SCIENCE AND TECHNOLOGY

Class - VII

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Preface

Syllabus revision and modernisation followed by preparation of textbooks on that basis is an essential component of educational process. In this direction State Council of Educational Research and Training, Raipur (Chhattisgarh) initiated the process of changing the syllabus and preparing textbooks from 2004-05 session. This book Science and Technology for Class VII is another step in that direction. The objective of this book is to help students to understand the basic concepts of Science rather than to load them with scientific information. Due to developments in technology, it has become important to give such education that establishes a relationship between Science, Technology and Society and provides students with the necessary knowledge and skills. It is necessary that the principles of Science be learnt and taught through activities. The activities given in the book can be easily performed by students using materials available at the local level. These activities will help them to develop a perspective that will motivate them to be curious and take up exploration and research.

We hope that this book will not only develop an interest in Science learning but would also help to develop the ability and attitude in students to analyse and to be constructive.

Right to Education Act 2009 gives emphasis on imparting quality education to children. NCERT, New Delhi has developed class wise, subject wise learning outcomes and pedagogical processes for classes I to VIII which will help to achieve the objectives of all-round development of children. So, textbook for the session 2018-19 have been made contextual and significant which will provide more opportunities to achieve desired outcomes. We hope that textbooks will be helpful for students and teachers to achieve these goals.

In the process of development of this book we have got help and support from teachers of many government and private schools, district institutes of education and training, Professors of colleges, non-governmental organisations and well informed citizens. We are extremely grateful to all of them.

We look forward to the well informed citizens of the State to give us more feedback and suggestions to improve the textbook as changes for improvements are always needed.

Director
S.C.E.R.T. Chhattisgarh, Raipur

Contribution of India to the World of Science

3000 years before the birth of Christ the development of science in India was surprisingly advanced. The people of ancient India had phenomenal success in solving difficult and unknown scientific problems. The contributions of Indians in the field of Mathematics, physics, chemistry, astronomy and medicine are very significant.

Last year we recollected the contribution of several of these scientists. This year too we will study the contributions of some Indian scientists which brought about revolutionary changes in the lives of human beings.

1. Shishir Kumar Mitra: He is famous for his contribution to studies of the 'Ionosphere'. He also explained why the night sky instead of being jet black is greyish. According to him this was due to one strata of the atmosphere being rich in ions and dispersing light rays. This is called 'alok deepti' of the night sky. 'Upper Atmosphere' – the book written by him has been appreciated all over the world.

2. Raja Ramanna: His chief contribution is in the area of 'Nuclear fission'. He also worked towards the use of atomic energy without harmful effects and for peaceful purposes. However, the 'Pokhran Atomic Test' was the brainchild of Ramanna. He contributed to development and establishment of the atomic reactors Apsara, Cyrrus and Purnima.

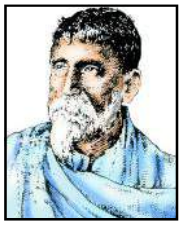
3. K.S.Krishnan: He was physicist of distinction and a philosopher. Krishnan studied the sequential arrangement of atoms in solid substances and the forces which help to maintain equilibrium of atoms and particles. He also studied the behaviour and ways to control electrons coming out of hot substances.

4. Satyendra Nath Bose: In order to understand radiation he postulated a new constant called 'Bose constant'. The basic particles like photons and alpha particles which follow the 'Bose formulae' are called 'Bosons'. Bose has also worked in other areas like X rays, crystallography and thermo-luminesence. A chemical developed by him is still used as a medicine for treatment of eyes.

5. Birbal Sahni: He was a Botanist. He conducted research on ferns, conifers, and Gymnosperms. He discovered some new Genera. His studies helped to understand the evolutionary connections between the ancient and the present-day plants. He discovered some new varieties of Gymnosperms.

6. John Warden Saderson Haldane: He was English by birth but later took Indian citizenship. He made basic contributions in several areas like functioning of the human body, medical science, development of life, micro-organisms, life science, mathematics and cosmology. He was famous for experimentation on himself.

7. Salim Ali: He is a known Ornithologist. He has written the book 'Indian Birds' which describes the various birds found in India and also has their pictures. He along with Dillon Ripleys wrote 'Handbook of the birds of India and Pakistan – The 10 volumes' of this describe the birds of the Indian peninsula.



8. Praphul Chandra Ray: He is considered the Father of Indian Chemistry. He helped in the development of research centres in Chemistry. His discovery of mercurous nitrate in 1896 is a major contribution to chemistry.

9. Ashima Chaterji : She was a Botanist she conducted research on medicinal plants specially found in India. She explained medicinal use of chemicals found in these plants. Her studies helped to develop industrial production of medicinal plants.

10. Anna Mani : She was a Deputy director of Indian Meterologic Institute. She also worked at Raman Research Institute as guest lecturer. She studied spectroscopic properties of Diamond and Ruby. Her major contribution is in the area of 'Wind energy'.

Content

Chapter 1

LIFE ON EARTH

In chapter 'Our Earth' of class VI you had read that all living organisms (plants and animals) have three basic requirements. No organism can survive without these. These three essential things are food, water and air.

Why do organisms need these things? Write in your own words. You may also consult class VI book.

Organisms live in different types of environment. Some live on land and some in water. Organisms on land are also of different kinds. Organisms easily get essential things required for living in most places on the earth, and they live in such places in large numbers.

On the other hand, there are some places on the earth where living conditions are very harsh. Desert is one such place. In the desert there is sand everywhere and water is scarce. There are no shady trees in deserts and the days are very hot. Nights are very cold as sand gets cold during night.

In the same way, in cold regions such as north and south poles and on the peaks of mountains, there is always snow and these regions are very cold. A very small number of organisms are found in such harsh conditions.

You have read about the geographical conditions in your district and state. You know that different types of environment are found in different parts of Chhattisgarh. Some parts of the state are plains, others have mountains, some have lakes and some have dense forests.

Our country is much bigger than Chhattisgarh. A lot of diversity is found in the environment of our country. India is surrounded by oceans on three sides and in the north there are Himalayas. Himalayas is a range of many small and big mountains. Small mountains have dense forests and the high mountain peaks are covered with snow. A part of Rajasthan is desert. There are vast plains in Uttar Pradesh and Bihar.

If we look at the whole earth, we find a greater variety of environments. You would have read that earth has two poles – north and south. Both these poles are very cold and their surface is always covered with snow. Apart from these, huge oceans, vast deserts, dense forests, mountains, plains etc. are found on the surface of the earth.

You know that organisms are connected to each other through food chains. A food chain always begins with a plant. Can you tell why?

Let's now travel around different types of environments and find out the conditions in which plants and animals live, their relation with each other and from where and how do they get things required for life.

Let us first go to the environment most familiar to us –our own surroundings. You would have seen *peepal* trees growing from the walls of old houses, monuments, etc.

These trees get plenty of oxygen from the air for respiration and carbon dioxide present in the air helps them in making their food. But where do they get water and minerals from? Can you guess?

Can you think of and write a food chain beginning with *peepal* tree?

You might have seen that often in the grains of wheat and rice, small insects called weevil (*ghun*) are found. These insects easily get air and food but how do they get water? Lizard, ghun and other animals are not seen drinking water because they get sufficient water from the food they eat and thus do not need to drink water.

Can you make a food chain in which there is Weevil (ghun)?

Try to find out from where do plants and animals around you get food, air and water.

We will now go to the historical city of Jaisalmer in the state of Rajasthan. Jaisalmer is in the middle of a desert and when we come out of the city we find sand all around. There are thorny bushes in place of big trees. A tree similar to *babool- khejdi* is found in abundance in Rajasthan. Apart from this, *cactus (nagphani)* and rajasthani grass are also found. These plants are the first links of food chains here.

Fig. 1.1 Desert Lizard

During the day it is sunny and so hot that no animals can be seen. In the evening many small and big animals come out in search of food. Desert lizards eat insects walking on the sand, and the rats who make burrows in sand also come out in search of food. Hawks and owls prey on these lizards and rats.

Foxes living in the desert also hunt these rats and birds. Many organisms are found even in dry environment like a desert. These organisms are also linked with each other in many ways forming multiple food chains.

Now we will go very far away from our home – to the oceans. Oceans have so much water that they never dry up. Three-fourth of earth's surface is covered with sea water and the rest is land. From this you can estimate how much water is there in the oceans.

Many types of algae, small and big plants keep floating on the surface of the ocean. These plants make food from carbon dioxide dissolved in water in the presence of sunlight. They get water and minerals from the ocean. They respire by taking oxygen from the air dissolved in water. These plants are found in large numbers in the oceans and are the first links of a long food chain. Even big animals living in oceans are dependent on these plants. Small animals swimming in water eat these plants. These small animals are eaten by animals bigger than them and by fish. Smaller fish are eaten by still bigger fish and the bigger fish are eaten by even bigger fish. Many big and small fishes, mammals and birds are found in the oceanic environment. Smaller organisms are eaten by organisms bigger than them – thus making long food chains. Not only the animals in the sea, but other animals living on the shores of the oceans are also dependent on these chains. We will see an example of this later.

Fig. 1.2 Polar Bear

After moving around the ocean, we now move to the north pole, called the Arctic region. The region is so cold that it is covered with a thick coat of snow almost all the year around. During summers, for a short time, a part of the snow melts and some small plants and algae grow. Rats, deer and rabbit are the main herbivorous animals found in this region. Most of the animals found here are white in colour, which makes it difficult to see them on the white snow. The common carnivorous animals of this region are bear, wolf, fox and owl. Bears found in Arctic region are white in colour and are huge in size (fig. 1.2). They are called polar bears. Think and tell why these bears

Fig. 1.3 Seal

are called polar bears? Seal, a mammal, is the main food of polar bears (fig. 1.3). Seals are similar to dogs in appearance. They can swim in the sea and hunt for fish. Polar bears catch the seals when the seals come on the shore to rest. The interesting part is that the food chain starting in the ocean ends on the earth with polar bears.

Ocean plants and algae → small animals → big animals and small fish → big fish → seal → polar bear

Now from polar regions we move to a country named Indonesia located towards the east of India. This country does not have plain land like India because it is made up of about thirteen thousand small and big islands. One of the big islands is Borneo. This island is very big and has huge caves in which millions of bats live. (fig. 1.4). These caves are so deep that sunlight cannot reach inside and they are always pitch dark. Bats hang on the walls of the caves and come out in the evening to search for food. Their food is small insects flying in the air, nectar of flowers and fruits.

Fig. 1.4 Bat

Would there be plants growing inside these caves? Give reasons

Why would bats live in caves where sunlight does not reach and no plants are found? They do this for their self-defence.During the day, they remain safe in the dark caves from predators. Still, in the evening, when they come out of the caves, predatory birds like hawks and owls catch and eat them.

Most of the food chain is outside the caves and only one link is inside. Like food, the bats get water only when they come out of the caves at night.

Plants → insects → bats → hawks and owls

We have seen that our earth is very vast and organisms live on it in varying conditions. In the examples given above, we have seen that all organisms live in an environment where they get the three things essential for life. The place where living beings live and reproduce is called their habitat. Body structures of organisms in different habitats gets modified so that they can live in their habitat without any difficulty. This is called adaptation. For example, organisms living in a desert can survive on very little water and they can tolerate very hot weather. Animals living in Arctic region have a lots of hair on their body and can tolerate very cold weather. Once an organism gets adapted to a certain habitat then it cannot survive in a different habitat. Organisms around us cannot survive in a desert or in the Arctic region. Similarly organisms living in the desert or in the Arctic region cannot survive in our habitat.

You have seen that there are big differences in the body structure of plants and animals found on earth. These differences are referred to as diversity in the living world.

As you know that various living and non- living components are in our environment. We find good co-ordination among them. Due to this balance we live in our earth without any difficulty. If the balance among various components and organisms is disturbed environments will be polluted and living beings face difficulty. It is neccessary for us that we should perform our duties and take the responsibility to save our environment, wild animals and forests, so that a better co-ordination can be created among our family, society and environment for a peaceful life without disturbing the balance of nature.

Good habits of sanitation at public places

A large amount of wastes and discarded materials are generated at crowded places like railway stations, bus depot, airports, hospitals, fairs, gatherings etc. If they are not disposed of properly, epidemics may break in. Hence we should strictly enforce the standards of cleanliness and sanitation laid down by our government. However, all of us can contribute in maintaining sanitation at public places. We should not scatter litter everywhere but should throw them in dustbins only. Toilets should be adequately flushed after use. Proper cleanliness should be maintained around the area surrounding the taps and water bodies.

We should be concerned about the health and hygiene of our environment and we must incorporate cleanliness as a habit in our daily life.

Answer these

1. Fill in the blanks

a. Compared to a country there is more ……. found in the earth's environment.
b. In comparison to a normal environment ……organisms are found in desert and cold regions.
c. Many long …… are found in oceans.
d. Some animals don't have to drink water because they get sufficient water from ……...

We have learnt

- Living organisms need food, air and water to live.
- Living organisms live in different environments. Living beings are found in large numbers at places where they can easily get things required for life.
- Desert and polar regions are respectively very hot and very cold. Therefore, the number of living organisms found in these places is very small.
- Living organisms are connected to each other through food chains.
- A food chain always starts with a plant.
- Food chain in a desert –
  Plants → desert insects → lizards and rats → hawk and owl
- Food chain in a polar region
  small plants and algae → very small animals → bigger animals and small fish → big fishes → seal → polar bear
- Other food chain
  Plants → insects → bats → hawks and owls
- On earth organisms live in different conditions.
- The place where organisms live and reproduce is called their habitat.
- Body structures of living organisms living in different habitats gets moulded so that they can live in that habitat without any difficulty. This is called adaptation.

Questions for practice

1. Fill in the blanks

a. The three essential requirements of life are -
……..., …… and ……...
b. In deserts, days are very……. and nights are very…….
c. Living organisms are linked to each other through……..
d. The place where living organisms live and reproduce is called……
e. Due to …….. living organisms live in their habitat without any difficulty.

2. Identify true and false statements from the following and correct the wrong statement and rewrite it.

a. There is water all around in a desert.
b. Sea plants respire by taking oxygen from the air.
c. Major carnivorous animals of Arctic region are rats, deer and rabbit.
d. Animals living in the Arctic region have hair on their body.
e. Organisms living in Arctic or desert region can live in our habitat.

3. Answer these –

a. Why don't we see lizards and weevil *(ghun)* drink water?
b. Where does the tree growing from a wall get water and minerals from?
c. Why are most of the animals found in arctic region white in colour?
d. Think of and write a food chain which starts in the ocean but ends on earth.
e. Make a food chain each for the desert and for the ocean.
f. Living organisms get modified according to the environment in which they live. If the environment on the earth became the same everywhere, how would be the living organisms effected? Write in your own words.
g. Write in your own words how bats found in the caves are dependent on the plants growing outside the caves.
h. How would polar bears be effected if all the algae on the surface of the oceans disappear?

Do these also

1. With the help of magazines, your teachers and friends, find out about the major vegetation of Chhattisgarh. Paste the photographs of the major plants in a scrap book. Have a discussion and put up an exhibition in your class and society.
2. The state animal of Chhattisgarh, 'wild buffalo'(Bubalus bubalis) is found in Udanti sanctuary and state bird 'Pahari mynah' (Gracula indica) is seen in parts of Bastar division. With the help of magazines, your teachers and friends, find out where the following animals are found in Chhattisgarh – Tiger, Leopard, Deer, Stag.

   Collect pictures of these animals and paste them in a scrap book. Display this book on special occasions of your school. From the pictures you collect make food chains which have tiger, leopard, deer, stag etc.
3. Due to some activities of human like cutting of trees, deforestation, hunting, capturing of birds for entertainment, the life of our state bird 'pahari mynah' and other birds is endangered. Is it happening in your area also ? make a report of it and spread awareness in your school and society.

Chapter 2

WATER

You know that about three-fourth of earth's surface is covered with water, yet during summers you would have read in the newspaper about the water crisis. Have you ever thought about the reasons for water crisis despite the abundance of water on the earth? Let us try to understand the reasons.

2.1 Water - A natural resource

Of the total water available on earth, 97% is found in oceans, 2% as ice on the peaks and the poles and the remaining 1% is in rivers, lakes, ponds and beneath the earth's surface. We use this underground water by digging wells. Water is also present in the atmosphere in the form of water vapour, mist and clouds. (Fig. – 2.1)

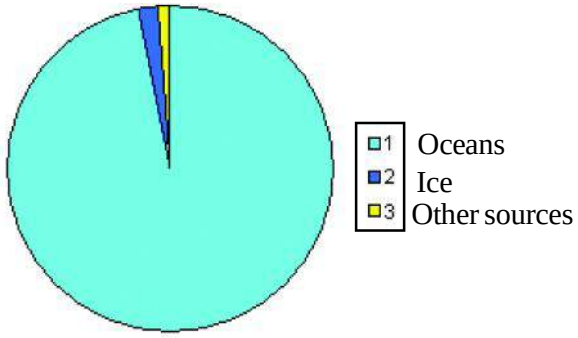


Fig. 2.1 Availability of water on earth

Many substances like common salt and other minerals are present in ocean water in large quantities. Due to these the water becomes salty or saline. It cannot be used for drinking, bathing, washing clothes or irrigation. Water present as icebergs is pure though it cannot be used easily. Of the total water available on earth, the quantity of water which can be used by human beings is very small. This is equivalent to 1 mL of usable water out of every 10 litre available i.e. 0·01%. You can now perhaps see that the quantity of water available for our use is really small and why water is so important? So, we should use water carefully, and prevent its wastage.

2.2 Importance of water for living

Water is an essential component of all living beings. Almost 70% of human body weight is water. Table 2.1 shows the approximate percentage of the water present in certain animals, plants and their products.

A healthy person needs about 2 to 3 litre of water for drinking daily. This is necessary for various process of body for which water acts as a medium. In the stomach water is necessary for the digestion, absorption of food and for the circulation of the digested food in the body. Along with water unwanted waste materials are thrown out of the body in the form of urine and sweat. The temperature of our body is also controlled by sweating. Thus, we should drink plenty of water so that all the processes of our body run smoothly. Water is as important for plants as it is for animals. Let us try to understand this through an activity-

Table - 2.1

Name of Items	Approximate percentage of water by weight
Elephant	80%
Plant	60%
Bread	30%
Milk	95%
Tomato	90%
Orange	85%
Potato	80%

Activity - 1

Materials required : Green gram seeds, bowl, water, cloth, soil

Take some Green gram seeds in a bowl and soak them in water for a few hours. Now take these 'wet seeds' and tie them in a cloth. In the same way take some similiar dry moong seeds and tie them in a cloth. Keep the cloth which has 'wet seeds' moist by sprinkling water on it at regular intervals. Compare the two sets of seeds after 3-4 days. Did you notice any difference? What could be the cause of this difference? Write.

Now divide the germinated seeds into two parts and sow them at separate places "A" and "B" in dry soil. Keep watering the place "A" daily and do not put water over place "B". After 2-3 days you will see that seeds in the place "A" have grown. Though the seeds in place "B" had germinated yet they did not grow further, after being put in the soil. What could be the reason?

Can you now conclude that water is necessary for germination and growth in plants? You also know that roots of the plants absorb minerals dissolved in water and transport them to various parts of the plant. Green plants use sunlight to make food from water and carbon dioxide. In this way we have seen how important water is for plants.

Water is also a habitat for plants and animals living in rivers, ponds and seas. Most of the times animals use oxygen dissolved in water for respiration and water plants use carbon dioxide dissolved in water for photosynthesis. Write in table 2.2 the names of a few plants and animals whose habitat is water.

Table - 2.2

S. No.	Aquatic organisms	Examples
1	Aquatic plants	Lotus, ……
2	Aquatic animals	Fish,……
3	Aquatic microorganisms	Amoeba, paramoecium, euglena……

Answer these

(1) Why can't human beings use water available in the oceans for their daily activities?

(2) Why is water essential for human body?

(3) What will happen if the plant in a pot is not watered? Explain giving reasons.

(4) How is water important for aquatic organisms?

2.3 Drinking water

Water fit for drinking is called drinking water. Is water from all sources fit for drinking? Water from different sources can have dissolved salts, suspended particles and microorganisms. Some salts dissolved in water are necessary for our body but if the amount of these is more than required then they need to be removed from water before it is used.

In the cities water is purified at the water treatment plants before its distribution. In these plants all the suspended impurities and bacteria are removed. To get rid of harmful bacteria present in water, bleaching powder is added to it. In the same way water from wells is made germfree for use at home by adding bleaching powder or potassium permanganate in small quantities or chlorine tablet. Water can also be boiled to make it germfree. Nowadays ultraviolet rays are also used to make water germfree.

To remove suspended impurities of water at home we can use a filter fitted with ceramic candle.

The cause of many diseases in our country is the non-availability of safe drinking water. Many government and non-government institutions have been making efforts continuously to remove this problem from Chhattisgarh and provide sufficient safe drinking water available to all..

Distilled water

This is the purest from of water. It is required for conducting experiments in laboratories. Distilled water is obtained by evaporating water to produce water vapour and then condensing these water vapours to get water.

You can also obtain distilled water at home. Take a big utensil and keep a small heavy bowl at the centre of the utensil. Now fill water in the utensil and make sure the bowl does not float in water. Tie a transparent plastic sheet over the utensil. Keep a small stone on the plastic right sheet over the bowl. Keep this apparatus in the sun. After some time water droplets accumulate in the bowl under the plastic sheet. This is distilled water (fig. 2.2).

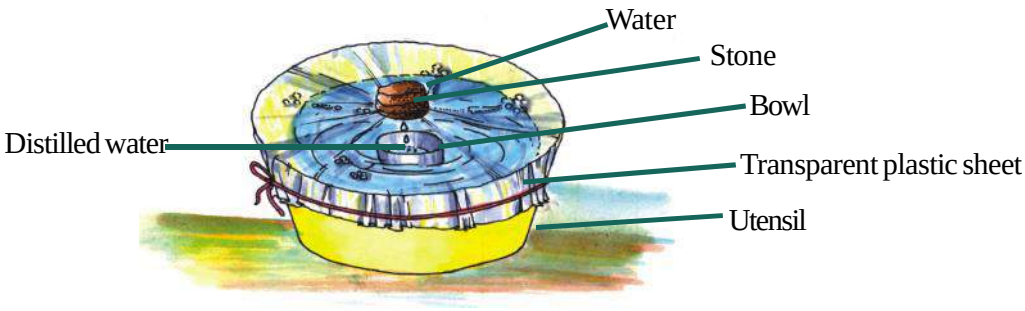


Fig.- 2.2 Collecting distilled water

Answer these

(1) Why is water from all sources, not fit for drinking?

(2) What are the various methods by which water can be made fit for drinking?

(3) What do you understand by distilled water?

2.4 Physical properties of water

Activity - 2

Material required :- test tube, water

Fill three fourth of a test tube with water. Look at the test tube carefully. Make the table given below in your copy and fill in the properties of water.

Table - 2.3

S. No.	Property	Observation
1.	Colour	.....
2.	Odour	.....
3.	Taste	.....
4.	Transparency	.....
5.	State (at Room temperature)	.....

It is only due to the transparency of water that light reaches the water plants and they are able to manufacture their food.

* Freezing point of water is 0°C which means that at this temperature water gets converted into ice. At the same temperature 0°C ice changes into water. This is called the melting point of ice.
* Boiling point of water is 100°C. At this temperature water boils and changes into vapour. At the same temperature 100°C water vapour condense into water.

In hot regions coolers are normally used during summer. In this water is poured over mats fixed on the three sides of the cooler. The air is sucked into the chamber through these wet mats and evaporation of water causes the air to cool. The fan in the cooler continuously sucks in air from outside and throws the cooled air into the room and makes it cool.

Activity - 3

Materials required :- beaker, distilled water, thick cardboard, carbon rods, bulb, wires, cell, salt.

Take some distilled water in a beaker. Now fix two carbon rods on the thick cardboard and place these over the beaker as shown in figure 2.3. Connect the two rods to the bulb and the cell with the help of copper wires. Does the bulb light up? Now dissolve a spoonful of salt in water and repeat the experiment. Does the bulb light up now?

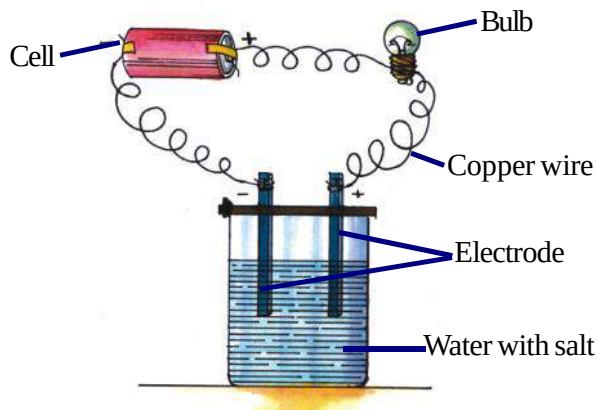


Figure 2.3 Flow or conduction of electricity

Distilled water is a bad conductor of electricity but when salt is added, it becomes a good conductor and the bulb ligths up.

Sometimes in the rainy season if an open electric wire touches a wet wall then we get an electric shock on touching the wall. The reason for this is the conduction of electricity by the water with salts from the wall.

2.5 Water a unique solvent

Many substances dissolve in water. This is why it is called the universal solvent. Materials dissolved in a solvent are called solutes. When a solute dissolves in a solvent the mixture is called a solution.

Activity - 4

Material required :- glass slide, tap water, source of heat

Put some drops of tap water on a slide and heat till the water evaporates completely. This evaporation can also be done by keeping the slide in sunlight. Do you find any residual material on the slide? These substances are the salts dissolved in water.

Activity - 5

Material required :- Beaker, salt, sugar, water, tripod stand, spoon, wire gauze, source of heat, glass rod.

Fill half of the beaker with water and add a spoon of salt to it. Stir it with a glass rod. Did the salt dissolve completely? Keep adding half spoons of salt and stirring till the salt stops dissolving. The solution thus obtained is the saturated solution of the substance at that temperature. Now place the beaker on a tripod stand and heat it. Add more salt and stir. You will see that with the increase in temperature more salt is dissolved. In this way we see that solubility changes with change in temperature.

Repeat this experiment with sugar and other materials. You will note that the quantity of material required to make a saturated solution is different for different materials. This means that different materials have different solubility in water.

The maximum quantity of a given substance that is soluble in 100 ml of water at a specific temperature is the solubility of the substance at that temperature.

Not only solids but gases like oxygen, carbon dioxide etc. are also soluble in water. Carbon dioxide is more soluble in water than oxygen is. While manufacturing cold drinks, carbon dioxide gas is dissolved in water at a high pressure.

Solubility of gases decreases with increase in temperature. This is the reason why in summers when the water of shallow ponds and lakes becomes hotter, the quantity of oxygen disolved in it reduces.

2.6 Salinity of sea water

Rain water is distilled water. It does not contain mineral salts. However, due to atmospheric pollution various gases dissolve in it. When this water flows over soil and rocks many types of mineral salts dissolve in it. This water reaches the sea through the rivers. In this way the amount of minerals present in sea water increases and it becomes saline. In one litre of sea water there are about 35 gram of salts. Common salt (sodium chloride) is the main salt present but small quantities of sodium bromide, magnesium chloride and potassium iodide are also present.

