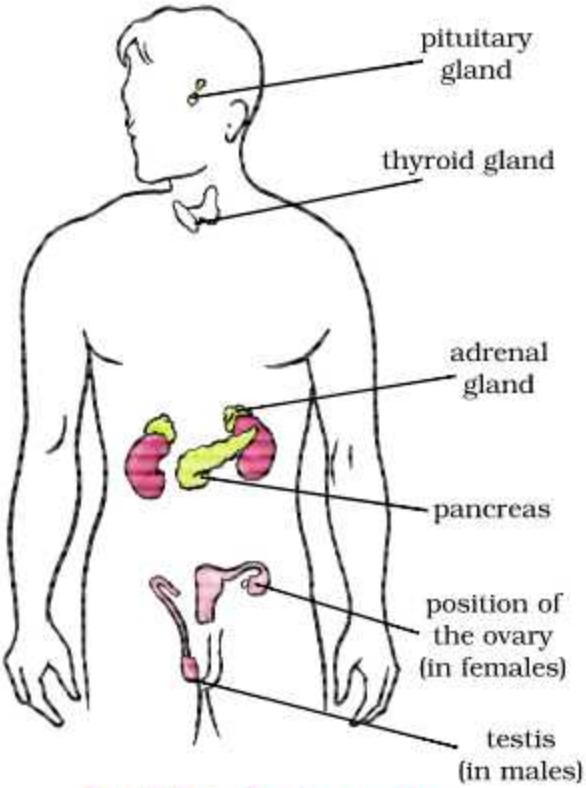


Fig. 7.3 Endocrine system

of iodine in the diet. That is why we are advised to take iodised salt

Insulinis a hormone released by pancreas, that lowers the glucose level in the blood fascilitating it's absorption from blood by body cells. If insulin is not produced in sufficient amount the person will suffer from the disease called**diabetes**.

The **adrenal glands** are located on the top of the kidneys. They produce **adrenalin hormone** which helps the body to adjust to stressful situations such as anger, worry and embarrassment etc.

7.8 ROLE OF HORMONES IN COMPLETING THE LIFE HISTORY OF INSECTS AND FROGS

Growth and metamorphosis in insects are controlled by hormones

produced by endocrine system. You have already learnt about the life history of butterfly and frog. The caterpillar has to go through various changes to become an adult. The change from larva to an adult is called **metamorphosis**. In insects, metamorphosis is controlled by insect hormones. A hormone, thryoxine released by thyroid gland is responsible for metamorphosis in frogs. The hormone production requires the presence of iodine in water. If there is no sufficient iodine in water in which tadpoles are growing they cannot become an adult.

7.9 REPRODUCTIVE HEALTH

The physical and mental well being of an individual is considered as an individual's health. To keep the body healthy, adolescents need (i) a balanced diet, (ii) to observe personal hygiene and cleanliness, and (iii) to undertake adequate physical exercise.

7.9.1 Nutritional needs of the adolescent

Adolescence is a period of rapid physical, emotional, intellectual and social maturation. Hence the diet for adolescents should be planned carefully. The adolescents require a balanced diet for proper growth and development. A balanced diet which include protein, carbohydrates, fats, vitamins and minerals is essential for them. Milk is a balanced food in itself. Fruits also provide sufficient nourishment they need.

Iron builds blood and iron rich food such as leaf vegetables jaggery, meat, citrus fruits, Indian gooseberry (amla) are good for adolescents. Once a girl has started menstruating, her need for iron increases.

Chips and packed or tinned food items, noodles, burger, hot doughs, do not have adequate nutritional value. Balanced diet having adequate amount of cereals, milk, meat, nuts and pulses provide essential nutrients required for proper growth.

Make a group with your friends in the class. Make a list of food items that you consume daily. Identify the items which are good for your health. Also make a list of food items which you consume but are not good for your health. With the help of your teacher prepare a list of food items which are essential for adolescents. You can also make charts and posters.

Think and Answer :

Q.1. Name the food items which are good for adolescents.

Q.2. What is a balanced diet ?

7.9.2 Personal hygiene

Both, boys and girls need to be aware and practice hygienic measures to promote personal hygiene. Increased activity of sweat glands makes the body smelly. So, everyone should have a bath daily. All parts of the body should be cleaned and

washed with soap. Girls should take special care of cleanliness during the time of menstrual flow. Undergarments should be changed daily. Sanitary napkins should be used instead of old clothes, which is safe and helps to prevent many diseases. We should wash hands with soap and water before and after taking meal.

7.9.3 Physical exercise

Physical exercises like jogging, walking, running, cycling and playing outdoor games keep the individual fit and healthy. Physical exercise helps in proper digestion, elimination of toxins from the body, improves blood circulation and increase the efficiency of lungs. Physical exercise gives relief and keeps good mental health.

7.10. SAY NO TO DRUGS

During adolescence, the body undergoes changes. Positive thinking will lead to positive personality development. A positive adolescent must say a **strong no** to drugs like alcohol and tobacco.

Experimentation with drugs should be avoided **To make the people aware about the ill effects of using tobacco, 'World No Tabacco Day' is observed every year on 31st May.**

Drugs are addictive. It is easy to start with them but to get rid of them. If you take it once, you will feel like taking them again and again. Using alcohol and tobacco at young age increases many risks. Adolescence is a period of much activity in the body and mind which is a normal part of growth. Everyone has to pass through this period.

So do not feel insecure or confused. If anyone suggests that you should take drugs to get relief, just say 'No'. Everyone should stay away from drugs because drugs damage brain, heart and other important organs. They ruin health and happiness.

You must have heard about AIDS. This disease can spread from one person to another by sharing syringes used for injecting drugs. So be cautious and take care of you and your friends also. In any difficult situation talk to your teachers and parents.

Myths, Taboos, Do's and Don'ts

You have learnt here and from Chapter 9 the scientific facts related to human reproduction. There are many wrong notions which you should now be able to discard as informed adolescents. For example, there are myths and taboos regarding bodily changes that adolescents experience. Some of these are given below and you can now argue why these are myths and not facts.

1. A girl becomes pregnant if she looks at boys during menstruation.
2. The mother is responsible for the sex of her child.
3. A girl should not be allowed to work in the kitchen during menstruation.

You may come across many other myths and taboos.**Discard them.**

POINTS TO REMEMBER

- Adolescence is a period when the body undergoes several changes, leading to reproductive maturity. It is a period of rapid physical, emotional, intellectual and social maturation.
- Human becomes capable of reproduction after puberty sets in. Between the age of 11 years to 19 years children are called adolescents.
- Endocrine glands are ductless glands which pour their secretions directly into the blood.
- The onset of puberty and maturity of reproductive organs are controlled by hormones.
- The major glands that make up the human endocrine system are pituitary, thyroid, pancreas, adrenals, ovaries and testes.
- The onset of puberty brings about growth of the reproductive organs. Hair grow at various parts of the body. Breasts develop in girls and facial hair appear in boys. Voice of boys becomes coarse as voice box enlarges during adolescence.
- Human beings have 23 pairs of chromosomes in the nuclei of their cells. Out of these 22 pairs are known as autosomes and the last pair is termed as sex chromosomes.
- Sex of the unborn baby is determined by the sex chromosomes of the father. The belief that mother is responsible for the sex of the baby is completely wrong.
- It is important to eat balanced diet and maintain personal hygiene during adolescence.
- The diet which includes protein, carbohydrates, fats, vitamins and minerals in requisite proportion is called as balanced diet.

Keywords

- Adolescence
- Menstruation
- Puberty
- Menarche
- Larynx
- Menopause
- Adam's Apple
- Adrenalin
- Hormone
- Thyroxine
- Testosterone
- Metamorphosis
- Pituitary Gland
- Insulin
- Endocrine Gland
- Sex Chromosomes
- Estrogen
- Balanced diet

EXERCISE

A. Fill in the blanks.

(a) If the ovum is fertilized by sperm, a ..... is formed.

(b) Endocrine glands release hormones directly into the .....

(c) The sex chromosome of ..... determines the sex of the unborn baby.

(d) The chemical substances secreted by the glands are called .....

(e) Acne and pimples are common during puberty due to the increased activity of .....

B. Write true (T) or false (F).

(a) Balanced diet is not essential for adolescents.

(b) The stoppage of menstruation is termed as menarche.

(c) Ovaries produce testosterone hormone.

(d) The change from larva to an adult frog is known as metamorphosis.

(e) Hormones have no role in the growth and development of the body.

C. Match the column A with column B.

A	B
Pancreas	Goitre
Thyroid Gland	Insulin
Testes	Estrogen
Pituitary Gland	Testosterone
Ovary	Growth Hormone

D. Choose the correct answer :

(i) Reproductive age in a woman starts when their :

(a) Menstruation starts (b) Height increases

(c) Weight increases (d) Menopause starts

(ii) The right meal for the adolescents is :

(a) Noodles, coke and chips (b) Pizza, chips and coke

(c) Pizza, Noodles and burger (d) Chapati, pulses and vegetables

(iii) Testes in the males produce :

(a) Estrogen (b) Testosterone

(c) Insulin (d) Progesterone

(iv) Deficiency of iodine in diet causes :

(a) Goitre (b) Diabetes

(c) Menopause (d) Menstruation

(v) The hormone whose deficiency may cause diabetes is :

(a) Estrogen (b) Testosterone

(c) Insulin (d) Thyroxine

E. Very Short Answer Type Questions :

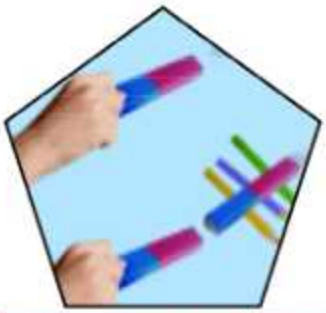
1. Define adolescence.
2. What will happen if tadpoles are in iodine deficient pond water ?
3. Why are endocrine glands known as ductless glands ?

F. Short Answer Type Questions :

4. Differentiate between menopause and menarche.
5. Why adolescents get acne and pimples on the face at the time of puberty ?
6. What is menstruation ? Explain.
7. Why is physical exercise important for adolescents ?

G. Long Answer Type Questions :

8. List the changes that take place at puberty.
9. What are hormones ? What is the role of hormones in human body ?
10. How is the sex of a human child determined ?



CHAPTER - 8

Force and Pressure

When you kick a ball, it moves and stops after covering some distance. A player while taking a penalty, kicks the ball towards the goal and the goal keeper either stops the ball or deflects it away. Sometime a player kicks the moving ball in the direction of motion and the ball starts moving faster. What makes a ball to move, stop its movement, changes its direction or makes it move faster ? In all these situations a force is responsible to move, stop, change the direction or make ball move faster. A force increases the length of a rubber band, depresses a seat, shortens the size of a sponge on squeezing. What is force ? What are its effects when it acts on a body ? We will study in this chapter.

8.1 FORCE- A PUSH OR PULL

To understand force, let us perform an activity.

Activity 8.1 : Identifying Actions as Push or Pull.

In table 8.1 few examples of daily life situations are given. Try to identify the action involved in each case. Classify the action as push or pull and record the observations.

From this above activity we observe that a push or pull or both are needed to move an object or change its direction of motion or to stop its motion.

It is pull or push on the body which imparts motion, stop or change the direction of the motion of the body.

Table 8.1

S No.	Description of a situation	Action:(pushing/pulling/picking/hitting/ lifting/lowering/flying/kicking/throwing/ shutting/flicking				Action can be grouped as a	
						Push	Pull
1.	Moving a book placed on a table	Pushing	Pulling	Lifting	—	Yes	Yes
2.	Opening or shutting a door						
3.	A football player taking a penalty kick						

S No.	Description of the situation	Action:(pushing/pulling/picking/hitting/ lifting/lowering/flying/kicking/throwing/ shutting/flicking				Action can be grouped as a	
						Push	Pull
4.	A cricket ball hit by a batsman						
5.	Moving a loaded cart						
6.	Opening a drawer						

Therefore, any pull or push which acts on a body which either generates motion in it, or stops its motion or changes its direction of motion is called a**force**.

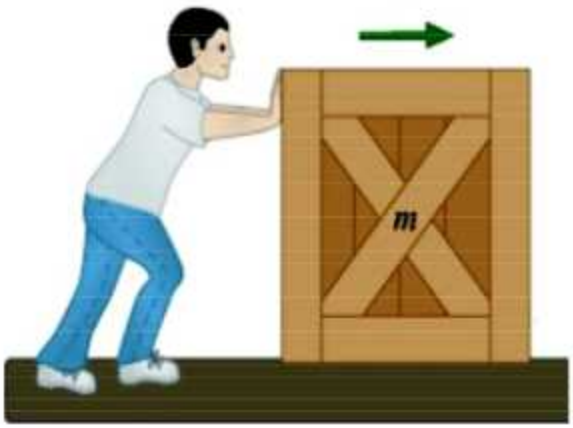


Fig. 8.1 : Pushing a box

Fig. 8.2 : Pulling a box

Force is defined as a pull or push which acts on a body that change or tends to change its initial state of rest, motion or direction of the motion.

8.2. FORCES ARE DUE TO INTERACTION

Force comes into play when at least two bodies interact.

Example 1

If you are standing near a stationary car, can the car move due to your only presence? Now you push the car, the car can begin to move in the same direction in which direction you are pushing. In this example you are interacting with car to move. Let us take another example while pushing.

Fig. 8.3 *(a) : A man standing behind a stationary car*

Fig.8.3 *(b) : A car being pushed by a man*

Example 2

In Fig. 8.4 (a) two girls are pushing each other and in fig. 8.4 (b) two girls are pulling each other. In both the cases, both girls are applying forces on each other. From these examples it is clear that at least two bodies must interact with each other for a force to come into play.

Fig 8.4 (a) : Who is pushing whom?

Fig 8.4 (b) : Who is pulling whom ?

So **force comes into play when at least two objects interact with one another**.

8.3 EXPLORING FORCES

Activity 8.2 : Take a heavy box and try to push the box by yourself. Now ask your friend to push the same box in same direction. In first case fig. 8.5(a), when you were pushing alone, it was hard to move and when you and your friend push the box jointly in the same direction it was easy to move. Why? Now ask your friend to push the same box in opposite direction, while you push the box in other direction fig. 8.5(b). Does the box move? If it moves, in which direction? Who is applying larger force?

Fig. 8.5 (a) two forces in the same direction

Fig. 8.5 (b) two forces in opposite direction

Fig. 8.5 : Two friends pushing a heavy load

8.3.1 The game of tug of war

In this game two teams pull at a rope in opposite directions. The team applying larger force moves the rope

and wins the game. When both the teams apply equal forces the rope does not move. (fig. 8.6)

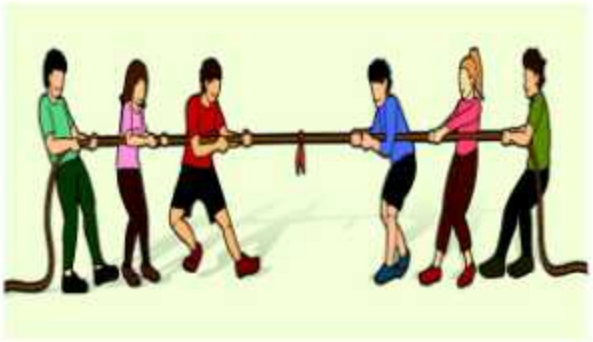


Fig. 8.6 : Tug of War

From these examples it is clear that effect of force gets added when forces acts in same direction and the effect of force gets reduced when forces acts in opposite direction.

When you and your friend push the box in same direction it becomes easy to move because forces get added in same direction. When you and your friend push in opposite direction the forces gets subtracted. The box will not move when both forces are equal and opposite or move in direction of larger force. Here net force is subtraction of smaller force from larger force showing net effect towards larger force.

Also notice that forces could be larger or smaller than the other. Larger is the force, larger will be its strength. So strength of force is expressed by its magnitude. We also saw that forces gets added in same direction and gets subtracted in opposite direction.

So direction of a force is also important. So force is expressed by magnitude and direction. If magnitude or direction of a force changes, the effect of force also changes.

8.4 A FORCE CAN CHANGE THE STATE OF MOTION

When you kick a football to take a penalty kick, you apply force on the ball. Before being kicked, it was at rest and its speed was zero. The applied force, makes the ball move towards goal. Suppose the goal-keeper dives or jump up to save the goal. By his action the goal-keeper tries to apply a force on the moving ball. Force applied by him can stop or deflect the ball, saving the goal being scored. If the goal-keeper succeeds in stopping the ball, its speed decreases to zero (fig. 8.7).

This observation suggest that force applied on an object may change its speed or direction. If force is applied on the object in same direction of its motion, the speed of the object increases. If force is applied in the direction opposite to direction of motion, then it results in decrease of the speed of the object.

Can applied force changes the direction of motion of an object ? Let us find out.

Fig. 8.7 : A goalkeeper saving a ball

In the game of cricket, a batsman sometimes only stops the ball and sometimes hit it hard across the boundary. In all these cases the batsman applies force which changes the direction of the motion of the ball and increases or decreases the speed of the ball. Above examples clearly shows, that force can change the initial state of the body (rest, motion or direction).

Fig. 8.8 : A fielder stopping a ball

Can force always change the state of motion? To answer this question let us take an example. When we try to push a heavy box, we apply the force, but the box did not move. Also when we try to push a wall, it will not move. The above examples shows that many a times force does not change the state of motion of the ball, but tends to change.

The state of motion means speed and the direction of the motion of the object. Body may be in rest or in motion; both are its state of motion.

Activity 8.3

Some situations have been given in Column 1 of Table 11.2 in which objects are not free to move. Column 2 of the Table suggests the manner in which a force can be applied on each object while Column 3 shows a diagram of the action. Try to observe the effect of force in as many situations as possible. You can also add similar situations using available materials from your environment. Note your observations in Columns 4 and 5 of the Table.

What do you conclude from these observations? What happens when you press inflated balloons with your palms? What happens when you press a rubber ball placed on the table? In the above examples we see that when force is applied on an object its shape may change.

Force applied on an object may change its shape.

In all the above examples and activities you would realised that a force.

1. May make an object move from rest.
2. May stop the moving object.
3. May increase or decrease the speed of the object.
4. May change the direction of the motion of the object.
5. May change shape of the object.
6. May cause some or all of these effects.

Table 8.2 : Studying the Effect of Force on Objects

Description of Situation	How to Apply Force	Diagram	Action of Force			
			Change in State of Motion		Change in Shape	
			Yes	No	Yes	No
A lump of dough on a plate.	Pressing it down with your hands.					
Spring fixed to the seat of a bicycle.	By sitting on the seat.					
A rubber band suspended from a hook/nail fixed on a wall.	By hanging a weight or by pulling its free end.					
A plastic or metal scale placed between two bricks.	By putting a weight at the centre of the scale.					

It is important to remember that none of the above effects can take place in the absence of force.

8.5 Types of Forces

1.Contact Forces : When you kick a football on the ground it will move. It will not move unless your foot is in contact with the ball. When you pick a book from a table with your hand, the book will be picked only when your hand touches the book. In all these cases forces are generated when there is contact between two bodies. These type of forces are known as contact forces.

Contact forces come into play when two surfaces are in contact with each other.

8.5.1 Types of Contact Force

1. Muscular Forces : A rickshaw puller applies force to pull a rickshaw. He applies force by using his muscles. Animals apply muscular forces in various tasks like pulling cart by bullocks.

Muscular force is contact force as this force comes into play when there is contact between two bodies.

Fig. 8.9 : Muscular force of animals is used to carry out many difficult tasks

Example

Weight lifting, running, lifting of a suitcase.

2. Friction : When you kick a football on the ground, it will stop by its own after covering some distance. When an engine is switched off, a moving car gradually stops after covering some distance. When you stop pedalling a bicycle, it gradually slows down and finally comes to rest. In all these examples, no force appears to be acting on each case. In all these cases objects comes to rest after some time. What causes objects to change their state of motion? Could some force be acting on them? In which direction the force is acting?

In all above cases a force is responsible to change the states of motion of the body known as force of friction.

In the above examples force of friction comes into play when ball moves over the ground. Force of friction is the contact force between two surfaces when one move over the other. Friction always opposes the motion of the body and acts opposite to the direction of the motion of the body.

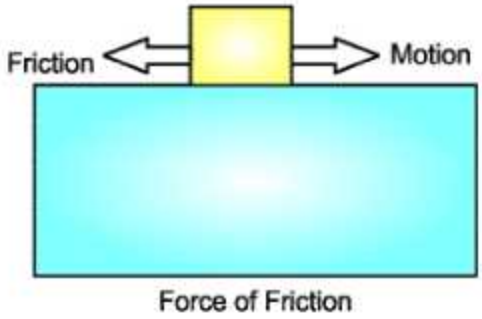


Fig. 8.10

8.6 NON-CONTACT FORCES

Take a magnet and place it near an iron pin. The pin will move towards the magnet without any touch. In another example rub a plastic ruler with your hairs and bring this ruler near to small bits of paper. Pieces of paper will move towards the ruler without any contact. What do you observe from the two examples? In both the cases a force is responsible. In the first case a force acts on a small pin by a magnet without any actual contact and in the second case force acts on small bits of paper due to a plastic ruler without any contact. These types of forces are known as non-contact forces.

8.6.1 Types of Non-Contact Forces

(1) Magnetic Force

(2) Electrostatic Force

(3) Gravitational force

(1) Magnetic Force : In the above example, when you place a magnet

near to the iron pin, it will be attracted by the magnet and moves towards the magnet without any contact. This type of force is known as magnetic force.

Activity 8.4 : Let us perform any activity to study magnetic force.

Take a pair of bar magnets. Place the longer side of one of the magnets over three round shaped pencils or wooden rollers as shown in Fig. 8.11. Now bring one end of the other magnet near the end of the magnet placed on the rollers. Make sure that the two magnets do not touch each other. Observe what happens. Next, bring the other end of the magnet near the same end of the magnet placed on the rollers (Fig. 8.11). Note what happens to the magnet placed on the rollers every time another magnet is brought near it.

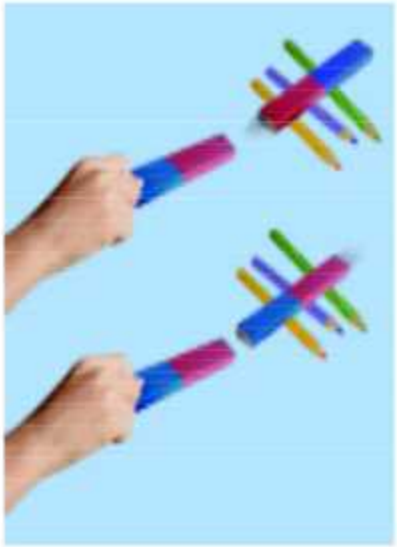


Fig. 8.11 : Observing attraction and repulsion between two magnets

In which direction the magnet over the pencils moves? Now reverse the side of the magnet and observe. Does the magnet also move now?. Is the direction same in both the cases?

In both the cases you will observe that magnet placed over pencils moves and in second case the magnet moves in the opposite direction. Some force is acting between the two magnets. This force is known as magnetic force. It is a non-contact force. Every magnet has two poles (North Pole and South Pole). Like poles repel each other and unlike poles attract each other. That is why in second case direction of motion of the magnet is reversed.

Force exerted by a magnet on objects of iron, nickel, cobalt or force of attraction /repulsion between two poles of magnet is known as magnetic force. It is a non-contact force.

8.6.2 Electrostatic Force

You have observed that a plastic ruler rubbed with hairs attracts small pieces of paper. Actually, by rubbing the plastic ruler with hairs, it aquires some electrostatic charge. Body which acquires charge is known as charged body. This type of force is known as electrostatic force. Let us perform an activity to understand electrostatic forces.

Activity 8.5

Take a plastic straw and cut it into nearly two equal pieces. Suspend one of the pieces from the edge of a table with the help of a piece of thread (Fig. 11.12). Now hold the other piece of straw in your hand and rub its free end with a sheet of paper. Bring the rubbed end of the straw near the suspended straw. Make sure that the two pieces do not touch each other. What do you observe?

Next, rub the free end of the suspended piece of straw with a sheet of paper. Again, bring the piece of straw that was rubbed earlier with paper near the free end of the suspended straw. What do you observe now?

You will see that the straw rubbed with paper attracts another straw but repels a straw similarly rubbed with paper sheet.

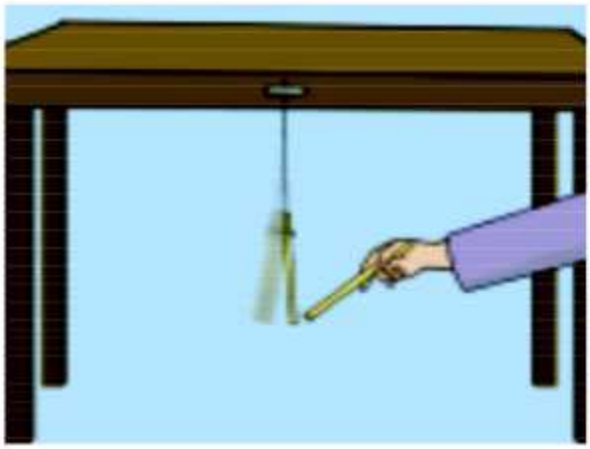


Fig. 8.12 : A straw rubbed with paper attracts another straw but repels it if it has also been rubbed with a sheet of paper

Force exerted by charged body on another uncharged or charged body is known as electrostatic force. Electrostatic force is non contact force.

8.6.3 Gravitational force

You know that a coin or pen falls to the ground when it slips off your hand. Leaves and fruits also fall to the ground when they get detached from the plant. Have you ever wondered why it is so?

When the coin is held in your hand it is at rest. As soon as it is released it begins to move downwards. It is clear that state of motion of the coin undergoes a change. Can this happen without a force acting on it? Which is this force?

Objects or things fall towards the earth because the earth pulls them. This force is called **force of gravity** or just **gravity**. This is an attractive force. The force of gravity acts on all objects. Force of gravity acts on all of us all the time without our being aware of it. Water begins to flow towards the ground as soon as we open a tap. Water in rivers flow due to the force of gravity.

Force of gravity is not only the property of earth. It is a universal force. Every object in the universe attracts other object with a force known as gravitational Force.

Unit of Force is

(1) newton (2) dyne

Questions :

Q.1. Is it always necessary that force make an object to move?

Q.2. Can force only increase or decreases the speed of the object?

Q.3. When a plastic scale is rubbed with hairs and brought near bits of paper, they stick to the scale. Why?

Q.4. Is Gravitational force a universal force?

Q.5. In which direction the force of friction acts to the direction of motion of the objects?

8.7 PRESSURE

Why it is easier to cut an apple with a sharp edge than a blunt edge? If you try to push a nail into a wooden plank by its head, will you succeed?, Now try to push the nail by its pointed end, will you succeed now ? You will succeed in latter case. Why ? When you stand on a mattress it sinks deeper than when you lie down on it.

To answer these questions, we have to observe these examples.

Have you observed the relation between the force and the area over which force is applied ?

Force per unit area is known as Pressure.

Pressure = Force/Area over which force acts

It is important to note that we consider the force which acts perpendicular to the surface.

From the above expression of pressure, it is clear that more is the area over which force acts lesser will be the pressure and and vice versa.

Now we will try to explain the answers of the above questions. It is easier to cut an apple with a sharp edge than blunt one, as area of a sharp edge is less than a blunt edge and pressure will be more in case of sharp edge than blunt edge. Due to more pressure on apple by a sharp edge it is easier to cut the apple easily. In the same way pointed side of the nail has lesser area than that of head side, so pressure is more on pointed side than the head side, so pointed side pushes into wood easily.

Similarly shoulder bags are provided with broad straps and not the thin straps as broader straps have larger area due to which less pressure is exerted on the shoulders. Do liquids and gases also exert pressure. Does it depend on the area on which the force acts. Let us find out.

8.7.1 Pressure Exerted by Liquid and Gases

Take a transparent glass tube or a plastic pipe of about 25 cm and diameter 5-7.5 cm. Also take a piece of thin sheet of a good quality rubber, say, a rubber balloon. Stretch the rubber sheet tightly over one end of the pipe. Hold the pipe at the middle,

keeping it in a vertical position (Fig. 8.13). Ask one of your friends to pour some water in the pipe. Does the rubber sheet bulges out? Note also the height of the water column in the pipe. Pour some more water. Observe again the bulge in the rubber sheet and the height of the water column in the pipe. Repeat this process a few more times. Can you see any relation between the amount of the bulge in the rubber sheet and the height of the water column in the pipe?

It clear from activity that water exerts pressure on the bottom of the container.

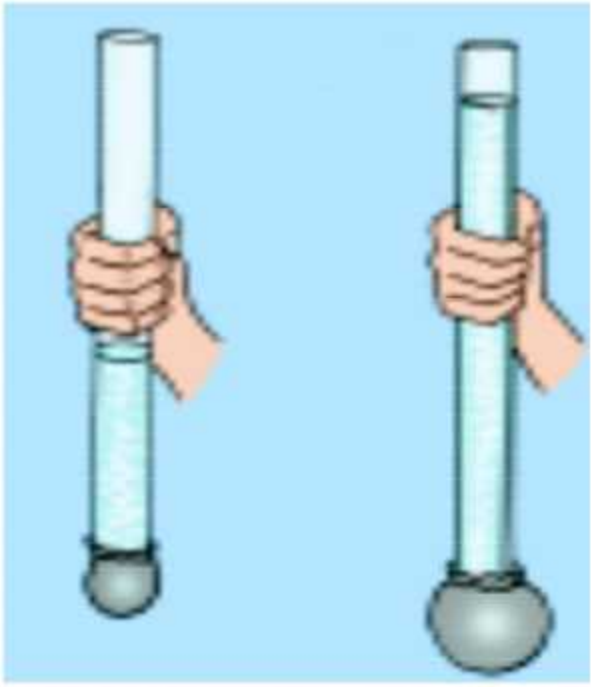


Fig. 8.13 : Pressure exerted by water at the bottom of the container depends on the height of its column

Also pressure depends upon the height of the water column, More is the height of the column more is the pressure.

Activity 8.7

Take a plastic bottle. You can take a discarded water or soft drink bottle. Fix a cylindrical glass tube, a few cm long near its bottom as shown in Fig. 8.14. You can do so by slightly heating one end of the glass tube and then quickly inserting it near the bottom of the bottle. Make sure that the water does not leak from the joint. If there is any leakage, seal it with molten wax. Cover the mouth of the glass tube with a thin rubber sheet as you did in Activity 8.6. Now fill the bottle upto half with water. What do you observe? Why does the rubber sheet fixed to the glass tube bulge this time? Pour some more water in the bottle. Is there any change in the bulge of the rubber sheet?

Fig. 8.14 : A liquid exerts pressure on the walls of the container

It is clear that water exerts pressure on the walls of the container.

Let us perform another activity.

Activity 8.8

Take an empty plastic bottle or a cylindrical container. You can take a used tin of talcum powder or a plastic bottle. Drill four holes all around near the bottom of the bottle. Make sure that the holes are at the same height from the bottom (Fig. 8.15). Now fill the bottle with water. What do you observe?

Do the different streams of water coming out of the holes fall at the same distance from the bottle? What does this indicate? You will see that water comes from all four holes with equal pressure and falls to same distance from the bottle. This means water at equal depth exerts equal pressure.

Fig. 8.15 : Liquids exert equal pressure at the same depth

Activity 8.9

Take a plastic bottle and make three small holes in side of it at different heights as shown in figure. 8.16.

Fill the bottle with water and observe.

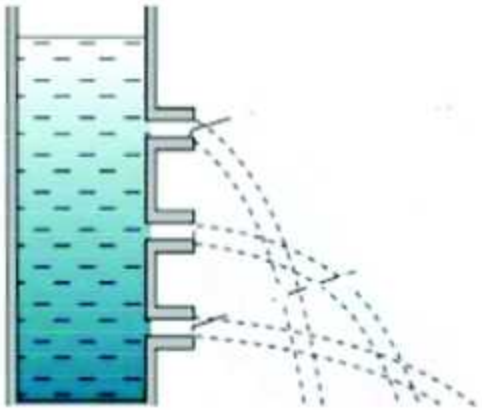


Fig. 8.16

What you observe?

You will see water at the hole near to bottom goes farthest and that from highest hole falls nearest and that from the middle hole falls between the two.

As water comes from the holes on the side of the container, this indicates that water exerts pressure on the sides of the container. As the height of the water column is highest above the bottom hole, the water from it comes out with highest pressure, for the hole at the maximum height, water column is lowest resulting in least pressure of water which falls nearest to the bottle.

It is clear from these activities that water (liquid) exerts pressures on the the bottom of the container as well as walls of the the container.

Liquid pressure increases with depth. Liquid exerts same pressure at same depth.

Walls of dams are made thicker at the bottom as pressure of water on the walls of dam increases with depth.

8.7.2 Pressure due to Gases

Do gases also exert pressure. Do gases also exert pressure on the walls of containers ? Let us find out.

When your bicycle tyre gets punctured or deflated, air comes out of it. When you inflate a balloon why do you have to close its mouth ? What happens when you open the mouth of an inflated balloon? You will observe that the balloon will deflate as soon you open its mouth. This shows that air exerts pressure on all sides of the balloon. Due to release of air pressure inside the tyre when punctured it gets deflated. These examples show that air exerts pressure on all sides of the container. If you have a balloon with holes. Would you be able to inflate it ? If not, why ?

Activity 8.10

Take a glass and fill it fully with water. Take a sheet of drawing paper or card board which fully covers the mouth of the glass. Cover the mouth of this glass with the drawing paper or cardboard. Put your palm over the glass and press gently and invert the glass holding with your palm. Now gently remove the palm. What will you observe? Will water come out from the glass?

You will observe that water will not come out in spite of the inversion of the glass. Which force is holding the water?

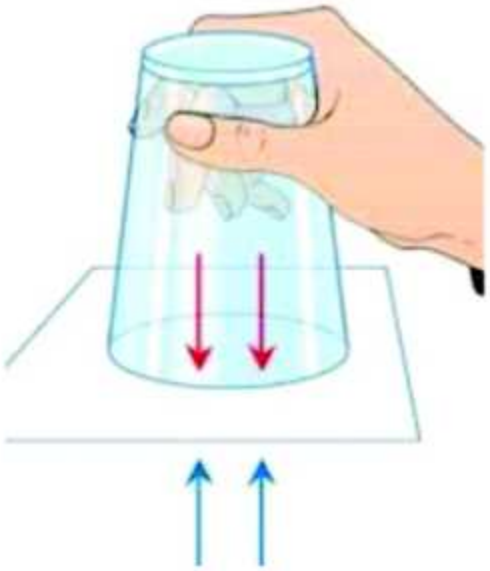


Fig. 8.17 : Atmospheric Pressure

8.8 ATMOSPHERIC PRESSURE

Earth is surrounded by a layer of air which is about 300 km thick. This layer of air is called atmosphere. This layer of air exert pressure on all things on earth and is called atmospheric pressure.

You have observed that water did not fall from glass on inverting it. This is due to atmospheric pressure.

Air has weight. If we fill a very long cylinder standing over a unit area, the weight of the air in this cylinder is atmospheric pressure.

Atmospheric pressure is the weight of air in a column of unit area.

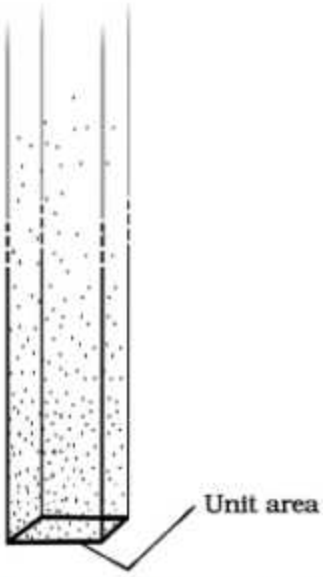


Fig. 8.18 : Atmospheric pressure is the weight of air in a column of unit area

Activity 8.11

Take a good quality rubber sucker. It looks like a small rubber cup (Fig. 8.19). Press it hard on a smooth plane surface. Does it stick to the surface? Now try to pull it off the surface. Can you do it?

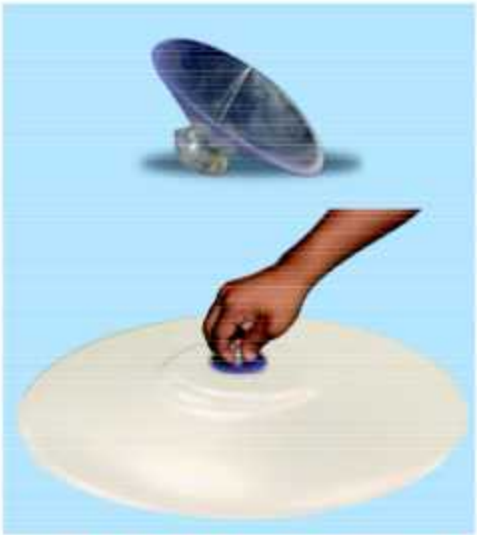


Fig. 8.19 : A rubber sucker pressed on a surface

When you press the sucker, most of the air between its cup and surface escapes out, the sucker sticks to the surface because the atmospheric pressure acts on it. Large force is required to pull the sucker off the surface to overcome the atmospheric pressure. If there is no air between the sucker and the surface, it will be impossible to pull the sucker off the surface by any human being. It gives the idea of magnitude of the atmospheric pressure.