Presence of a small quantity of iodine in our body is important for it. Salt obtained from sea water has small quantities of potassium iodide. But this is separated at the time of purification. Required quantities of this compound are however added to pure salt to iodize it. This helps prevent goitre – a disease caused by deficiency of iodine.

Answer these

1. Why is water called a universal solvent?
2. Write the names of some of those salts that are present in sea water?
3. Write short notes –
   a. Saturated solution b. Solubility
4. Due to which property of water does sunlight reach the water plants?

2.7 Anamolous behaviour of water

Normally the solid form of a substance is heavier than its liquid form. But this is not correct for water. You would have seen that in summer ice cubes put in a glass of sharbat (soft drink) float on its surface. Thus we can say that the density of ice is less than that of water.

Density of a substance is its mass per unit volume. $\text{Density} = \frac{\text{Mass}}{\text{Volume}}$

Density of water is the maximum at 4°C. This is one kilogram per litre whereas the density of ice is 0.9 kilogram per litre. This is why when ice is added to water about 1/9 th part of the ice is above the water surface and 8/9 th part is below the water surface. This is the reason why in cold regions one cannot make out the exact size of the rock of ice floating on water immediately. Due to this the captains of the ships have to be cautious when passing by the sides of the ice rocks.

Thousands died when a ship named Titanic sank in water after colliding with a floating rock of ice which is called an iceberg.

Density of ice being less than of water is a boon for water organisms. In extreme cold climates when the atmospheric temperature is less than 0°C the water on the surface of sea and on the ponds starts freezing. Being less dense than water ice floats on the water surface. As ice is a bad conductor of heat, the heat trapped inside cannot get out and the temperature of the water is maintained comparatively higher. This is how plants and animals living in water survive in winters.

We have seen that on freezing the density of water decreases and its volume increases. If a fully filled bottle of water is kept in the freezer of a refrigerator fridge the bottle would break when the water freezes due to an increase in volume.

2.8 Hard and soft water

Soap is used for washing and bathing usually. When soap gives a lot of lather with water then that water is called soft water. Water from some sources that does not give good lather is called hard water. Calcium and magnesium salts dissolved in hard water react with soap to form insoluble substances and hence soap can not form adequate lather.

Hardness of water is of two types –

1. Temporary hardness
2. Permanent hardness

Temporary hardness is due to presence of bicarbonates of magnesium and calcium. This can be removed by boiling the water.

Permanent hardness is due to chlorides and sulphates of calcium and magnesium salts dissolved in water. This hardness cannot be removed by boiling.

2.9 Electrolysis of water- (demonstration by the teacher)

To find the constituents of water we electrolyse it..

Materials required :- a wide mouthed plastic bottle, knife, a rubber cork with two holes, a stand, sulphuric acid, water, two carbon rods, two test tubes with corks, battery (6 volt), matchbox**.**

To do this experiment take a wide mouth bottle and cut out its bottom. Now put the cork with the two holes on the mouth of the bottle and insert the two carbon rods in the holes. Set up the apparatus as

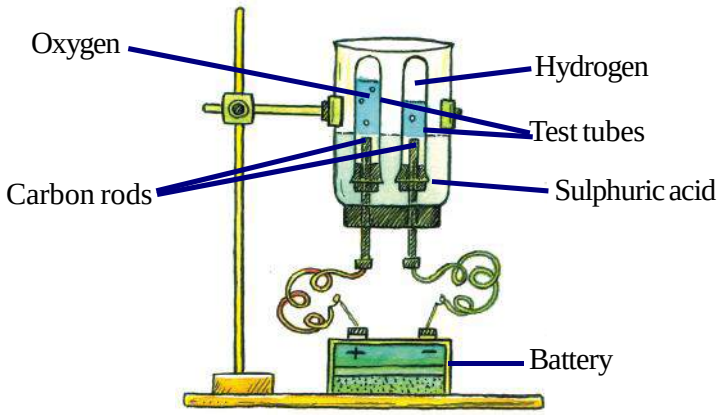


Figure 2.4 Electrolysis of Water

shown in fig.2.4. Fill the inverted bottle upto two-third with water and add a few drops of sulphuric acid. Now fix the two test tubes on the electrodes. Ensure that the test tubes are filled with water. Connect the two electrodes to a source of electricity (battery). After some time bubbles of gas start rising from electrodes and collect in the test tubes. Is the amount of gas collected in both the test tubes equal? The amount of gas collected in one test tube would be almost double of that in the other test tube. When the faster filling test tube is completely filled with gas, remove it from the electrode by putting your thumb over the mouth of the test tube. Close the mouth of the test tube with a cork. To test the gas take a burning matchstick near the mouth of the test tube. The gas burns with a blue flame and a 'pop' sound is produced. This shows the presence of hydrogen gas. When the other test tube gets filled, remove the test tube from the electrode in the same way. Take a smouldering matchstick near the mouth of the test tube. What happens? The matchstick starts burning. This happens because of oxygen gas.

By this we can see that water is formed by the reaction between hydrogen and oxygen and the volume of hydrogen is double than that of oxygen.

2.10 Water cycle

Water from oceans, ponds, lakes and other sources is continuously evaporating. Plants and animals also produce some water vapour through various living processes. This water vapour keeps accumulating in the atmosphere.

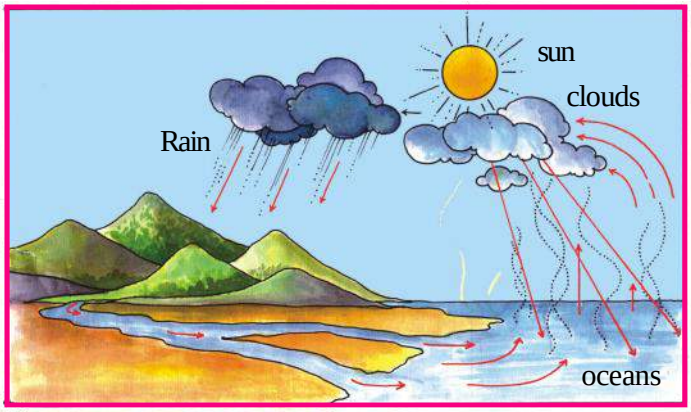


Fig. 2.5 Water cycle

As water vapours are lighter they rise upwards. In the upper layers of the atmosphere the temperature is lesser and because of this the water vapour condense to small droplets of water and form clouds. When small droplets of water come together then big droplets of water are formed and they start falling in the form of rain. This way water reaches its various sources again and the water cycle is completed (fig – 2.5).

Answer these

1. How do plants and animals living inside water in cold regions survive even after the freezing of water?
2. State the reason why ice floats on water.
3. How would you identify hard and soft water?
4. With the help of an experiment show that water is made up of two gases.

2.11 Water pollution

Many chemical substances, excreta and other unwanted substances like waste materials, dirty water from drains etc. get mixed with water from different sources. Due to this the water becomes unfit for

drinking and household use. This water is called polluted water. The substances which pollute water are called pollutants and the process of the water getting polluted due to these pollutants is called 'water pollution'. Due to growing industrialization water pollution has become a serious problem.

2.11.1 Causes of water pollution -

1. Activities of human beings

Many activities of human beings pollute water. You would have seen that people usually throw the waste and rotten materials from their homes in to the drains. Water from these drains pollutes water of ponds, rivers etc. Similarly people pollute water of rivers and ponds by bathing, washing clothes, animals and vehicles. In some places dead bodies are also thrown in water. Water also gets polluted due to the colours used in the making of idols of god – goddesses that are immersed in water. Waste material thrown by hospitals, urine and excreta of animals also pollutes water. Many germs that can cause disease get in to water because of this.

2. Through agriculture

To save the crop from pests and to increase productivity, many insecticides, weedicides and different kinds of manures are used. These substances dissolve in water and reach rivers and ponds, thus pollute the water.

3. Through industries

Along with useful materials manufactured in industries some waste products are also produced. These products are often harmful. When there are no proper systems of disposing these products in the factory they are disposed off in rivers and ponds, resulting in water being polluted. This water is harmful when used by plants and animals. If these disposed materials contain lead, mercury, chromium, cadmium etc. then they can cause fatal diseases.

2.11.2 Controlling water pollution

Government has made some rules to stop environmental pollution. These rules should be compulsorily followed by all citizens, institutions and industries. Many measures can be taken to stop water pollution. For example, industries should put up such equipment which can remove harmful substances, organic compounds, colour and odour from water. This would make water reusable.

Make a list of causes of water pollution in near by water sources and its preventive measures in your note book and discuss it with your class.

2.11.3 Treatment of polluted water

To help you understand, the processes that take place at the waste water treatment plant let us perform the following activity.

Activity - 6

Materials required: A large glass jar, 4 test tubes, orange peels or grass twigs, detergent, water, ink, stirrer, filter paper, stand, funnel, sand, fine gravel and medium sized gravel.

Divide yourself into groups to perform the activity. Record your observation at each stage -

Fill a large glass jar 3/4 full of water. Add some dirty organic matter such as grass pieces or orange peels, a small amount of detergent and a few drops of an ink of any colour. Cap the jar, shake it well and let the mixture stand in the sun for two days. After two days, shake the mixture and pour a small sample into test tube. Label this test tube as'Sample-1'how does it smell? Use a stirrer or mixer and stir the sample several times and leave overnight. Next day pour another sample into a second test tube. Label it as 'Sample-2.'Fold a piece of filter paper to form a cone. Wet the paper with tap water and then insert the cone in a funnel. Mount the funnel on a support (as you have learnt in class VI)

Place layers of sand, fine gravel and finally medium gravel in the funnel (fig 2.6). An actual filtration plant does not use filter paper, but the sand filter is several meters deep. Pour the remaining stirred liquid through the filter into the beakers. Do not allow the liquid to spill over the filter. If the filtered liquid is not clear, filter it a few times till you get clean water. Pour the sample of the filtered water into a third test tube labeled as "Filtered Sample-3'.

Pour another sample of the filtered water into a fourth test tube. Add a small piece of a chlorine tablet. Mix well until the water is clear. Label the test tube "Chlorinated Sample-4".Observe carefully the samples in all the test tubes. Do not taste. Just smell them.

Now answer the following questions.

- What changes did you observe in the appearance of the liquid after stirring?
- Did aeration change the odour?
- What was removed by the sand filter?
- Did chlorine remove the colour?

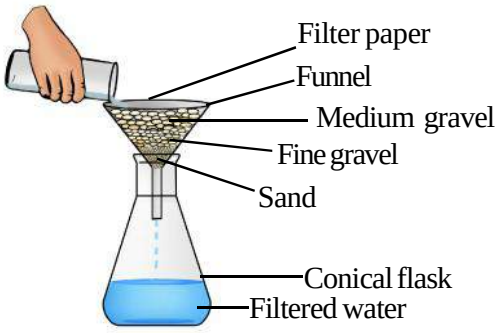


Fig 2.6 Filtration process

2.12 Ground water and Ground water table

If we dig a hole in the ground near a water body, we may find that the soil is moist. The moisture in the soil indicates the presence of water underground. If we dig deeper and deeper, we would reach a level where all the space between particles of soil and gaps between rocks are filled with water .The upper limit of this layer is called the water table. The water found below the water table is called ground water. What is the source of this ground water? The rain water and water from other sources such as rivers and ponds seeps through the soil and fills the empty spaces and cracks deep below the ground.

2.12.1 Depletion of water level

You must have noticed that a huge amount of ground water is bore through pumps to fulfill the requirement of drinking, construction work, irrigation and various other purposes. Generally this water gets replenished by seepage of rainwater and other natural processes. However water table may go down if the water is not sufficiently replenished. This may happen due to many reasons like increase in population, industrial and agricultural activities. Scanty rainfall is another factor that may deplete the water table. Yet another factor affecting water table could be deforestation, urbanization and decrease in the effective area for seepage of rain water. All these factors contribute to depletion of water table.

Table - 2.4

S.No	Activity	Yes/No
1.	Keeping the tap open while washing teeth, face & bathing and using a lot of water.	
2.	Not closing a running or leaking tap but move on.	
3.	Take a full glass of water, drink half and throw the rest.	
4.	Water, garden plants in the morning instead of in the evening	
5.	Not reusing the water left over from washing of fruits, vegetables etc. in the kitchen for watering plants in the garden.	
6.	Use a pipe to bring water from a source (pond) instead of a bucket for washing vehicles.	
7.	Filling water in utensils, buckets and tanks till it starts overflowing.	

2.12 Water Managment

We normally recognize the importance of water only when adequate water is not available to us. Every drop of water is valuable. Human activities are largely responsible for the depletion of water table. We should try to save it. In our country the tradition of water conservation exists since ancient times. Presence of a pond in every village and town is an evidence of this. Due to industrial development and growing urbanization, there is a decrease in their numbers. This could become a cause of water crisis in the future.

You can also help in water conservation. Consider the following and see for yourself whether you help in water conservation or waste water.

If your answer to the above questions is no, then you are helping in water conservation.

Water is a precious resource and we should use it with care. There are many other ways of water conservation. Discuss them in your class. Nowadays, many special ways for water conservation are being used in cities.

A farmer using water in the field can also use water economically by adopting certain techniques like drip irrigation, use of sprinklers and using narrow tubing which deliver water directly at the base of the plant.

2.14 Rain Water Harvesting

Collecting rain water for use as per requirement is called rain water harvesting. The rain falling on house roofs is collected and routed to pits in the ground through pipes. This pit is of an appropriate shape with concrete walls. The bottom of the pit is (not cemented) kuchcha and a layer of small stones (gitti) and sand is spread on it. These layers help in filtering the water. The filtered water then seeps through the soil. In this way the ground level of the water rises. This water is pumped up by tube well and hand pumps and then used.

In the villages, village panchayats can play an important role in this direction. They can dig up the bottom surface of dry ponds before monsoon so that the rainwater does not flow out but seeps in to the soil easily. Small ponds can also be constructed before monsoon to collect rainwater.

Answer these

1. What are the main causes of water pollution? What measures would you take to stop water pollution?
2. Why is conservation of water necessary?

We have learnt

- $\frac{3}{4}$ th of earth's surface is covered by water. However, the amount of usable water is a very small portion of this.
- Water is necessary for living. It acts as a medium for various living processes.
- Aquatic organisms use oxygen dissolved in water for respiration and carbon dioxide is used by plants in photosynthesis.
- Drinking water should be free of suspended impurities and harmful microorganisms. Water can be made bacteria free by bleaching powder, potassium permanganate and ultraviolet rays.
- Freezing point of distilled water is 0°C and boiling point is 100°C. Density of water is maximum at 4°C.
- Sea water is unfit for drinking due to large quantities of salts being present in it.
- Density of water is more than the density of ice.
- Water is a universal solvent. Solubility of different substances in water is different.
- Water is made up of hydrogen and oxygen. By electrolysis of water we can see that the volume of hydrogen in water is double than the volume of oxygen.
- Water gets polluted due to impurities.
- Shortage of water can be reduced by rain water harvesting.

Questions for practice

1. Choose the correct answer –

a) Ice floats on the surface of water because –

(i) density of ice is more than water. (ii) density of ice is equal to water.
(iii) density of ice is less than water. (iv) air bubbles are found in ice.

b) Ratio of hydrogen and oxygen in water is 2:1 –

(i) as per weight (ii) as per volume
(iii) as per density (iv) as per weight and volume both

c) Water cycle is a —

(i) process of evaporation (ii) process of condensation
(iii) process of evaporation and condensation (iv) process of melting

d) Distilled water is the closest to —

(i) sea water (ii) rain water
(iii) ground water (iv) tap water

2. Fill in the blanks –

a) Water is a …… solvent.

b) …… gas is more soluble in water than …….. gas.

c) Hardness in water is due to …… and …….. salts dissolved in it.

d) Distilled water is a …….. conductor of electricity.

e) ….....……gas obtained by electrolysis of water produces a 'pop' sound on burning.

3. Identify true and false statements and rewrite the false statement after correcting them.

a) Bleaching powder is used to make water bacteria free.

b) Distilled water is suitable for drinking.

c) Solubility of gases in water increases with temperature.

d) Density of ice is more than the density of water.

e) Heating water kept at $0^{o}C$ leads to an increase in volume.

4. Answer the following questions –

1. Why is there a water crisis even though $\frac{3}{4}^{th}$ of the Earth's surface is covered by water?
2. What would happen if all the sources of water in a forest, dry up?
3. Explain water cycle on earth.
4. How will you make a saturated solution of sugar? What would happen if this solution is heated?
5. Water containing salts is a good conductor of electricity. Give an activity to explain it.
6. What is water pollution? Write the causes of water pollution.
7. What would you do to stop water pollution in your city/village?
8. What is meant by rain water harvesting?

Do these also

1. Make a list of water sources around you and specify, water from which source is fit / unfit for drinking. What would you do to keep the drining water source clean?
2. Every drop of water is valuable. Thus, wastage of water should be stopped. To fulfill the above objective start a community awareness campaign with your friends.
3. List the different measures that can be adopted for the treatment of polluted water. You can also discuss about it with your family members, and neighbour and also search in newspapers and internet.

Chapter 3

STRUCTURE OF MATTER

We know many methods by which a mixture can be separated into its constituents e.g. picking, filtration, crystallization, sublimation etc. No chemical reaction is involved in these methods. Substances whose constituents can be separated by simple physical processes are called mixtures. All substances are however, not mixtures. There are some substances whose constituents cannot be separated by simple physical methods. They are called pure substances.

3.1 Different structure of substances

Mixture and pure substances can be recognized and identified by another method too. It is by the change in the state on heating. Pure substances change their state at a particular temperature whereas this temperature for mixtures is not fixed. The temperature depends on the ratio of different constituents in the mixture. Pure substances are of two types – elements and compounds.

What is a compound? How is it different from a mixture? Let us understand through an activity.

Activity - 1

Materials required: Beaker, Copper Sulphate, Pins and Water.

Take water in a beaker and make a solution of copper sulphate. Put 4-5 pins in this solution and let it remain undisturbed for an hour. Do you note any change in the colour of the pins? Does the colour of the solution also change? The change in the colour of pins is due to the deposition of copper present in copper sulphate. Copper cannot be separated from copper sulphate by physical methods.

By putting iron in copper sulphate we get a fixed quantity of copper. (164 g of copper sulphate will always have 64 g of copper). This means copper is a constituent of copper sulphate and is present in a fixed amount, whereas constituents of a mixture are not in a fixed ratio.

The compounds used in daily life are water, salt, sugar etc. whereas the types and examples of different types of mixtures are given in table 3.1.

Table - 3.1

S.NO.	Types of mixture	Examples
1	Gas in gas	Air
2	Gas in liquid	(i) Soda water (carbon dioxide in water) (ii) Oxygen and carbon dioxide in normal water
3	Liquid in liquid	Lemon juice and water
4	Solid in liquid	Sea water, sugar solution
5	Solid in solid	Alloys e.g. brass and bronze
6	Solid in gas	Smoke

The other type of pure substances are those which have only one constituent. They are called elements. Copper separated from copper sulphate in activity 1 is an element. No more constituents can be separated from an element by any physical or chemical method. Some other elements are gold, iron, silver, oxygen, nitrogen etc.

Till date more than 114 elements have been found. Out of these 92 elements are present in nature and the rest have been synthesized by scientists in laboratories.

Every element has its specific properties. These properties help in identifying the elements. Elements are found in all states. Complete table 3.2 by filling some more examples of elements present as solids, liquids and gases at normal temperatures.

Table - 3.2

Elements that are Solid	Elements that are Liquid	Elements that are Gases
Silver	Bromine	Hydrogen
Gold	Mercury	Nitrogen
.....	.....	.....
.....	.....	.....

Elements can be classified into metals and non-metals on the basis of certain properties. Metals are good conductors of heat and electricity. They have a special lusture (shine). Normally they are solids like gold, silver, iron but mercury is a metal that is normally found in liquid state at room temperature. Non-metals occur in all the three states at normal temperature - solid (sulphur), liquid (bromine) and gaseous (Hydrogen, Nitrogen etc). They are bad conductors of electricity.

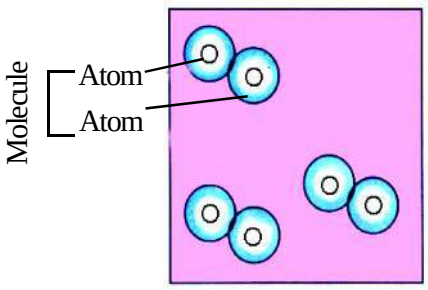
Two or more than two elements can react (chemical reaction) with each other to form compounds. Hydrogen and oxygen react to form water, similarly carbon and oxygen react to form carbon dioxide. If we simply mix oxygen and hydrogen no water is formed. Water is formed only when oxygen reacts chemically with hydrogen.

What is air? An element, compound or a mixture? Till 200 years ago air was considered to be an element. But scientist have now proved that air is not an element but is a mixture of nitrogen, oxygen, carbon dioxide and many other gases.

Elements and compounds can also be classified on the basis of particles also. Let us understand this.

All substances are made up of particles. Different substances have different types of particles. For e.g. the properties of all particles of water will be the same but water particles and iron particles will be very different from each other. These particles are so tiny that they cannot be seen even by a good quality microscope. A crystal of salt is made up of billions of particles. These smallest particles of a substance can be atoms or molecules.

An element has same type of atoms. In some elements these atoms can exist on their own in a free state and in others they can only exist in combination with other atoms. These combinations are known as molecules of the element. e.g. two atoms of oxygen combine to form a molecule. Every atom has a specific mass known as its atomic mass.



3.1 Molecule of oxygen

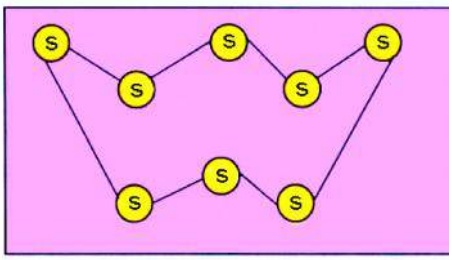


Fig 3.2 Molecule of sulphur

Sulphur is an element in which one molecule is made of eight similar atoms. (Fig. 3.2)

Compounds are formed when two or more than two elements combine together in a fixed ratio. Like hydrochloric acid is a compound in which each molecule is made up of one atom of hydrogen and one atom of chlorine. (fig.3.3)

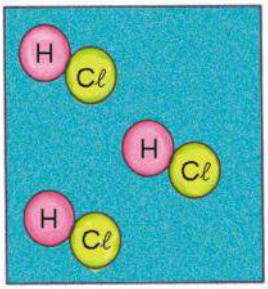


Fig. 3.3 Molecule of hydrochloric acid

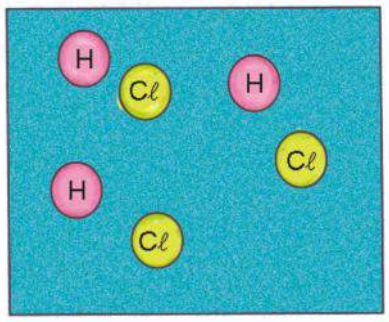


Fig. 3.4 Atoms of hydrogen and chlorine

The smallest particle of a compound is a molecule. On further dividing this molecule of a compound we get constituent atoms of its elements (fig. 3.4).

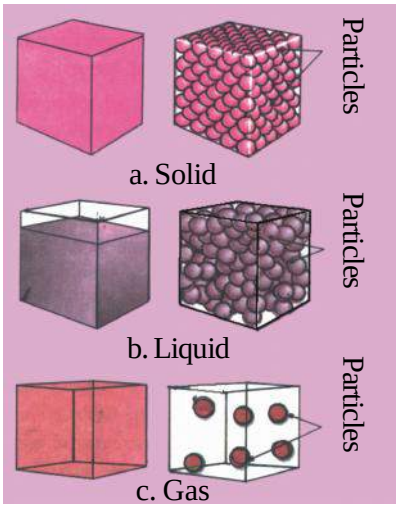


Fig. 3.5 Arrangement of molecules in a. Solid b. Liquid c. Gas

Now we know that substances are made up of atoms and molecules. What is the arrangement of these molecule in the three states of matter? Let us try to find out.

In solids like marbles, iron etc. the molecules are tightly packed, organised and arranged in a definite pattern. Therefore the molecules do not have freedom to move freely. The force of attraction between particles of solids is very strong. The solids therefore have definite shape and volume. (fig. 3.5a).

In liquids the particles are somewhat loosely packed (fig. 3.5b). Therefore, they can be compressed to an extent. These particles can move around each other within the liquid. Liquids take the shape of the container in which they are kept. The force of attraction between particles is weaker.

In gases there is no fixed organisation of the particles and the particles are further apart in comparison to solids and liquids (fig. 3.5c). Thus they can be easily compressed. The particles of a gas are free to move about in any direction. Volume and shape of a gas is not fixed. Gases take the shape and occupy the volume of the container in which they are kept. The force of attraction between the particles of gas is very weak.

Answer these

1. Separate the following substances into elements, compounds and mixtures –
   Copper, air, ice-cream, salt, oxygen, water
2. What is an element?
3. Specify the differences between a mixture and a compound?

Symbols of alchemists

Symbols have been used to represent a substance for a long time. In ancient times alchemists tried to make gold and elixir (amrit) by chemical reactions. They used symbols to keep their knowledge a secret. They used symbols for substances (elements, compounds, mixture) used in daily life and for reactions (fig. 3.6a). Common salt was represented by the symbol ⊖ Sometimes different symbols were used by alchemists to represent the same substance.

After many years John Dalton made formula for compounds using symbols. Symbols used by Dalton are as follows -

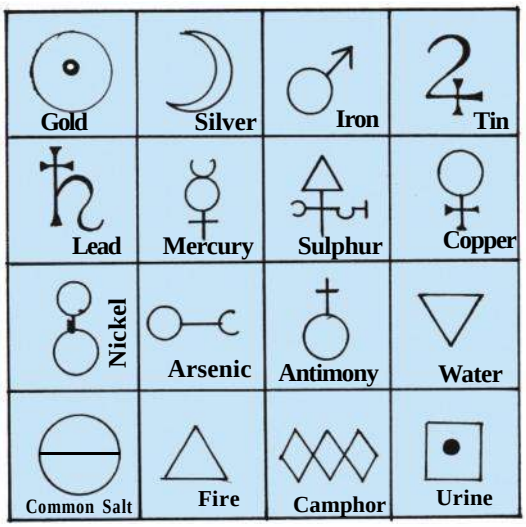


Fig. 3.6 a Symbols used by alchemists

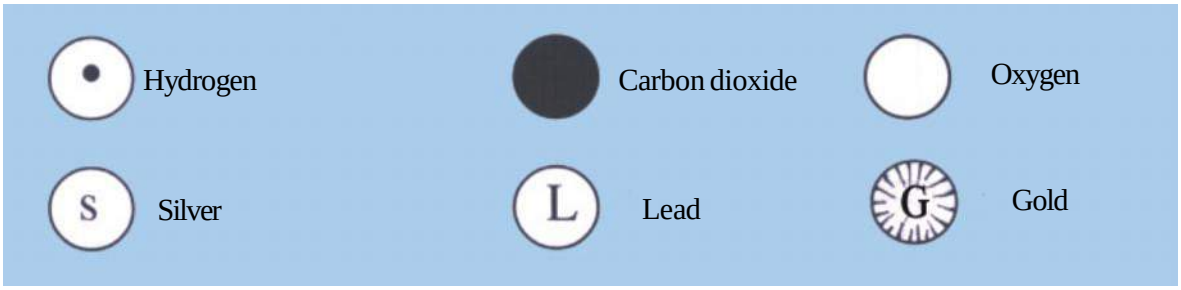


Fig. 3.6 b Symbols used by Dalton

3.2 Symbols

We use symbols and short forms as per our need in our daily life. For example we use NH to represent national highway and a straight arrow to depict a straight path. Till date 118 elements and millions of compounds made by them are known. When referring to a substance it is not convenient to use full name of the substance every time. Therefore scientists use symbols and groups of symbols to represent these elements and compounds. These symbols are accepted internationally.