The force due to air in a column of the height of the atmosphere and area 15 cm × 15 cm is hearly equal to the force of gravity on an object of mass 225 kg.

Then why we not crushed under this pressure?

Answer is that pressure inside our body is equal to atmosphere pressure and cancels pressure from outside.

8.8.1 Applications of Atmospheric Pressure

Winds blows due to difference in atmosphere pressure.

Working of dropper-A dropper is filled with liquid by reducing the pressure inside it. When dropper is dipped in a liquid and its rubber bulb is pressed, the air inside the dropper tube is expelled into the liquid. This reduces the pressure inside the dropper. However when the bulb is released, the atmospheric pressure acting on the surface of liquid pushes the liquid inside the dropper.

Atmospheric pressure decreases as height increases from (surface of earth). Therefore people are often advised not to carry fountain pens while travelling by air.

Questions :

Q.1. Pressure = Force /.....

Q.2. Show that liquid exerts equal pressure at same depth.

Q.3. What is Atmosphere and atmospheric pressure?

- Unit of pressure is N/m^2 or pascal.
- Instrument which measures atmosphereic pressure is barometer.
- Atmospheric pressure decreases with height.

POINTS TO REMEMBER

- Force is defined as a pull or push which acts on a body and changes or tends to change its initial state of rest, motion or direction of the motion of the body.
- Force comes into plays when at least two objects interact with one another.
- When two or more forces acts on same objects their net effect will the sum of all the forces.
- Forces may make an object move from rest. Force may change the direction of the motion of the object. Force may change the shape of an object. Force may increase or decrease the speed of the object. Force may stop a moving object. Force may cause some or all these effects. None of the above effects can take place in the absence of the force.
- Two types of forces are

  (1) contact force

  (2) non contact forces
- Contact force come into play when two surfaces are in contact with each other.
- A non contact force is that which is generated when two bodies interact but are not in contact with each other.
- Units of Force (1) newton (2) dyne
- Force per unit area is known as pressure.

  Pressure=Force/Area over force acts normal to the surface

POINTS TO REMEMBER

- Liquid and Gases exert pressure on the walls of the container.
- Liquid pressure increases with depth.
- Liquid exerts same pressure at same depth.
- Earth is surrounding by a layer of air which is about 300 kilometre thick known as atmosphere.
- Atmosphere pressure is weight of the air in the air column of unit area.
- Newton/meter^2 is unit of pressure also known as pascal.

Keywords

- Force
- Area
- Non-contact
- Gravitation force
- Atmosphere pressure
- Magnetic Force
- Speed
- North pole
- Newton
- Pascal
- Pull
- Friction
- Pressure
- Gravity force
- Liquid
- Motion
- Muscular force
- South pole
- Dyne
- Push
- Contact
- Electrostatic Force
- Atmosphere
- Fluid Gases
- Rest
- Barometer
- Universe
- N/m^2

EXERCISE – 1

1. What is force?
2. What are contact forces?
3. What are non-contact forces?
4. Give two examples each of contact forces and non contact forces?
5. What is gravitational force?
6. What is force of friction?
7. What is electrostatic force?

8. Can force change the direction of the motion of the body?

9. Differentiate between contact and non-contact forces.

10. What are types of forces?

11. Give an activity to show that air exerts pressure.

12. What is pressure?

13. What is atmosphere and atmospheric pressure?

14. Why it is easier to cut the apple with knife of sharp edge than a blunt one?

15. Why the tools meant for cutting and piercing always have sharp edges?

16. Why it is easier to push a nail in the wood with pointed end than the head?

17. Show with an activity that liquid pressure increases with depth.

18. Show with an activity that atmosphere exerts pressure.

19. Why are we not crushed under the huge atmosphere pressure?

20 Why walls of the dam always made thicker at the bottom?.

21. Choose the correct answers.

1. Liquid pressure is least at the bottom of the container.
2. Force of friction is a non-contact force.
3. North pole of the magnet repels the south pole of the another magnet?
4. Gravitational force is a contact force.
5. Force can change the state of motion of the body.

22. Fill in the Blanks with suitable words.

(1) Pressure is ..... per unit .....

(2) Gravitation force is ..... Force.

(3) South pole of a magnet ..... north pole of another magnet.

(4) To draw water from a well we have to ..... at rope.

(5) A charged body ..... an uncharged body towards it.

23. Match the terms given in column I with those given in column II

	Column I	Column II
1.	Pressure	Pull or Push
2.	Gravitational force	Working of a dropper
3.	Atmosphere Pressure	Force/Area
4.	Force	Opposes the motion of the body.
5.	Friction Force	Non Contact Force.

CHAPTER - 9

Friction

INTRODUCTION

You must have seen a driver of a car or bus slows down the vehicle at a traffic signal. We also slow down our bicycles wherever needed by applying brakes. Have you ever thought why a vehicle stops when brakes are applied? Not only vehicles, any object moving over the surface of another object slows down and finally stops when no external force is applied on it. A moving ball stops by its own after some time. Why? Why we slip when we fall on a banana peel?(Fig. 9.1). Why it is risky to walk on a wet floor? We will find answers to these questions in this chapter.

Fig. 9.1 A boy falls when he steps on a banana peel.

9.1 FORCE OF FRICTION

Activity 9.1

Gently push a book on a table. (Fig. 9.2). You will observe that it stops after moving some distance. Now push the same book from the opposite direction.You will see that book stops this time too after moving some distance? Can u find an explanation for this?

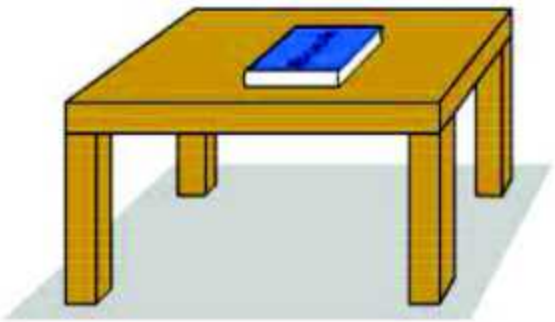


Fig. 9.2 a book pushed on a table

We know that motion can only be stopped by some force. Therefore, some force must be opposing the motion of the book. This force which opposes the motion is called**force of friction** or simply **friction** or **frictional force.**

When we apply force on the book along the left, friction acts along the

right. When we apply force along the right the friction acts along the left to stop the motion of the book. In both the cases the friction opposes the motion of the book. Therefore, **force of friction is always opposite to the applied force.**

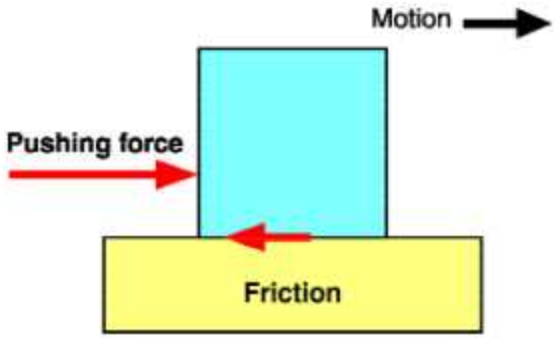


Fig. 9.3 force of friction is always opposite to applied force

In the above activity, the force of friction acts between the surface of the book and that of the table.

Is the friction same for all types of surfaces? Or it depends on the smoothness of the surfaces? Let us find out by doing an activity

9.2 FACTORS AFFECTING FRICTION

Activity 9.2

With the support of books make an inclined plane on a table or a smooth floor. (Fig. 9.4). Mark a starting point on the inclined plane with a pen. Let a dry cell move down this inclined plane on the table. Note the distance before it stops. Now spread a piece of cloth on the table and roll down the dry cell from the same mark.

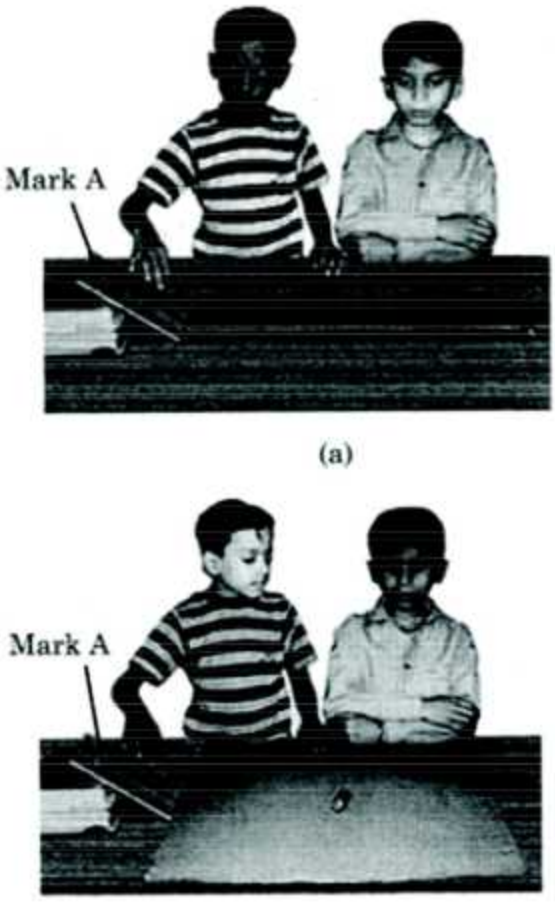


Fig. 9.4 a dry cell covers unequal distance down an inclined plane on different types of surfaces.

Are the distances same or different? You will see less distance is covered by dry cell on surface of cloth. Why?

9.3 CAUSE OF FRICTION

Surface of all objects has minute irregularities or projections. (Fig 9.5) When one object moves over the surface of other, these projections get interlocked and oppose the motion of the object which gives rise to force of friction.To move the object over the surface of another the applied force must be greater than force of friction.

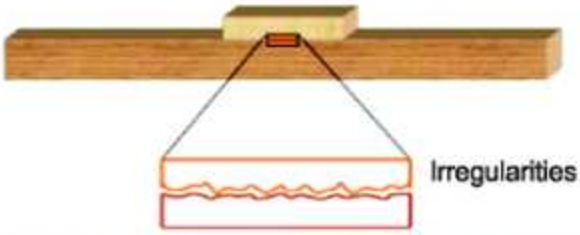


Fig. 9.5 interlocking of irregularities or projections of two surfaces in contact

Rough surfaces like sand, mud, road have more irregularities, so offers greater friction.

Smooth surfaces like glass, ice, banana peel have less irregularities and hence offers less friction.

This explains why we slip when we fall on a banana peel.

We now know that friction is caused by interlocking of irregularities of the two surfaces. It is obvious that force of friction will increase if the two surfaces are pressed harder. We can experience it by dragging a mattress when nobody is sitting on it and when a person is sitting on it.

9.4 TYPES OF FRICTION

Try moving a heavy box from one place to another which is at rest initially and then try moving a box which is already in motion. Which is easier to move? What if rollers are placed under the block? Isn't it easier to move the block now?

Depending on how the two surfaces in contact interact with each other there are three types of friction (fig 9.6):

1. Static Friction
2. Sliding Friction
3. Rolling Friction

Static Friction	Sliding Friction	Rolling Friction
1. It is the friction between two surfaces when one object just starts moving over the surface of another from its state of rest.	1. It is the friction between two surfaces when one object is already moving or sliding over the surface of another.	1. It is the friction between two surfaces when one object is rolling over the surface of another.
2. Static friction is the maximum force of friction present between two bodies.	2. Sliding friction is slightly less than static friction.	2. Rolling friction is even less than sliding friction.
3. Interlocking is more, So more external force is required to overcome force of static friction.	3. Due to sliding motion irregularities don't have enough time to lock, so interlocking is not very strong. So less external force is required to overcome sliding friction.	3. Interlocking is weak or area of contact is much smaller. Hence force required to overcome rolling friction is even less than sliding friction.

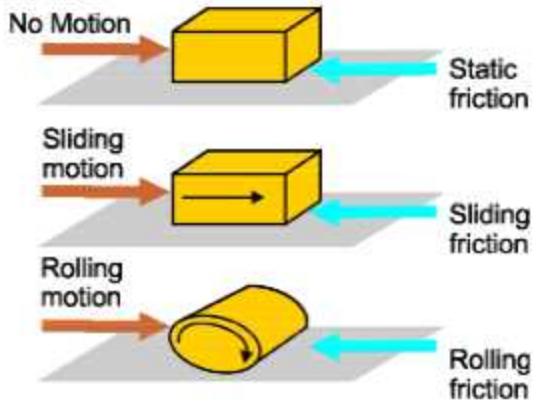


Fig. 9.6 Types os friction

Therefore :

Static Friction > Sliding Friction > Rolling Friction

9.5 FRICTION : A NECESSARY EVIL

Friction acts all the time around us. It is not improper to say that friction is a necessary evil because it has both harmful as well as beneficial effects.

a) Advantages of Friction

1. Friction enables us to walk and run. (Fig. 9.7)

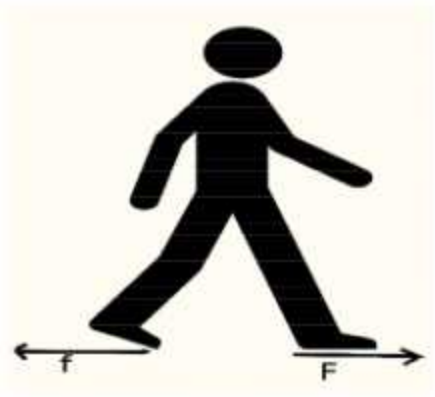


Fig. 9.7 walking is possible due to friction.

Without friction no walk or run is possible. During walk, we apply force F on the ground which in turn provide necessary frictional force *f* which prevents us from slipping.

2. Friction enables us to write and hold things.

Friction between the pen and the hand allow us to hold it firmly. Similarly, we can hold anything like a glass of water due to friction. It is only due to friction, we can write on a notebook or blackboard.

3. Friction produces desired amount of heat.

Due to friction when we strike a matchstick against a rough surface heat produced is enough to light the matchstick.In winters rubbing our hands produces heat due to friction. (Fig. 9.8)

Fig. 9.8 striking a matchstick against a rough surface produces heat due to friction

4. Friction allows objects to slow down or stop when desired.

A vehicle can be slowed or stopped by increasing the friction between the brake pads and the wheel.

b) Disadvantages of Friction

1. Friction causes wear and tear

Friction causes the soles of the shoes and tyres of vehicles to wear out slowly. Moving parts of the machines also wear out due to friction.(Fig. 9.9)

Fig. 9.9 wearing of soles of shoes due to friction

2. Friction slows down the motion of object when it is not desired.

For example, on a muddy road friction is so high that it decreases the speed of the vehicle.

3. Friction produces undesired amount of heat

Undesired heat produced by friction cause damage to machine parts and tyres. Sometimes friction produces so much heat that it makes the tyres burst on roads. Jar of a mixer becomes hot when it is run for a few minutes. This heat can also damage the motor of the mixer if it is run for a longer duration.

9.6 WAYS OF INCREASING FRICTION

Friction can be increased by:

1. By making surfaces in contact extra rough or uneven friction can be increased. Roughness increases projections on the surfaces and hence increases interlockings to a great extent increasing friction

2. By creating grooves and treads on the moving objects or surfaces. Grooves are shallow depressions made on the soles of the shoes to make them rough to increase friction while running or walking. (Fig. 9.10)

Fig. 9.10 grooves on shoes to increase grip on roads due to friction.

Treads are series of patterns made on tyres which increases the friction between the tyres and the road. (Fig. 9.11)

Fig 9.11 treads on tyres to increase friction

2. Applying a coarse substance on the contact surface.

Kabaddi players rub soil on their hands to increase friction to get a better grip on the opponent. Gymnasts apply a coarse substance (magnesium carbonate) on their hands to increase friction to get better grip on bars and beams.

9.7 WAYS OF REDUCING FRICTION

Friction can be decreased by

(1) making the surfaces in contact, even or smooth.

Smoothness reduces projections on the surfaces and hence prevent interlockings to a great extent reducing friction.

(2) Applying oil, grease(lubricant) on the contact surfaces.

This method creates a layer between interlockings due to which interlocking is prevented between projections of the two surfaces thus reducing friction. For example,we apply a fine powder (usually vegetable starch or boric acid powder or talcum powder) on the surface of a carom board to minimise friction of striking carom-coins with the board (Fig. 9.12). Oil or grease**(lubricant)**is applied on door hinges and moving parts of machinery to reduce friction (fig 9.13.) A lubricant is a substance that helps to reduce friction between surfaces in mutual contact.

Fig 9.12 applying powder on carom board reduces friction

Fig 9.13 applying lubricant (oil or grease) to machine parts reduces friction

(c) using rollers, ball- bearings and wheels to convert sliding friction into rolling friction.

A heavy object with wheels or rollers moves easily over a surface as rolling friction is less than sliding friction.It is easy to pull a luggage fitted with rollers (Fig. 9.14). In machines sliding friction is replaced by rolling friction by use of ball-bearings (fig. 9.15) In daily life you can see ball bearings used between hubs and axles of bicycles and ceiling fans. Wheels which are rightly said to be one of the greatest invention of mankind has made our life a lot easier and faster (Fig. 9.16).

Fig. 9.14 rollers on luggage bags reduces friction

Fig. 9.15 ball bearings reduces friction

Fig. 9.16 wheel one of the greatest invention of mankind reduces friction

12.6 FLUID FRICTION

Like solids, liquids and gases (collectively called fluids) also offers friction on the bodies moving through them. The air which is very light and thin exerts frictional force on objects moving through it. This frictional force exerted by fluids to the motion of bodies through them is called fluid friction or drag (Fig 9.17).

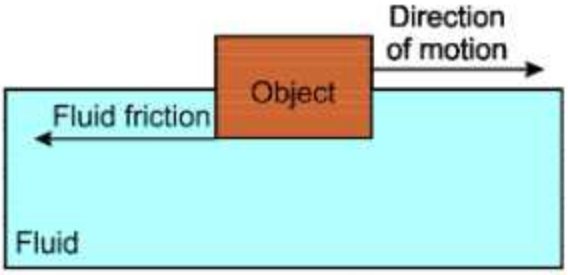


Fig 9.17 fluid friction

The frictional force on an object in a fluid depends upon its speed with respect to the fluid. It also depends upon the shape and the nature of the fluid. Due to their high speed, meteors or shooting stars get burned while entering the atmosphere due to fluid friction. Objects like spacecrafts coming back from space are traveling many times faster than the speed of sound. So, to keep them from burning up or breaking up they must be protected from the intense heat caused by that of atmospheric friction. (for that special heat shields are used which are made of special material).

While its motion through fluids objects and animals lose energy to overcome fluid friction. To minimise fluid friction nature has given streamline shapes to aquatic and aerial animals like fishes and birds. Ships, aeroplane, submarines and even cars also have streamlined shapes to reduce fluid friction. (Fig 9.18 and 9.19)

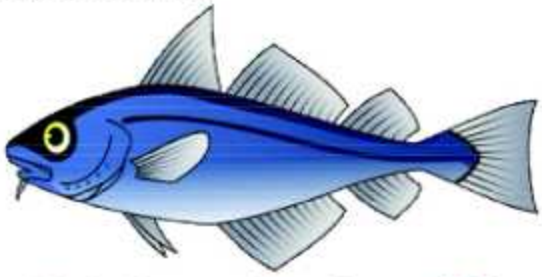


Fig 9.18 streamline shape of fish

Fig 9.19 Streamlining reduces fluid friction

POINTS TO REMEMBER

- Friction is an opposing force which come into play when one body moves over surface of another.
- Friction is experienced during pull or push.
- Friction helps us to walk on a surface, burn a match-stick, sharpen a weapon etc.
- It was the friction between two stones that ancient man learned to make fire.
- When friction causes wear and tear then it is undesirable.
- Atmospheric friction saves us from meteors or shooting stars.
- Smooth surfaces cause less friction than rough surfaces.
- Oiling and greasing decreases friction and wear and tear of machinery parts.

POINTS TO REMEMBER

- Wheels are used in vehicles which have rolling friction which is always less than sliding friction.
- Rollers help us to carry heavy logs of wood as it converts sliding friction into rolling friction.
- Rolling friction is less than sliding friction.
- Friction caused by fluids is also called drag or fluid friction.
- Athletes wear shoes which have spikes and grooves on the sole which save them from being slipped.
- Aquatic animals and flying birds have streamlined body shapes.
- Man-Made boats, ships and airplanes also have streamlined shape.

Keywords/Vocabulary

- Pull
- Lubricant
- Grooves
- Projections
- Drag
- Shooting Star
- Streamlining
- Rollers
- Ball-bearing
- Greasing
- Atmospheric friction
- Fluid friction
- Treads
- Static friction
- Rolling friction
- Contact points
- Sliding friction

EXERCISE

A. Fill in the blanks :

(i) ..... is an opposing force which comes into play when one surface moves over another surface.

(ii) Friction on the bodies moving through fluids is called ..... .

(iii) Rubbing both hands produces ..... due to friction.

B. Write true or false (T/F) for following :

(i) Use of rollers in trolley bags makes it difficult to pull the trolley.

(ii) Oiling and greasing minimize the friction.

(iii) We throw sand on a slippery path to increase friction.

C. Match the correct answers from column II with their alternatives in column I.

	COLUMN I		COLUMN II
(i)	Ships, boats and airplanes are made in this shape.	(a)	ball-bearings
(ii)	The sole of shoes of the athletes have special features called	(b)	atmospheric friction
(iii)	The opposing force due to fluid friction	(c)	grooves
(iv)	This phenomenon saves us from meteors or shooting stars	(d)	streamlined
(v)	Machinery parts having least friction due to	(e)	drag

D. Multiple choice question (M.C.Q.) :

(i) Which type of friction is greatest ?

(a) Sliding friction

(b) Rolling friction

(c) Static friction

(d) None of these

(ii) We use these measures to minimize friction.

(a) Make surfaces smooth

(b) use ball-bearings

(c) Apply oil or grease

(d) all of these

(iii) We adopt following measures to increase friction

(a) Use rollers

(b) treads on tyres

(c) use oil or grease

(d) make surfaces smooth

(iv) Which of the following is an example of sliding friction.

(a) Dragging a sand bag on floor

(b) use of rollers in a trolley

(c) use of ball bearings

(d) laborers use rollers to pull logs of wood.

(vi) This shape help aquatic animals to swim in water.

(a) Flat body

(b) streamlined body

(c) broad body

(d) rough body

E. Very short answer type questions.

1. How did early man learnt to make fire?
2. What is drag?
3. Why do we use roller trolley to pull luggage ?
4. Write two methods to increase friction?
5. Write any two situations where friction is experienced.

F. Short answer type of questions.

6. Write two methods to increase friction.
7. How does atmosphere save us from shooting stars ?

8. Write any three situations where friction is harmful for us?

9. Why do the ships, boats and airplanes are made streamlined?

10. Why do we rub our hands in winter?

G. Long answer type questions.

11. Friction is a necessary evil. Explain with examples.

12. Write few methods to reduce friction.

CHAPTER - 10

Sound

How do you come to know that someone is knocking at your door, or an aeroplane is passing over you or if your period is over or your mother is calling you ?

In daily life you hear a variety of sounds. You are familiar with sounds produced by musical instruments. You can recognize your friend by his voice without seeing him. How can you differentiate the sound of a girl and a boy without seeing them? What is the difference between the sound of a lion and a mosquito? How sound is produced? How sound reaches you ? Why musical sound pleases you, while the sound of a pressure horn disturbs you ? In this chapter we will study all of this in detail.

10.1 WHAT IS SOUND ?

Sound is the sensation felt by our ears. It is a form of energy that makes us able to hear. To hear a sound, there should be presence of some source of sound, a medium and a sensing body like ear.

10.1.1 Sound is Produced by a Vibrating Body

Activity 10.1

Materials required : A school drum, a stick, rice grains.

Take a school drum and place it on the ground and strike it with a stick. It will start producing sound. Place some grains of rice over it. What will happen to the grains ? You will see that grains will also start moving. (fig. 10.1)

Fig. 10.1

It is clear from the above activity that when the drum is producing sound, its membrane start vibrating. Due to this vibration grains of rice also start moving and stops moving when drum ceases to produce sound. Lets do another activity.

Activity 10.2

Materials required : A metal plate/pan, a stick.

Take a metal plate/pan. Hang it in such a way that it does not touch anything. To produce sound strike the plate with the stick and then hold the plate with your hands firmly. You will feel some vibrations. (Fig. 10.2)

After some time the vibrations die out and sound can no more be heard. This activity proves that sound is produced when a body vibrates and stops producing sound when it stops vibrating.

Fig. 10.2 : Vibrations produced in a pan produces sound

10.1.2 Sound Produced by Humans

In humans sound is produced by the **voice box** (or the **larynx**). Put your fingers on the middle of your throat underneath your chin. You will feel a bony lump like structure. This part of the body is known as voice box (larynx). It is at the upper end of the windpipe. Two vocal chords are stretched across the voice box in such a way that it leaves a narrow slit between them for the passage of air. (fig. 10.3)

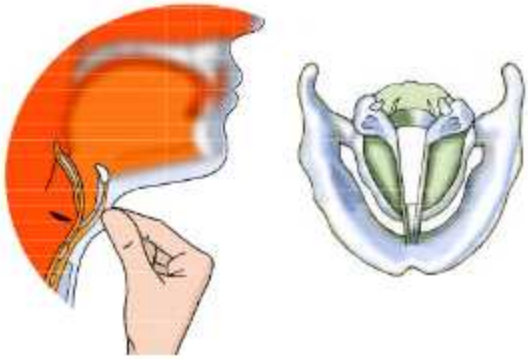


Fig. 10.3 : Voice box (larynx)

When the lungs force air through the slit, the vocal cords vibrate, producing sound. Muscles attached to the vocal cords can make it tight or loose. When the vocal cords are tight and thin, the type or quality of voice is different from when they are loose and thick. To understand how the vocal cords work, let us perform an activity.

Activity 10.3

Material required : Two rubber strips.

Take two rubber strips of the same size. Place these two pieces one above the other and stretch them tight. Now blow the air through the gap between them. (Fig. 10.4 (a)). As the air blows through the stretched rubber strips, a sound is produced. You can also take a piece of paper with a narrow slit and hold it between your fingers as shown in (Fig 10.4 (b)). Now blow through the slit and

Fig. 10.4 (a) & (b)

listen to the sound. Our vocal cords produce sound in a similar manner.

Vocal cord is 20 mm long in men and about 15 mm in women. In children it is very short in length. That's why the sounds of men, women and children are different.

Questions :

Q.1. What is sound ?

Q.2. When grains are put on a drum after striking it with a stick, why grains start moving ?

Q.3. Can a body produce sound without vibration?

10.2 VIBRATION, AMPLITUDE, OSCILATIONS, FREQUENCY AND TIME PERIOD

We have used the term vibration in this chapter. To understand vibration let us perform another activity.

Activity 10.4

Materials required : A rubber band, a pencil box.

Take a rubber band. Put it around the longer side of the pencil box and stretch it. Insert pencils between box and rubber as in fig. 10.5. Now, pluck the rubber band somewhere in the middle, Do you feel vibration? Do you hear sound?

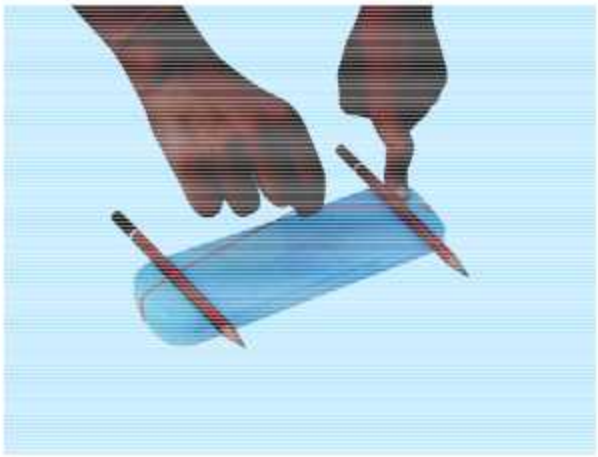


Fig. 10.5

You will hear the sound of the stretched rubber band and also see to and fro motion of the rubber band. To and fro motion of any thing (rubber band) is called vibration. Every vibrating body has to and fro motion.

Activity 10.5

Material required : A simple pendulum.

You have studied about simple pendulum in previous class. To understand the concept, suspend a metallic ball called bob with a non stretchable string on the stand as shown in fig. 10.6. Allow the ball to

Fig. 10.6 : Simple Pendulum

come to rest. This position is called mean position. Mark it as A. Give a gentle push to the ball; it will start to and fro motion about its mean position A. Ball will go to extreme left position C and other extreme right position B. C and B are extreme positions on the left and right side of ball.

To and fro motion of the ball about its mean position is called **vibration** (or **oscillation**).

Pendulum complete one vibration when it moves from its mean position in the following way :

A→C→A→B→A

Number of vibrations per second is called **frequency**. Unit of frequency is hertz (Hz). **Frequency is said to be one hertz if one vibration is completed in one second**. For example if a body completes 20 vibrations in one second then its frequency will be 20 hertz.

Maximum displacement of the body from its mean position is called **amplitude**. If you push the pendulum with a less force it will move less distance away from the mean position, then amplitude will be less and if you give stronger push to the ball it will move more distance away from the mean position then amplitude will be more. SI unit of amplitude is metre (m)

Time taken by the ball to complete one vibration is called **time period**. It is expressed in seconds.

Frequency = 1/Time period.

Numerical Problem

A pendulum completes 64 vibrations in 4 seconds. Calculate its frequency and time period.

Solution : frequency = number of vibrations/total time taken
= 64/4 = 16 Hz
Time period = 1/Frequency
= 1/16 seconds.

Questions :

Q.1. Define the terms :-
(a) Amplitude (b) Frequency
(c) Time Period

Q.2. When the ball of the pendulum is at rest position; what is the name of this position?

Q.3. Name and define the unit of frequency.

Q.4. What is the relation between time period and frequency ?

10.3 SOUND REQUIRES MEDIUM TO TRAVEL

You hear the sound of your school bell. Do you know how does the sound travel to you? Does sound require a medium to travel? Can sound travel through solids, liquids or gases ? To answer these questions we can do some activities.

Activity 10.6

Materials required : A metal or glass tumbler, a cell phone.

Take a dry metal or glass tumbler. Put a cell phone in it. Ask your friend to give ring on this cell phone. Listen to the sound carefully. Now, cover the rim of the tumbler with your hands. Put your mouth on the opening between your hands. Suck the air and indicate your friend to ring the bell again. Note the difference. Does the sound become fainter as compared to the previous sound when the air was not sucked? Now remove the tumbler from the mouth and listen to the sound carefully. Does the sound become louder again?

Fig. 10.7

Can you explain the reason why loudness of the sound decreases as you suck the air and sound becomes louder again when the tumbler is removed from the mouth? If you were able to remove the air completely there would be no sound. Actually sound requires a medium to travel. Here the medium is air which is a gaseous medium.

You can also perform an activity by putting the cell phone in a bell jar and connecting the bell jar to a vacuum pump. No ringtone would be heard as air is expelled out from bell jar by vaccum pump. This activity proves that sound cannot travel through vaccum.

Can we hear sound on moon or in outer space ? Since moon or outer space has no air or atmosphere at all, sound can not be heard there due to the absence of any medium. Thus astronauts are not able to talk directly to one another in space. They talk through wirless sets.

10.4 CAN SOUND TRAVEL THROUGH LIQUIDS ?

Activity 10.7

Material required : A bell, a tub with water.

Take a bell in your hand and take a tub filled with water. Put the bell in the water and shake it. Can you hear the sound of ringing bell? Yes, you can. This can only be possible if sound travels through water. You can use a squeaking toy (sound producing toy) in place of the bell.

Fig. 10.8

This activity proves that sound can travel through water. If you take some other liquid instead of water, you will also hear the sound. This proves that sound can travel through liquids.

10.4.1 Can Sound Travel Through Solids ?

Activity 10.8

Material required : a table (metallic or wooden).

Place your ear at one end of a long table. Now put the hand on the other ear and ask your friend to tap the table from other end. Can you hear the sound of the tapping? Definitely you will hear the sound. This is possible only if sound travel through table. This proves that sound can travel through solids.

Fig. 10.9

Let us perform another activity to prove that sound can travel through solids.

Activity 10.9

Materials required : Two empty plastic or paper cups or two match box, a long thread.

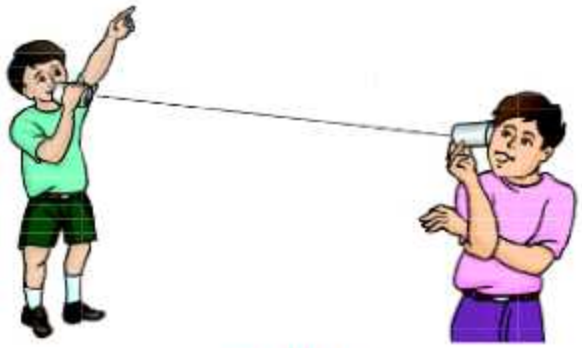


Fig. 10.10

Take two empty plastic glasses or empty match boxes and make a hole at the bottom of each glass. Pass a string through the holes of both the glasses. Make knots at the ends of the string so that string is tightly fitted with the glasses. This is a toy telephone. (Fig. 13.10) Stretch the string tightly and ask your friend to speak into one of the glass and listen the voice from the other glass. You will hear the sound of your friend. This activity clearly indicates that sound travel through string (solids).

Questions :

Q.1. Can astronauts hear the sound on moon ? Why or why not ?

Q.2. Can sound travel through vacuum? If not, demonstrate it by an activity.

Q.3. When you place your ear at one end of the table and your friend keeps on tapping the table on the other end, Can you hear the sound? If yes, what conclusion did you draw?

Q.4. When you shake a bell in water, you hear the sound of the bell. What does it prove?

10.4.2 Speed of Sound

Sound travels fastest and most easily through solids. This is due to the fact that the molecules in a solid are very closely packed. Closer the particles, easier will be transfer of sound. The molecules in liquid are less closely packed, therefore sound travels slower in liquid. The speed of sound in gases is the least as the molecules are quite farther apart.

Speed of light is much more than the speed of sound in the air. Speed of light in air is 300000 kilometer per second while the speed of sound in air is about 340 meter per second. Speed of sound in water is about 1500 meter per second and in solids it is about 5000 meter per second.

Do You Know :

- The fact that sound needs a medium to travel was discovered by Otto Von Guericke of Germany in 1654.
- Sound travels 16 times faster in metal and 4 times faster in water than in air.

10.5 CHARACTERSTICS OF SOUND

You can recognize your friend by his/her voice without seeing him/her. You can tell whether the voice is of a girl or a boy without seeing them. What is the difference between the sound of a lion or a bird ? To answer these questions we have to know the **Characterstics of Sound.**

A sound has three main characteristics :-

1. Loudness
2. Pitch
3. Quality or timbre

10.5.1 Loudness

Activity 10.10

Material required : Metallic glass, water, thermocol balls, table spoon.

Take a metallic glass and fill it with water. Now take a thermocol ball and suspend it in such a way that it touches the glass. (Fig. 10.11) Now strike the glass gently with a table spoon. Note the displacement of the ball and the sound produced. Again strike the glass at the brim with a

larger force. Note carefully the displacement of the ball and the sound produced. What have you observed?

You might have noticed that when the spoon strikes, with less force, sound is feeble and displacement of the ball is less and when the spoon strikes with larger force, the displacement of the ball is more and sound is louder. It is clear from this activity that loudness of the sound depends upon the amplitude of the vibrations of the sound produced. Displacement of the ball represents the amplitude of the sound. **More is the amplitude of the vibrations produced by the sound, louder will be the sound produced.**

Fig. 10.11

Amplitude (or loudness) of sound is measured in decibel (dB).

Above 80 dB sound becomes painful and unbearable.

Various sounds in units of decibel	
Rusting of leaves	10 dB
Whisper	30 dB
Mosquito buzzing	40 dB
Busy traffic	70 dB
Average factory	80 dB
Lawn mover	100 dB
Fast Train	130 dB
Nearby jet airplane	150 dB

Actually loudness is proportional to the square of the amplitude of the vibrations of the sound. If amplitude is doubled then loudness will increase four times.

10.5.2 Pitch

Compare the voice of a child with the voice of an adult. Is there any difference? Even when the two sounds are equally loud, they are still different. How ?

Sound of a child is shriller than the sound of an adult. This shrillness or pitch depends upon the frequency of the vibrating body. More is the frequency of the vibration of the body, more will be shrillness of its sound. **Shrillness of the sound is called pitch**. Sound of child has more pitch than the sound of adult. Sounds produced by birds have more pitch than the sound of the roar of the lion. Sounds of girls have more pitch than the sound of boys even when both the sounds are equally loud. Sounds of mosquitoes have more pitch than the sound of lion. Different instruments have different pitches. A musician changes the pitch while

playing the instrument for different tunes.

10.5.3 Quality of sound

Quality (or timbre) is that characteristic of a musical sound which enables us to distinguish between the sounds of same pitch and loudness.