At present we use simple symbols given by Sweden scientist J.J. Berzelius to represent elements. He had suggested that the symbols of elements should be represented by alphabets in English language. His other suggestions are as follows:-

1. First alphabet of the English name of an element should be used as its symbol e.g. O for oxygen, N for Nitrogen, S for sulphur, and H for hydrogen. This should be written in capital letter.
2. When the name of more than two compounds start with the same alphabet then another alphabet should be added to the first one.

In this situation the first alphabet should be in capital letter and the second one in small letters. For example – elements beginning with the word c are –

C - Carbon
C – Calcium
C – Chlorine
C – Cobalt
C – Chromium

Here carbon is represented by symbol C, for calcium "a" is added with the first alphabet "C". So, the symbol of calcium is "Ca". In this way symbol of chlorine is Cl, cobalt is Co and chromium is Cr.

Symbols of some other elements are as follows:

Table - 3.3

Name of the substance	Symbol
Aluminum	Al
Argon	Ar
Boron	B
Fluorine	F
Helium	He
Iodine	I
Magnesium	Mg
Manganese	Mn
Neon	Ne
Phosphorous	P
Silicon	Si
Sulphur	S
Zinc	Zn

3. Names of some substances are based on their Greek and Latin names. For example the symbol of sodium is 'Na" instead of 'So' because its latin name is *natrium*. Similarly some more names are being given in table 3.4.

Table - 3.4

Substance	Latin name	Symbol
Potassium	Kalium	K
Silver	Argentum	Ag
Iron	Ferrum	Fe
Copper	Cuprum	Cu
Tin	Stannum	Sn
Gold	Aurum	Au
Lead	Plumbum	Pb
Mercury	Hydrargyrum	Hg
Antimony	Stibium	Sb

3.3 Formula

A symbol represents an atom of an element whereas formula represents a molecule of an element or a compound. It gives information about the number of atoms in the molecule. The formula of a molecule indicates the number of atoms of each constituent element contained in it. The number of atoms is shown at the foot of the symbol of each element. Some elements occur in free state as atoms and some in the form of molecules. To represent an atom only its symbol is used, e.g. the symbol of Helium is He. Its molecule is made up of only one atom, so its formula is He. In case of such substances there is no need to write one at the foot of the symbol.

To write the molecular form of an element, it is necessary to know how many atoms it is made up of. For example a molecule of chlorine is made up of two atoms of chlorine. So atomicity of chlorine is 2.

To show a molecule of chlorine (Fig. 3.7) we use the numeral 2 at the foot of its symbol Cl to make it Cl_2. Similarly nitrogen, iodine and ozone are represented as N_2, I_2 and O_3. This is called the molecular formula.

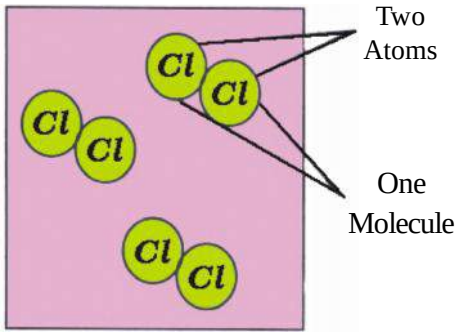


Fig. 3.7 Three molecules of chlorine

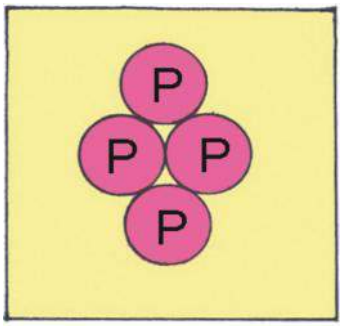


Fig. 3.8 One molecule of phosphorous

Molecules of phosphorous (Fig. 3.8) and sulphur are made up of 4 and 8 atoms respectively. Thus, their molecules are represented by P_4 and S_8. (Most of the solids are found in groups of atoms therefore they are represented by their symbols.)

The number of atoms present in a molecule of an element is known as its atomicity. In this way we can write the formulas of elements by knowing the number of atoms in a molecule. Fill table 3.5 according to the information provided -

Table - 3.5

Element	Symbol	Atomicity	Formula
Bromine	Br	2	.....
Iodine	I	.....	I_2
Sulphur	S	8	.....
Oxygen	O	.....	O_2
Hydrogen	H	2	.....

All compounds are present as molecules. Therefore they are represented by their molecular formula. We know that compounds are made up of two or more than two elements in a fixed ratio. Therefore, to write the formula of a compound we need to know its constituent elements and how many atoms of each element are present in a molecule. Let us consider this by taking the example of water. One molecule of water (fig. 3.9 a) is made up of two atoms of hydrogen and one atom of oxygen. So its molecular formula is written as H_2O. In a similar way a molecule of carbon dioxide (fig. 3.9 b) is made up of an atom of carbon and two atoms of oxygen. Its molecular formula is CO_2. A molecule of ammonia is made up of an atom of nitrogen and three atoms of hydrogen. Therefore its molecular formula is written as NH_3. Complete table 3.6 –

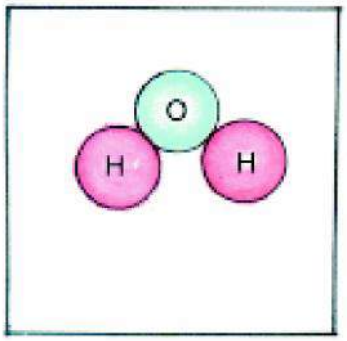


Fig. 3.9 a A molecule of water

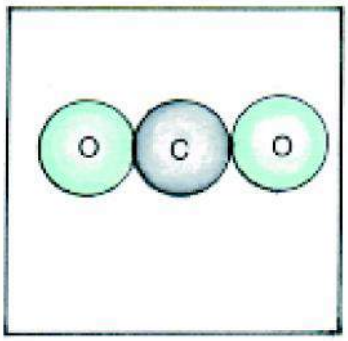


Fig. 3.9 b A molecule of carbon dioxide

Table - 3.6

S.NO.	Compound	Constituent Elements	Number of Atoms	Formula
1.	Sulphur dioxide	S O	1 2	SO_2
2.	Sulphuric acid	H S O	2 1 4	.....
3.	Nitric acid	H N O	1 1 3	.....
4.	Sodium hydroxide	Na O H	....	NaOH
5.	Hydrochloric acid	H Cl	....	HCl
6.	Ammonium chloride	N H Cl	1 4 1	.....
7.	Sodium carbonate	Na C O	2 1 3	.....

To represent more than one molecule of an element or a compound or to represent more than one atom of an element, we write the number before the molecular formula or before the symbol. For example if we write 2 NH_4Cl, it means two molecules of ammonium chloride. $2O_2$ represents two molecules of oxygen and 2 Ca represents two atoms of calcium.

3.4 Equations

Activity - 2

Materials required :– iron fillings, sulphur, test tube, source of heat.

Take some iron fillings and sulphur in a big test tube and heat the mixture. Do you find any difference between the substances taken and the substances formed in the reaction?

When a mixture of iron and sulphur is heated, a new substance is formed. This is called iron sulphide. What is the nature of the change in the above reaction physical or chemical? A new substance (Iron sulphide, FeS) is being formed as a result of the reaction between iron and sulphur, hence, it is a chemical change. We can represent this reaction with the help of symbols and formulae as follows:

Fe	+	**S**	⟶	**FeS**
Iron	+	Sulphur	⟶	Iron sulphide

Coal reacts with oxygen in air to form carbon dioxide.

C	+	O_2	⟶	CO_2
Carbon	+	Oxygen	⟶	Carbon dioxide

Equations used to represent a chemical reaction using symbols and chemical formulae are called chemical equations.

In a chemical equation the substances written on the left side of the arrow (→) take part in the reaction and are called reactants. On the right side of the arrow (→) we write products of the reaction. On either side of the arrow if the reactants or products are more than one then + sign is used. The tip of the arrow is used to show the direction of the reaction. More information about the reaction conditions like need for heat, presence of any other material, sunlight etc. is specified above or below the arrow.

Fe	+	**S**	on heating ⟶	FeS
Reactants				**Product**

The number of atoms of each element on both sides of a chemical equation should be equal. Such an equation is known as a balanced equation. In a balanced equation we can use (=) sign in place of ⟶ For example -

Fe	+	**S**	⟶	FeS
or Fe	+	**S**	=	**FeS**

A balanced equation signifies that in any reaction, atoms can neither be formed nor destroyed only their rearrangement takes place. Therefore, the number of atoms of an element obtained after a chemical reaction would be the same as number of atoms taking part in the reaction. In the reaction given above the number of atoms of iron and sulphur on both sides of the equation are the same (one each) so the equation is balanced.

What is to be done if the number of atoms of an element is different on the two sides of the equation? Let us understand with an example.

Decomposition of water is represented in the form of following chemical reaction –

$$\mathbf{H_2O \longrightarrow H_2 + O_2}$$

In this equation the number of molecules of hydrogen is the same on both sides but the number of molecules of oxygen is not the same. On the left there is one atom of oxygen whereas on the right there are two atoms of oxygen. If we take two molecules of water on the left side the number of atoms of oxygen would be balanced. But on doing this the number of atoms of hydrogen on both sides become unequal. On the left side there are four atoms of hydrogen whereas on the right there are only two.

$$\mathbf{2H_2O \longrightarrow H_2 + O_2}$$

Therefore, to balance the equation we write two in front of hydrogen on the right. In this way the number of atoms of hydrogen on both sides become equal.

$$2H_2O \longrightarrow 2H_2 + O_2$$

In this equation the number of atoms of each element participating is the same on both sides, that is the equation is balanced. This simple and concise method to represent a chemical reaction is called a chemical equation. Here a balanced equation shows that two molecules of water on decomposition give two molecules of hydrogen and one molecule of oxygen. The reaction with the required conditions is represented as follows:

$$2H_2O \xrightarrow[\text{decomposition}]{\text{Electric}} 2H_2 + O_2$$

A chemical equation gives us the following information–

1. What substances take part in the reaction and which substances are formed.
2. How many atoms or molecules of the reactants react and how many atoms or molecules of the products are formed.
3. Under what conditions does the reaction takes place.

Answer these

1. What would be the atomicity of following substances?
   O_3, P_4, S_8, Br_2
2. What is a molecular formula?
3. What information does one get from a chemical equation?

John Dalton

In year 1766 A.D. in England John Dalton was born to a poor weaver's family. He started his work at the age of 12 as a teacher in a village school. He became the headmaster of the school after seven years. In 1793 A.D. he went to Manchester to teach mathematics, physics and chemistry in a school. He resigned from his job soon after as his teaching assignment was hampering his research work.

In 1808 A.C. Dalton gave his atomic theory. He was amongst the first scientist to give the name 'atom' to the smallest particle of an element. Dalton proposed that all atoms of an element behave in the same manner. He postulated atoms as very minute, hard and solid particles. Dalton also proposed that an atom of an element can be represented by a symbol or a sign. Dalton died in the year 1844.

We have learnt

- Substances whose constituents can be separated by physical methods are called mixtures.
- Pure substances that have only one substance are called elements.
- Two or more elements combining in a fixed ratio form a compound. The constituents of a compound can only be separated by chemical methods.
- The smallest freely existing unit of a substance is a molecule. A molecule can sometimes consist of only one atom.
  Two or more atoms can combine to from a molecule.
- In solids, particles of the substance are very close to each other, and are arranged in definite order. The force of attraction between particles of solids is strong.

- In liquids particles are not fixed at one position and a particle can move around anywhere within the liquid. In comparison to solids the force of attraction between particles is weaker.
- In gases, particles are very far from each other. The force of attraction between the particles of a gas is much weaker than for solids and liquids.
- Elements and compounds are represented by symbols and formulae.
- First letter of the English name of an element is written in capital letters to represent its symbol. If necessary another letter written in small case is added to the first capital letter.
- Number of atoms present in a molecule of an element is called its atomicity.
- When one or more than one substance react to form new sustances then the process is called a chemical reaction.
- An equation used to represent a chemical reaction using symbols and chemical formulae is called a chemical equation.
- A balanced equation signifies that no atoms can be produced or destroyed during a chemical reaction.

Questions for practice

1. Match the names of the elements with the corresponding symbols-

i.	Carbon	Cl
ii.	Sulpur	Mn
iii.	Chlorine	Na
iv.	Magnesium	C
v.	Zinc	Mg
vi.	Manganese	S
vii.	Sodium	K
viii.	Gold	Fe
ix.	Iron	Zn
x.	Potassium	Au

2. Match the names of elements with their atomicity –

i.	Iodine	8
ii.	Sulphur	4
iii.	Phosphorous	1
iv.	Sodium	2

3. Fill in the blanks –

1. ……... metal is found in a liquid state at normal temperature.
2. Elements are formed by the same type of …….
3. Air is a ……..
4. ……. ..... State of matter can be easily compressed.

4. Balance the following chemical equations -

I. $Mg + O_2 \longrightarrow MgO$

II. $N_2 + H_2 \longrightarrow NH_3$

III. $SO_3 \longrightarrow SO_2 + O_2$

5. Write chemical equations for the following reactions -

1. An atom of sulphur reacts with a moleclue of oxygen to from a molecule of sulphur dioxide.
2. An atom of zinc combines with two molecules of hydrochloric acid to form a molecule of zinc chloride and a molecule of hydrogen.

6. Define the following –

a) Element b) Compound

7. Give three examples each of an element and a compound.

8. When a substance A is heated then two substances are formed. Explain with reasons if the substance A is an element or a compound.

9. Explain the difference between:-

1. Mixture and compound
2. Element and compound

Do these also

1. Categorize the substances like soil, stones etc. around you into elements, compounds and mixtures. Write the reasons for the categorization also.

2. Find out the chemical constitituents of the substances specified in the above activity. To do this discuss with the students of higher classes and your teachers. Write their possible formulas also.

Chapter 4

ACIDS, BASES AND SALTS

While eating if some food spills on our clothes then it leaves a stain of turmeric. You might have tried to remove these stains with soap. Have you noticed the colour of the stain changing? What could be the reason for this? This happens due to a special property of soap. Let us try to understand it.

Activity - 1

Materials required :- A piece of white cloth, Turmeric, Washing soap, Lemon, Water, Bowl.

Make a thick paste of turmeric in water. Put some drops of this paste on a white cloth. Apply soap on this cloth. What change in colour do you see? Now, put a few drops of lemon juice on this red colour. You will see that the colour changes back to yellow. This shows that lemon juice has a property that neutralizes the effect of the soap.

Many substances used by us in daily life have this neutralizing property. This nature of substances can be identified with a litmus paper.

Activity - 2

Materials required :- Red and Blue Litmus paper, Lemon juice, Washing soda, Tamarind (imli) juice, Baking soda, Salt, Sugar, Some beakers or Bowls, a Dropper and a Spoon.

To do the experiment make a solution of each substance. For this put less than half a tea-spoon of the substance in a bowl and fill one-third of it with water. Now stir it with a spoon till the substance dissolves fully. With the help of a dropper put a drop of the solution on a leaf of red and blue litmus paper. Note the change in the colour of both the litmus papers. Similarly make solutions of all the other substances one by one and test on both the litmus papers. Remember to wash the dropper with water after each test. Record your observations in table 4.1.

Table - 4.1

S.No.	Substance	Effect on blue limtus Colour becomes red/ no change	Effect on red litmus Colour becomes blue/ no change
1.	Lemon juice	Colour becomes red	No change
2.	Washing soda	.....	.....
3.	Tamarind juice	.....	.....
4.	Baking soda	.....	.....
5.	Sugar Solution	.....	.....
6.	Salt Solution	.....	.....

On the basis of change in colour we can divide the substances given in table 4.1 into three groups. First group would be of those substances that change the colour of blue litmus to red. All these are acids. Second group would be of those that change the colour of red litmus to blue. All these are bases. There are some substances that do not cause any change in colour of either litmus papers. These are neutral substances.

Table - 4.2

S.No.	Acidic substances	Basic substances	Neutral substances
1. 2. 3.			

Write the names of substances from table 4.1 in appropriate columns in table 4.2 as acids, bases or neutral. substances.

4.1. Indicators

Substances that change colour to indicate an acidic or basic medium are called indicators. Methyl orange and phenolphthalein are also used as acid-base indicators apart from litmus. Methyl orange gives red colour with acids and yellow colour with bases. Phenolphthalein remains colourless in acidic solution while it turns pink in basic solution. We have identified acids and bases using indicators but they have other characteristics that can help to identify them.

4.1.1 Let us find out, if there can be some other indicators? Petals of flowers can also act as indicators. Let's do an activity.

Activity - 3

Materials required: China rose petals (Gudhal) breaker, test tube, warm water, dropper, some acidic, alkaline and neutral substances.

Collect some China rose (Gudhal) petals and place them in a beaker. Add some warm water. Keep the mixture for some time till water becomes coloured. Use the coloured water as an indicator. Add five drops of the indicator to each of the solution given in table 4.3. Now note the change in colour before and after adding the China rose indicator (fig 4.1).

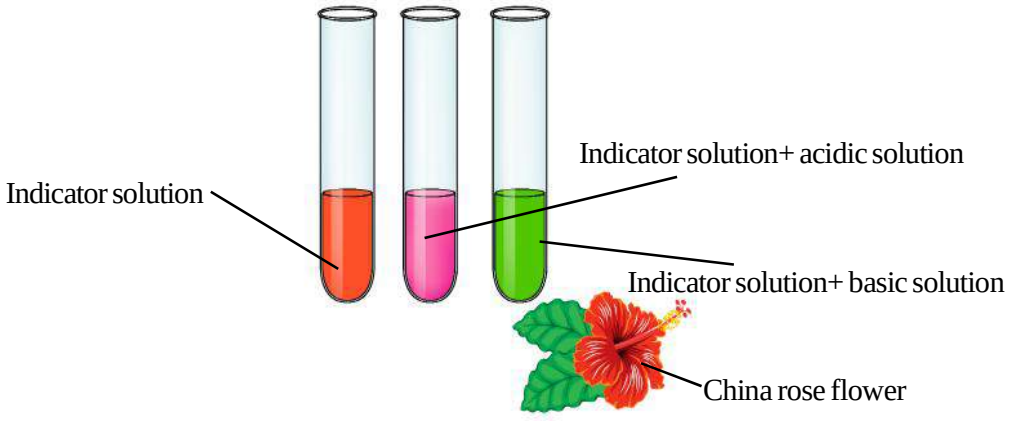


Fig 4.1 China rose flower and indicator prepared from it.

Table - 4.3

S.No.	Test Solution	Initial Colour	Final Colour
1.	Baking Soda Solution	……..	……..
2.	Lemon Juice	……..	……..
3.	Soda Water	……..	……..
4.	Sugar Solution	……..	……..
5.	Tamarind Juice	……..	……..
6.	Washing Soda Solution	……..	……..
7.	Salt Solution	……..	……..
8	Milk	……..	……..
9.	……..	……..	……..
10.	……..	……..	……..

What is the effect of the indicator on acidic, basic and neutral solutions? China rose indicator turns acidic solutions to dark pink (magenta) and alkaline solutions to green. Repeat this activity with some other flower extracts.

4.2 Acids

The word 'acid' is derived from latin word *acidus* which means sour.

Lemon, orange, amla, tamarind, raw mango etc. are all sour due to the presence of acids. You may have experienced a burning sensation when bitten by an ant. This sensation is due to the presence of formic acid that the ant releases at the place of the bite. Acids present in animals, and plant vegetation/ flora are called natural acids. Names of some natural acids and their origins are given in table 4.3.

Table - 4.4

S. No.	Source	Acid	S. No.	Source	Acid
1.	Orange, lemon	Citric acid	5.	Vinegar	Acetic acid
2.	Apple	Malic acid	6.	Tea	Tannic acid
3.	Ant and honeybee	Formic acid	7.	Tamarind	Tartaric acid
4.	Spoilt milk/ sour milk, curd	Lactic acid	8.	Tomato	Oxalic acid

We can also make acids from the minerals obtained from the soil like hydrochloric acid (HCl), sulphuric acid **(H_2SO_4)**, nitric acid **(HNO_3)** etc. These are called mineral acids. Mineral acids also taste sour. Do not touch or taste these chemicals without instructions from your teacher. They can be harmful. If the amount of water added to pure acid is more, then it is a dilute acid. If the amount of water in an acid is less then it is called concentrated acid.

When a sour substance is kept in a brass or bronze container for a long time then a blue-green layer is formed on the inner walls of the container. The copper present in brass or bronze reacts with the acid to form this blue-green compound. To avoid this reaction, the brass containers are coated with tin. This coating protects the containers from reacting with acids and avoids corrosion of the metal of the container. You must have noticed that articles made of iron and silver get tarnished on exposure to air and moisture, this is known as corrosion. Let us take up the process of corrosion (rusting) in iron.

Rusting is a change that affects iron articles and slowly destroys them. The process of rusting can be represented by the following equation:

Iron (Fe) +Oxygen (O_2, from air) + Water (H_2O) $\longrightarrow$ Rust (Iron Oxide Fe_2O_3)

For rusting, the presence of both oxygen and water (or water vapour) is essential. So, to prevent iron from rusting we have to prevent iron articles from coming in contact with oxygen, or water or both.

One simple way is to apply a coat of paint or grease. Another way is to deposit a layer of a metal like chromium or zinc on iron. This process of depositing a layer of zinc on iron is called galvanization. Thus, corrosion can be prevented by protecting iron articles from exposure to air and moisture.

Activity - 4

Materials required :- Dilute hydrochloric acid, zinc granules, matchbox, test tube

Fill a test tube upto approximately ¼ part with dilute hydrochloric acid. Add some zinc granules. There would be a reaction that would produce a gas. Bring a burning matchstick near the mouth of the test tube in the path of the emerging gas. What happens? You will see that the gas burns with a blue flame and produces a pop sound. The gas produced is hydrogen (figure 4.2)

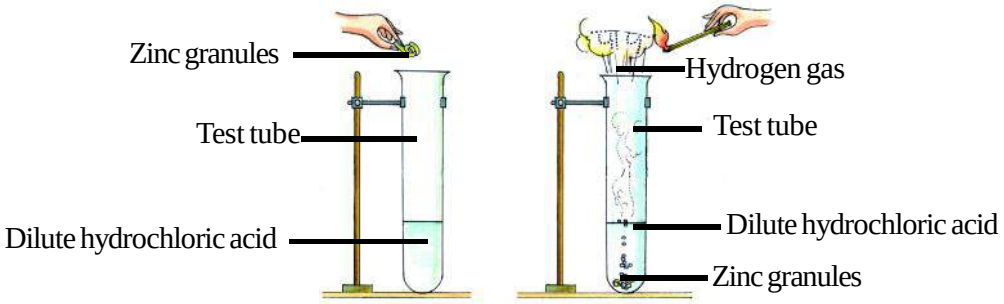


Fig. 4.2 Reaction of zinc granules with dilute hydrochloric acid

$$Zn + 2HCl = ZnCl_2 + H_2$$

Zinc + Hydrochloric acid = Zinc chloride + Hydrogen

Acids react with some metals to release hydrogen gas.

Activity - 5

Materials required :- Marble chips, Dilute hydrochloric acid, Test tube

Take some marble chips in a test tube and add some dilute hydrochloric acid to them. What do you see? A gas comes out of the test tube with effervescence. As the marble chips are made of calcium carbonate they react with dilute hydrochloric acid to form carbon dioxide. Acids react with carbonates and bicarbonates to produce carbon dioxide gas. This property of acids is used in fire extinguishers.

$$CaCO_3 + 2\,HCl = CaCl_2 + H_2O + CO_2$$

Calcium carbonate + Hydrochloric acid = Calcium chloride + Water + Carbon dioxide

4.2.1 Uses of acids

1. Sulphuric acid is used in making fertilizers like ammonium sulphate, and super phosphate, in car batteries as battery acid and in fire extinguishers etc.
2. Hydrochloric acid is used in the purification of salt, to clean ceramic utensils and tiles.
3. Nitric acid is used in making fertilizers like ammonium nitrate etc. and in cleansing silver and gold ornaments.

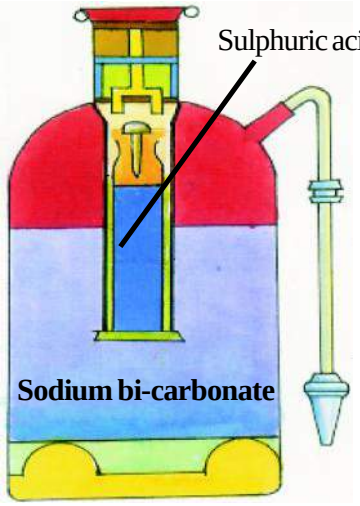


Fig. 4.3 Fire Extinguisher

4.2.2 Fire Extinguisher

This comprises of a metal cylinder filled with sodium bicarbonate. A glass bottle filled with dilute sulphuric acid is kept inside the cylinder. Bottle has a knob going inside it. In case of fire the knob is hit on a hard surface. This breaks the glass bottle enabling the sulphuric acid in the bottle to come in contact with sodium bicarbonate. They react to produce carbon dioxide. This carbon dioxide and the effervescence help to extinguish fire (figure 4.2).

$$2\,NaHCO_3 + H_2SO_4 = Na_2SO_4 + 2H_2O + 2CO_2$$

Sodium bi-carbonate + Sulphuric acid = Sodium Sulphate + Water + Carbon dioxide

Answer these

1. Name three natural and three mineral acids.
2. What do the terms dilute and concentrated acids mean?
3. Why are acids not stored in a metal container?
4. Acidic, basic and neutral solutions are given in three test tubes. If you are given a strip of red litmus how will you identify the three solutions?

4.3 Alkalis

The word alkali has originated from an Arabic word that means ash. Ash has alkaline properties.

Put some lime water on your fingers, rub them against each other. Do you feel some greasiness? Repeat this activity with soap water, mashed leaves of china rose and washing soda. All of these are basic in nature. Water soluble bases are called alkalies.

Activity - 6

Materials required :- Magnesium ribbon, some source of heat like burning candle, test tube, water, tongs, red and blue litmus.

Burn a small piece of magnesium ribbon by holding it with a tongs. Collect the white ash and dissolve it in little water. Touch the solution formed and put some drops on blue and red litmus paper.

$2Mg + O_2 = 2MgO$

Magnesium Oxygen Magnesium oxide

Oxide of magnesium dissolves in water to form magnesium hydroxide. Similarly oxides of potassium and sodium dissolve in water to form potassium hydroxide (KOH) and sodium hydroxide (NaOH) respectively. All these are bases. They are soapy to touch and change the colour of red litmus to blue.