We can distinguish between the sounds of a guitar and sitar by their timbre though both have same pitch and loudness. Thus the sounds of different musical instruments can be distinguished by its timbre. We can even recongise a person from his/her voice (even without seeing him) on the basis of the unique quality of his voice.

Questions :

Q.1. What do you understand by the pitch and loudness of the sound ?

Q.2. Which sound has more pitch, sound of a child or an adult?

Q.3. On which factor does the loudness of the sound depend?

Q.4. Name three characteristics of sound.

10.6 AUDIBLE AND INAUDIBLE SOUNDS

Can you hear the sounds of all vibrating bodies? How bats can find their path in night? Can some other animals hear the sound which human cannot hear?

In fact we cannot hear the sound of all vibrating bodies. Human ear can detect the sound having frequency more than 20 Hz and less than 20000 Hz and is known as **audible sound range**. Sound of frequency less than 20 hertz (Hz) and more than 20000 hertz cannot be detected by human ear and are known as inaudible sound. Sounds having frequency less than 20 Hz are known as**Infrasonics**. Sounds having frequency more than 20000 Hz is known as **Ultrasonics**. Rhinoceroses communicate by using infrasonics. They can hear sound having a frequency as low as 5 Hz. Dogs can hear up to the frequency of 50000 Hz. Cats can hear the ultra sounds of frequency 65000 Hz, and bats can produce the sound of frequency more than 100000 Hz. Bats catch their prey by using ultra sonic vibrations.

Dolphins also use ultrasound to detect their prey. Elephants communicate among themselves with the help of infrasonics.

10.6.1 Uses of Ultrasonics

Uses of Ultrasonic Sounds/Waves

- By using ultrasound imaging (or sonography) defects in the internal body parts can be seen on a screen and detected. In pregnancy growth of the foetus can also be determined using it.
- Ultrasonic waves are used in dish washing machines to clean the utensils .
- Ultrasonic vibrations are used to drive rats and cockroaches away from godowns.

- Ultrasonics are also used in the detection of cracks in metal blocks.
- Ultrasonics are also used to break kidney stones.

Questions :

Q.1. What is ultrasound and what are its uses in medical treatments?

Q.2. What is audible frequency range for humans ?

Q.3. What is the difference between infrasonic and ultra sonic vibrations ?

10.7 NOISE AND MUSIC

We hear different type of sounds around us like sound of jet aeroplane, conventional T.V. sound, sound of machines in factories etc. Some of these sounds make us comfortable while others make us uncomfortable.

When all the students in your class speak together, you feel uncomfortable. You feel uncomfortable when you hear the sound of air jet and sound of vehicles. When you visit a factory, sound of the machines makes you feel uncomfortable. An unpleasant sound which makes you feel uncomfortable is known as**noise**.

When you listen to some music you feel pleasant. Sound produced by harmonium and other musical instrument pleases you. The sound which produces pleasing effect to your ear is known as **musical sound** or **music**.

Musical sounds are produced by regular vibrations. On the other hand in noises frequencies are irregular and have no definite ratios with each other. Musical sound can become noise if its loudness is very high and unbearable. Thus, noise is an unpleasant, discontinous and non - uniform sound produced by irregular disturbances. Too loud music can also be considered as noise.

10.7.1 Noise Pollution

You might have known about air pollution, water pollution and soil pollution. They are harmful to the environment. Similarly sound can also be harmful to the environment if the sound is too loud, unbearable, offensive and unwanted, For example sound of pressure horn of vehicles, sound of crackers, sound of explosions, sound of factories, sound of air jet, loud music, sound of loud speakers, TV and musical players. Presence of excessive, unwanted, loud and offensive sounds in the environment which have harmful effects on human health is called as **sound pollution**. Sound having loudness above 80 dB is harmful and counted as sound pollution.

10.7.2 Harmfull Effects of Noise Pollution

- Exposure to sound more than 80dB can cause permanent hear loss.
- Sound pollution can cause high blood pressure.
- Continuous exposure to sound pollution can cause heart diseases.

- Sound pollution can lead to anxiety, sleeplessness, stress or lack of concentration.
- It even affects other animals along with humans.

10.7.3 How To Reduce Noise Pollution

There are some steps which can be helpful to reduce sound pollution

- There should be complete ban on loud crackers.
- All factories should be outside the residential areas.
- Silencing devices should be installed in all vehicles, aircraft engines, industrial machines and household appliances.
- Trees must be planted alongside roads. Trees absorb and deflect the sound energy.
- Thick curtains inside our homes contribute to the reduction of unwanted noise.
- Machines in factories should be checked regualrly and repaired time to time.
- Domestic appliances should be lubricated and maintained timely.
- Use of loudspeakers should be restricted and only permitted for limited period with low intensity.
- TV, radio and other musical instruments should be heard at low level of noise.
- There should be complete ban on pressure horns. Horns should be used only when it is absolutely necessary.

Do You know ?
The Larch is the most effective tree in absorbing sound with its bark.

Questions :

Q.1. What is the difference between noise and music?

Q.2. What is noise pollution ?

Q.3. What are the bad effects of noise pollution?

Q.4. How can you reduce noise pollution?

10.8 HOW CAN WE HEAR SOUND THROUGH OUR EARS?

Ask your friend to ring a bell. You will hear the sound of the bell. Put your hands on both your ears. Can you hear the sound? Now take off the hands from the ears. You might have observed that, you will not be able to hear the sound when you put your hands on the ear and you will be able to hear the sound again when you put off the hands.

From the above activity it is clear that we hear the sound through our ears.

10.8.1 Structure of human ear and its working

Our ear consists of three parts: outer ear, middle ear and inner ear.

OUTER EAR : The shape of the outer part of our ear is like a funnel called pinna. It is the only part of the

ear which we can see. When sound enters in pinna, it travels down a canal at the end of which a thin membrane is stretched tightly. This membrane is called the **eardrum**. When sound vibrations fall on the eardrum, it starts vibrating. It then sends vibrations to the middle ear.

Fig. 10.12 : Structure of Human Ear

MIDDLE EAR : Middle ear consists of three bones called malleus, incus and stapes. These bones are interlocked with each other. Ear drum transfers the vibrations to middle ear which again transfers these vibrations to inner ear.

INNER EAR : Inner ear is the innermost part of the ear. It consists of tubes called cochlea which are semi circular canals filled with fluid and auditory nerves. This part is also responsible for balance. From here signal goes to the brain, which help us to hear and recoginze the sound.

Let us understand the working of the eardrum.

Activity 10.11

Material required : Plastic or tin can, cutter, rubber ballon, rubber band, grains of cereal like rice.

Take a plastic or tin can. Cut its ends. Stretch a piece of rubber balloon across one end of the can and fasten it with a rubber band. Put four or five grains of dry cereal on the stretched ballon. Now ask your friend to speak "Hello, Hello" from the open end. (Fig. 10.12.) Observe what happens to the grains. Why do the grains moves up and down?

Fig. 10.13

The ear drum is also like a stretched rubber sheet. Sound vibrations make the ear drum vibrate.

We should not put anything (like pin, pen, pencil etc) inside our ears, because they can tear the eardrum, which can make a person deaf. We should take proper care of our ears.

Questions :

Q.1. Explain the working of ear drum with an activity.

POINTS TO REMEMBER

- Sound is a form of energy
- Sound is produced by vibrating bodies.
- Sound requires a medium to travel.
- To and fro motion of the body about its mean position is called vibration (oscillation).
- Number of vibrations per second is called frequency.
- Unit of frequency is hertz (Hz).
- If a body completes one vibration in one second then frequency is one hertz (Hz).
- Maximum displacement of the vibrating body from its mean position is called amplitude (A).
- Time taken by the body to complete one vibration (oscillation) is called Time Period (T).
- Shrillness of the sound is called Pitch
- More is frequency of the vibrating body, more will be its pitch and vice versa.
- Loudness depends upon the amplitude. More the amplitude, more will be the loudness and vice versa.
- Human ear can detect sounds between 20Hz to 20000 Hz known as audible sound range.
- Sound having frequency more than 20000 Hz is known as ultra sonic and having frequency less than 20 Hz is called Infrasonic.
- Unpleasant sound is called Noise and sound which makes pleasing effect to our ear is known as musical sound. *
  Presence of excessive, unwanted, loud and offensive sound in the environment is called sound pollution.
- Sound more than 80 dB is harmful.
- Loudness of the sound is expressed in decibel. (dB)

Keywords

- Amplitude
- Loudness
- Oscillation
- Time period
- Hertz
- Pitch
- Frequency
- Vibration
- Noise

- Eardrum
- Larynx or Voice box
- Vocal cords
- Mean position
- Extreme position
- Ultrasonics
- Infrasonics
- Audible Sound
- Inaudible Sound
- Decibel(dB)
- Displacement
- Pollution
- Bob
- Medium
- Pendulum

EXERCISE

A. Fill in the blanks.

(a) Time taken by an object to complete one vibration is called .....

(b) Sound requires a ..... to travel.

(c) Sound travels fastest in..... .

(d) Hertz (Hz) is the unit of ..... .

(e) Unwanted sound is called ..... .

(f) Sound having frequency more than 20000 Hz is called ..... .

(g) Shrillness of the sound is called---------

B. Write "T" for true and "F" for false statements.

(a) Sound having frequency less than 20 Hz is known as Infrasonic.

(b) Sound can travel in vacuum.

(c) Sound having frequency more than 80dB is harmful.

(d) Sound of lion has more frequency than the sound of a mosquito.

(e) Pitch of the sound depends upon amplitude of vibrations.

(f) Sound cannot travel through a string.

C. Multiple Choice Questions

(a) The amplitude of the sound decides its .....

(1) speed (2) loudness

(3) pitch (4) source

(b) Sound can travel in

(1) Gases only (2) liquids only

(3) Solids only (4) Gases, liquids and solids, all.

(c) When you hold the ringing bell with hand

(1) Bell stops vibrating and stops ringing.

(2) Bell starts vibrating with inaudible frequency.

(3) No change in vibration

(4) Amplitude increases

D. Match column 1 with column 2

	Column I		Column II
(1)	Noise	(a)	unit of frequency
(2)	Larynx	(b)	human organ which produces sound
(3)	Hertz	(c)	Loudness
(4)	Decibel	(d)	musical instrument
(5)	Flute	(e)	Unwanted sound

E. Very Short Answer Questions :

1. Name the organ which produces sound in humans.
2. What is difference between noise and music?
3. Define one vibration.
4. What are ultrasonics and infrasonics ?
5. Name the units for measuring loudness and pitch.
6. What is the relation between frequency and time period.

F. Short Answer Questions :

7. A pendulum oscillates 50 times in 5 seconds. Find its time period and frequency.
8. The sound from a mosquito is produced when it vibrates its wings at an average rate of 500 vibrations per second. What is the time period of vibration.
9. What is audible and inaudible frequency range for human.

10. Define the following relating to sound :

    (a) Loudness (b) Pitch

    (c) Quality (or timbre)

G. Long Answer Questions :

11. List sources of noise pollution in your surroundings. Explain why noise pollution is harmful for humans.
12. Describe the construction of human ear and explain its working.
13. Lightning and thunder take place in the sky at the same time and at the same distance from us Lighting is seen earlier and thunder is seen later explain why ?
14. List some methods to reduce noise pollution.
15. Can sound travel through solids. If yes explain with an activity.

CHAPTER - 11

Chemical Effects of Electricity

You must have been cautioned against touching an electric appliance with wet hands. Do you know why ?

We have learnt earlier that the materials, which allow electric current to pass through them, are good **conductors**of electricity. On the other hand, materials, which do not allow electric current to pass through them easily, are poor conductors of electricity. (also called**insulators**)

In clas VI we made a tester to test whether a particular material allows the electric current to pass through it or not.

We found that metals such as copper and aluminium conduct electricity whereas materials such as rubber, plastic and wood do not conduct electricity. However, so far we have used our tester to test materials which were in solid state. But what about liquids? Do liquids also conduct electricity? Let us find out.

11.1 DO LIQUIDS CONDUCT ELECTRICITY?

To test whether a liquid allows electric current to pass through it or not, we can use the same tester (Fig. 11.1)

However, replace the cell by a battery. Before using the tester, we should check whether it is working or not.

Activity 11.1 To check the working of tester.

Join the free ends of the tester together for a moment. This completes the circuit of the tester and the bulb should glow. However, if the bulb does not glow, it means the tester is not working. This may happen because of loose connections of wires. This may be also due to fused bulb.

After ensuring the working of tester, let us now study the whether the liquids conduct electricity or not.

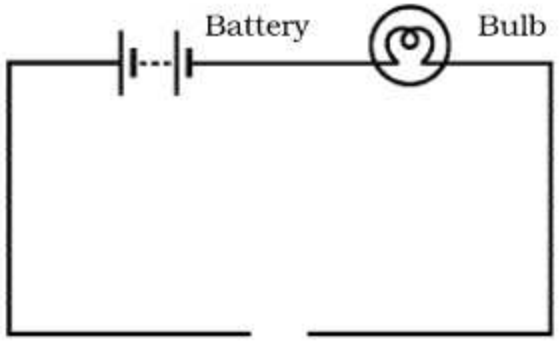


Fig. 11.1

*(**Caution:** While checking your tester, do not join its free ends for more than a few seconds. Otherwise the cells of the battery will drain very quickly.)*

Activity 11.2

Collect a few small plastic or rubber caps of discarded bottles and clean them. Pour one teaspoon of lemon juice or vinegar in one cap. Bring your tester over this cap and let the ends of the tester dip into lemon juice or vinegar as shown in Fig. 11.2. Take care that the ends are not more than 1 cm apart but at the same time do not touch each other. Does the bulb of the tester glow? Does lemon juice or vinegar conduct electricity? How would you classify lemon juice or vinegar ? A good conductor or a poor conductor?

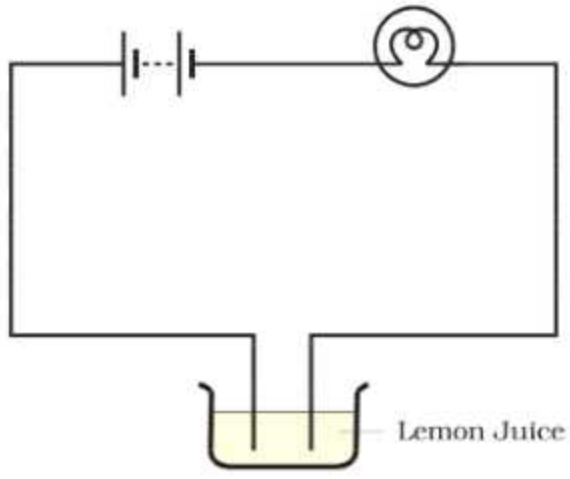


Fig. 11.2 : Testing conduction of electricity in lemon juice or vinegar

When the liquid between the two ends of the tester allows the electric current to pass, the circuit of the tester becomes complete. The current flows in the circuit and the bulb glows. When the liquid does not allow the electric current to pass, the circuit of the tester is not complete and the bulb does not glow.

In some situations even though the liquid is conducting, the bulb may not glow. This may happen due to weak current passing through the circuit. What causes the bulb to glow when current passes through it ? Do you remember ? It is only due to heating effect of current that the filament of bulb gets heated to a high temperature and it starts glowing. However, if the current through a circuit is too weak, the filament does not get heated sufficiently and it does not glow. And why is the current in the circuit weak? Well, though a material may conduct electricity, it may not conduct it as easily as a metal. As a result, the circuit of the tester may be complete and yet the current through it may be too weak to make the bulb glow. Can we make another tester which can detect a weak current? We will use a LED bulb to make this tester.

LED stands for light emitting diode. LED bulb can be used in place of electric bulb in the above activity for detection of weak current. An LED bulb has two terminals, one slightly longer than the other. The longer terminals is connected to the positive terminal of battery and the shorter end to the negative terminals of battery. LED's are available in many

colours and are very popular for saving electricity.

Fig. 11.3 : LEDs

Questions :

Q.1. Why bulb does not glow even when liquid is conducting ?

Q.2. Does the strength of current has any effect on the circuit?

We can use another effect of an electric current to make another kind of tester. Recall the magnetic effect of electric current. We will use this effect to make a new tester.

11.2 MAGNETIC TESTER

A magnetic tester can be made by using a magnetic compass. A current carrying wire has a magnetic field around it. When current carrying conductor passes over magnetic compass, the needle of the compass shows deflection. This principle is used to make a magnetic tester.

Activity 11.3

Material Required : An empty match box, a magnetic compass, an insulated copper wire.

Make a cut in the upper flap of match-box and fix a magnetic compass inside it so that needle of the compass is visible from the top [Fig. 11.4 a, b & c]. Wrap the insulated copper wire around the match box with the free ends on the opposite sides. Now connect one free end of wire to the terminal of battery. Leave the other end free. Take another piece of wire and connect it to the other terminal of battery. Join the free ends of both wires slowly [Fig. 11.4 c]. If the compass shows deflection then our tester is ready. Repeat the same activity by dipping the open ends in lemon juice, tap water milk, honey, vegetables oil etc. and check which of these liquids conducts electricity and complete the table 11.2. You will see that the magnetic compass shows deflection when open ends of wire are dipped in lemon juice and salt solution.

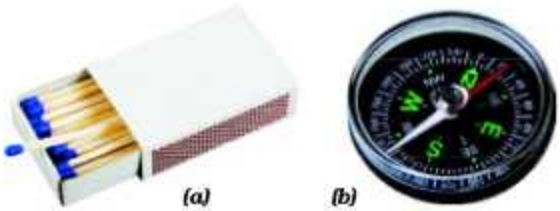


Fig. 11.4 (a) Match box and (b) Magnetic Compass

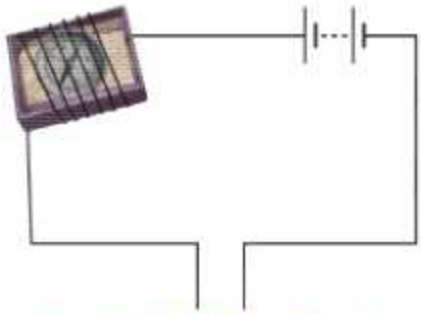


Fig. 11.4 (c) Magnetic tester

Table 11.1 : Good/Poor Conducting Liquids

S.No	Material	Compass Needle Shows Deflection Yes/No	Good Conductor/ Poor Conductor
1.	Lemon juice	Yes	Good Conductor
2.	Vinegar		
3.	Tap Water		
4.	Vegetable oil		
5.	Milk		
6.	Honey		
7.			
8.			
9.			
10.			

From Table 11.1, we find that some liquids are good conductors of electricity and some are poor conductors.

Actually, under certain conditions most materials can conduct. That is why it is preferable to classify materials as good conductors and poor conductors instead of classifying as conductors and insulators.