Generally oxides of metal are basic in nature. All basic substances are not soluble in water.

4.3.1 Uses of bases

1. Bases are used in the manufacture of soap, medicines, paper, bleaching powder etc.
2. Bases are used to reduce the acidity of soil and water.
3. Bases are also used in laboratories.

Answer these

1. When drops of lemon juice are put on blue litmus it turns red. What will happen if you put some drops of soap solution on it?

2. Is the solution of the white powder obtained by the combustion of magnesium in water acidic, basic or neutral?

We have seen the properties of acids and bases till now. What will happen if acid and base react with each other?

Activity - 7

Materials required :- Test tube, Sodium hydroxide, Hydrochloric acid, Phenolphthalein, Dropper.

Put about 20 drops of dilute sodium hydroxide in a test tube and add one or two drops of phenolphthalein. The colour of the solution changes to pink. Add a few drops of dilute hydrochloric acid while shaking the test tube continuously. Keep adding drops of acid till the pink colour disappears. Stop adding the acid at this stage.

Carefully add a few drops of dilute sodium hydroxide to this colourless solution and shake the mixture. Is there any change in colour? Again add a few drops of dilute hydrochloric acid. What change do you see now ?

Base solutions gives pink colour with phenolphthalein while acidic solutions remain colourless. When an acid is added to a base, the base looses its basic properties and when a base is added to an acid the acid looses its acidic properties. They neutralize the effect of each other. The reaction between a base and an acid is known as neutralization.

We see many examples of neutralization in our daily lives:-

1. The burning sensation caused by ant-bite is due to an acid. If some washing soap or baking soda is applied at the place of the bite then the person feels better due to the neutralization of the acid.
2. Neutral soil is necessary for proper growth of plants. If the soil is acidic some lime stone is added to make it neutral. If the soil is basic, organic matter is added to it. Organic matter releases acids which neutralizes the basic nature of the soil.

Often people complain of acidity in the stomach. Our stomach produces a very dilute solution of hydrochloric acid to help in the digestion of food. If the acid produced is less in quantity there is problem in digestion. However, if the quantity of acid is more than needed the persons from sour belches. To provide relief, acidity is reduced by giving milk of magnesia and other such tablets or solutions that are weak bases. Now you know why these tablets are called antacid.

4.4 Salt

The compound formed due to the neutralizing reaction between an acid and an alkali is called a salt.

Acid + Alkali = Salt + Water

For example – hydrochloric acid and sodium hydroxide react to form sodium chloride (salt) and water.

HCl + NaOH = NaCl + H_2O

Hydrochloric acid Sodium hydroxide Sodium chloride Water

Salt is a general term. It is used not only for the common salt we eat daily but for all compounds formed by the reaction of an acid with a base.

Activity - 8

Material required :- Three Test Tubes, Water, Copper Sulphate, Sodium Carbonate, Common Salt, Red and Blue litmus paper, Three Droppers.

Take copper sulphate, sodium carbonate and common salt in three different test tubes. Add a few drops of water to each to make solutions. Now pour a few drops of each solution on a red and a blue litmus paper using separate droppers. Note the changes in colour and write the observations in the given table.

Table - 4.5

S.No.	Salt	Effect on blue litmus paper	Effect on red litmus paper
1	Copper sulphate		
2	Common salt		
3	Sodium carbonate		

Salt which changes blue litmus to red is an acidic salt and the other salt which changes red litmus to blue is a basic salt. Some salts effect neither blue litmus nor red litmus. These are called neutral salts. Here copper sulphate is acidic salt, sodium carbonate is basic salt and common salt is a neutral salt.

4.4.1 Uses of salts

1. Common salt (Sodium chloride NaCl) is an essential component of our food. This makes the food tasty and helps prevent the rotting of fish, pickles etc.

2. Washing soda (Sodium carbonate Na_2CO_3) is used to wash clothes.
3. Baking soda (Sodium bicarbonate $NaHCO_3$) is used to prepare cakes, soda water, cold drinks and to reduce acidity in stomach.

Our body needs many types of salts. These salts are mainly chlorides, iodides, sulphates, bicarbonates and phosphates of calcium, magnesium, iron, sodium and potassium. We lose some salts through perspiration. This is why our sweat is salty. When we lose a lot of water due to diaorrhea or dysentery, we also lose many salts. In such condition of dehydration we should drink plenty of water with salt and sugar added so that the concentration of salts in our body is restored. This oral rehydration saves children from probable death from diaorrhea or dysentery.

Answer these

1. What is neutralization? Give an example.
2. Explain different types of salts with examples.

We have learnt

- Acids are sour in taste.
- Acids change the colour of blue litmus to red.
- Acids can be classified into natural and mineral acids.
- Bases turn red litmus to blue.
- Bases are soapy to touch.
- Acid reacts with a base to form a salt.
- Salts can be classified into acidic, basic and neutral salt.
- Coloured petals like that of China rose etc. can also act as indicators.

Questions for practice

1. Choose the correct answer:

1) The colour of phenolphthalein in an acidic medium is –

(a) pink (b) red (c) orange (d) colourless

2) Formation of salt by the reaction of an acid with a base is called –

(a) acidification (b) basification (c) dehydration (d) neutralization

3) Gas used to extinguish fire in a fire extinguisher is -

(a) oxygen (b) hydrogen (c) carbon dioxide (d) nitrogen

4) The juice of raw mango is –

(a) acidic (b) basic (c) neutral (d) none of these

2. Fill in the blanks –

1) Acids are ……. in taste.

2) Bases are ……..to touch.

3) The nature of common salt solution is …….

4) Water soluble bases are called …….

3. Make appropriate connections –

Soap solution	Indicator
Sugar solution	Acidic substance
Litmus paper	Basic substance
Lemon juice	Neutral substance

4. Identify true and false statements from the following and rewrite the false statement after correcting them.

a) Lemon juice changes red litmus to blue.

b) Bases feel rough to touch.

c) The function of an antacid is to increase acidity in the stomach.

d) Coating of utensils prevents them from burning in fire.

5. What is an acid?

6. How will you differentiate between an acid and a base?

7. What are salts? Explain the reaction by which they are formed?

8. What are antacids? What is their function?

9. Write the common and chemical names of at least three salts that we use in our daily life.

Do these also

1. Make a list of a few acids, bases and salts that we use in daily lives along with their use.

S.No.	Name of the substance	Type	Use
1.	....	.....	.....
2.	....	.....	.....
3.	....	.....	.....

2. Get information from your teacher about the main acidic substances, basic substances and salts found in our body. Make a list of their names and functions.

S.No.	Name of the substance	Type	Function
1.	....	.....	.....
2.	....	.....	.....
3.	....	.....	.....

Chapter 5

MEASUREMENT

5.1

We make different kinds of measurement at our home, shop, playground etc. in our daily life. Measurement is the fundamental basis for scientific studies and practical technology. We generally estimate quantities as per our needs. But these can never be accurate measurements. For accurate and precise measurements, we use some special instruments. For example to measure the length of an object we need a scale or a tape, to measure the mass we need the physical balance, for measurement of volume a measuring cylinder etc. All these are direct methods of measurements. Sometimes measurements can not be as conveniently possible. Can you measure the thickness of a page of your book or of a coin with a meter scale? No, we cannot. Now let us try to understand the process of these measurement by indirect methods with the help of the following activities.

Activity - 1

Materials required :- Ten similiar one rupee coins, a scale.

Place the scale on a horizontal surface. Make a stack of ten one rupee coins by placing them on each other. Hold this stack of coins with one hand and place one end at some cm mark of the scale. If you keep one end of the stack at 1 cm, then note the reading of the other end of the stack on the scale (fig. 5.1). Subtracting from this reading the earlier reading (i.e. 1) gives us the thickness of the ten coins. Divide this thickness by 10, the number of coins and you will get the thickness of one coin. Repeat this activity with five and fifteen one rupee coins.

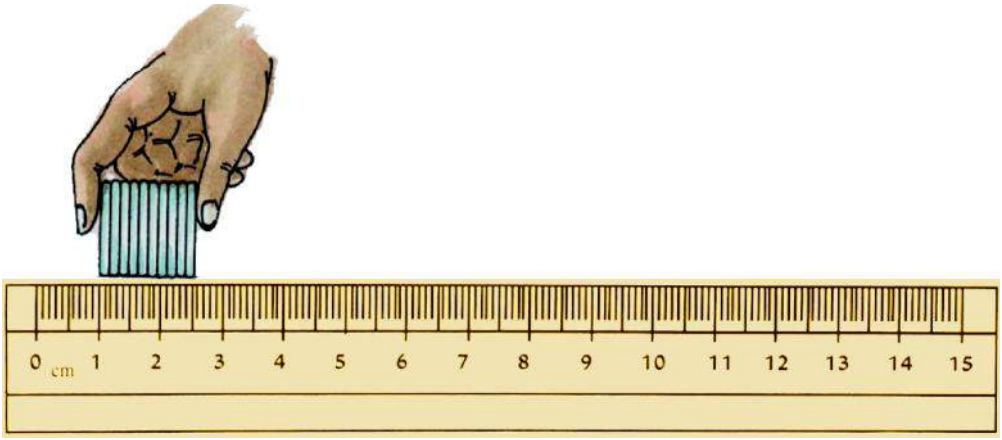


Fig.. 5.1- To find the thickness of a coin

Table - 5.1

S. No.	Number of coins	Reading of the stack of coins		Thickness of the coins	Thickness of one coin (cm)	Average Thickness of one coin (cm)
		First end (cm)	Second end (cm)			
1. 2. 3.						

Out of the three measurements, which is more accurate? Larger the number of coins taken the better would be the measurement.

Activity - 2

Materials required :- A piece of wire, cylindrical pencil and a scale.

Take a piece of wire. Wind it twenty times around a cylindrical pencil (fig. 5.2). Remember that the turns of the wire should be such that they are close to each other and there is no space between them. Wire wrapped in such a manner is called a coil.

Measure the length of this coil with a scale. Write the readings in table 5.2. Divide the length of the coil of the wire by the number of turns and find the thickness of the wire.

$$\text{Thickness of the wire} = \frac{\text{Total length of the coil (in cm)}}{\text{Number of turns of the wire}}$$

In the same manner, making a coil of 30 or 40 turns, find the thickness of the wire and fill in table 5.2.

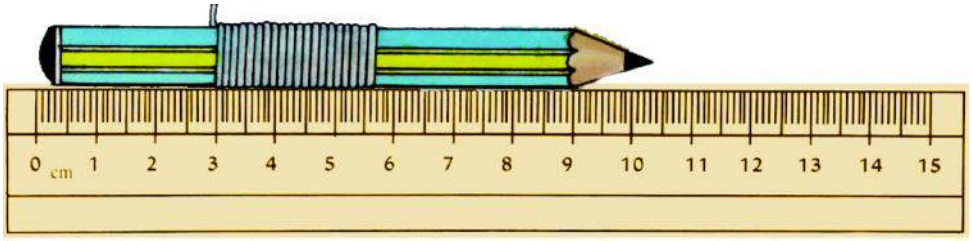


Fig. 5.2- To find the thickness of the wire

Table - 5.2

S. No.	Number of turns of the wire	Length of the coil of wire (cm)	Thickness of wire (cm)	Average Thickness of wire (cm)
1. 2. 3.				

Can we measure the diameter of a ball with the help of a scale? This task is difficult because the ball is spherical. For this we will take the help of two wooden blocks.

Activity - 3

Materials required :- A spherical object, two cuboidal wooden blocks, scale.

Place the scale on the table. Adjust the spherical object(ball) between two wooden blocks in such a way that it touches the surfaces of both the blocks. The edges of both the blocks touching the spherical object should be joined to the scale. Note the readings of these positions of wooden blocks on the scale and write those readings in table 5.3. The distance between both the blocks is the diameter of the spherical object. Remember that surfaces touching the spherical object should be parallel to each other and perpendicular to the scale.

Diameter of the spherical object = Reading of the second surface (cm) – Reading of the first surface (cm)

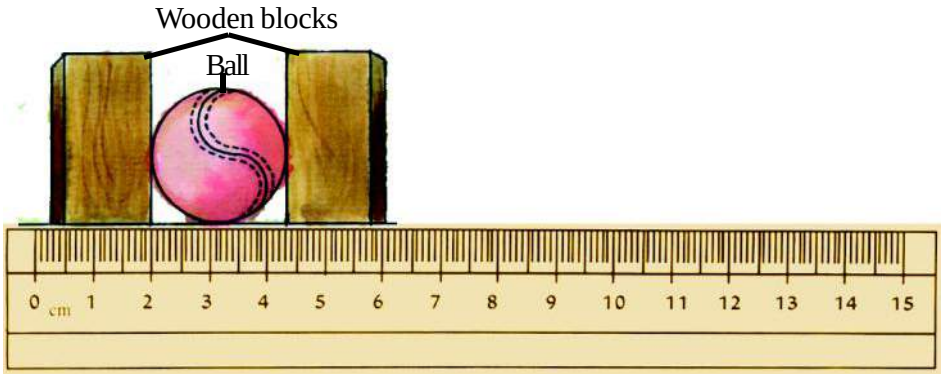


Fig. 5.3 To find the diameter of a spherical object

Table - 5.3

S. No.	Readings of blocks touching the ball		Diameter of the ball (cm)	Average diameter of the ball (cm)
	First surface (cm)	Second surface (cm)		
1.				
2.				
3.				

Child specialists use this technique to measure the height of infants.

Answer these

1. How will you measure the thickness of a page of your book?
2. The thickness of 100 sheets of paper is 10mm. Find the thickness of one sheet.
3. Torch cell is placed between two rectangular blocks. The readings of the two blocks touching the spherical surface of the cell on the scale are 2cm and 5.2cm. Find the diameter of the cell.

5.2 Area

In Fig. 5.4 given below, maps of some fields are given. Among others, the fields of Kiran, Salma and Shyamu have been depicted.

Just by observing the map, can you say, which field, out of the fields of Kiran, Salma and Shyamu is bigger? How can we decide whose field is bigger and whose is smaller?

The size of the square or rectangle made on any field or paper, depends on the extent of the surface it covers. Larger the square or rectangle made on a field or on paper, more is the surface it will cover. The measure of the surface covered by an object is called its area.

SI unit of area is square metre, and is written as m^2. This is the area of a square with a side of one metre. It is more convenient to represent the area of small objects like tiles, books, photo frames or postcards in square centimetre (cm^2). One square centimetre is the area of a square of side one centimetre. A very large surface like the area of a field is represented in Acres or Hectares.

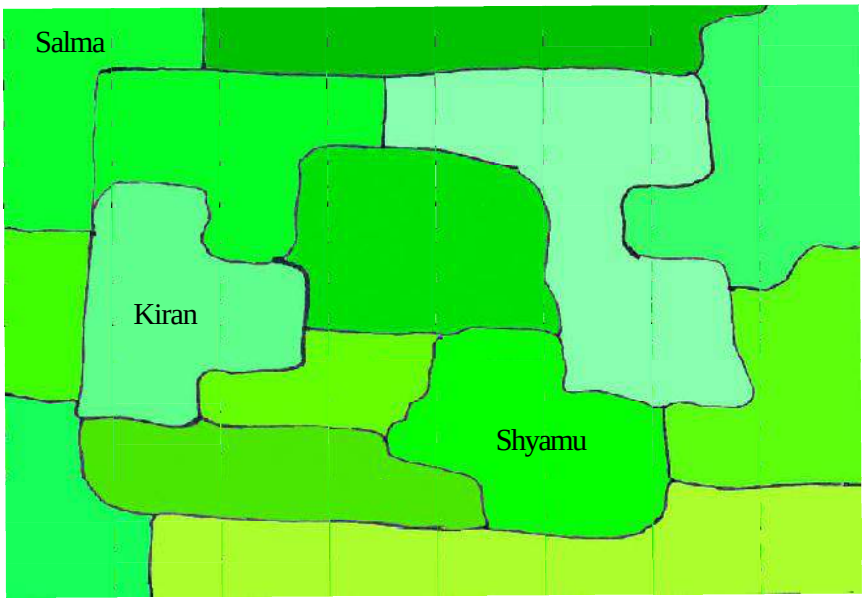


Fig. - 5.4 Fields: larger or smaller

Identify one square centimetre and one square millimetre squares in a graph paper and count the number of squares of one squares millimetre area present in a square of one square centimetre.

5.2.1 Multiples of the units of area

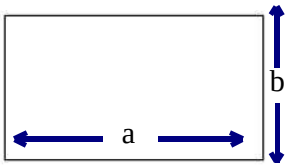
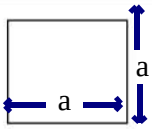
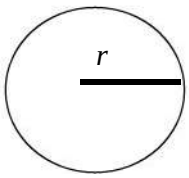
1 Square meter = 10000 Square centimetre
1 Hectare = 100 Acers
1 Decimal = 40 Square metre
1 Acre = 4000 Square metre

1 Aer = 100 Square metre
1 Hectare = 10000 Square metre
1 Acre = 100 Decimal

We can find the area of the surfaces of objects with regular shapes from their length / breadth / height / radius etc. We find the area of objects with faces shaped as a rectangle by measuring the length and breadth and then using the formula for the area. The area of a circle is calculated by measuring its diameter or radius. We can even find the area of any object of fixed size with the help of a graph paper. Make the outline of the object on the graph paper and then count the number of squares present within that boundary. This will be the area of the object.

Table - 5.4

Formula to calculate the area of regular surfaces

S. No.	Figure	Name	Formula for the area
1.		Rectangle	length × breadth = a × b = ab
2.		Square	$(side)^2$ = side × side = a × a = a^2
3.		Circle	π × radius × radius = πr^2

Answer these

Calculate the area of the objects given in Table 5.5 by measuring their length and breadth.

Table - 5.5

S. No.	Object	Length / breadth / radius (cm)	Area (square cm)
1.	Cover page of the text book		
2.	Postcard		
3.	Upper surface of the table		
4.	Surface of the bottom of a bottle		

5.2.2 Finding the area of the surface of objects having irregular shapes-

Sometimes we have to find the area of a surface with an irregular shape like leaf, palm, sole of the feet etc. The area of such surfaces cannot be calculated by using the formulae given in Tables 5.4 or by other formulae of such kind. The area of such surfaces is calculated using a graph paper.

Activity - 4

Materials required :- Centimetre graph paper, a leaf, pencil and scale.

Place the object (leaf) of irregular size on the graph paper. Draw the outline with a pencil as shown in fig.-5.5. Now find the number (x) of complete squares lying inside the outline and write it in Table 5.6. Count the number (y) of squares with half or more than half part inside the outline. Leave those squares with less than half part inside the outline. The total number of squares (x + y) is the approximate value of the area of the leaf. Its unit will be square centimetre.

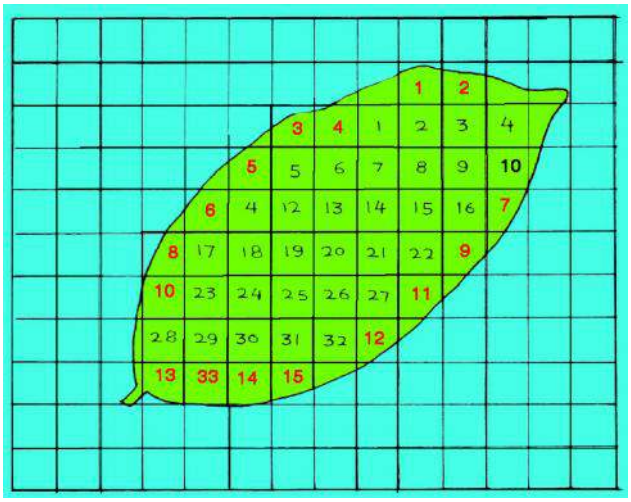


Fig. 5.5 To find the area of a leaf using the graph paper

Table - 5.6

S. No.	Number of complete squares (x)	Number of half or more than half squares (y)	Total number of squares (x + y)	Area of leaf (x + y) square cm
1.	33	15	33 + 15 = 48	48
2.	…….	……..	……..	……..

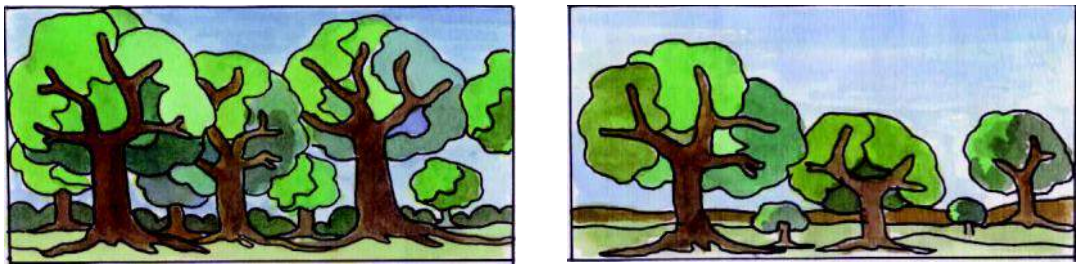
Here the area of leaf comes out to be approximately 48 square centimetre. Use the graph paper to find the area of other regular shapes like the bottom circular shape of a glass and check your answers by comparing with area found by the formula.

Answer these

1. Length and breadth of a train ticket are 5.5 cm and 3.0 cm respectively. Find its area.
2. How will you find the area of an irregular shape? Explain with the help of an example.
3. The radius of the circular bottom of the glass is 3.5 cm. Find the area of its bottom surface.
4. Give the SI unit of area.

5.3 Density

See the picture in fig. 5.6 carefully. You will find that in the first picture, trees are very close to each other while in second picture, they are far apart. This means that the first arrangement is denser because the number of trees per unit area is more in it. In the same way the distance between particles in different materials is not the same. In some like in solids, particles are close to each other while in gases they are far apart. As a result of this, the number of particles in a unit volume of different types of materials is different. Masses of particles of different materials are also different.



(a) Dense forest (b) Rarer forest

Fig. - 5.6

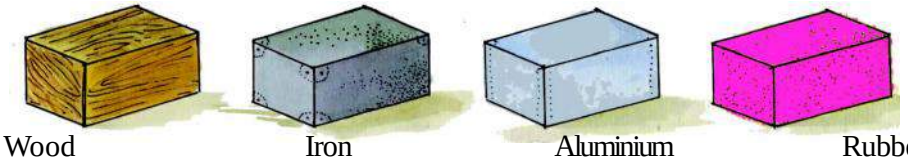
The mass of the unit volume of a material is the density of that material. Density is represented by D and its SI unit is kg per cubic metre. If V is the volume of an object and M is its mass, then

$$\text{Density D} = \frac{Mass}{Volume} = \frac{M}{V}$$

Activity - 5

Materials required :- Four cuboids of the same size and shape made of different materials.

Suppose these cuboids are made of rubber, iron, aluminium and wood respectively. Compare the masses of these cuboids by lifting them with your palm or with the help of a balance. Are their masses equal? Arrange their masses in ascending order. You will find that the cuboid of iron has the maximum mass. So the density of iron is more than that of aluminum (fig. 5.7). Therefore we can say that the quantity of matter in one cubic centimetre of iron is more than the quantity in one cubic centimetre of aluminium (fig. 5.7). This means matter in iron is denser than in aluminium.



Wood Iron Aluminium Rubber

Fig. - 5.7 Cuboids of same size and shape made up of different materials

Activity - 6

Materials required :- Three bottles with equal volumes, water, kerosene and glycerine.

Weigh the three bottles having equal volume on a balance. Fill these bottles with water, kerosene oil and glycerin respectively and weigh them. Write the weights of equal volume of the different liquids in an ascending order. Find out that inspite of equal volume, which material is the heaviest or we should say whose density is highest?

Table - 5.7

Density of some common materials

Material	Density (kg / m^3)	Material	Density (kg / m^3)
Gold	19300	Silver	10500
Copper	8900	Iron	7600
Aluminium	2740	Glycerine	1300
Water	1000	Ice	920
Kerosene oil	800	Cork	200

"Density of a material is 19300 kg / m^3; means that the mass of the matter contained in one cubic metre of that substance would be 19300 kg."

"Density of a materials is 2.5 g / cm^3; it means that the mass of the matter contained in one cubic centimetre of that substance would be 2.5 g."

5.4 Accuracy of measurement

In the age of science and technology precise and accurate measurement is extremely important. In engineering and scientific works, purchase of expensive materials require correct and accurate measurement. Even scientists and pharmacists need to measure the masses of chemicals and medicines accurately. In computers and communication systems, electrical appliances, rockets, automobile industry, in the construction and maintenance once of dams for water etc, we need precise and accurate information about the size of different parameters. Even to construct the doors and windows of a building, accurate measurements are needed.

Nowadays different parts of a machine are produced at different places. If during the making of these parts precise and accurate measurement is not carried out then the parts would not fit in the machine.

Accuracy of measurement depends on the measuring instrument and we use instruments for measuring that can give us the required accuracy. For example, we can use the meter scale to measure the length of a wire but to measure its thickness accurately we use a special instrument called the screw gauge. To buy expensive things like gold, silver, platinum, diamond etc in the market, it is necessary to carry out precise and accurate measurements.

5.5 Distance-Time Graph

You might have seen that newspapers, magazines, etc. present information in various forms of graphs to make it more interesting. Let us learn to plot a distance - time graph using the data given in table 5.8 below-

Table 5.8 Motion of a Car

Time	Distance
0	0 km
1 min	1 km
2 min	2 km
3 min	3 km
4 min	4 km
5 min	5km

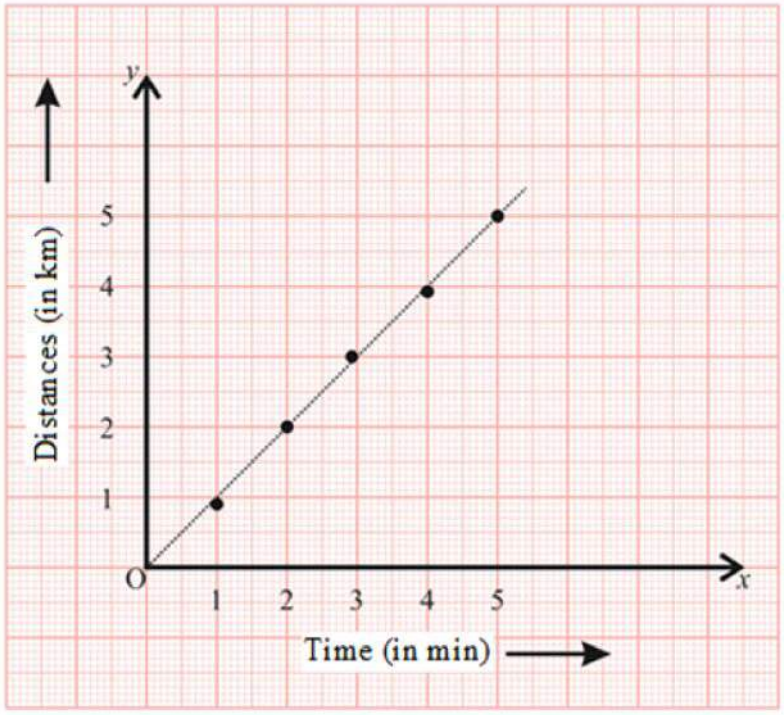


Fig 5.8 Distance- Time Graph of motion of a car.

Let us learn to plot of graph -

Take a sheet of graph paper.

- Draw two lines OX and OY perpendicular to each other, as shown is fig. 5.8.
- Take time along x-axis and distance along y-axis.
- Choose a scale to represent the distance and another to represent time on the graph. For the motion of the car scales should be as follows -

Time	1 min	= 1cm
Distance	1 km	= 1cm

- Mark values for the time and the distance on the respective axes according to the scale you have chosen. Form the motion of the car mark the time 1 min, 2 min ……. on the x-axis from the origin O.
- Similarly mark the distance 1km, 2 km …….. on the y-axis.
- Now you have to mark the points on the graph to represent each set of values for distance and time.
- According to table 5.8 mark on the graph paper the various points corresponding to different set of values.
- Join all the points on the graph as shown in figure. We obtain a straight line. This is the distance-time graph for the motion of the car.

- As it is a straight line it indicates that the car is moving with a constant speed. However if the speed of the object keeps changing, the graph can be of any shape.

5.6 Measurement of speed of an object in motion

You all know that, speed of a moving object = $\frac{\text{Distance travelled}}{\text{Time taken}}$

Let us measure speed with the help of values given in the table 5.9 -

Table - 5.9

Distance travelled and time taken by a moving ball.

Distance travelled by a moving ball (m)	Time taken (s)	Speed = Distance/ Time taken (m/s)
5	2	
10	4	
15	8	

You have learnt how to calculate speed. There is a meter fitted on the top of a scooter, motorcycles dashboards of cars, buses, etc. which is called speedometer. It records the speed directly in km/h.

5.7 Time period of a simple pendulum-

In previous classes you have learnt about the time-period of a simple pendulum. The time taken to complete one oscillation by a pendulum is called its time-period. In this way by calculating the time taken for 20 complete oscillations, we can measure the time period of one oscillation.

You have already learnt to calculate the speed of a moving object, now, let us find out, how winds moving at high speed cause cyclone.

5.8 High speed winds and Air Pressure.

Table - 5.10

Materials required- Empty bottle (Wide mouthed) paper, etc.

Crumple a small piece of paper into a ball of size smaller than the mouth of an empty bottle. Hold the empty bottle on its side and place the paper ball just inside its mouth. Now try to blow on the ball to force it into the bottle. Try the activity with bottle of different mouth sizes. What did you observe? Why is it difficult to force the paper ball into the bottle?

When we blow into the mouth of the bottle, the air near the mouth has higher speed, this decreases the pressure there. The air pressure inside the bottle is higher than near the mouth. The air inside the bottle pushes the ball out (fig. 5.9).

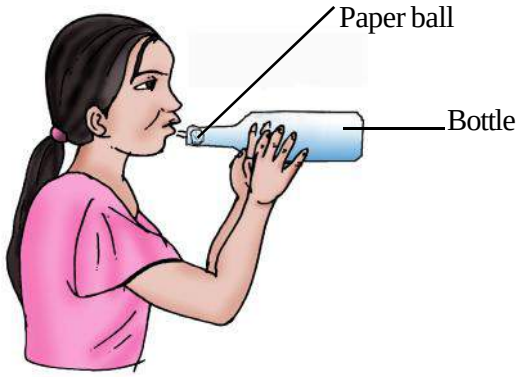


Fig 5.9 Blowing into the bottle

We see that the increased wind speed is indeed accompanied by a reduced air pressure. Air moves from the region where the air pressure is high to the region where the pressure is low. The greater the difference in pressure, the faster the air moves. The formation of a low pressure system with very high-speed winds revolving around it leads to cyclone.

Answer these

1. What does the statement "Iron is heavier than wood," mean?
2. What is meant by density? Give its SI units.
3. The mass of a material contained in 10 cm^3 is 10000 kg. Calculate its density.
4. Why is it essential that different parts of a machine fitting in to each other have the same measure?
5. The distance between two stations is 240 km. A train covers this distance in 4 hours. Find the speed of the train.

We have learnt

- Indirect methods are used to measure small lengths and widths.
- The measure of the extent of the surface of any object is called its area. SI unit of area is square metre.
- It is more convenient to represent the area of small objects in square centimetre or in square millimetre.
- The area of big surfaces like fields and grounds is represented in units like Acres or Hectares.

- The area of the surfaces of objects having regular shapes is found by measuring their length / breadth / radius etc and then by making use of suitable formulae.
- Area of an irregular shape is calculated by using a graph paper.
- The mass of a unit volume of the material is called its density.
- SI unit of density is kg / m^3.

Questions for practice

1. Choose the correct answer

1. The length and breadth of a room are respectively 6m and 5m. The area of its floor would be-

(a) 30 square centimetre (b) 30 square metre

(c) 15 square metre (d) 22 square metre

2. Average of lengths 5m, 5.2m, 5.4m, 5.6m and 5.8m would be

(a) 5.2 metre (b) 5.0 metre

(c) 5.4 metre (d) 5.5 metre

3. Area of a card having an irregular shape is measured -

(a) by an inch tape (b) by a metre scale

(c) by a graph paper (c) by a measuring cylinder

4. Hectare is the unit of -

(a) area (b) length

(c) density (d) perimeter

5. Formula for the density of material is -

(a) mass x volume (b) mass / volume

(c) volume / mass (d) mass + volume

2. Fill in the blanks -

1. SI unit of density is _____.
2. Space occupied by the surface of an object is called its_____.
3. The _____ of a unit _____ of any material is called its density.
4. The SI unit of area is _____.

3. Find the true and the false statements. Correct the false statements.

1. The total distance in going around any shape is called its area.
2. Density of iron is greater than that of water.
3. The area of an irregular shape is found by using a graph paper.
4. The area of a field is measured in square centimetre.

4. Answer the following questions-

1. You have been given a long wire, a metre scale and a bangle. How will you find the diameter (thickness) of the bangle?
2. A stack has been made by keeping 25 identical coins one over the other. The lower and upper ends of the pack lie at 5.0 cm and 13.6 cm respectively on the scale. Find the thickness of one coin.
3. One side of a square object is 4.3cm. Find its area.
4. Arrange copper, aluminium, wood and iron in order of increasing density.
5. Write water, kerosene oil and glycerine in decreasing order of density.
6. What do we mean by saying that the density of an object is 920 kg / m^3?
7. Density of glass is 2500 kg / m^3. If the mass of a piece of glass is 0.025 kg, find its volume.
8. In the given liquid which solid substance will float or imerge.

Ice	-	Kerosene oil
Aluminium	-	Glycerine
Cork	-	Water

9. Draw distance- time graph using given values.

Time(s)	10	20	30	40	50	60	70	80	90
Distance (m/s)	20	40	60	80	100	120	140	160	180

10. If a simple pendulum takes 32 seconds to complete 20 oscillations, find its time period.

Do these also

1. Take a piece of thread or a wire of length 16cm and with its help make

(1) a square with a side 4 cm.

(2) a rectangle having length 5 cm and breath 4 cm.

(3) a rectangle having length 7 cm and breath 9 cm.

Using a graph paper find the area of the surfaces occupied by each of the shapes made. Find the area also by using the formula.

2. Take a test tube and pour 5 mL each of water, glycerine and coconut oil in it. Take care not to shake the test tube. Which liquid is at the bottom? Why?

3. To find the area of the curved surface of a cylindrical pencil, take a rectangular piece of paper with width equal to the length of the pencil. Now place the pencil at one end of the paper parallel to its width and wrap the paper over the pencil a number of times. Count the number of wraps and also find out the area of the rectangular paper. Divide that area by the number of wraps. This is the area of one wrap or the area of the curved surface of the cylindrical pencil.

4. Anemometer

Materials required:- 4 small paper cups, 2 strips of cardboard, gum, stapler, a sketch pen, a sharpened pencil with eraser at one end.

Method: -Take a scale; draw crosses on the cardboard strips. This will give you the centers of the strips. Fix the strips at the centre, putting one over the other so that they make a plus (+) sign. Now fix the four cups at the ends of the two strips. Colour the outer surface of one cup with a marker or a sketch pen. All the four cups should face in the same direction.

Push a pin through the centre of the strips and attach the strips and the cups to the eraser of the pencil (fig.5.10). Check that the strips rotate freely when you blow on the cups. Your anemometer is ready. Counting the number of rotations per minute will give you an estimate of the speed of the wind. To observe the changes in the wind speed, use it at different places and different times of the day. Check whether the speed is same or different?

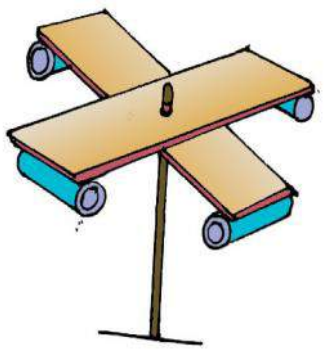


Fig 5.10 Anemometer

5. In class 6th you have learnt about the oscillatory motion of a simple pendulum, to measure time. Now, try to record the time period of a pendulum using strings of different length. State whether using different lengths of string affect the time period of oscillation. Discuss it in the class with your friends.

Chapter 6

STRUCTURAL ORGANIZATION IN LIVING ORGANISM

6.1 Different Levels of Organization

You know that there are various metabolic activities like nutrition, respiration, and digestion. To carry out these processes, the systems of the body have been listed in table in 6.1. Write down the names of the organs associated with each and their functions.

Table - 6.1

S.No.	Name of organ system	Name of organs	Function of system
1.	Respiratory System	Nose, Trachea, Lungs	Respiration
2.	Digestive system	----------	----------
3.	Circulatory system	----------	----------
4.	Excretory system	----------	----------
5.	Reproductive system	----------	----------

Each organ, though being part of a particular organ system, performs its own separate function; for example, nose, trachea and lungs are organs of the respiratory system. The nose helps in inhalation and exhalation, tract carries air to the lungs and lungs help in the exchange of oxygen and carbon dioxide.

Different organs perform different functions. But all these organs collectively carry out the respiratory function. In this way, the group of all the organs associated with a particular system is called the organ system. But an organ is not the smallest structural unit of the body. You have already learnt that body of every animals and plant is made up of very small cells. Cells can be seen using a microscope (fig. 6.1)

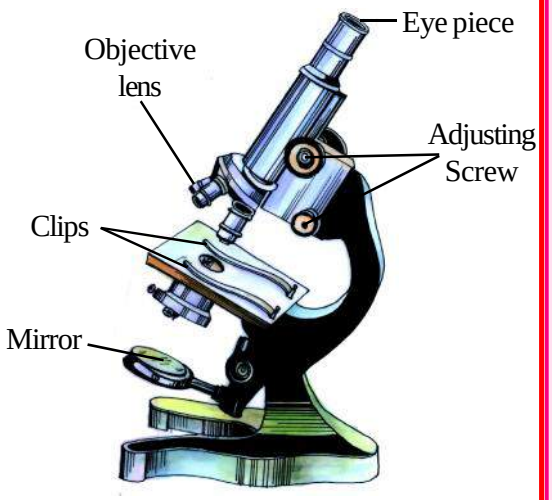


Fig. 6.1 Microscope

Let us see, how a microscope is used. Maximum experiments of this chapter are based upon studies using a microscope. Those who are not used to handling a microscope may initally face problems. It takes hours to study the fine (microscopic) structures in detail. After practice, it is easier to see even minute structures.

That's why it is said, "Practice makes a man perfect". The more you practice, the more perfect you become. When you learn how to use the microscope, you will be able to view small structures and learn about them.

The correct way of using a microscope -

i. Keep the microscope in a place with sufficient light.

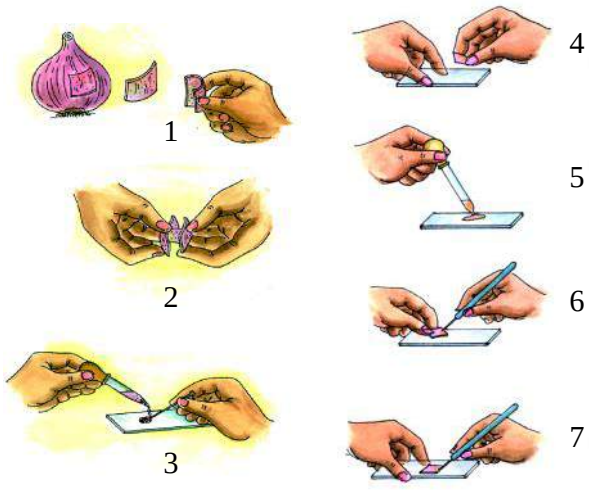
ii. Clean the lens and mirror of the microscope with a cloth.
iii. Wash the slide properly and wipe it dry.
iv. In order to observe an object, put 2 –3 drops of water on the slide, place the object carefully on the water drop with the help of a forceps or a pin or a babool thorn. Ensure that the object does not float around in water, but remains stationary.
v. Fix the slide just below the lens with clips and focus it.
vi. Observe the object after adjusting the light by turning the mirror. .

Now let us observe some cells with the help of the microscope

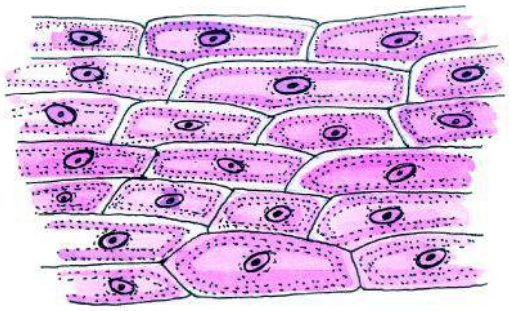
Activity - 1

Materials required :– Microscope, onion, slide cover slip, water, safranine or red ink.

To observe the cells under the microscope, separate a thick, fleshy peel of onion and break it into two pieces. On separating the two pieces, you will see a thin, transparent layer. Now remove this layer and cut it into small pieces. Put 2 –3 drops of water on the slide, place one of these pieces on it and then put safranine or red ink. Now, warm it gently on the candle – flame and leave it for 10 minutes. Be careful not to let the piece dry up. If it starts drying, put 1- 2 drops of water over it (fig. 6.2 a). Now observe the piece under the microscope. Draw a diagram of whatever you see. You will see that the layer of onion is made up of many small structures, called cells. All the cells of the membrane are alike, but different types of cells are found in other plants (fig. 6.2 b).



(a) Making a slide of onion peel



(b) Cells of an Onion peel

Fig. 6.2

You know that, like other organisms, human body is also made up of cells. Let us observe them under microscope.

Activity - 2

Materials required :– A microscope, slides, cover slip, water, safranine or red ink.

Clean your mouth properly with water. Scrape the inner epithelial lining of your cheek lightly with the help of an icecream spoon or a match stick (without the head). Now, place the scraping on the slide, in 1- 2 drops of water and put a drop of safranine or red ink over it. Warm it gently on candle flame

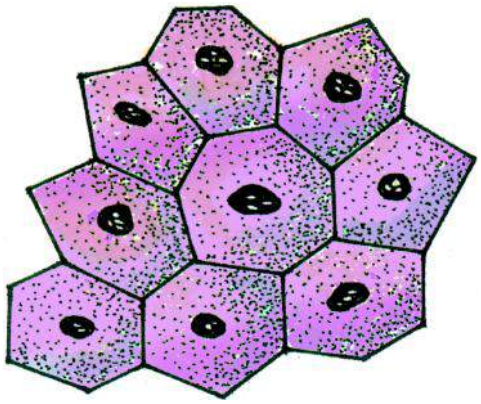


Fig. 6.3 Tissues of Cheek Epithelial

and leave it for some time. Observe it under the microscope after 10 minutes. Draw a diagram of whatever you see.

You will see the tissue of cheek epithelium, which is made up of many small cells. All these cells are identical. (Fig. 6.3)

A group of cells that are similar in structure and function is called a tissue.

Cells → Tissues → Organs → Systems → Body.

6.1.1 Lower Order of Organization

All plants and animals are made up of cells and tissues. It is not necessary that small organisms have smaller cells and large organisms have large cells. Usually cells of large animals are structurally similar to those of small animals but the number of cells is larger

Some cells of human body are so small that a heap of 40,000 – 50,000 such cells is as big as the head of a pin.

Organisms viewed under the microscope may be made up of one or many cells. Some plants and animals are made up of just one cell. They are called unicellular organisms. Amoeba, Paramecium, Yeast and bacteria etc are such organisms. In these organisms the single cell carries out the processes of nutrition, respiration, excretion, locomotion and reproduction.

Most organisms have bodies made up of many cells. They are called multicellular organisms. In these organisms different organs perform different functions, for example, the – cells of lungs perform respiratory function and the cells of the digestive system digest food. Cells performing similar functions in the same organism have similar size and shape.

Tissues of plants are called plant tissues and those of animals are called animal tissues.

Plant Cells

Let us observe plant cells under a microscope.

Activity - 3

Materials required :- Stem of any plant, microscope, cover slip. slide, glycerine, red ink

Take a stem of a soft plant i.e. of a herb. Cut transverse sections of the stem; they will look like the section shown in fig. 6.4. Keep the thinnest section on a slide. Put one drop of safranine or red ink over it followed by 2-3 drops of glycerine. Now put a cover slip over the section and observe it under microscope. What do you see?

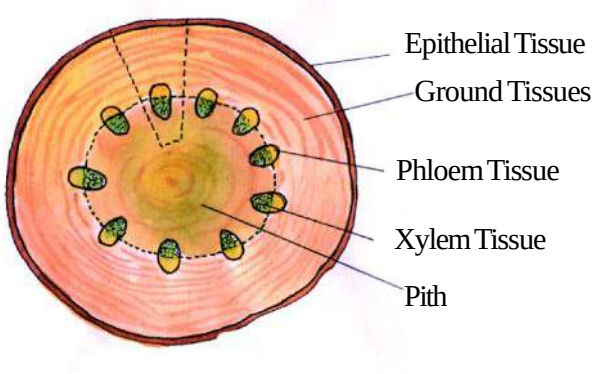


Fig. 6.4 Stem of plant

Compare what you saw under the microscope with fig 6.4. You will find that there are different types of tissues. Plants have mainly four types of tissues.

(a) Meristematic Tissue : These tissues are found at the tip of roots and stems. The cells of these divide quickly and this results in an increase in the length of roots and stems.

(b) Epithelial Tissue : If you observe fig. 6.4, you will see epithelial tissue in the form of the outermost layer. This tissue forms the outer covering of every part viz. root, stem, leaf, flower, fruit and seed. Apart from providing protection,

these tissues also exchange carbon, oxygen and water vapour for respiration, photosynthesis etc. the epithelial tissues of the plant roots help in drawing water from the soil.

(c) Vascular Tissue : These tissues transport water, and food to different parts of the plant. In earlier classes, we have done experiments related to functions of root and stem. Plants have two types of vascular tissues, one type carries water and mineral salts from roots to leaves. This vascular tissue is known as Xylem. Another type of vascular tissue distributes the food manufactured in leaves to different parts of the plant. This tissue is called Phloem. Generally, Xylem and Phloem are found in groups called vascular bundles.

(d) Ground Tissues : In fig. 6.4, ground tissue has been shown just inside the outermost or dermal layer. Its function is to provide support to the plant. In leaves it manufactures food through photosynthesis and also stores food in the roots of many plants. Pith is also a ground tissue.

Answer these

i. Write names and functions of the tissues found in plants.

ii. What are vascular bundles? What is its importance for the plants?

iii. Write cell will be bigger - that from an elephant's body or that of an ant's body?

Animal Tissues-

Body of almost all multicellular organisms is made up of four types of tissues.

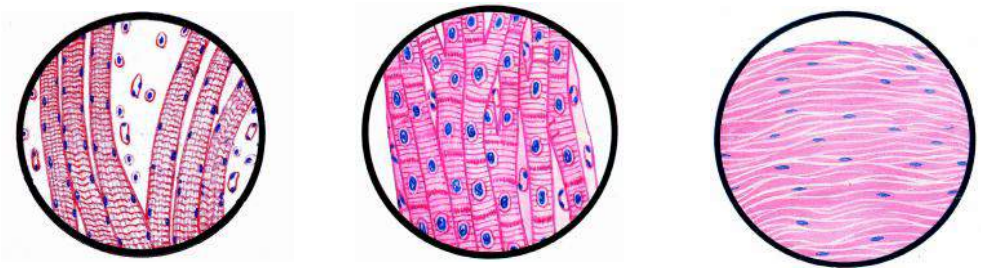
(a) Epithelial Tissue :

Keep a live frog in a bottle filled with water. After some time, you will see a transparent membrane floating on water. Find out where did it come from on the surface of water.

You will see that the floating membrane has come from the outer skin of the frog. This is a kind of tissue that provides covering to the outer and inner body – surfaces. This is called **epithelial tissue**. It protects the body and its organs. Epithelial tissue of stomach forms digestive enzymes and that of intestine helps in digestion and absorption of food (fig. 6.5)

(b) Muscular Tissue :

You might have seen the moving fleshy structure of the rump and shoulders of cow, buffalo etc during their locomotion. These structures are called Muscles. These are made up of muscular tissue. Make a list of those parts of your body, by touching or moving so that you can feel the muscles. You will see that muscular tissue is found in all the moving body parts Cells of this tissue can contract and relax due to which there is movement of hands, feet and other organs(fig. 6.6).There are three different types of muscles.



(a) Voluntary Muscles (b) Involuntary Muscles (c) Cardiac Muscles

Fig. 6.6 Muscular Tissue

(a) Voluntary Muscles : They work according to our will. Example: Muscles of hand and feet.

(b) Involuntary Muscles : They do not work according to our will e.g. muscles of the digestive tract, blood vessels, etc.

(c) Cardiac muscles : Heart is made up of cardiac muscles. Their structure is the same as voluntary muscles but their function is not under our control.

Activity - 4

Sit on the floor, fold one of your feet and hold the calf-tightly. Now lift your leg slightly above the ground and move the leg up and down.

Now, answer the following questions:

a. Can you feel the movement of the muscles of the calf?

b. Can you move the foot without moving the muscles?

c. What is the relationship between muscles and the movements of parts of the body?

Fig. 6.7

(d) Connective Tissue : Bones and blood present in your body are actually connective tissue. Their cells are of a different structure and function differently according to conditions. This tissue provides structure and support to our body. You know that transport of oxygen and food material throughout the body is carried out by blood. Since these tissues connect to all tissues of the body, they are called connective tissue.

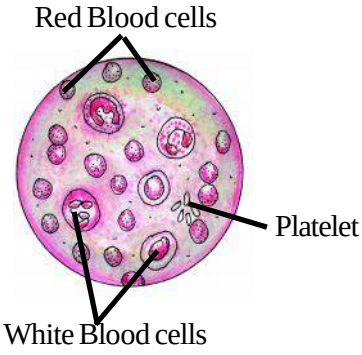


Figure 6.8 Connective Tissue

(e) Nervous Tissue : This tissue is made up of nerve cells. You know nerves, brain, spinal cord and sensory organs constitute the nervous system. All these organs are made up of nerve cells. These cells join together to form long, fiber-like structures. The network of these fibers is spread throughout the body. They carry impulses to different body parts and to the brain. Due to the nervous system, we can perceive the smell of a flower, the taste of a biscuit, melodious music and feel pain when injured.

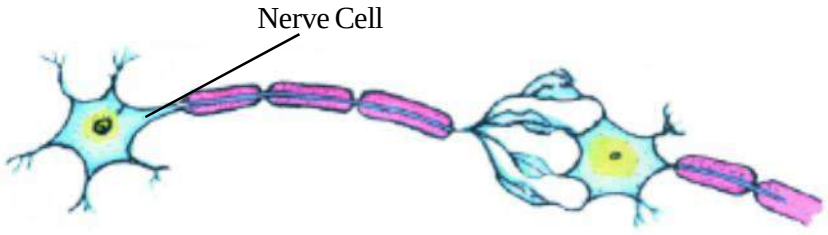


Figure 6.9 Nerve fibre

Now you would have understood the different levels of the organization of the body.

Cells ⟶ Tissues ⟶ Organs ⟶ Organs System ⟶ Body of the Organism

In the organization of living world; these levels show the internal organisation of the body, hence they are called the lower level of organization.

Answer these

1. What would have happened if:-
   i. Muscles did not have the capacity to contract and relax?
   ii. Blood were absent from the body?
   iii. There were no nervous cells in our body?

Let us now see how the higher level of the organization of the biotic world is formed.

6.1.2 Higher Level of Organization

Can you live in a place where there are neither human beings, nor animals, nor plants? Every living organism is dependent upon other living organisms and non-living things found in its own environment. Actually it is impossible for us to live alone.

Activity - 5

Go to a garden or a field near your home or school. Here, choose an area of about 1 square metre near a tree. Write down in table 6.2 the names and numbers of animals and plants known to you found in that area. If you don't know the name, write it as (a), (b) or (c) and mention its number.

Table - 6.2

S.No.	Name of plant/animal	Number
1.	----------	----------
2.	----------	----------
3.	----------	----------
4.	----------	----------
5.	----------	----------

We see small groups of different plants and animals around us. Every small group amongst them represents a particular species. The number of individuals of a particular variety or species is called the population of that particular variety or species. In the natural environment organisms of different species live together to form a community.

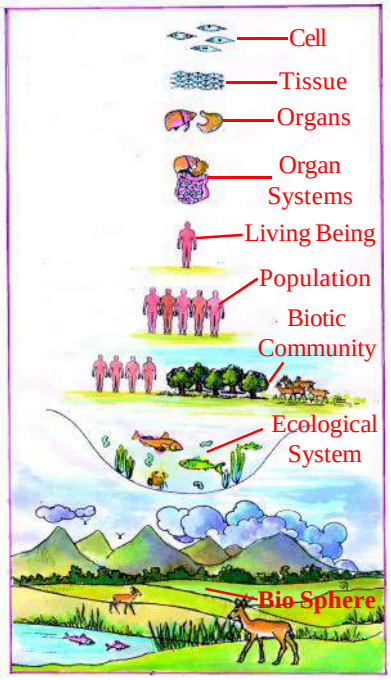


Fig.6.10

Answer these

i. Count and write the population of your school.

ii. Find out and write the population of your village / town.

In your previous class, you have learnt about the interdependence of living organisms, food chain and food webs. Such communities of living beings are also found in our environment. All these communities are dependent upon other organisms for their survival. For example, many other families live in your colony and they all form a community despite differences in caste, language, work and nature.

Several plants and animals live together. We call them Biotic Community. Now tell, how many such communities can there be on the earth? Do all biotic communities live under similar environmental conditions? You will be surprised to know that, many biotic communities live together even in small pond of water. Similarly different biotic communities live together in oceans, mountains, deserts and forests. Together with the abiotic factors of that environment, they constitute the Ecosystem. A small pond of water can be a small ecosystem and an ocean a large ecosystem. There are many such ecosystems on the earth. All these ecosystems together constitute the biosphere (fig.6.10).

The biosphere is constituted by all the biotic communities of the hydrosphere, lithosphere and atmosphere and includes the biotic and abiotic factors included in these.