Questions :

Q.1. How does a magnetic compass needle behave when a current carrying wire passes over it ?

Q.2. What is a magnetic compass ?

We have tested the conduction of electricity through tap water. Let us now test the conduction of electricity through distilled water.

11.4 : Conduction of electricity through distilled water.

Material Required : A glass cup, LED tester, distilled water, connecting wires, common salt.

Procedure : Take distilled water in a glass cup. Set up the tester arrangement as shown in figure below with connecting wires, battery and bulb. Now check whether bulb glows or not after immersing both open ends of wire in a cup. Now add a teaspoon of common salt in this distilled water and immerse both ends of LED tester in it.

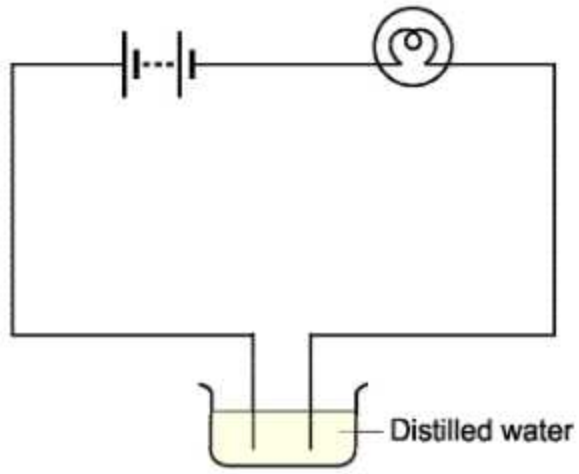


Fig. 11.5

To your surprise you will observe that bulb glows when wires are immersed in salt solution and does not glow with pure distilled water. This happens because the water we get from resources such as taps, hand pumps, wells and ponds is not pure. It may contain several salts dissolved in it. Small amounts of mineral salt are naturally present in it. This water is now good conductor of electricity. On the other hand, distilled water is free from salts and is a poor conductor. We found that common salt dissolved in distilled water, makes it a good conductor of electricity . Most liquids that conducts electricty are solution of acids, bases and salts.

11.3 CHEMICAL EFFECTS OF ELECTRIC CURRENT

Activity 11.5 : To study the chemical effects of electric current.

Material required : One battery, two carbon rods with metal caps (or iron nails), connecting wires, a beaker and tap water.

Procedure : Take two carbon rods (from used dry cells) and clean their caps with sand paper. Wrap copper wires around the caps. Join the caps to the battery. Pour the water in the beaker. Add a tablespoon of salt or few drops of lemon juice to the water. Immerse carbon rods in the solution. (Make sure the top of caps are outside water). Wait for 4-5 minutes. Carefuly observe the carbon rods.

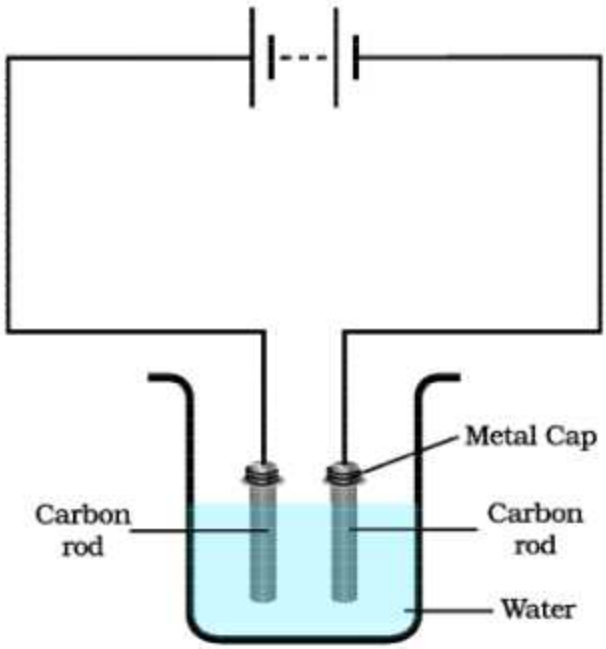


Fig. 11.6

Bubbles of gas may be formed near the carbon rods, which acts as electrodes. This shows that when electric current is passed through a conducting solution, a chemical reaction occurs. Deposits of metals may be seen on electrodes. Change of colour of solution may occurs. This reaction would depend on what

solution and electrodes are used. These are some of chemical effects of electric current.

11.4 ELECTROPLATING

A new bicycle has a shiny handle and wheel rims. With repeated use, the coating wears off. The process of depositing a layer of a desired metal on another metal by means of electricity is called electroplating. It is one of the application of chemical effects of electric current.

Activity 11.6 : To observe the deposition of one metal on another.

Material Required : Copper sulphate crystals, sulphuric acid, connecting wires, two copper plates of size approx 9cm × 4cm, a beaker, a battery and distilled water.

Procedure : Take 250 ml of distilled water in a beaker. Dissolve two tablespoons of copper sulphate in it. Add few drops of sulphuric acid to this solution. Connect the copper plates to the terminal of battery and immerse them in the solution. [Fig. 11.7].

Allow the current to pass for about 15 minutes. Now remove copper plates from solution and observe them carefully. Is there any difference in any one of them ? Do you find a coating over any of them ? What is the colour of this coating ? Note down the terminal of the battery with which this electrode is connected.

When electric current is passed through the copper sulphate solution, it breaks it into copper and sulphate ions. The free copper gets deposited on to the copper plate, which is connected to the negative terminals of the battery. The copper plate, which is connected to the positive terminal of the battery loses an equal amount of copper which gets dissolved in the solution. Thus the loss of copper from the solution is restored and this process keeps going. The process of depositing a layer of any desired metal on another material by means of electricity is called **electroplating**.

Note : Substance which gets dissociated into ions, when current is passed through it in liquid state is called an **electrolyte**. Examples common salt NaCl, copper sulphate etc.

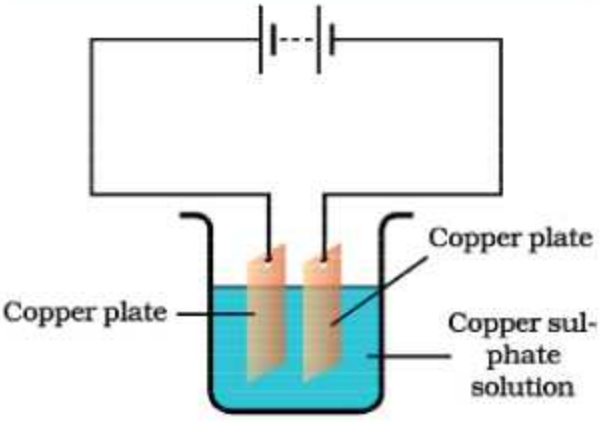


Fig. 11.7 : Electroplating

11.4.1 Uses of Electroplating

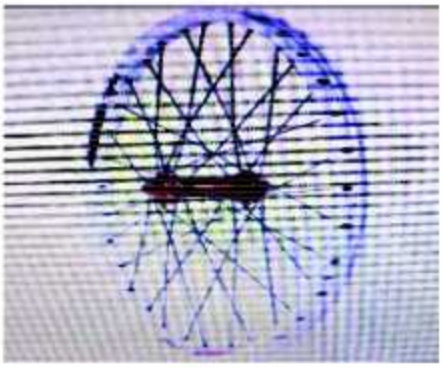
It is one of the most useful application of chemical effects of current. Electroplating is a very useful

process. It is widely used in industry for coating metal objects with a thin layer of a different metal (Fig. 14.8) The layer of metal deposited has some desired property, which the metal of the objects lacks.

Uses of electroplating in daily life.

1. Electroplating of inferior metal with superior metal prevents its corrosion and rusting.
2. Chromium has a shiny appearance. It does not corrode. It resists scratches. However, chromium is expensive and it may not be economical to make whole objects out of chromium. So the objects is made from cheaper metal and only a coating of chromium over it is deposited. For example chromium plating is done on many objects such as car parts, bath taps, kitchen gas burners, rims etc.
3. Coating of zinc over iron is called **galvanization**. It protects iron from rusting and corrosion.
4. Jewellery makers electroplate silver and gold on less expensive metal ornaments. These ornaments have the appearance of silver or gold but are much less expensive.
5. Tin cans used for storing food are made by electroplating tin onto iron. Tin is less reactive than iron. Thus food does not come into contact with iron and gets protected from getting spoiled.

Cutlery



Rims

Bicycle Parts

Ornaments

Fig. 11.8 : Some electroplated objects

POINTS TO REMEMBER

- The substance through which current can flow easily are called conductors.
- Conducting wires are coated with insulators like rubber, PVC (Polyvinyl chloride) to prevent them from exposure.
- An electric tester is used to detect current in a circuit.
- A liquid through which charge flow is called an electrolyte.
- Some liquids are good conductors of electricity and some are poor conductors of electricity.
- Electrolytes dissociate into ions when current is passed through them.
- Most liquids that conduct electricity are solution of acids, bases and salts.
- The passage of an electric current through a conducting liquid causes chemical reactions. The resulting effects are called chemical effects of current.
- The process of depositing a layer of any desired metal on any material using electricity is called electroplating.
- Metals likes iron can be saved form corrosion/rusting by electroplating them with a superior metal like zinc or chromium.
- Coating a layer of zinc metal over iron objects is called galvanisation.

Keywords

- Conductor
- Electrolyte
- Rusting
- Insulators
- Electrolysis
- Magnetic compass
- Artifical jewellery
- LED
- Cathode
- Metallurgy
- Electroplating
- Magnetic Tester
- Electric tester
- Electroplating
- Electrode
- Distilled water
- Galvanization
- Corrosion

EXERCISE

A. Fill in the blanks:

i. Metals are ..... conductor of electricity.

ii. Magnetic tester uses ..... effect of current.

iii. Electric tester uses ..... effect of current.

iv. An electrolyte dissociate into ..... when direct current passes through it.

v. Copper and brass utensils are coated with ..... metal.

B. True or False

i. Electric current does not flow through liquids.

ii. Electroplating uses heating effects of current.

iii. An electric tester is used to check if a wire or appliance carries current.

iv. Artifical jewellery is costlier than gold jewellery.

v. Coating of chromium over iron is called galvanization.

C. Choose the single correct option

i. This is a good conductor of electricity.

(a) Bakelite (b) Rubber

(c) PVC (d) Graphite

ii. Galvanisation is coating of this metal over iron

(a) Gold (b) Silver

(c) Zinc (d) Murcury

iii. Which liquid is not a good conductor of electricity.

(a) Lemon juice (b) Distilled water

(c) Common salt solution (d) Copper Sulphate solution

iv. It is based on chemical effects of electricity.

(a) Electroplating (b) Glowing of bulb

(c) Sublimation (d) Distillation.

v. Rims of vehicles are usually are coated with

(a) Gold (b) Silver

(c) Chromium (d) Copper.

D. Match the following with correct options:

S.No	Column I	S.No	Column II
1	The flow of charge	A	Chromium
2	A source of current	B	Electroplating
3	Cycle handles are coated by this metal	C	Galvanization
4	Coating of superior metal over inferior metal using electric current	D	Current
5.	Coating of zinc over iron sheets	E	An Electric Cell

E. Very short answer questions. (Answer these question in one or two sentences) :-

1. What is an LED ?
2. Define electric current.
3. What is conductor ? Give examples.
4. Give two examples of electrolytes.
5. Name the instrument used to detect current flowing through a wire.

F. Short answer question.

6. How can a pure water be made an electrolyte ?
7. Draw a labelled diagram of an electric tester.
8. Why do electricians wear rubber shoes and rubber gloves ?
9. Write some effects of electric current.

G. Long answer type questions.

10. How are impure metals purified using electric current ? Explain using diagram
11. Write five uses of electroplating.
12. With the help of labelled diagram explain how a copper plate is electroplated by tin metal ?

CHAPTER - 12

Some Natural Phenomena

12.1 Introduction

Every organism depends upon nature for its basic needs. Air, water and food make the first and foremost need. We get these from nature. If nature provides its gift in balanced quantities then they are useful for the living world. When their balance is disturbed, they bring disaster.

Wind, rain, and soil are useful if remain in balance. But when this balance is disturbed, it results in floods, landslides, storms, lightning, cyclone and pandemics.

12.2 PANDEMIC & EPIDEMIC

12.2.1 Epidemic

An epidemic is the rapid spread of a disease among a large number of people in a given population of a given area for a short time e.g. Dengue, Swine flu, Chikungunya, Cholera etc. These epidemics spread in particular area from time to time and thousands of human being become their victims.

12.2.2 Pandemic

A pandemic is a disease that spreads over a large area of many countries and causes deaths of millions of people.

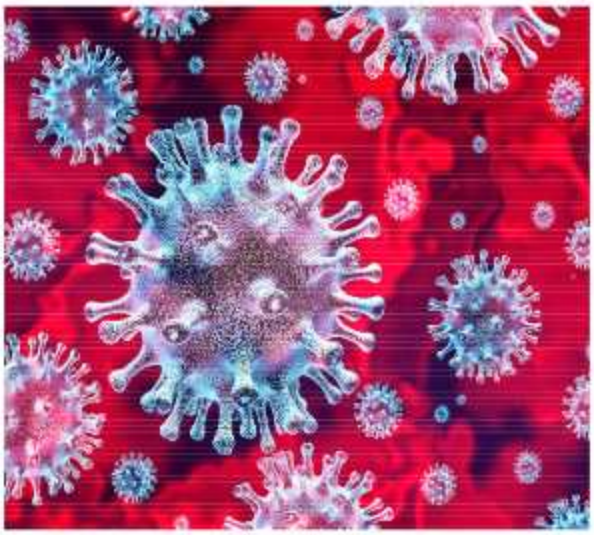


Fig. 12.1 : Virus

In the past when there was no vaccine of diseases like Cholera and Plague; these diseases spread like pandemic. In 2019, the Corona virus (SARS-CoV-2) causing COVID-19 which originated in Wuhan city of China, spread almost in all the countries of the world and killed millions of people. Many countries had to be kept under lockdown or curfew.

You must have heard the news of cyclone Amphan in the month of may-2020 which hit Orissa and West Bengal.

12.3 WIND, STORMS AND CYCLONE

Air is necessary for all living organisms. Oxygen from air is used during respiration, burning and decaying of open organic matter. Air shows its various states/phases which depend upon its movement. If it is not in motion, only then it is air.

Fig. 12.2 : Air moved by fan

12.3.1. Wind

Still air causes suffocation in summer. If it is not moving then we feel uneasy. Air in motion is called **wind.**It helps in evaporation of sweat. It also causes transpiration from leaves of plants. In summer, we use fans and coolers to move the air which help in evaporation of sweat. The speed of wind is measured by **anemometer**. The direction of wind is found by**wind vane**.

Fig. 12.3 (a) Wind direction is found by wind vane

Fig. 12.3 (b) Wind speed is measured by anemometer

12.3.2. Storm

When the speed of air/wind is more than 100 km/h, it is called **storm.** Sometimes, a storm has a speed of about 200km/h. During the month of May and June when the heat of the sun heats the earth, the hot air rises up and creates a low pressure area. The air from the surrounding rushes to that low

Fig. 12.4 : Storms

pressure area. It forms the storm. More storms in the month of May and June are a good sign of heavy monsoon.

12.3.3. Cyclones

Cyclone is a weather condition with high speed winds revolving around a central area of very low pressure.

When there is very low pressure, winds of surrounding place rush to the place rotating anticlockwise in the Northern Hemisphere and rotating clockwise in the Southern Hemisphere. Cyclone is another name for tropical spiraling storm. They are also named hurricanes and typhoon. Basically cyclones, hurricanes and typhoon all are types of tropical storms.

Fig 12.5 : Cyclones

A cyclone consists of central eye, eyewall and surrounding rain belt. Different cyclones are named according to their places of origin. East coast of India is generally hit by cyclones which originate from the Bay of Bengal. The cyclone which hit Western coast of India originate in Arabian Sea.

- Cyclones are tropical storms formed over the south Pacific and Indian Ocean.
- Hurricans are tropical storms formed over North Atlantic Ocean and North-East Pacific ocean.
- Typhoons are tropical storms formed over North-West Pacific ocean (near china)

12.4 PRODUCTION OF CHARGES AND LIGHTNING

12.4.1 Production of Charges

Every substance is made up of atoms. Atoms have protons and neutrons in the nucleus. But the electrons are present in shells outside the nucleus (Fig. 15.6). When two substances are rubbed with each other, the electrons from the atoms of one substance get transferred to the other. As the electrons are negatively charged, the body loosing electrons gain a positive charge and the body receiving electrons, gets negative charge. In the sky, clouds moving in

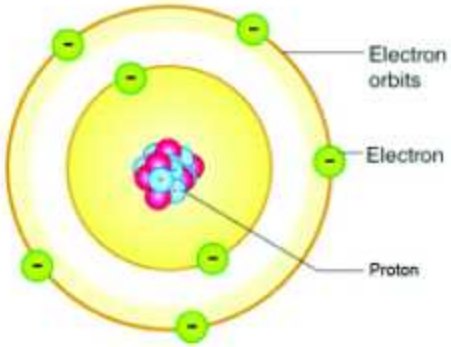


Fig 12.6 : An Atom

air get rubbed with other clouds and get positive charge by losing electrons, or negative charge by gaining electrons. We can show the production of charges by the following activity.

Activity 12.1

Spread small pieces of paper on a table. Now rub a plastic comb with your hair. Take the comb near the pieces of paper. You will see that comb attracts the pieces of paper. This is due to the charge developed on the comb due to rubbing with hair. This activity shows that static charge is produced during rubbing.

Fig. 12.7 : paper pieces get attracted by a plastic comb

12.4.2 Lightning

When the two clouds with opposite charges come near each other, they attract each other and get discharged. A huge thunder and lightning is produced. The charge moves towards the earth. If a conductor or a living thing like a plant or an animal comes in the path of this charge, a large amount of charge passes through it and the animals can die.

Fig. 12.8 : Lightning on Earth

12.4.3. Lightning Conductor

Lightning conductor is a device used in tall buildings. It is in the shape of a metallic trident(Trishul) connected to the earth through a copper wire. (Fig. 12.9) During lightning the charge flows to the Earth through this wire and building is saved from damage.

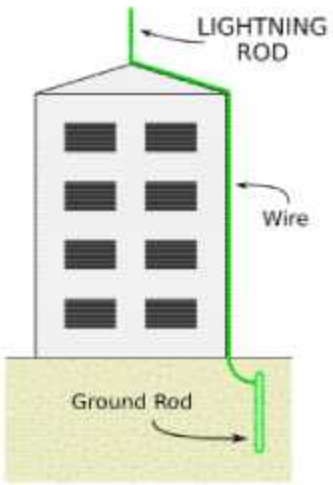


Fig 12.9 : Lightning Conductor

Activity 12.2

This activity is done in dark or at night. Take a comb and stand near a plane mirror at night. Switch off the light so that there is complete darkness in the room. Now move the comb in your hairs. You will see

sparks from your hairs. This is due to the charge produced during rubbing of comb with your hairs. Bringing opposite charges near each other produce a spark due to discharging. Charges can be detected by an instrument called **Gold Leaf Electroscope.**

12.4.4 Gold Leaf Electroscope (construction and working)

A gold leaf electroscope consists of a glass bell jar with a wooden base. A metal wire hangs from a metal plate with wire inside the electroscope. The leaves made of metals (aluminium foil/gold foil) are fitted at the end of wire. (Fig. 12.10) On touching the electroscope plate by a charged body the charge flows to the leaves. Being the same charge on both the leaves, they repel each other.

12.4.5. Detection and Transfer of Charge through Electroscope

The charge on a body can be detected by using a gold leaf electroscope. When we touch metal plate of electroscope with a given body, if the leaves of electroscope diverge then body is charged but if leaves do not diverge then body is uncharged.

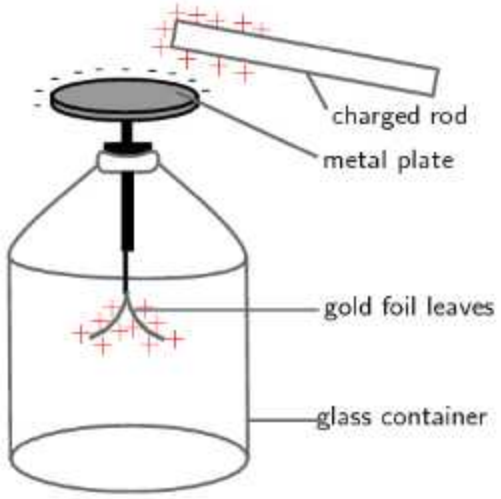


Fig 12.10 : Detection and Transfer of Charge

12.4.6. Electrostatic induction

Gaining charge by an uncharged body due to a charged body near it is called**electrostatic induction**.

Activity 12.3

Charge an ebonite rod AB by rubbing it with flannel/muslin cloth. Now take two wooden blocks and put this charged rod on one of the wooden block. Place an uncharged rod on second wooden block near the first block as shown in the figure 12.11 so that they do not touch each other. Now put some bits of paper near the end of the second rod CD. Bits of paper will be attracted towards end D. The near end C of the uncharged rod develops the opposite charge (opposite of rod AB) and farther end develops the same charge as that of AB, due to electro static induction.

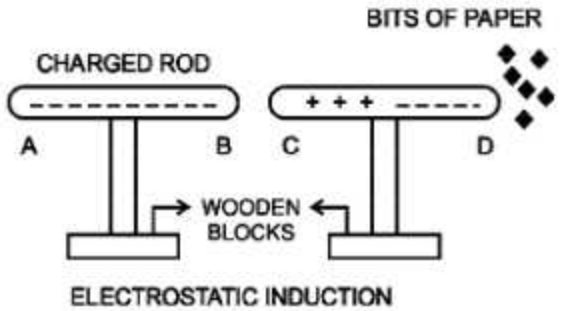


Fig 12.11 : Electrostatic Induction

Questions :

Q.1. What is electrostatic induction ?

Q.2. If you place a positively charged rod near an uncharged rod; which charge is present on the near end of uncharged rod?

12.4.7. Safety Measures during Lightning

Whenever you hear a little thunder, rush to a safe place from where the charge of clouds does not pass. Hearing thunder is an alarm of coming danger.

- Take shelter inside a building. But never take shelter near an electric pole, power line or under a tree.
- If you are traveling in a bus or a car, do not come out, but park the vehicles away from trees or poles.
- If you are near the thick forests take shelter under the shortest tree.

Fig 12.12 : Safety measures during Lightning

- Never stand on an elevated place but choose a deep or shallow place.
- Never use an umbrella during lightning.
- In open, sit with your head between knees so that you become of smallest size.

12.4.8 Precautions Inside The Home During Lightning

During lightning if you are inside the building or house, you have to follow some precautions as lightning can strike electric or telephone poles and damage the wire and equipments.

- Switch off all the electrical appliances and remove the plugs from sockets.
- Avoid talking on phone calls during thunder storms/lightning.
- Do not take bath and do not go in running water.

12.5 EARTHQUAKE

How does an earth quake originate? How is it measured? What is the effect of an earthquake? Can we know in advance about an earthquake ?

12.5.1 Origin Of Earthquake

There are huge molten land masses flowing in the crust/outer most layer of earth. These are called plates or plate's tectonics. Sometimes two plates stuck each other causing rise in pressure. When the tectonic plates suddenly cross each other

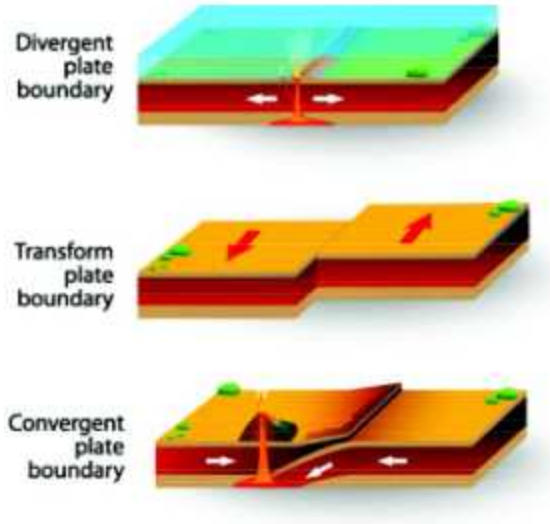


Fig 12.13

causing shaking or trembling of earth. This is called earthquake. The point inside the crust where earthquake originates is called **Hypocentre**. The point just above the hypocentre on the surface of earth is called **Epicentre**.

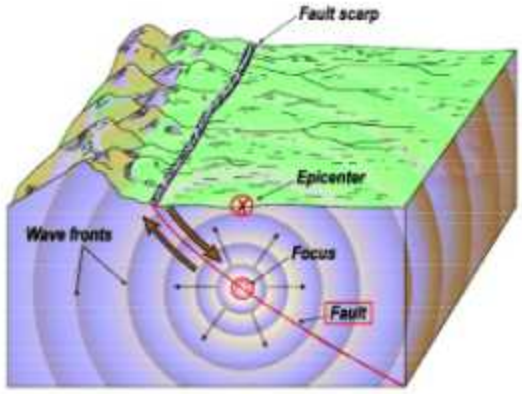


Fig 12.14 : Epicentre and Hypocentre of earthquake

12.5.2 Measuring Earthquake

The jerk caused by sliding of plate tectonics over each other cause tremors. The number of times earth trembles in one second is called frequency. The frequency of Earthquake is measured by an instrument called**Seismograph**. The power of an earthquake is measured in terms of a magnitude on a scale called Richter scale. Destructive earthquakes have magnitudes higher than 7 on Richter scale.

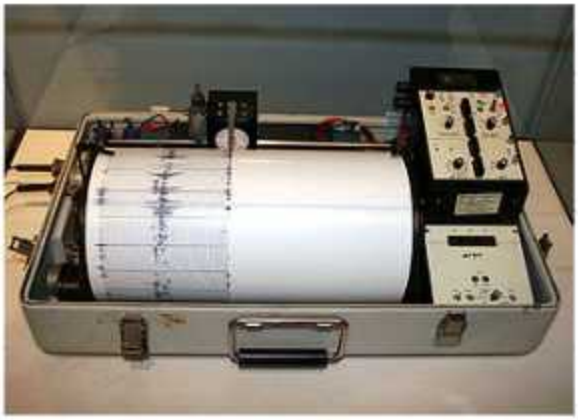


Fig 12.15 : Seismograph

12.5.3 How Does A Seismograph Work?

The tremors produced at hypocenter of earthquake produce waves at epicenter and around it. These are called seismic waves. These waves are recorded by an insturment called seismograph. The instrument has a vibrating rod with which a pen is attached. It moves on the graph paper wrapped on a roller, which records seismic waves.

12.5.4. Can We Predict An Earthquake in Advance

Though an instrument is not made to predict on earthquake, but by knowing the action of certain animals or some natural changes predictions can be made few s econds/minutes before an actual earthquake.

- Dogs start howling and come in open.
- Birds leave their nests and fly in open.
- If cattle are tied with pegs they start jumping.
- If there is an old well then radon gas leaks out of it. If some expert is near the old well, he can predict it.

12.5.5. Safety Measure during Earthquake

The damage caused to life and property can be minimized if we adopt following safety measures.

- During construction of big and tall buildings, we must take advice from an expert who has full knowledge of earthquake proof buildings.
- Dams or very tall buildings should not be constructed near or over the junction of plate tectonics.
- Cupboards and shelves should be fixed to the walls so that they may not fall by jerks of earthquake.
- Water heaters, wall clocks, photo frames, wall hangings should be properly tied so that they may not fall during shocks of earthquake.
- Firefighting system must be fitted in tall buildings as these buildings may catch fire during earthquake.

The Central Building Research Institute Roorkie has developed know how to make Earthquake resistant houses/buildings.

Whenever you know about earthquake near your area, please follow these instructions.

A. If you are inside home.

- Stay away from tall and heavy objects which may fall upon you.
- Take shelter under a table and stay there till the earth is shaking.
- If you are on bed do not get down but cover your head with a pillow.

B. If you are outside your home.

- Stay in an open place away from buildings, walls, poles, trees etc.
- If you are in a bus or car, do not come out of it. Ask the driver to slow down the speed and park it in an open place.

POINTS TO REMEMBER

- Cyclones, floods, earthquake, forest fires etc. are natural disasters.
- Some of the natural phenomenon are caused by micro-organisms e.g. plague, cholera, covid-19 etc.
- A pandemic is a disease that spreads over a large area of many countries and causes deaths of millions of people.

- In the past even cholera and plague became pandemic because there were no vaccines for them.
- COVID-19 is the most dreaded disease which originated in china in 2019 and spread in the world during 2020 and still spreading.
- Storms and cyclones are caused due to fast moving wind.
- Cyclones which originate in the Bay of Bengal cause great loss of life and property in the eastern coastal areas of Bengal, Orissa, Andhra Pradesh and Tamil Naidu.
- During rubbing two types of charges positive charge and negative charge are produced.
- The thunder and lightning are caused when oppositely charged clouds strike each other.
- Lighting conductors are used to save tall buildings from the charge of lightning.
- The speed of wind is measured by Anemometer.
- Gold leaf electroscope is an appliance used for detection of charge on a body.
- Cyclones which hit west coasts of India originate in Arabian sea.
- If an uncharged body is placed near a charged body, the near end of the uncharged body gets opposite charge than charged body and farthest end gets the same charge temporarily till the charged body is placed near it. It is called Electrostatic induction.
- We should not stand near a tree or an electric pole during lightning.
- Plugs of electrical appliances such as television, cooler, computers etc. be removed from sockets during lightning.
- The point inside earth where an earth quake originated is called "Hypocentere" and the point just above it on the surface of earth is called Epicenter of an earthquake.
- The instrument used for measuring Earthquake is called "Seismograph" and the scale used to measure power of an earthquake is Richter Scale.
- Some animals like dogs and cattle show special behaviour before an earthquake.

Keywords

- Floods
- Land slides
- Epidemic
- Pandemic
- Covid-19
- Cyclone
- Evaporation
- Storm
- Typhoon
- Hurricane
- Electrons
- Charge
- Lightning
- Lightning Conducter
- Electroscope
- Earthquake
- Hypocentre
- Epicentre
- Plates Tectonics
- Seismograph
- Richter Scale
- Radon Gas
- Fire Fighting System
- Frequency

EXERCISE

A. Fill in the blanks.

1. Covid-19 is a ..... disease.
2. On rubbing two bodies we get ..... and ..... charges.
3. An ..... is the rapid spread of a disease in a large population in a particular area.
4. Air in motion is called ..... .
5. An uncharged body can be charged by ..... .

B. Write True (T) Or False (F) for the following.

1. Cyclones, hurricanes and typhoons are all tropical storms.
2. During lightning and thunder we should stand under a tall tree or an electric pole.
3. Lightning Conductor is used to save tall buildings and towers from lightning.
4. The speed of wind is measured by seismograph.
5. Do not use an umbrella during lightning.

C. Correct answer from given Multiple answers (MCQ).

1. Which of these are epidemic

   (a) Dengue (b) Swine flu

   (c) Cholera (d) All of the above

2. It is not an epidemic but a Pandemic

   (a) Dengue in Delhi (b) Covid-19

   (c) Plague of Bengal (d) Draught in Ethiopia

3. The frequency of Earthquake is measured by.

   (a) Barometer (b) Anemometer

   (c) Seismograph (d) Lactometer

4. Charge is produced by transfer of

   (a) Electrons (b) Protons

   (c) Atoms (d) neutrons

5. During lightning and thunder we should take shelter

   (a) Under a tall tree (b) Near an electric tower

   (c) Inside a building (d) Under an umbrella

D. Match the correct alternative from Column II with Column I:-

S.No	Column I	S.No	Column II
1.	In 2020 the pandemic that hit the whole world	a.	Gold leaf electroscope
2.	Cyclone that hit Orissa in may 2020	b.	Lightning
3.	When two charged clouds approach each other it cause	c.	Hypocentre
4.	This is used to detect charge on a body	d.	Corona
5.	Point inside the Earth where Earthquake originates	e.	Amphan

E. Very Short answer question:-

1. What is an Epidemic?
2. Define wind.
3. Where do the cyclones originate which hit the west-coast of India?
4. Name two methods to charge an uncharged body?
5. Define epicenter of an Earth quake.

F. Short answer type question (Answer in 4-5 sentences):-

6. What is pandemic? Name any two pandemics.
7. What is epidemic ? Give examples.
8. Draw a labelled diagram of gold leaf Electroscope. Give its construction.
9. Write any three safety measures during lightning.
10. How does a Seismograph work?

G. Long answer type questions (Answer in 10-12 sentences):-

11. Write some precautions to minimize damage during an Earthquake.
12. With the help of labelled diagram, Explain the working of lightning conductor.

CHAPTER - 13

Light

Last night when family members were having their dinner; suddenly due to electric cut, light was off. There was complete darkness and nothing was visible. Candle had to be used to enlighten the room and everything was visible again. What is light? How does it help us to see objects ? Let us find out.

13.1 LIGHT MAKES THINGS VISIBLE

Light is a form of energy which when falls on a body and then enters our eye, we are able to see that body. Absence of light leads to darkness. We cannot see things without light.

Light can pass through **transparent** bodies like air, water, glass etc.

Light can not pass through **opaque** objects like stone, wood, human body, coal, iron etc.

Light can partially pass through **transluscent** objects like coloured glass, glazed glass.

Any natural or artifical material that gives light is called a source of light. Sun, stars, phosphorescent insects like firefly are natural sources of light Fig. 13.1 (a), (b). Candle, fire, electric lamps, tube rods, L.E.D.'s are artificial sources of light Fig. 13.2. Moon does not have its **own light**. It reflects the light of the sun falling on it. Light is reflected by shining surfaces like mirror, stainless steel objects (Fig. 13.3). Let us study about reflection.

(a) Phosphorescent Insects

(b) Stars

Fig. 13.1 : Natural Sources of Light

Fig. 13.2 : Artifical sources of light (Fire, Candle, Electric Lamp, etc.)

13.2 LAWS OF REFLECTION

Reflection is the phenomena in which, when light falls on a shining surface it comes back in the same transparent medium. Due to reflection we see **images** of the objects behind the mirror or shining surfaces.

The point on the shining surface of mirror where incident ray of light falls is called **point of incidence**. Perpendicular, at point of incidence is called**Normal**.

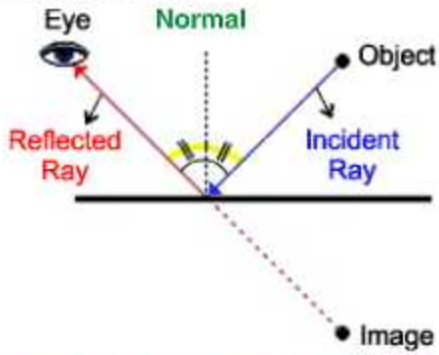


Figure : 13.4 : Laws of Reflection

The **angle of incidence** ($\angle i$) is angle between incident ray and normal. The **angle of reflection** ($\angle r$) is angle between reflected ray and normal. Reflection obeys following laws called **laws of reflection** (Fig. 16.4).

1. Angle of incidence and the angle of reflection are always equal.
   i.e. $\angle i = \angle r$

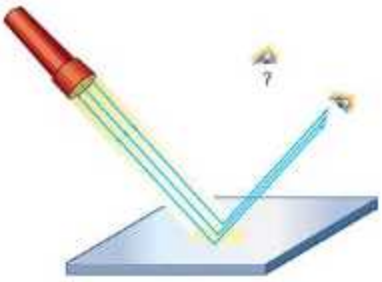


Fig. 13.3 : Mirror or Steel plate, reflecting light

2. Incident Ray, reflected ray and the normal all lie in the same plane.

In a plane mirror, the image is seen as far behind the mirror as the object is before it.

13.3 REGULAR REFLECTION AND IRREGULAR/DIFFUSED REFLECTION

Reflection from a smooth surface like plane mirror is called **regular reflection.**But reflection from a rough surface like carboard, wood or paper is called**irregular reflection/diffused reflection.**

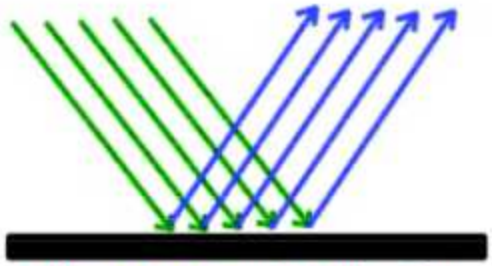
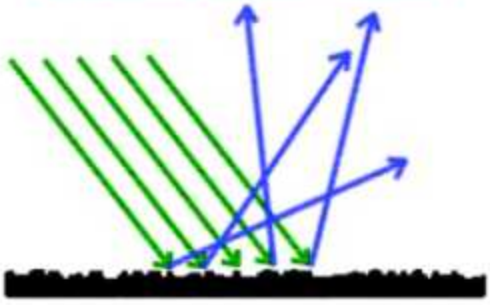


Fig. 13.4 : Regular reflection



(b) Irregular reflection

Fig. 13.5 Irregular Reflection

13.4 MULTIPLE REFLECTIONS

You must have seen that in a barbershop/saloon parallel mirros are fitted facing each other, which shows many images of a person sitting in the chair of saloon. This is due to multiple reflections. A body placed between two parral plane mirrors; shows infinite images.