Organisms → Species → Population → Community → Ecosystem → Biosphere

We have learnt

- Living world has two levels of organization – lower and higher
- Cell is the smallest unit of the body of an organism.
- The group of cells that are structurally similar and together carry out the same function is called Tissue.
- Cells form tissues, tissues form organs, groups of organs form organ systems, and organ systems together constitute the body of the organism.
- Four types of plant Tissues – meristematic, epithelial, vascular and ground tissue
- In animals mainly four types of tissues are found, viz., epithelial, muscular, connective and nervous tissue.
- Every living organism is dependent on other organisms and non-living things of its environment.
- Each species has its own population.

Questions for practice

1. Choose the correct answer.

a. The lowest level of organization in the living world-

i. Organ
ii. Tissue
iii. Cell
iv. Body

b. Stem is made up of -

i. Epithelial tissue
ii. Vascular Tissue
iii. Ground Tissue
iv. All the above

c. Skin of our body is made up of -

i. Epithelial tissue
ii. Skeleton
iii. Blood
iv. Nervous Tissue

d. **Cells of some tissue are -**
- i. Only structurally same
- ii. Only functionally same
- iii. Structurally and functionally different
- iv. Similar in structure and function

e. **Highest level of organization in the living world is-**
- i. Species
- ii. Biosphere
- iii. Community
- iv. Ecosystem

2. Fill in the blanks

a. Different……..together constitute the organ – system in multi cellular organisms
b. **…….**tissue is found at the tip of root and stem**.**
c. Cells → ……. → Organ → …… → Body
d. ……..and……. together constitute the biotic community.
e. Organism → …… → Community → …… → Biosphere
f. Amoeba, Paramecium are …….. organisms
g. The…….. tissue of the plant root absorbs water.
h. Bones and Blood are…….tissues.
i. Cells of muscular tissue may be……and……

3. Identify the true and false statements among the following. Correct the false statements and rewrite them.

i. The length of root and stem increases due to vascular tissues.
ii. Xylem transports the food manufactured in the leaf to the other parts of plant.
iii. Different organs of excretory system are made up of nerve cells.
iv. Every organism depends upon other living organisms in its environment.
v. Different biospheres of the earth together constitute the ecosystem.

Do these also

4. Answer the following questions.

i. If in a pond, all the living organisms except fish die, what will happen? Write.
ii. How would the death of the entire vegetation affect the life on earth? Write
iii. Draw labelled diagrams of the following
   a. Nerve Cell
   b. Section of stem

- Go to the nearby garden/field/pond etc. with your teacher. Identify different biotic communities found there. Write them as written below;

Place	**Biotic Community**
Pond	Algae, small insects, fish, frogs, human beings.

- Prepare coloured, clear and labelled posters of the tissues found in plants and animals and organize a competition in your school.

Chapter 7

HEAT AND TEMPERATURE

We often use the words like 'hot' and 'cold' in our daily life. We feel hot when we sit in the sunlight or in front of fire. We feel cold when we put a piece of ice on our palm. Have you ever thought why this happens?

Heat is a kind of energy that transfers from an object at a higher temperature to the colder object. In the first example energy enters our body either from the sun or the fire. That's why we feel hot. While in the second case energy moves from our body to the piece of ice. That's why we feel cold.

"The energy flow which makes an object appear hot or cold to us is called heat."

7.1 Heat, a kind of energy

Our palms become hot when they are rubbed together and iron becomes hot on being beaten with a hammer. In both these cases mechanical energy is being converted into heat energy or we can say that the heat energy is increasing. When a candle burns, chemical energy gets converted into heat energy. While in an electric heater, electrical energy gets converted into heat.

In the above examples, different kinds of energy are being converted in to heat. In the same way heat energy can also be converted into other forms of energy. You may have heard that in a thermal power station, heat energy is converted into electrical energy. In a steam engine, heat energy is converted into mechanical energy which helps in moving the engine. Food eaten by us keeps our body warm and gives us energy for doing different kinds of work. Can you give examples where heat energy gets converted into other forms of energy and vice versa?

Let us, try to understand the different stages of water being heated through an experiment.

Activity - 1

Materials required :- Hot water, cold water, luke warm water and three tubs.

Take hot water in one tub, cold water in the second tub and luke warm water in the third one. Dip your left hand in hot water and right hand in cold water for about half a minute. Now dip both hands together in the luke warm water (fig. 7.1). What do you feel?

Fig. 7.1

The water is same but the left hand fingers feel it is cold while the right hand fingers feel it is hot. Why is it so? This implies that it is not possible to guess the temperature of a substance on the basis of feeling only. It is certain that water in different tubs has different degree of hotness, that can be measured only by finding their temperatures with a thermometer.

"The physical parameter used to compare the hotness of the objects is called temperature." or "the temperature of an object is the measure of thermal stage that determines the direction of flow of heat energy."

7.2 Effects of heat

We see different effects of heat in our daily life. When two objects are brought in contact then heat energy flows from the object at higher temperature to the object at lower temperature until temperature of both objects become equal. Though we cannot see the flow of heat yet the effect of the flow of heat on different objects can definitely be felt. Some effects of heat are as follows-

(1) Increase in temperature :- we will be able to see this effect through activity-2.

Activity - 2

Materials required :- Test tube, water, thermometer, candle and a stand.

Take some water in a test tube. Measure its temperature with a thermometer. Light a candle and use it to heat the test tube from below. After some time note the temperature of the water again (fig. 7.2). Has the temperature of water in the test tube increased? What could be the reason for this rise?

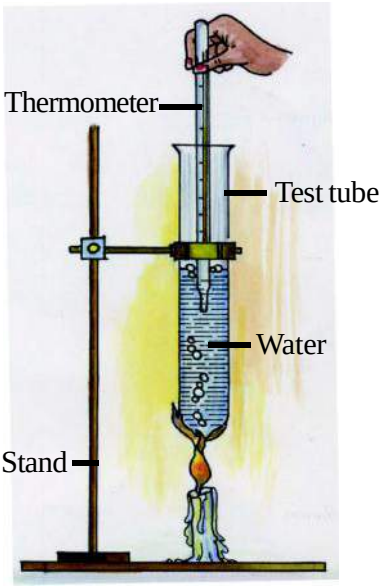


Fig. 7.2 Increase in temperature due to heat

(2) Expansion :-

Most of the solids, liquids and gases expand on heating and contract on cooling. Let us understand this with the help of some activities.

(a) Expansion in solids

Activity - 3

Materials required :- a ball and a ring apparatus, some arrangement for heating.

The diameter of the ring in the ball and ring apparatus is just enough for the ball made of metal to pass through it, (fig. 7.3(a)). Heat this ball for sometime and keep it over the ring. Can the ball still pass through the ring? If not (fig. 7.3(b)) then think about why this happens?

Some examples of thermal expansion in solids from our daily life are given below-

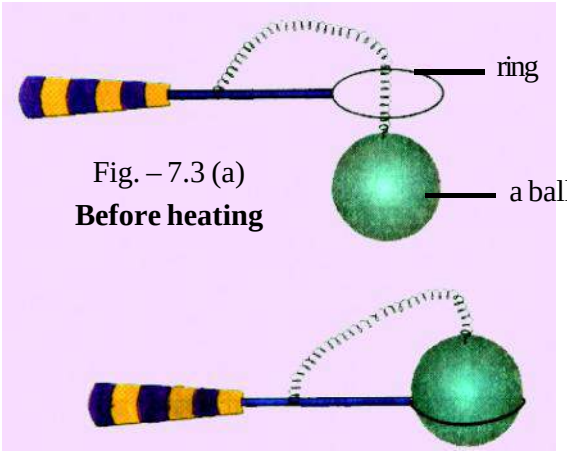


Fig. – 7.3 (a)

Before heating

After heating

Fig. – 7.3 (b)

(1) If the lid of a glass bottle becomes tight and we dip the lid in hot water by turning the bottle up side down, then the lid opens as it becomes loose due to thermal expansion.

(2) An iron ring is fixed over the wooden wheel of a bullock cart. For this the ring is made a bit smaller than the wooden wheel. Before fixing it over the wheel, it is heated so that it expands and go over the wheel. On cooling it contracts and tightly fits the wooden wheel.

(3) When boiling water is poured into a thick glass tumbler, the tumbler breaks, as the expansion of the inner surface of the tumbler is more than that of the outer surface.

(4) In summer the wires of telephone and electricity between two poles are kept some what longer and hanging in the middle so that they do not shrink and break in winters.

(b) Expansion of Liquids -

Activity - 4

Materials required :- A glass test tube, a cork having one hole fitted with a glass tube, red ink, arrangement for heating.

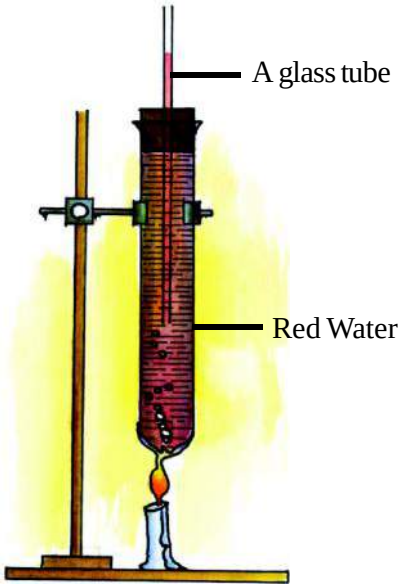


Fig. – 7.4 Expansion in liquid

Fill the glass test tube up to the top with water. Add two drops of red ink into the water. Fix the cork, with a tube fitted the mouth of the test tube. Some water will rise in to the tube. Mark the level of water in the tube. Now heat the test tube and mark the water level in the tube again. You will see that the level of water in the tube rises. If we stop heating then the water level comes down. What is the reason?

As water expands on heating so does mercury. Mercury, is the only metal that is liquid at room temperature. It is used as the liquid for indicating temperature in the thermometer.

Some examples of thermal expansion in liquids are as follows –

(1) When the bulb of a thermometer is dipped in hot water, the mercury in the bulb rises due to thermal expansion. On taking the thermometer out of water, the mercury shrinks in to the bulb again.

(2) For cooling the engines of motor cars, water in the radiator is not filled up to the top. There is a danger of the radiator bursting due to water expansion from the heating of the engine.

(c) Expansion of gases :– We discussed the thermal expansion of solids and liquids. Let us now observe whether gases show the same behaviour?

Activity - 5

Materials required :- A test tube, a cork having one hole fitted with a glass tube, an arrangement for heating, a rubber tube.

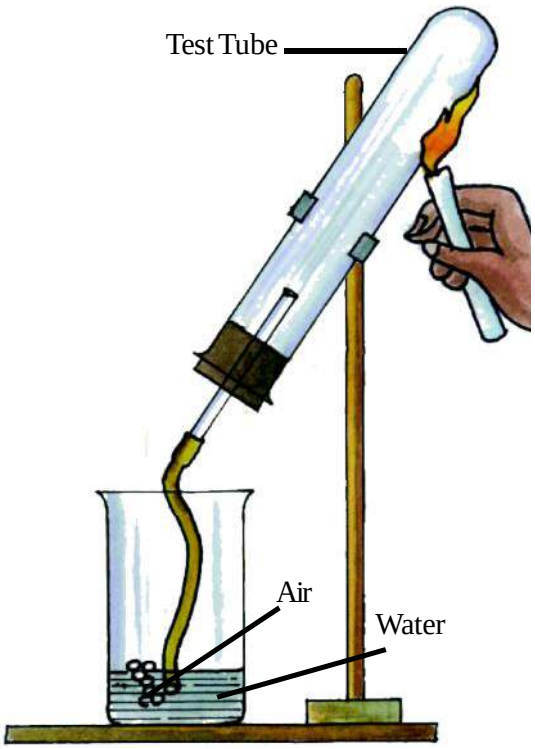


Fig. – 7.5 Expansion of air

Fit the cork, having the tube, on the mouth of the test tube. Attach a rubber tube at the mouth of the glass tube fitted in the test tube. Place the test tube up side down such that the top of the rubber tube remains inside the water taken in a beaker (fig. – 7.5). Heat the test tube with the help of a candle. You will see that some of the air in the test tube comes out as the bubbles in water. Why do the air bubbles come out? Stop heating the test tube. You will see that the air in the test tube shrinks on getting cooled and to take its place water starts entering the test tube through the tube. Thermal expansion in gases can also be understood by the following examples–

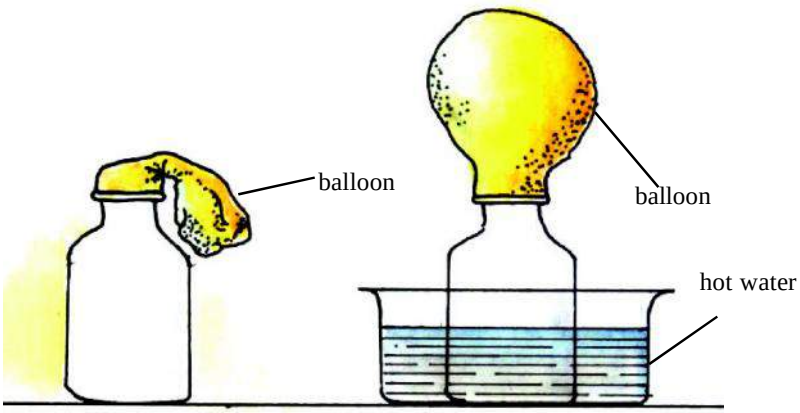


Fig. – 7.6 Expansion in gases on heating

(i) Attach a balloon to the mouth of a bottle. On keeping the bottle in the tub of hot water, the balloon expands (fig. – 7.6). The reason for this is the thermal expansion of air inside the bottle.

(ii) The tyres of vehicles burst in summer days.

(iii) *Poori* and *Chapatti* expand on being heated.

This way we see that solids, liquids and gases expand on heating and shrink on cooling. The expansion in solids is less than that in liquids and expansion in gases greater than that in liquids or in other words we can say that on heating, expansion in gases is much more than the expansion of liquids..

Answer these

1. If we touch an object and it feels cool then what is the direction of flow of heat.
2. Write solid, liquid and gas in order of the extent of their thermal expansion.
3. Give the method, with reason for opening the tight lid of a glass bottle.
4. There are chances of a bicycle tube bursting when placed in the sun. What could be the reason for this?

7.3 Change of state

All materials in nature are made up of molecules that are always in motion. In solids molecules are arranged in an orderly manner with fixed positions. These molecules keep vibrating around their mean positions. Molecules of solids do not have the freedom to leave their positions due to the intermolecular force of attraction between them. The intermolecular force between molecules of gases is very small. That's why they are far apart. They are free to move any where and are in continuous motion. Molecules of the liquid are closer to each other than those of a gas. Therefore the intermolecular force between them is less in comparison to that in a solid and

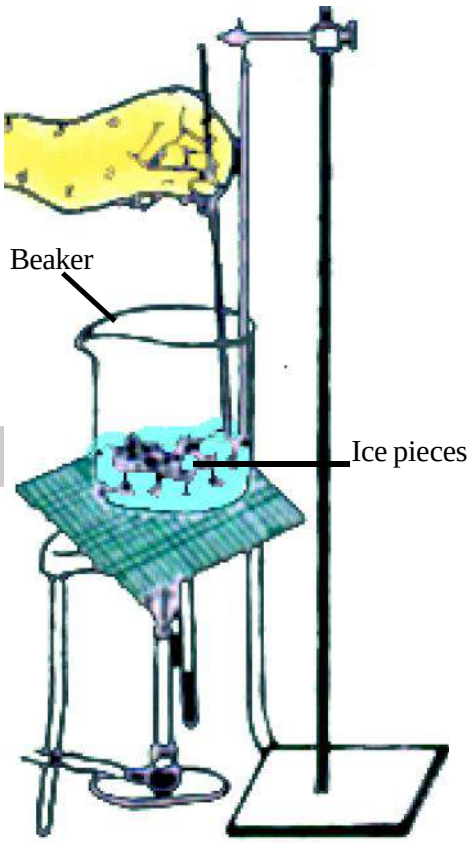


Fig. – 7.7 Change of state

is greater in comparison to that in a gas. So these molecules move within the boundary of the liquid. Since heat is a form of energy, on heating, the energy and motion of molecules get increased. This is the reason for the solids being converted in to liquids and liquids in to gases when heated. Similarly, on cooling, the energy and motion of molecules in materials decreases and because of this gases get converted to liquids and liquids to solids. All these changes are called change of state.

Let us understand this by an activity.

Activity - 6

Materials required :- Beaker, tripod stand, thermometer, wire gauze, ice pieces, glass rod, arrangement for heating.

Break ice into pieces (approx. 300 g) and keep them in a beaker. Now place the beaker on the wire gauze kept on a tripod stand and heat it. Note the temperature of the beaker after every 1 minute and write the observations in table 7.1. During this period keep shaking the ice with a glass rod (fig. – 7.7).

Table - 7.1

S. No.	Time	State of matter	Temperature
1.	0 Minute	Solid	0^0C
2.	1 Minute	Solid and some liquids	0^0C
3.	2 Minute	Solid and some liquid	0^0C
4.	3 Minute	----------	----------
5.	----------	----------	----------
6.	----------	----------	----------
7.	----------	----------	----------

We observed that the temperature remains at 0°C until the entire ice melts. (fig. -7.7). Where has the heat given to the beaker and the ice during this period gone? This heat is used in changing the state of ice or should we say that this heat is consumed in making the intermolecular forces weaker.

"The fixed temperature at which a material changes its state from solid to liquid is called its melting point."

Similarly, "each liquid gets converted to a solid at some fixed temperature. During this process, the temperature of the liquid remains fixed even while it gives up heat. This fixed temperature is called the freezing point of that material"

Any solid material when given heat energy at its melting point, changes into its liquid form. While on taking away heat from the liquid, at its freezing point, to the same extent makes the liquid return to its solid form.

The melting and freezing points of any material are always the same. For example, water freezes if it is cooled at 0°C and ice melts if it is heated above 0°C.

Table - 7.2

S. No.	Name of the substance	Melting point / Freezing point
1.	Mercury	-39 °C The Minus sign denotes that the temperature 39°c is lower than 0°c
2.	Ice	0 °C
3.	Lead	327 °C
4.	Gold	1063 °C

In the above activity, if we keep on heating the water for a long time, then its temperature will increase till it starts boiling. At this stage the water starts changing in to steam. While the state is changing even if the water is heated more, its temperature will not increase.

"The temperature at which a liquid starts boiling and changes to its gaseous state is called its boiling point."

At the same temperature the vapour of the liquid or the gaseous form condenses to its liquid state. Therefore this is also called condensation point.

Solid ⇌ (Melt / Freeze) Liquid ⇌ (Evaporate / Condense) Gas

Different liquids have different boiling points. The boiling points of some materials are given in the table -7.3.

Table - 7.3

S. No.	Name of matter	Boiling point (^{0}C)
1.	Wax	54
2.	Water	100
3.	Mercury	357
4.	Zinc	907
5.	Copper	2336

Some examples of change of state -

1. The heat energy given to boiling water goes into steam. This is the reason why steam burns us more in comparison to boiling water.
2. When a piece of ice is put into a sherbat then the sherbat becomes cooler because ice takes energy from the sherbat to change its state.
3. The temperature of the atmosphere decreases after snowfall. This is because snow absorbs heat from the atmosphere to melt and return to its liquid form.

7.4 Chemical and biological changes

Many chemical changes are possible only on heating. When we mix iron pieces with sulphur powder, no chemical reaction takes place. When we heat this mixture, then iron sulphide is formed. Similarly oxygen is released when we heat potassium chlorate and potassium permagnate.

Heat energy is produced in some chemical changes. For example, on mixing lime stone with water, on putting sodium in water or on mixing water with sulphuric acid.

Besides chemical changes, heat energy is responsible for biological changes also. We all know that in summer, milk and other edible things get stale and spoil quickly. Bacteria responsible for spoiling these become more active at temperatures (30^0C to 45^0C). But if these things are heated up to 60^0C or beyond, then many bacteria are killed. That's why in summers we need to boil the milk several times in order to save it from spoiling. Fruits, milk and food etc. are kept in refrigerators at low temperatures in order to save them from spoiling because bacterias die at very low temperatures also.

37^0C temperature is suitable for the mammal cells and 40^0C for birds. This is the reason that for the development of eggs, it is necessary to warm them and keep them at a comfortable and steady temperature.

Answer these

1. Why does the melting and freezing of a material take place at the same temperature?
2. Doctors clean the skin with spirit before giving an injection. Why does that place feel cold?
3. During summers, water in a pitcher made up of smooth black soil does not become as cool as the pitcher made of red soil (having small pores). Why?
4. To save milk from going stale we boil it many times or keep it in the refrigerator. Why?

7.5 Measurement of heat

We have studied that heat is an energy whose effect causes the temperature of an object to increase. This property is used to measure the heat energy. SI unit of heat energy is joule. Other units of heat energy are calorie and kilocalorie.

"One calorie heat is the amount of heat that increases the temperature of 1g of water by 1°C."

1 calorie = 4.186 joule

and 1000 calorie = 1 kilo calorie

"One kilocalorie heat is the amount of heat that raises the temperature of 1 kg of water by 1°C."

7.6 Specific heat capacity

Let us think about the factors that govern the amount of energy to be absorbed by the body for increasing its temperature. Experiments show the thermal energy required to heat an object depends on the following factors -

(a) Mass of the object (m) - larger the mass of the object, higher the required thermal energy for increasing the temperature by a fixed amount.

(b) Extent of the change in temperature (t)- higher the increase in temperature, larger is the thermal energy needed.

(c) Nature of the material of the object - to increase the temperature by the same amount, objects of different materials, with equal mass, require different amounts of thermal energy. This energy needed depends on the nature of the material.

Metals and oils heat up faster in comparison to water. It means that to increase the temperature of these objects by the same amount we require less thermal energy than for water. We call this property of materials as their specific heat capacity.

"The amount of thermal energy required to raise the temperature of one kg of a material by 1°C is called the specific heat capacity of the material."

The unit of specific heat capacity is joule / kg°C or joule per kilogram degree celsius.

The specific heat capacities of some materials are given in the following table.

Table - 7.4

S.No.	Substance	Specific heat capacities (Joule / kg ^{O}C)
1.	Water	4185
2.	Ice	2060
3.	Glass	840
4.	Iron	450
5.	Copper	386
6.	Mercury	140
7.	Lead	128

Effect of high specific heat capacity of water-

From the above table we see that water has the maximum heat capacity. It means that to increase the temperature of water by a fixed amount, we need the largest amount of thermal energy. It also releases the largest amount of energy while cooling. That is why-

1. Water is used as a cooling agent in engines of vehicles.
2. Warm water is used in bottles for massaging.
3. Deserts quickly become hot during day time and also quickly cool down at night. While sea water heated by sunlight during the day time does not cool at fast. At night when the atmosphere starts cooling, coastal areas remain hot due to the thermal energy released by sea water.

We have seen above that the specific heat capacity of any material is its special characteristic property. Different masses of the same materials need different amount of thermal energy for equal temperature increase. This property of the object is known as its heat capacity.

"The required thermal energy for increasing the temperature of an object of any substance by 1^{o}C is called the heat capacity of the object."

To heat the object, the required amount of thermal energy depends on its mass, specific heat capacity and increase in its temperature.

The amount of thermal energy required for an object to increase its temperature by t^{o}c is Q = m s t.

Q = mass x specific heat capacity x change in temperature

Example -

The required thermal energy for increasing the temperature of an object made of copper having a mass 100 kg by 10^{o} C is

Q = 100 kg x (386 joule / kg^{0}C) x (10^{0}C) = 386000 joule = 3.86 x 10^{5} joule

In the above example if the same copper object is cooled by 10^{0}C then it will release 3.86 x 10^{5} joules of thermal energy.

7.7 Thermometer

We can sense whether the object is hot or cold by touching them but it is not possible to find the value of the accurate temperature by this. Therefore for measuring temperature we use an instrument called the Thermometer. We have all seen the thermometer (fig. 7.8). This is a tube made up of thick glass having a narrow hole (capillary) of uniform diameter in it.

One end of the tube has a bulb made of thin glass filled with mercury. The other end of the glass tube is sealed after removing air from it. Temperature divisions in Celsius or in some other unit are marked on

the tube. The SI unit of temperature measurement is degree Celsius. In the thermometer, mercury is generally used as the liquid for temperature measurement. The reasons for this are as follows –

1. Mercury is a shining and non-transparent liquid, this means it can be seen very easily from the outside of the glass.
2. It does not stick to the glass walls.
3. It remains in the form of a liquid for a large range of temperatures (freezing point -39°C and boiling point 357°C).
4. Its rate of expansion remains the same for almost all temperature.

In a thermometer, divisions are marked from 0°C (freezing point of water) to 100°C (boiling point of water). Look at your thermometer and find its least count (Least count is the minimum temperature change that can be measured).

The bulb of the thermometer needs to be in close contact with the object whose temperature we wish to find. To find the temperature of your palm, place the bulb of the thermometer in contact with the palm and see the mercury rise. When the mercury stops rising and its level become steady, note the position of its upper end. This is the temperature of your palm.

Find the temperature of your room. Find the temperature shown by the thermometer in Sunlight and in shadow. Now you could understand the usefulness of an umbrella in Sunlight. Use the school thermometer and note the temperature in your school daily.

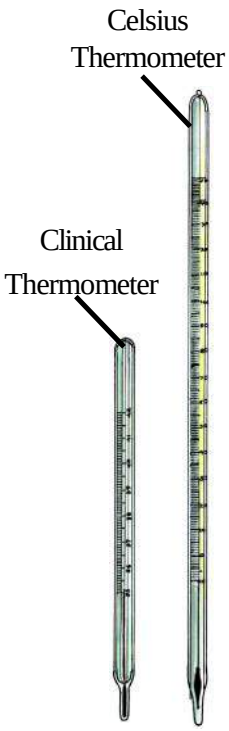


Fig. 7.8 Thermometer

7.7.1 Precautions using thermometer-

You all are familiar with thermometer and had learnt about it. Let's see the precautions to be taken while reading a clinical thermometer:-

- Thermometer should be washed before and after use, preferably with an antiseptic solution.
- Ensure that initially the mercury level is below 30°C.
- Read the thermometer keeping the level of mercury along the line of sight. (at eye level)
- Handle the thermometer with care. If it hits against some hard object, it may break.
- Don't hold the thermometer by the bulb while reading it

In Libia (Africa) on a particular day in the year 1922 it became so hot that the temperature of air even in shade was as high as 58°C. At some places in Chhatisgarh the maximum temperature of air sometimes reaches 48°C and more. When it is so hot we feel extremely uncomfortable as the normal temperature of the human body is 37°C. The minimum temperature of air in the world has been measured to be -89°C in the Antarctica continent. The use of the negative sign shows that this temperature was 89°C below 0°C (the freezing point of water). In winters when the atmospheric temperature around us becomes 15°C – 20°C, we begin to feel a bit cold.

Answer these

1. Give the definitions of calorie and kilocalorie and write the relation between them.
2. On what factors does the amount of heat required to raise the temperature of an object up to some fixed temperature depend?
3. Mercury is supposed to be the most suitable liquid for measuring temperature. Why?