Figure 13.6 : Multiple Reflection/ Repeated Reflection at Barbar's Saloon.

13.5 MULTIPLE IMAGES

Have you ever stood between two mirrors placed at an angle. Two mirrors placed at 0° or 90° angle to each other shows multiple images of an object.

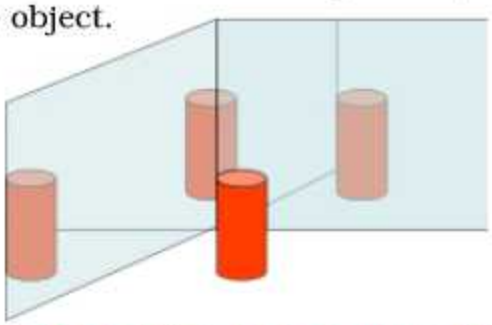


Fig. 13.7 (a) Mirrors at an angle of 90°

Fig. 13.7 (b) Mirrors at an angle of 45°

Activity 13.1

Take two rectangular plane mirrors and place them at 90° facing shining surface towards each other. Now place a pen or a sharpner in front of these mirrors and see its images and count them. You will see three images. Now change the angle to 60°, 45° and then to 120° and count the number of images. Number of images can be counted by the formula.

$$\text{Number of Images} = \left(\frac{360°}{\text{Angle between mirrors}}\right) - 1$$

Questions :

Q.1. How many images can you see if angle between mirrors is 72°?

This idea of mutiple images formed by mirrors placed at an angle to one another is used in a kaleidoscope to make numerous beautiful patterns. you can make a **kaleidoscope** urself.

Activity 13.2

To make a kaleidoscope, take three long rectangular mirror strips with a cellophane tape. Join them together to form a prism as shown in fig 16.8 (a)

Fix this arrangement of mirrors in a circular tube of thick cardboard or chart paper. (This circular tube should be longer than the mirror strips). Close one end of this tube by

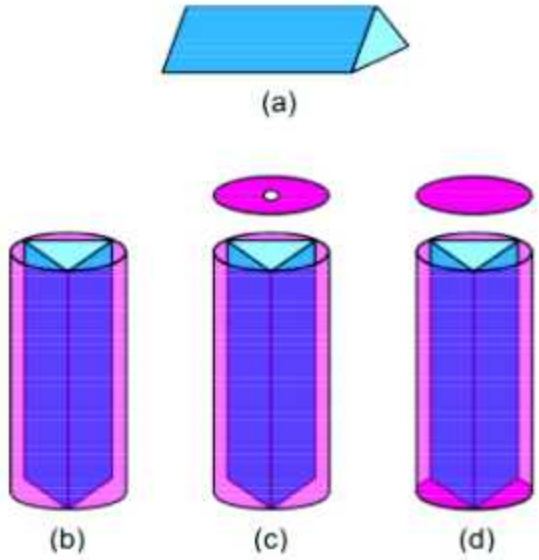


Fig. 13.8 (a), (b), (c), (d) : Making of a Kaleidoscope

a cardboard disc with hole in the centre through which you can see. fig 13.8 (c). At the other end of tube, fix a circular plane glass plate, touching the mirrors. fig 13.8 (d) Place Several small pieces of coloured beads or glass (like broken pieces of coloured bangles) On the glass plate. Close this end of the tube by a ground glass plate. Allow enough space for the colour pieces to move around. Your **kaleidoscope** is ready.

Through the tiny hole you will be able to see variety of patterens in the tube. An interesting feature of a kaleidoscope is that you will never see the same pattern again. Designers of fabrics and wallpapers use kaleidoscope to get ideas for new patterns.

13.6 SUNLIGHT : WHITE OR COLOURED

Light we receive from sun or from flourescent tube appears to be white.

Fig. 16.9 : White light emerging as spectrum of seven colours through a prism

But this light is actually a mixture of seven colours. When you use a prism in sunlight, you can see a spectrum of seven colours as shown in fig. 16.9.

Activity 13.3

Take a circular disc with a handle and a pointed base which can be rotated by fingers. Paint the top surface of this spinning top (disc) with seven bands of colours as seen in a rainbow. This spinning top is called Newton's disc.

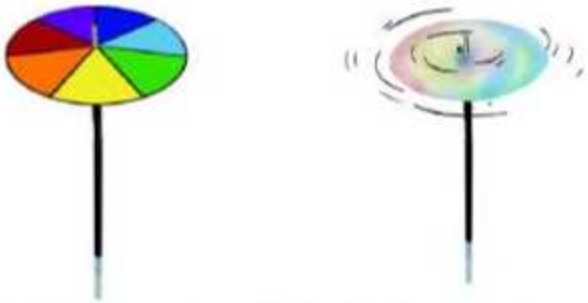


Fig. 13.10 : Newtons Disc / Spining Top Painted In seven Colours.

Now rotate this spinning top (Bhambiri) with fingers. You will see that top of this spinning top (Newton's disc) appears white. This activity shows that white light is made of seven colours. Red (R), Orange (O), Yellow (Y), Green (G), Blue (B), Indigo

(I), Violet (V). Spilliting of white light in seven constituent colours is called dispersion of light.

Questions :

Q.1. What is Newton's disc ?

Q.2. Name the phenomenon of splitting of white light into seven colours.

13.7 HUMAN EYE : HOW DO WE SEE ?

We see objects with our eyes. To see an object or a body, it is important that :

- Object or body must be opaque and light should not pass through it.
- Light must fall on that body.
- The body must be before our eyes or the light reflected by the body must reach our eyes.
- Our eyes must be healthy.

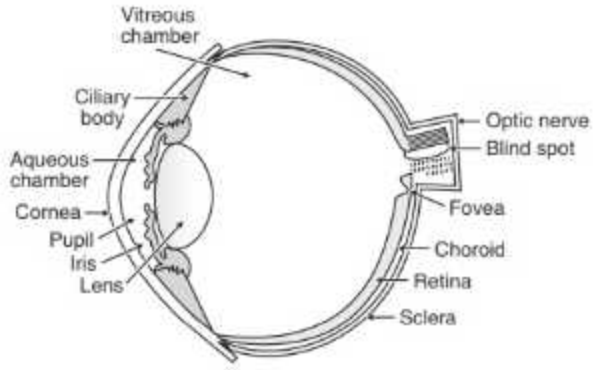


Fig. 13.11 : Human Eye

Human eyes are located on the front side of body. Main part of our eye is eye-ball which is covered by upper eye-lid and lower eye-lid. Both the eye-lids have eye lashes to check the dust or small particles which may enter our eye.

Eye-ball has three layers sclerotic, choroid and Retina.

Sclerotic : The outermost layer of eye is sclerotic or sclera. Its front part is transparent called**cornea**.

Choroid : It is the middle layer of eye. Its front portion is coloured called **iris**. There is a small opening in the centre of iris, called**pupil**. Light enters the eye through pupil. In dim light pupil gets wide opened so that maximum light may enter our eye but in bright light it becomes narrow.

Retina : Retina is the inner most layer of eye ball. At its front side there is biconvex lens. This lens is held by cilliary muscles which help to adjust the focal length of the lens. The part of retina just opposite to eye-lens has light sensing cells **rods and cones**. This region is called yellow spot.

Cone and Rod Cells : Rod cells are responsible for vision in low light conditions. Cone cells are responsible for vision in bright light and colour vision.

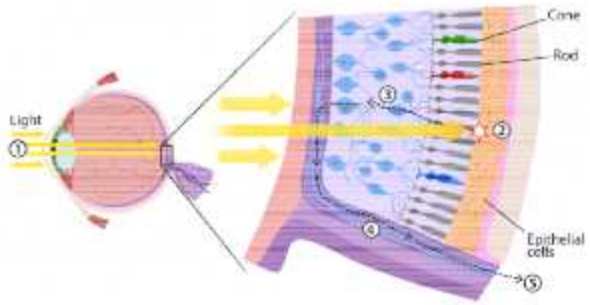


Fig. 13.12 : Rod & Cone cells

Eye Fluids : The region in front of lens has Aquous humour and behind the lens has Vitreous humour.

Optic Nerve : Optic nerve carry the sensation of sight from retina to the optic centre of brain.

At the junction of optic nerves and retina, there are no sensory cells. This region is called blindspot.

EYE DONATION

There are millions of blind people who cannot see this beautiful world. Such people can also see by cornea transplant. If we pledge to donate eyes after our death then one person can give sight to two persons by donating eyes. Only cornea not the whole eye-ball is transplanted during eye donation. Let all of us make eye-donation a movement.

13.8 CARE OF OUR EYES

Our eyes are the most sensitive sense organs of our body. We must be very careful for the safety of our eyes. We must have following safety measures.

- Do not look at any bright source of light such as sun, welding flash, without using special sun-glasses.
- Use solar filter for looking at sun during solar eclipse or watching sun.
- Avoid reading in dim light.
- Be careful while working in yard, home or playing in the play-ground.
- Do not wide open your eyes when you come in bright light from a dark room.
- Wash your eyes with cold water. Avoid going in smoky areas.
- While reading keep the paper or book at least 25cm away from eyes or farther. 25cm is the least distance of distinct vision of a healthy eye.

13.9. PERSISTENCE OF VISION

Our brain and eyes retain a visual impression of an object seen for about $\frac{1}{30}$th of a second even if the object is removed. The ability to retain an image is known as persistance of vision. In moving pictures, it is the **persistence of vision** which help us to see an object moving when the next image comes before $\frac{1}{30}$th of a second before our eyes. It can be explained by following activity.

Activity 13.3

Take a rectangular card board. Cover its both sides with white paper. Draw picture of a parrot on one side. Draw parrot cage on other side of the cardboard. Hang the cardboard with a rotating hook and rope. Now rotate the card-board fast while keeping your

eyes towards the cardboard. It will appear as the parrot is inside the cage. This is due to the appearance of next image before the first image vanishes because of persistence of vision.

Fig. 13.13 (a) Picture of parrot and cage on two sides of cardboard

Fig. 13.13 (b) On rotating parrot appears to be in the cage

Questions :

Q.1. What is persistence of vision?

Q.2. For how long does the effect of image remain on our eye/ brain?

13.10. EYES OF INSECTS

Insects like mosquitoes, houseflies, butterflies, cockroaches etc have compound eyes. They have more than hundred lenses even in one eye. All the lenses collectively form the image of object.

(a) Housefly

(b) Mosquito

(c) Cockroach

(d) Butterfly

Fig. 13.14 : Insects with compound eyes

13.11 ROTATING EYES OF CHAMELEON

A chameleon is a lizard which can rotate its eyes. One eye can look forward and other eye can look backward. By rotating its eyes, a chemeleon can look all around it in 360°.

Fig. 13.15 : Eyes Of Chemeleon Looking At Different sides

13.12 NOCTURNAL ANIMALS

Many animals can see objects even at night. Their eyes have special features with which they can see even in the dark. Eyes of an owl, cat-family animals like tiger, lion, cat and

cheetah have a reflecting layer on their eye ball. It reflects the small light falling on it. This reflected light falls on the object before them and they see it even in dark.

(a) Tiger

(b) Cheetah

(c) Cat

(d) Owl

Fig. 13.16 : Noctural animals

Cockroach is also a noctural animal and can see in the dark. A bat can fly at night. But it cannot see at night. It emits ultrasonic waves. When these waves are reflected by the object; its ears detect them.

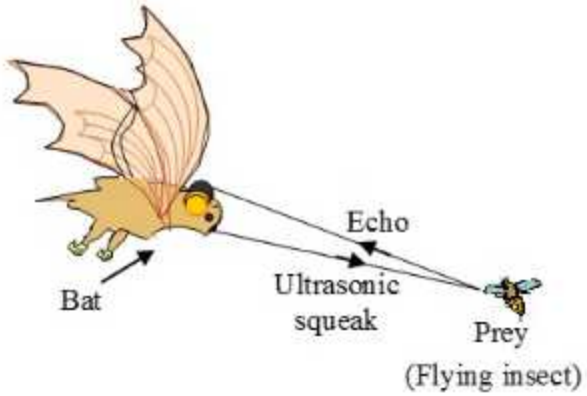


Fig. 13.17 : Bat

16.13 READING AND WRITING BY VISUALLY CHALLENGED PERSONS

You might have seen that even visually challenged persons can read and write. Some of them are blind from birth and some have lost sight due to some diseases or incident, Such persons have highly developed sense of touch and sense of hearing. They use a special method of reading; where letters are raised and they identify these letters by touching. This system of reading and writing is called Braille System.

ENGLISH BRAILLE ALPHABET

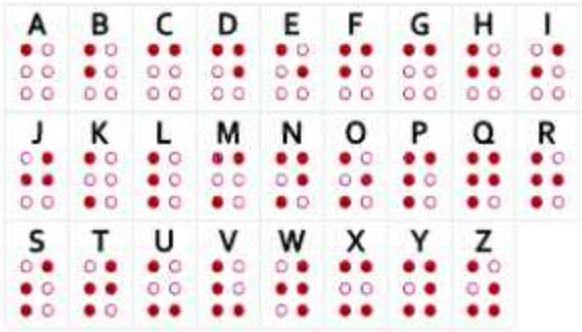


Fig : 13.18 Examples of Dot Patterns For Letters

13.13.1 Braille System of Reading And Writing

Braille is a system of reading and writing in which letters are represented by raised dots. These dots are arranged into cells of two vertical rows of three dots each. Each pattern of dots represent some english letters and some common words. These patterns when embossed on Braille sheets help visually challenged

persons to identify the words by touching them.

13.14. GREAT ACHIEVEMENTS OF VISUALLY CHALLENGED PEOPLE

Many visually challenged people had shown tremendous performance and got name and fame.

- Ravinder Jain a great Indian lyricist, singer and composer was born completelly visually challenged. He got Sangeet Prabhakar degree from Allahabad.
- Lal Advani a visually challenged; established an association for special education and rehabilitation of disabled in India. He also represented India on Braille problems in UNESCO.
- Helen A Keller; an American Author and lecturer is a well known visually challenged lady. She lost her sight when she was just 18 months old. But she got graduation degree due to her determination. She wrote many books. Her famous book is The story of My Life (1903).

Louis Braille

Louis Braille was son of a shopkeeper. He was born on 04–01–1809. At the age of three years when he was playing in his father's shop; his eyes got injured by a sharp tool. Though best care was provided but all in vain. Louis lost his sight and became completely blind.

Fig. 13.19 : Louis Braille (04–01–1809 to 06–01–1852)

In 1824 at the age of 15 Louis invented a universal system for reading and writing to be used by visually impaired people and published first Braille book. Second time the book was published in 1829; when he was of 20 years age. He died on 06 January 1852 at the age of 43 years.

POINTS TO REMEMBER

- Light is a form of energy which help us to see objects.
- Light can pass through transparent objects.
- Light does not pass through opaque objects.
- Light passes partially through transluscent objects.

- Sun, Stars and phosphorescent insects are natural sources of light.
- Fire, Candle, electric lamp are artificial sources of light.
- Mirrors and shining surfaces reflect the light falling on them.
- Laws of reflection
  1. Angle of incidence and the angle of reflection are always equal. i.e. $\angle i = \angle r$
  2. Incident Ray, reflected ray and the normal all lie in the same plane.
- In a plane mirror image is seen as far behind the mirror as the object is in front of it.
- Rough or curved reflecting surfaces show irregular reflection.
- We can see multiple images of an object by placing the object in front of two mirrors placed at an angle.
- Splitting of sunlight into seven colours by a prism or rain drops is called dispersion of light.
- When light falls on a body and body is in front of our healthy eyes; we can see the object.
- Only Cornea of eye of a dead person is donated during Eye-donation.
- Eyes of many insects are made of hundreds of lenses.
- The organisms which can see in the dark or at night are called noctural animals.
- Chameleon can rotate its eyes. It's one eye can see forward and other can see backward.
- Visually challenged persons can read and write using Braille system of writing.

Keywords

- Light
- Darkness
- Opaque
- Transluscent
- Mirror
- Reflection
- Incident Ray
- Reflected Ray
- Regular Reflection
- Irregular Reflection
- Multiple Images
- Rainbow
- Optic Nerves
- Yellow Spot
- Blindspot
- Eye Donation
- Near Point
- Braille
- Nocturnal Animals
- Persistance of vision
- Kaleidoscope
- Least distance of distinct vision

EXERCISE

A. Fill in the blanks.

1. Absence of light is called ..... .
2. Light can pass through ..... bodies/medium.
3. Sunlight is made of ..... colours.
4. In human eye image is formed at ..... .
5. ..... can rotate its eyes in various directions.

B. Write True (T) or False (F) for following statements.

1. A candle is a natural source of light.
2. Retina is the outermost layer of eye-ball.
3. Central hole of iris is called pupil.
4. Nocturnal animals can see only in bright light.
5. Braille system of writing for blinds was invented by Helen Keller.

C. Match the correct alternatives from Column II with Column I

S.No	Column I	S.No	Column II
1.	During reflection through mirrors the angle of reflection is equal to.	a.	Cornea
2.	This part of eye gives colour to eyes.	b.	Sun
3.	It is a natural source of light.	c.	Owl
4.	It is the front transparent part of sclerotic or sclera.	d.	Angle of incidence
5.	It is a nocturnal animal.	e.	Iris

D. Find the correct answer from the multiple answers. (MCQ)

1. Carry the sensation of sight to brain.

   (a) Rainbow (b) Yellow spot

   (c) Blind spot (d) Optic Nerve

2. The least distance of distinct vision of a normal human eye is at about.

   (a) Infinity (b) 50 m

   (c) 25cm (d) 05cm

3. Eye fluid present behind the lens in eye-ball.

   (a) Aquous Humour (b) Vitreous Humour

   (c) tears (d) saliva

4. It can rotate one eye towards backside and other towards front side.

   (a) Butterfly (b) Chemeleon

   (c) Housefly (d) Owl

5. It is used to see different beautiful patterns.

   (a) Solar filter (b) Mirror

   (c) Telescope (d) Kaleidoscope

E. Very Short answer questions.

1. Define opaque body.
2. What is a mirror ?
3. What are nocturnal animals ?
4. How can visually challenged persons read and write.
5. Name two organisms whose eyes have multple lenses.

F. Short answer questions.

6. What is Newton's disc.?
7. Name various colours of spectrum of white light in a sequence.
8. How will you arrange (set) two plane mirrors to obtain five images of a body.

9. What is persistence of vision ?

10. Write some precautions for the safety of eyes.

G. Long answer type questions.

11. With the help of labelled diagram, explain human eye.

12. Write laws of reflection of light and draw diagram.

13. What is a Kaleidoscope. What are its uses.

14. How will you demonstrate that white light is made of seven colours?