We have learnt

- Heat is a form of energy.
- The measure of the degree of hotness of an object is called its temperature. Higher or lower temperature fixes the direction of heat flow.
- The effects of heat are – increase in temperature, area or volume, change of state and chemical and biological changes.
- Solid, liquid and gas all expand by taking heat.
- On being heated the solids expand the least and the gases expand the most.
- One calorie heat is the amount of energy that increases the temperature of 1 g of water by 1^0C. One calorie equals to 4.186 Joule.
- Change of state of a material occurs at some fixed temperatures.
- Melting point is the temperature at which a solid changes to the liquid state.
- Boiling point is the temperature at which a liquid changes to the gaseous state.
- A material melts (goes from solid state to liquid state) at the same temperature as at which it freezes (goes from liquid state to solid state).
- A material condenses (goes from gaseous state to liquid state) at the same temperature as at which it boils (goes from liquid state to gaseous state).
- Some chemical changes need thermal energy while some chemical changes produce thermal energy.
- Bacteria, that spoil edibles, become more active in the normal temperature range (30°C to 45°C).
- The heat required to increase the temperature of an object by 1°C is called its heat capacity.
- The amount of heat required to increase the temperature of one kilogram of a material, by 1°C is called the specific heat capacity of that material. Its unit is joule / kg °C.
- The heat taken or given by an object Q = mst.

Questions for practice

1. Choose the correct answer-

(1) On heating an object, its expansion depends –

(a) On the initial size or the volume of the object.

(b) On the increase in temperature.

(c) On the material used to make the object.

(d) On all the above.

(2) With 10 calorie heat, the temperature of 2 g of water will increase by –

(a) 2°C (b) 5°C (c) 8°C (d) 10°C

(3) The magnitude of heat absorbed by an object depends –

(a) On the mass of the object (b) On the nature of the object

(c) On the increase in temperature (d) On all of them

(4) The heat required to increase the temperature of 1 g of water by 1°C –

(a) 1 calorie (b) 1 kilo calorie

(c) 1 joule (d) 1 kilo joule

(5) Out of the following which unit is not used for measurement of amount of heat–

(a) calorie (b) °C (c) kilo calorie (d) joule

2. Fill in the blanks –

(a) The growth of mammal cells needs a temperature of ……..^{o}C.

(b) Hot water is filled in bottles to massage because it has a high……..

(c) The rate of expansion of mercury is almost the same at all temperatures, therefore it is used in…….

(d) One calorie of heat is equal to ……..joule.

(e) The boiling point of water is …….^{o}C.

3. Give reasons for the following –

(a) When boiling water is poured in to a tumbler made up of thick glass, the tumbler cracks.

(b) In summers to keep the water cool we keep it in pitchers made of red soil and not in metal pitchers.

(c) The mercury in the thermometer rises up on getting hotter.

(d) While sweating contact with air makes us feel cool.

(e) When a gas filled balloon is brought near fire, it bursts.

4. Write two uses of water expansion in daily life.

5. On what factors does the heat required by an object to increase its temperature depend?

6. Calculate the heat required for the following –

(a) To increase the temperature of 0.5 kg water from 25^{o}C to 80^{o}C.

(b) To increase the temperature of 12 kg copper by 50^{o}C.

7. Specific heat capacity of water is 4186 Joule/kg^{0}C and specific heat capacity of glass is 840 Joule/kg^{0}C. If a glass heated at 80^{0}C is kept in water at 80^{0}C. What will be the effect of temperature in both the cases ?

Do these also

1. With the help of a thermometer note the temperature at fixed times daily and write it in the table-

Date	Morning 6:00 A. M.	Noon 12:00	Night 10:00 P. M.

Chapter 8

TRANSFER OF HEAT

We have seen that on heating one end of an iron bar, the other end also gets hot. If we take water in a beaker and heat it from below, then the whole of the water gets heated. Similarly, inspite of there being a large distance between the Sun and the Earth, heat reaches the Earth from the Sun.

"The propagation of heat from one place to another is called the transfer of heat."

8.1 Methods of heat transfer

The method by which heat gets transferred depends upon the nature and state of the matter and it occurs in three ways-

1. Conduction
2. Convection
3. Radiation

8.1.1 Conduction

In solids the transfer of heat is through conduction. Let us do an activity to understand this phenomenon-

Activity - 1

Materials required :- Beaker, metal spoon, hot water.

Take hot water in the beaker, immerse one end of the metal spoon in this water and hold the other end of the metal spoon in your hand (fig. 8.1). You will see after sometime that this end of the metal spoon also becomes so hot that it is not easy to hold on to it. How did this happen?

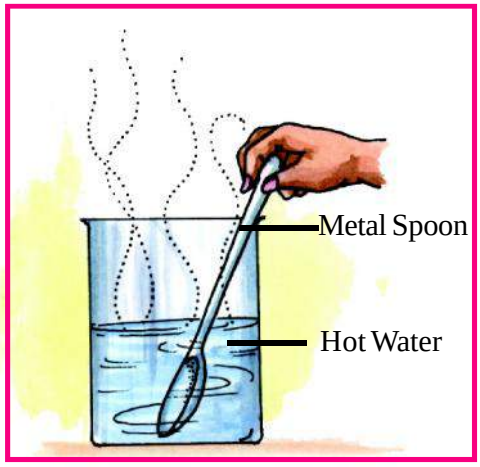


Fig. 8.1 Heat propagation

This process takes place only when a hot object comes in contact with an object at a relatively low temperature. This type of heat transfer is called conduction.

"Conduction is the heat transfer in which the molecules of matter transfer heat without changing their position. "

Conditions for heat transfer between two objects by conduction are as follows -

(i) The objects should be in contact.

(ii) Their temperatures should be different.

Conductors and insulators of heat -

Materials that transfer heat easily through conduction are called conductors, while those materials that do not transfer heat easily through conduction are called insulators or non-conductors of heat.

All metals are conductors of heat while some materials like wood, wool, thermocole, cork, plastic, paper etc. are insulators. This is the reason why the non-burning end of a burning wooden stick continues to remain at normal or room temperature. Liquids and gases are normally insulators of heat. Let us do an activity to compare the conductivity of different substances.

Activity - 2

Materials required :- 15 cm long flat iron strip, 4 - 5 all pins, candle.

Start at a distance of 5 cm from one end of the iron stip and fix four all pins vertically with the help of wax at intervals of 1 cm each. Fix one end of the strip to a stand (fig. 8.2) Heat the free end of the strip with a candle.

Which of the all pins falls first? Why do all all pins not fall at a time ? Was there any special order to their falling? If the strip is inclined at 60^0 will there be any change in order of their falling ?

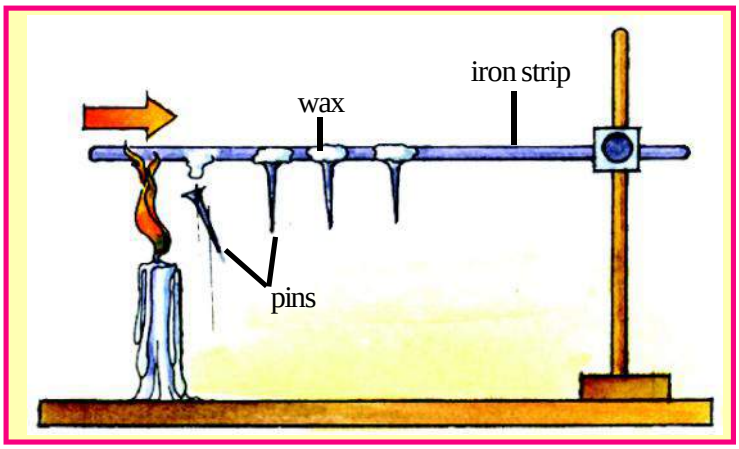


Fig. 8.2 Heat conductivity of the matter

If this activity is repeated with a copper bar, you will see that all the pins fall in a relatively shorter time. This is because copper is a better conductor of heat in comparison to iron.

An experiment was done to compare the conductivities of different materials. A rectangular box with six holes was taken. Six rods made of different materials but of the same length and diameter were taken and were initially immersed in wax. Due to this, a layer of wax of the same thickness got deposited on each of them. They were fitted in the holes of the box with help of a cork in such a manner that same length of each rod remained outside the box. The box was then put in contact with boiling water. On observing the amount of wax melted on each of the rods, it was seen that the wax on the silver rod had melted the most,

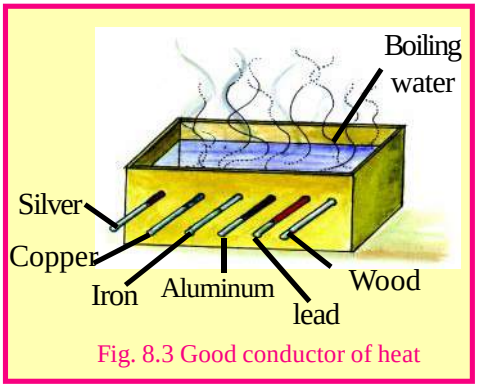


Fig. 8.3 Good conductor of heat

the wax on the copper rod melted relatively less, while that on wooden rod had melted the least. We can therefore conclude that the conductivity of silver is the maximum, of copper relatively less, and of wood the least.

Effects of heat conduction

In daily life, both conductors and insulators have their uses. The following are illustrations of some common insulators and conductors-

1. To cook food in short time we use cooking utensils made from alloys of copper, aluminium or brass (all conductors) which allow for faster heat transfer to the food.
2. Fold a thin paper to make an inkpot. Fill it with water and heat it over a flame. The water gets heated but paper does not burn. Here, the heat given to the paper gets transferred to the water. Therefore, the temperature of the paper does not increase enough to make it burn.
3. If we wrap an iron hammer with paper and throws it into a flame, the paper does not burn, while on putting a piece of wood similarly wrapped in paper in a flame, the paper burns. This is because the heat given to the paper wrapped over the iron hammer transfers itself to the iron due to the high heat conductivity of iron.
4. Handles of cooking utensils are made of non-conducting materials so that they can be handled easily as they do not become hot.
5. To save ice from melting in the summer, it is wrapped in a jute bag or with rice husk. Since these are insulators of heat, they protect the ice from atmospheric heat and prevent its melting.
6. We wear woollen clothes in winter because wool and the air trapped in its fibers are insulators of heat, therefore they prevent the conduction of the heat away from the body. In deserts when the temperature is close to 50^0C in summer, woollen blankets can save the body from heat.

Answer these

1. What are conductors and insulator of heat? Give two examples of each.
2. A water tank is cool in summers while it is hot in winters, why?
3. How does a blanket keep you warm in winter nights if it is not a source of heat?
4. Why do birds sit with their wings spread out in winters?

8.1.2 Convection

Since some gases and liquids are non-conductors of heat, heat cannot be transferred in them by conduction. Let us do an activity to understand how heat gets transferred in them:-

Materials required : - A round bottom flask, potassium permanganate, tripod stand, wire gauge, heating source (candle or burner etc.).

Activity - 3

Fill half of the flask with water and add some pieces of potassium permanganate to it and heat it from below. Since the water in contact with the bottom of the flask gets heated first, it expands and becomes lighter, and starts rising towards the top, while the cold water in the upper part starts descending to the bottom as it is heavier. This movement of water can be seen as red trail due to the potassium permanganate that gets carried by the water currents. Because of this continuous movement, the entire water eventually becomes warm and red too. These currents that arise occur on heating gases or liquids are called convection currents. (fig. 8.4)

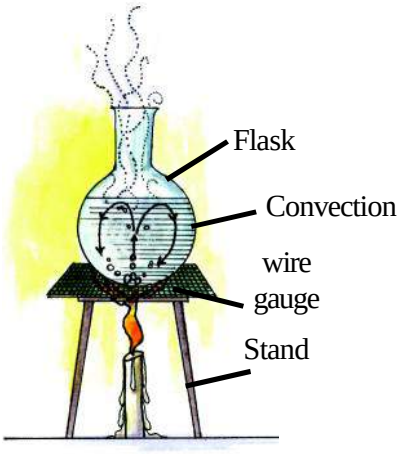


Fig. 8.4 Convection currents

"Convection is the method of heat transfer which takes place due to the motion of molecules in liquids or gases."

If the liquid were to be heated from the upper side, would the entire liquid get heated?

Let us try to understand this through the following activity.

Activity - 4

Materials required : - A test tube of tough glass, a piece of ice wrapped in metal wire, a burner or candle.

Take cold water in the test tube. Wrap the piece of ice with wire and put it inside the test tube in such a way that it remains in the lower part of the test tube. Now hold the test tube at an angle, and heat the water from the upper end (Fig. 8.5). You will see that the water in the upper portion starts boiling due to the heat while the ice in lower portion does not melt until much later.

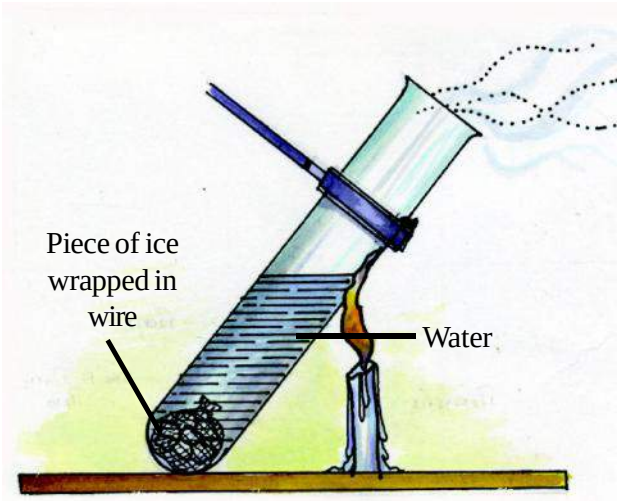


Fig. 8.5

The question that arises is why did the water in the lower part not get heated due to convection?

The reason is clear - because water is an insulator of heat, so the transfer of heat to ice does not take place by conduction in the water.

The convection currents move from bottom to top so the heat in this case since the heating is the top end heat cannot easily flow to the bottom.

Convection currents in daily life -

1. In houses and factories, smoke and hot air rise and dissipate outside, escaping through windows or ventilators, because they are lighter than the surrounding air.
2. The coldest part of a refrigerator, the freezer, is in the upper portion of the refrigerator so that the air that gets cooled and becomes heavy due to contact with it, starts descending to the lower part. These convection currents make the entire air inside the refrigerator cool.
3. Since warm air is lighter, it remains in the upper part of a room. This is the reason why the air from a ceiling fan is warm.

Answer these

1. In Fig. 8.6, there are two holes A and B, made as paths in the rectangular box X. A candle C is burning inside this box.

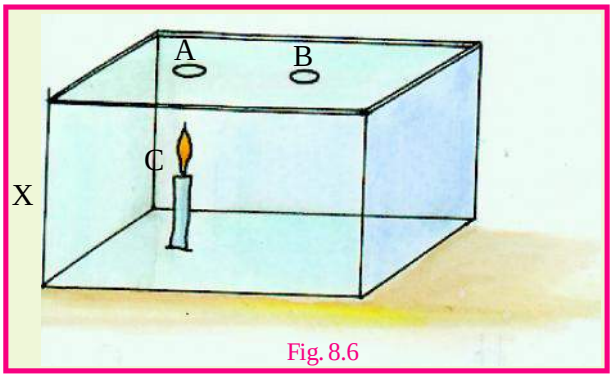


Fig. 8.6

(i) How do the convection currents flow inside the box? Show them by drawing arrows

(ii) If hole B is blocked, what will happen?

(iii) If we put a fragrant stick on A, in which direction will the smoke flow?

2. Why are the chimneys of factories where coal is burnt made very tall?

8.1.3 Radiation

A medium is required for both the conduction and convection of heat. But there is no medium in space between the Sun and the Earth. Instead, there is vacuum, but the heat from the Sun still reaches the Earth. Let us do an activity to understand how this happens.

Activity - 5

Materials required :- A candle, thermometer.

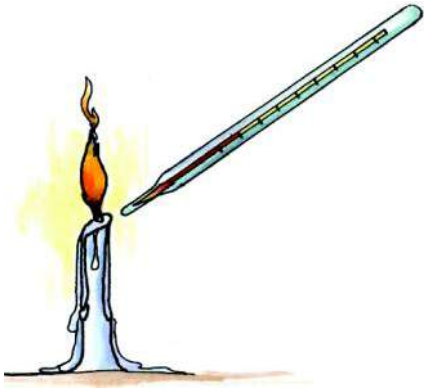


Fig. 8.7 Radiation

Note the temperature of air (room temperature) using the thermometer. Now, bring it near the candle flame(fig. 8.7) keeping the bulb of the thermometer below the candle flame. Note the temperature again. You will see that the temperature has increased.

Since air is an insulator of heat, therefore heat cannot reach the thermometer by conduction, nor can the heat get transferred to the thermometer by the means of convection currents that act downward. Then how does the heat reach the thermometer? This kind of heat transfer is called "radiation."

"Radiation is heat transfer for which no medium is required."

The heat absorbed by the body being heated through radiation depends on the distance between the body and the source of heat. The larger the distance, the less heat will reach the body. Planets that are furtheraway from the sun compared to the earth, receive less heat and are cold.

All hot bodies (solid, liquid or gas) radiate heat. The amount of radiated heat depends upon:-

(i) Temperature of the body.

(ii) Colour of the body or the nature of the surface of the body (rough or smooth)

Let us do two activities to understand this.

Activity - 6

Materials required : - Two tin boxes, black paint, a thermometer.

Take two boxes of the same shape and size that are sealed tightly. Paint one box black and keep the second box unpainted. Make a hole in each box to fix the thermometer in it. Now fill these boxes with the same amount of boiling water in them. Read the temperature on the thermometer placed in each boxes.After ten minutes, again read the temperature of the two boxes. Which thermometer shows a lower temperature?

You will see that the temperature of the water in the box painted black is lower than the temperature of the water in the unpainted box. This is because-

"Black surfaces are good radiators of heat in comparison to unpainted or shiny surfaces."

Generally, dark-colored surfaces are good emitters of heat in comparison to light colored surfaces.

Let us do an activity related to the absorption of heat.

Activity - 7

Materials required : - Two identical boxes, black paint, white paint, thermometers

Paint one of the two boxes with black paint and the other with white paint, (fig. 8.8). Now fill them with water up to same height at room temperature, and read the initial temperature with the help of the thermometer in each box. Now put these boxes in sun-light for an hour. Read the temperatures on the thermometers after an hour. Which water has become warmer?

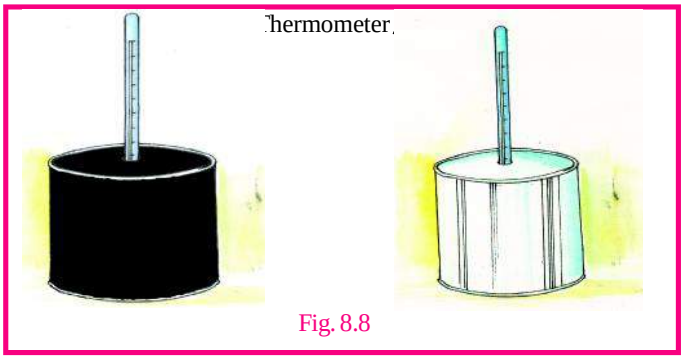


Fig. 8.8

The water in the black box is warmer. We may conclude from this that black colour is a better absorber of heat compared to white colour. In fact, all dark colors are good absorbers of radiated heat.

Examples of heat radiation in daily life -

1. During summer we wear light-coloured clothes so that the heat absorption is low and we do not feel hot. Light coloured clothes reflect most of the heat radiations. So it is comfortable to wear light coloured clothes in summer.
2. During winter, we prefer to wear dark-colored clothes because they are good absorbers of heat and help to prevent us from the cold.
3. The bottoms of cooking pans, the interior of a solar cooker and the pots placed inside it are painted black so that they can absorb more heat.
4. Kettles are usually made shiny to prevent the tea kept inside from getting cold.

8.2 Thermos flask

We use a thermos flask to keep the temperature of cold or hot liquids unchanged for a long time. This flask is constructed in such a way to try and prevent the flow of heat away from the liquid kept inside through conduction, convection or radiation.

It is generally constructed using double-layered glass, by evacuating the air between the layers of glass (fig. 8.9). Since there is no medium between the layers, the heat does not flow due to convection or conduction. This bottle is then closed with a cork or plastic cap. This glass bottle is then placed inside another bottle of the same shape but of bigger size. Cork (bad condcutor) is used as the base to prevent the inner bottle breaking due to shock. To prevent the loss of heat by radiation, both walls of the double-layered bottle (in which liquids are kept) are painted with silver polish. The inner silver-polished layer reflects heat back to the hot liquid in the flask, so that it does not cool down, If the flask contains cold liquid then the outer layer also polished silver, reflects the outside or external heat away from the inner, cold liquid. The walls in the evacuated double wall region are also silvered to reduce heat emission or absorption. Thus, energy does not flow into or out of a flask by conduction, convection or radiation, or if is does it flows very slowly. Therefore, the temperature in the thermos does not change for a long time.

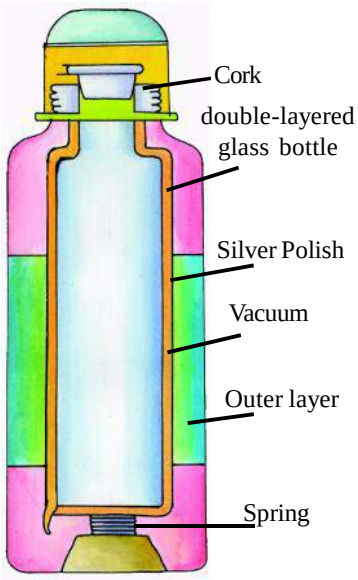


Fig. 8.9 Thermos flask

Answer these

1. The energy received from the Sun has more heat while the energy received from the Moon has negligible heat. Why?
2. People like to wear white clothes in summers. Why?
3. Explain the following facts related to how a thermos flask is constructed–
   (1) The air between the double-layered bottles is evacuated.
   (2) Both the layers of the double layered bottle are painted silver.

We have learnt

- The flow of heat from hot objects to cold objects takes place in three ways namely, conduction, convection and radiation.
- When two objects are at the same temperature there is no flow of heat.
- Heat flow that takes place through the molecules of matter is called conduction. The molecules do not move during this transfer.
- Materials that conduct heat are called conductors of heat. Metals like silver, copper, aluminium and iron etc are examples of conductors.
- Wool, wood, straw, paper and thermocole etc are examples of insulators of heat.
- Liquids and gases are insulators of heat. However, even though mercury is a liquid, it is still a conductor of heat because it is a metal.
- In liquids and gases, the flow of heat takes place through the movement of molecules and is called convection.
- In convection heat always transmitted from lower portion to upper portion.
- The phenomenon of heat flow from hot objects to colder objects without any medium in between is called radiation. The heat that gets transferred like this is called radiation energy.
- The heat from the sun reaches us by radiation.
- Black or dark-coloured objects are good absorbers as well as good emitters of heat in comparison to white or light colored objects.
- A thermos flask is constructed in such a manner that heat cannot be exchanged from it by conduction, convection or radiation.

Questions for practice

1. Choose the correct option.

1. The transfer of heat through solids is due to
(a) conduction (b) convection (c) radiation (d) due to all above.

2. Which is a non-conductor / insulator out of these
(a) water (b) air (c) thermocole (d) all the above

3. In the following methods of heat transfer, the particles of the medium move from one place to another.
(a) conduction (b) convection (c) radiation (d) none of these

4. A good absorber of radiation energy is -
(a) black painted ball (b tin box (c) white cloth (d) iron ball

2. Fill in the blanks -

1. Heat flow by means of _____ is the fastest.
2. There is _____ between the double layer of the thermos flask.

3. Good emitters of radiation energy are also good _____
4. _____ colour is a good absorber of heat.
5. Both the front surfaces of the double-layered glass bottle inside a thermos flask are painted with white shiny paint to prevent heat loss by _____

3. Answer the following questions -

1. Write down the methods of heat transfer.
2. Write down two essential conditions for heat transfer by conduction.
3. Which materials are conductors of heat? Give any two examples.
4. Explain convectional currents.
5. Solids cannot be heated by convection. Why?
6. On what conditions does the heat emitted from hot bodies depend?
7. Desert areas are very hot in days and very cool at nights. Why?
8. Why are white coloured clothes preferred in summers?
9. Why are interiors of solar cookers usually painted black?

Do these also

1. Put some pieces of wax in a test tube. Now start heating it from the bottom and after every minute note the temperature of wax using a thermometer. Now complete the table drawn below.

Time (in minute)	0 (initial)	1	2	3	4	5	6	7	8
Temperature (^oC)	……..	……	……	……	…….	……	…….	….	…..

2. Cut a long strip of paper according to the figure. Fix one end of this paper with a needle or piece of wire and tie it to the stand. Put a lighted candle under the free end of this strip in such a way that the flame of the candle does not touch the paper (fig. 8.10). Can you see the paper turning and whirling? Think about why this whirling happens and write down your reasons.

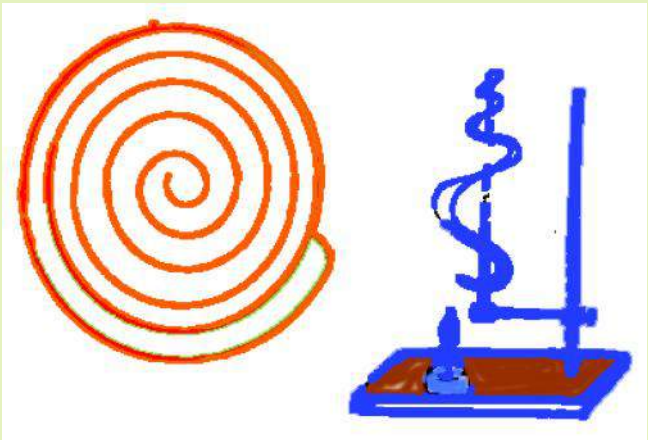


Fig. 8.10

Chapter 9

NUTRITION IN LIVING ORGANISMS

You might have heard that before sowing a crop, the soil is tested and proper manuring is done in order to obtain a high yield. What is the reason behind this?

Soil testing provides information about the quantity of different nutritive elements present in the soil. Any deficiency of nutritive elements is made up by manuring the soil. All living beings need nutritive elements to carry out various metabolic activities and for body growth. They obtain these from their food.

9.1 Nutrition in Plants

All green plants make their own food in the presence of sunlight, using carbon dioxide and water. Such plants are called autotrophs. Let us understand this through an activity.

Activity - 1

Materials required :- Beaker, test tube, funnel, black cloth, Hydrilla(aquatic plant) and water.

Keep some Hydrilla twigs in a beaker filled with water. Keep an inverted funnel in the beaker in such a way that the plant is completely covered by it. Now place an inverted test tube filled with water over the pipe of the funnel. Keep the complete set-up in sunlight for half an hour. You will see bubbles of oxygen, formed during the process of photosynthesis, coming out of the plant and entering the test tube. The level of water in the test tube falls as more and more oxygen enters it. Measure the volume of oxygen collected in 30 minutes (fig.9.1)

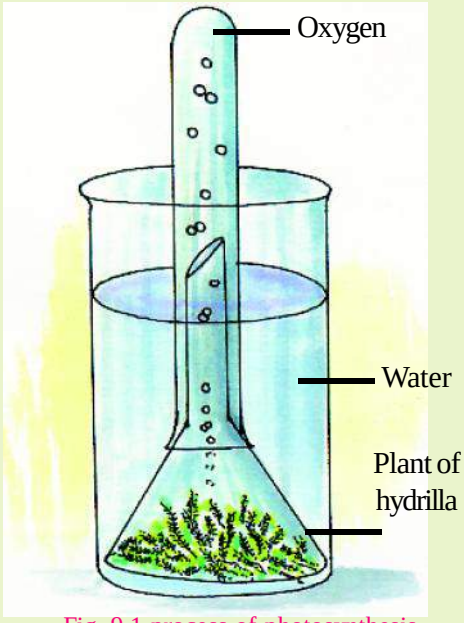


Fig. 9.1 process of photosynthesis

Now, rearrange the apparatus as before, keep it inside a room and cover it with a black cloth.. Again measure the volume of oxygen collected in the same period of time and compare it with the earlier reading. You will see that photosynthesis does not take place in the dark.

In our surroundings we often come across certain plants with variegated leaves, do they also carry out photosynthesis?

Let's find it out with the help of an activity.

Activity - 2

Materials Required-Variegated leaves, dropper, test tube, iodine solution, water.

Take few variegated leaves, add few drops of water and mash them to make a paste, collect the extract by squeezing the paste (pulp).Put 5-6 drops of the extract into a test tube. Also add two drops of iodine solution. Note your observations.

The colour of the leaf extract turns blue black. This shows the presence of starch in the leaves, produced by the process of photosynthesis, in the presence of chlorophyll. Non green (variegated) leaves also contain chlorophyll but the presence of red, brown and other pigmented chlorophyll masks the green chlorophyll. The photosynthesis carried out by such variegated leaves is also due to the presence of chlorophyll.

$$\text{Carbon dioxide} + \text{Water} \xrightarrow[\text{Sun light}]{\text{chlorophyll}} \text{Carbohydrate} + \text{Oxygen}$$

Some plants lack chlorophyll. How do they obtain their food? These plants depend upon other organisms for their food. Organisms which depend upon other organisms for nutrition are called heterotrophs. Cuscuta (amar bel) is a plant that coils around some other plant which is called the host. Cuscuta sends out special root-like structures called haustoria into the body of the host and draws nutrition from it.Thus, Cuscuta is a complete parasite.

Many green plants such as Mistletoe (Bhangra)and Loranthus (Banda) make their own food by photosynthesis, but depend upon the host plant for water and mineral salts. Such plants are called partial parasites.

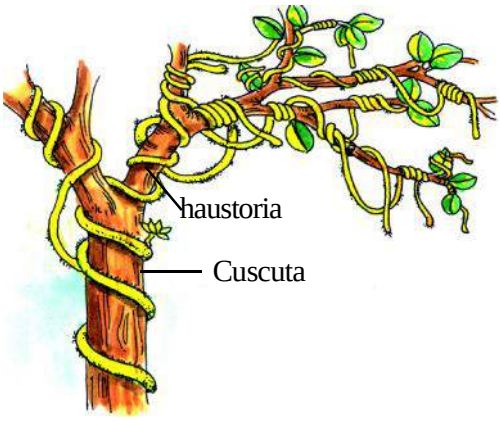


Fig. 9.2 : Cuscuta (Complete Parasite)

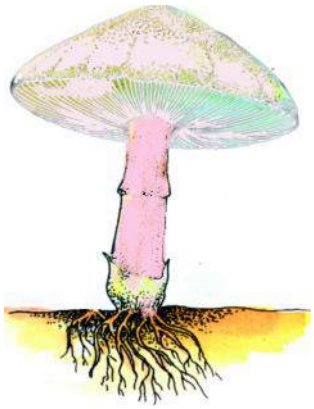


Fig. 9.3 : Mushroom (Saprophyte)

You might have seen that black spots appear on bread pieces, pickle, jelly, etc. when these are kept in moist places. These black spots are plants called fungi. After a while the eatables start decaying. This process of decay occurs due to microorganisms. The microorganisms and fungi obtain their food from dead or decaying materials. Hence, they are called saprophytes. You must have seen mushrooms (kukurmutta) growing on dead and decaying matter, especially during the rainy season. These do not have chlorophyll. A few plants manufacture their own food but also obtain a part of their nutrition by ingesting insects. Leaves of these plants are specially modified to trap insects. They are called insectivores, e.g. Pitcher plant, Bladderwort, Drosera, etc. These

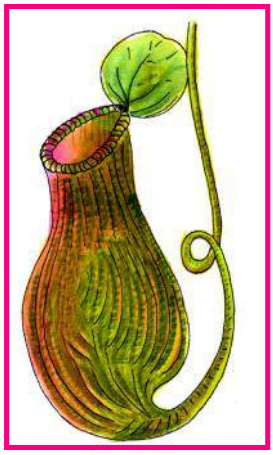


Fig. 9.4 : Pitcher plant (Insectivores)

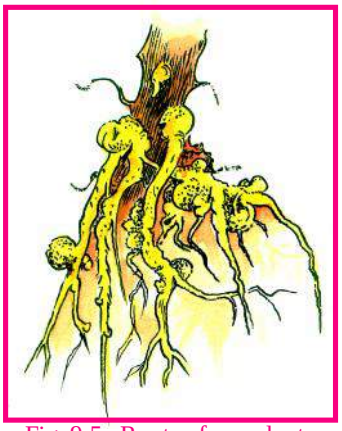


Fig. 9.5 : Roots of pea plant (Symbiotic)

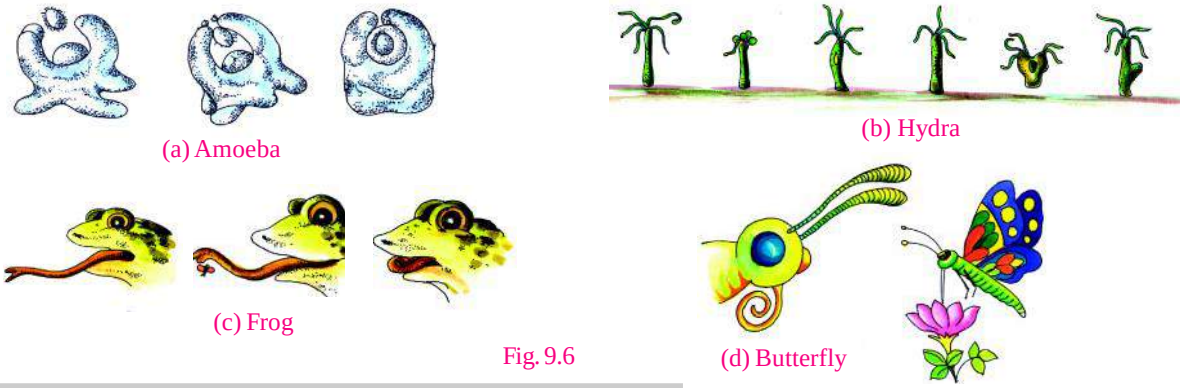
plants are found in marshy areas, which are deficient in nitrogen. Hence, they meet their nitrogen requirements from insects. Nodule-like structures are found on the roots of leguminous plants like Pea, Gram, Groundnut etc. Special kind of bacteria living in these nodules fix and convert atmospheric nitrogen into nitrogenous compounds. These nitrogen compounds are useful to the plants. The bacteria also take food prepared by the plant. In this way, plant and bacteria live with the help of each other. Hence they are said to have a symbiotic relationship and the process is called symbiosis.

9.2 Nutrition in Animals

Animals are called heterotrophs because, for their food requirements, they depend upon the food prepared by plants.

Different organisms adopt different modes to obtain food. Amoeba takes in its food with the help of pseudopodia, Hydra does so with the help of tentacles and frog traps its food with its tongue. Butterfly and honey bee have special tube-like mouth parts for sucking liquid food (fig.9.6).

Vertebrates have developed jaws and teeth with the help of which they can hold, cut and grind food material.



(a) Amoeba (b) Hydra (c) Frog (d) Butterfly

Fig. 9.6

9.2.1 Digestion of Food in Human

You must have noticed that your teeth vary in appearance and also perform different functions. Accordingly they are given different names-Incisors, Canines, Premolars and Molars which have their specific functions of cutting and biting, piercing and tearing, chewing and grinding respectively (fig 9.7)

Table 9.1 Types of Teeth and its functions

S.No.	Name of teeth	No. of teeth		Position	Shape	Function
		Upper jaw	Lower jaw			
1.	Incisors	Four	Four	In front	Like chisel	Cutting and biting
2.	Canines	Two	Two	Behind Incisor	Pointed	Piercing and tearing
3.	Premolars	Four	Four	Behind Canine	Like grinder	Grinding and chewing
4	Molars	Six	Six	Behind Premolar	Like grinder	Grinding and chewing

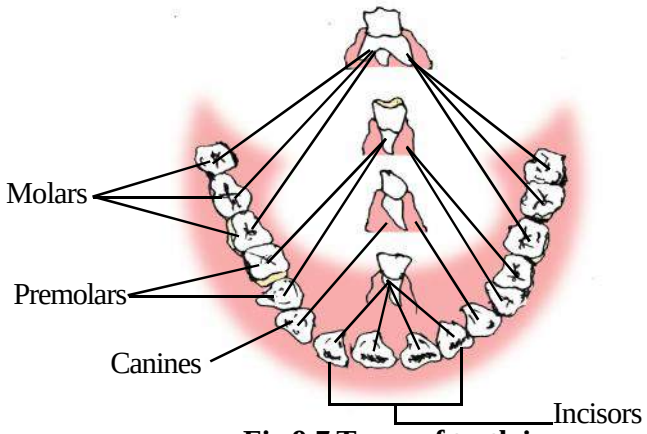


Fig 9.7 Types of teeth in human being

Most of the food material that we ingest can not be utilized as such by the body. It is necessary to first convert it into simpler substances which can be utilized by the body.

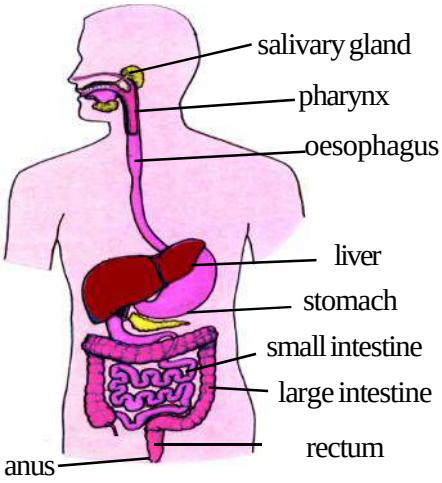


Fig. 9.8

This process is called digestion and it takes place in the internal organs of the body (fig.9.8) and hence it is not possible to observe it. Digestion of starch, however, starts in the mouth itself and we can observe the process. Let us try to understand it by means of an activity.

Activity - 3

Materials required :- Piece of chapatti, test tubes, iodine solution, dropper, wheat flour, beaker, water.

Chew the piece of chapatti slowly. Does the taste change after some time? If yes, what is the change in the taste? In the beginning, it was not sweet but later on its taste begins to changes and becomes sweet. What can be the reason behind this change? What is the sweet food material that we consume almost daily? We can understand this process by another activity.

Dissolve ½ spoon of flour in a beaker filled ¼th with water. Keep 10-12 drops of this solution in a test tube or in a small bottle, add 2 drops of iodine solution to it. If the solution turns blue or black, it indicates the presence of starch. Stick two small pieces of paper on two clean test tubes and mark them A and B. Pour 25 drops of the flour solution in each test tube.

Add some saliva only to test tube A, and not to test tube B. Leave the test tubes standing for half an hour. After that, add two drops of iodine to each of the test tubes. Draw table 9.1 in your notebook and write the results of your experiment in it.

Table - 9.2

Test Tube	Saliva present / Absent	Appearance of blue or black colour with iodine	Starch present / Absent
A	.....	.....	.....
B	.....	.....	.....

Food reaches the stomach from the buccal cavity via the osophagus. Enzymes coming from stomach, intestine and digestive glands mix with the food and digest the remaining starch as well as other carbohydrates, proteins and fats. In this way, the complex compounds in the food are converted into simpler forms. These simpler compounds are absorbed by the small intestine, and finally reach the tissues via blood. This is called assimilation. Undigested matter (faecal matter) is excreted from the body.

Different types of proteins are found inside the cell. Some of these proteins catalyze the reactions taking place in the cell. These are called enzymes. Different types of enzymes are found in saliva and in digestive juices.

Digestion in man is extracellular (outside the cell), but in unicellular animals like Amoeba, food particles directly enter the cell where they are digested by digestive juices. This type of digetion is called intracellular.

The entire process of taking in food, its digestion, utilization of the digested food by the body and excreting the undigested part of food is called nutrition.

9.2.2 Digestion in grass eating animals

Have you observed cows, buffaloes and other grass eating animals chewing continuously even when they are not eating? Actually they quickly swallow the grass and store it in a part of the stomach called rumen (fig 9.9)

In rumen, food gets partially digested and is called cud. But later the cud returns to the mouth in small lumps and animal chews it again. This process is called rumination and these animals are called ruminants.

The grass is rich in cellulose, a type of carbohydrate. In ruminants, the cellulose of the food is digested by the action of certain bacteria present in the rumen of grass eating animals. Many animals including humans cannot digest cellulose due to the absence of such bacteria.

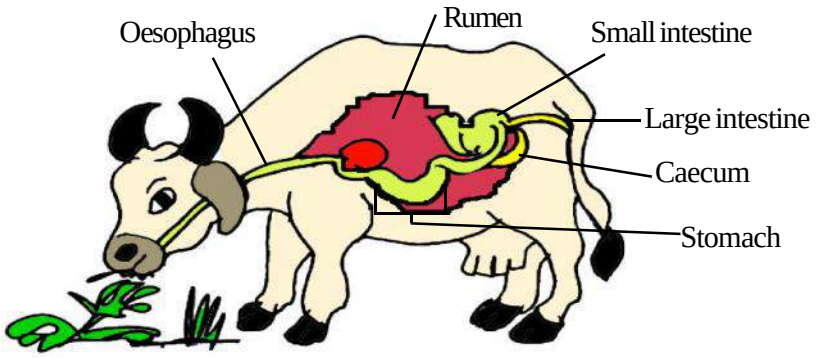


Fig. 9.8 Digestive system of ruminant

We have learnt

- Nutrition is necessary for life.
- Green plants make their food with carbon dioxide and water in the presence of sunlight,
- Most plants are autotrophs while all animals are heterotrophs.
- Some plants may be parasites (Cuscuta), partial parasites (Mistletoe), saprophytes (mushroom), symbionts (with symbiotic bacteria), or insectivores (Pitcher Plant)
- The process of nutrition in animals includes intake of food, digestion, absorption, assimilation and excretion.
- In human beings, digestion takes place due to the coordinated action of organs of digestion and digestive glands.
- During digestion, complex compounds are broken up into simple molecules.
- Simple molecules are absorbed by the small intestine and are transported to each tissue by blood.
- Digestion is intracellular in unicellular organisms like amoeba.
- Variegated leaves also contain chlorophyll hence, undergo photosynthesis.
- Ruminants have cellulose digesting bacteria present in their rumen.

Questions for practice

1 Fill in the blanks-

1. ……..are needed to carry out metabolic activities.
2. Food is digested by …… formed in digestive glands.
3. Digestion in Amoeba is ……
4. In human beings, digested food is absorbed in ……..
5. In cow, cellulose is digested in the .....

2 Answer the following question.-

1. What is the difference in the mode of nutrition in autotrophs and heterotrophs?
2. Explain parasites, saprophytes and symbionts with examples.
3. Which organs help Amoeba and Hydra in ingesting food?
4. Draw a labeled diagram of the human digestive system and . explain the process of digestion of starch.
5. Explain digestion in grass eating animals.

Do these also

Collect small plants, or the branches or other parts of big plants from your locality and classify them into autotrophs, parasites, saprophytes, and symbionts. With the help of your teacher, preserve them in the form of specimens in the biology laboratory of your school and label them as shown below:

Name – Cuscuta (Amarbel)

Mode of nutrition - Parasite

Chapter 10

RESPIRATION IN LIVING ORGANISMS

10.1 Respiration in Man

Often, when a truck or a tractor emitting smoke passes us, we either cover our nose or stop breathing. Have you ever thought why do we do so? We feel suffocated by the smoke, and we don't want to inhale it. Let us see what all and how we inhale through our nose:

We inhale and exhale through our nose. The nasal cavity is divided into two nasal chambers by a partition. Each nasal chamber opens to the outside by a nostril. Nasal chambers have nasal hair and mucus. What do you think are their functions?

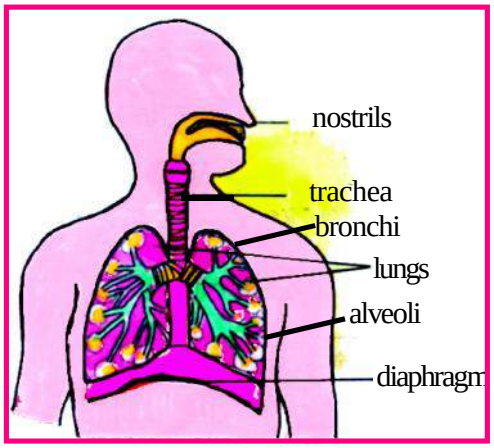


Fig 10.1 : Respiratory System in Human

Oxygen-carrying air reaches the trachea via the nasal chambers. The trachea bifurcates into two parts called bronchi (singular bronchus). Lungs are present in a cavity called the pleural cavity. You might have seen a honey comb and the small cavities in it. Many similar cavities called alveoli are found on the inner wall of the lungs. The inner wall of the alveoli is lined by a thin membrane that has many blood capillaries in it. The ends of the bronchi open into these alveoli. At the bottom of the pleural cavity is a muscular partition called the diaphragm.(fig 10.1)

Activity - 1

Materials required :- Measuring tape or string.

Measure the chest of your friend using a measuring tape or a string. Hold the ends of the tape or the string loosely. Now, tell your friend to take a deep breath and again measure the chest (fig. 10.2). Do you find a difference in the two measurements?


Fig 10.2 : Measuring the chest

You might have understood from the above activity that when we breathe in (inhale), the chest moves upwards and the diaphragm moves downwards, and this causes the lungs to expand. Air pressure in the lungs decreases and oxygen-rich air comes into the lungs (fig 10.3a) it is called inhalation During breathing out or exhalation, the chest moves downwards and the diaphragm moves upwards, air pressure in the lungs increases and the lungs contract. As a result of this, carbon dioxide rich air filled in the lungs goes out through the nostrils. The process of inhalation and exhalation together is called breathing. The

number of times a person breaths in a minute is termed as the breathing rate.When oxygen-rich air reaches the alveoli, oxygen is taken up by the blood and transported to the cells of the entire body. In the cells, the oxygen reacts with sugar to form CO_2 , water vapour and energy is released. The energy thus released is stored in special type of molecules.

Sugar + Oxygen $= CO_2$ + water vapour + Energy

Now, you would have understood how organisms get the energy to do work. (Fig10.3a, b)

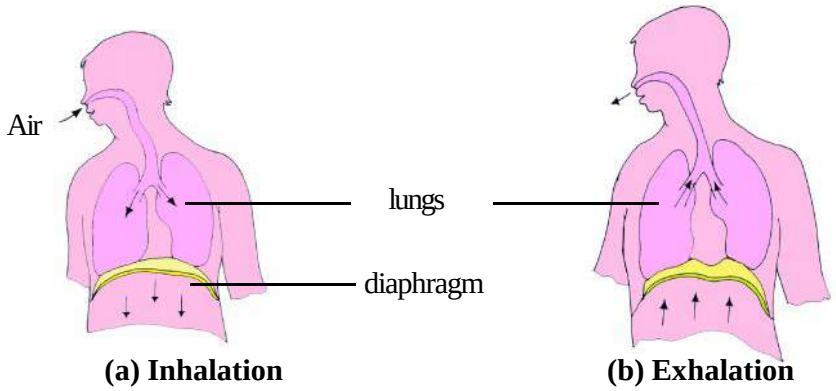


Fig. 10.3 (a) (b)

Energy is released as a result of many chemical reactions during respiration. Enzymes speed up the rate of the reactions. This is called cellular respiration. It is carried out in all organisms from bacteria to man.

10.2 Respiration in Other Organisms

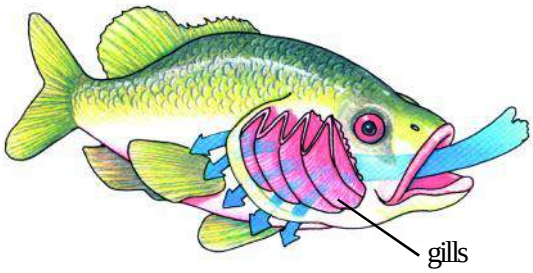


Fig.10.4 : Gills of a fish

Like human beings, cows, buffaloes, lizards, birds, etc also have lungs as their main respiratory organs, but there are some organisms that respire through gills. You might have seen a fish opening and closing its mouth regularly. There are flaps on both sides of the head. Gills can be seen inside these flaps. These are the respiratory organs of fish (fig. 10.4). Water, taken in through the mouth, passes over the gills, and the oxygen present in the water dissolves in the blood circulating in the gills. Carbon dioxide is released into the outgoing water. Insects like butterfly, cockroach, mosquito, etc have a network of respiratory pipes (tracheae) spread throughout body. These tracheae open to the outside through openings called spiracles.

Have you ever thought why earthworms live in moist soil? Earthworm does not have any special respiratory organs but its skin is very soft, thin, and porous and it acts like a respiratory organ. Leeches and frogs also respire through the skin, but when a frog comes out of water and onto the land, it respires through lungs.

10.3 Respiration in Plants

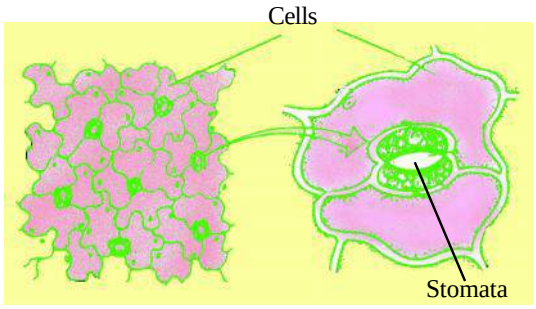


Fig.10.5 : Stomata

Like animals, plants take oxygen from the atmosphere and release carbon dioxide.The surface of the leaf bears innumerable small pores called stomata

(fig.10.5). Generally the lower surface of the leaf has more stomata as compared to the upper surface . Exchange of oxygen and carbon dioxide takes place through the stomata. Water vapour also goes out of the leaf through the stomata.

We have learnt

You would have seen the thick stems of big trees. Their tissues also need oxygen for respiration, for which the bark has many openings called lenticels.

- Respiration occurs in all organisms. In this process, oxygen is taken in while carbon dioxide and water vapour are released.
- During respiration, digested food present in the cells reacts with oxygen to produce energy. This energy enables the body to do work.
- Gills, tracheae and lungs are the respiratory organs of, respectively, fish, cockroach, and cow.
- Nostril, trachea, bronchus and lungs are the respiratory organs of man.
- Oxygen reaches different parts of the body through blood.
- Stomata and lenticels are the respiratory organs of plants. Stomata are found on the leaves and lenticels on the stem.

Questions for practice

1. Fill up the blanks:

a) ..... are the respiratory organ of fish.

b) In a cockroach, a network of ….. is found.

c) …. are found on leaves for the exchange of gases.

2. Choose the correct answer:

(i) The most important organ of the respiratory system is

(a) Nasal chamber (b) trachea (c) lungs (d) bronchi

(ii) Process of inhalation and exhalation is called:

(a) Excretion (b) respiration (c) digestion (d) breathing

(iii) The animal respires through moist skin :

(a) mosquito (b) leech (c) fish (d) butterfly

(iv) Thick stem of trees respire through:

(a) trachea (b) lenticels (c) stomata (d) stomata or lenticels

(v) Inside the lungs, the ends of bronchi open into:

(a) alveoli (b) trachea (c) cells (d) blood vessels

3. Name the respiratory organs found in following animals;

mosquito, lizard, earthworm, cow, fish

4. Draw a labelled diagram of a human respiratory system.

5. How does respiration take place in unicellular aquatic animals?

6. The surface of the leaf bears innumerable small pores. What is the name and the function of these pores ?

Do these also

1) Prepare a colourful, well labelled poster of human respiratory system and put it up in your classroom.

Chapter 11

FIBRE TO FABRIC : ANIMAL FIBRE

11.1 In your previous class you have read about some plant fibres. We obtain fibres not only from plants but also from animals. Think, from which animals do we obtain fibres. Usually we obtain fibres from sheep, goat, yak, camel, rabbit, horse and silk worms.

What kind of clothes do you wear in winter? You know to protect us from cold; we use woollen clothes like sweaters, shawls. blankets, mufflers etc. These are made of wool, in the same way we obtain silk from the silk worm, which is used to make different types of clothes. Wool, silk etc are fibres which are obtained from animals so they are known as animal fibres.

1.Wool -Wool is obtained from sheep, goat, yak, camel and some other animals. The body of these animals is covered with a thick layer of hair or fleece which protect them from cold (fig.11.1). Different breeds of sheep are found in different parts of our country. However the fleece of sheep is not the only source of wool, though wool commonly available in market in sheep wool. In Ladakh and Tibet, wool is obtained from yaks. Very high quality pashmina shawls are made from the soft fleece of Kashmiri goat (Angora species).The hair obtained from the body of camels is also used as wool. Apart from these in South Korea and other countries wool is obtained from other animals as Llama and Alpaca

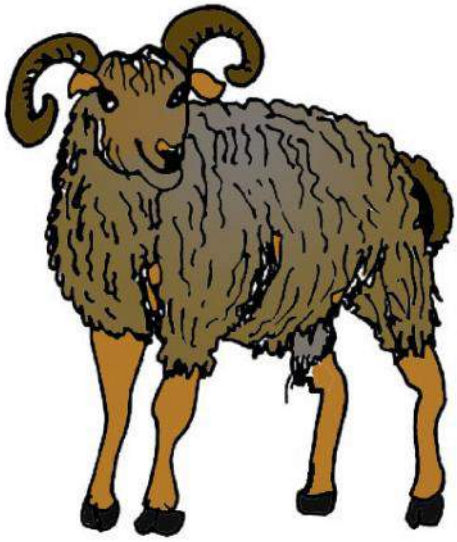


Figure 11.1 Sheep with thick fur

Fur obtained from a special species of rabbit is white, silky and very soft which is used to make high standard of quality clothes. Horse hair is used to make brushes and also to make strings of violin and other stringed musical instruments. These are strong smooth and thin. These are also used in decorating the house.

11.2 From fibres to wool -

For obtaining wool sheep are reared. The wool used for knitting sweaters or weaving shawls is obtained in a step wise long process.

Step - 1 - The fleece of the sheep along with thin layer of skin is removed from its body (fig. 11.2 a). This process is called shearing. Usually, hair are removed during the hot weather. This enables sheep to survive without their protective coat of hair. The hair provide woollen fibres. Shearing is similar to how you get a haircut. It does not hurt the sheep because the upper most layer of the skin is dead. Also the hair grow again. Woollen fibres obtained from these hair are then processed to obtain woollen yarn.

Step - 2 - The sheared skin with hair is washed thoroughly in tanks to remove grease, dust and dirt this is called scouring (fig. 11.2 b & c)

Step - 3 - After scouring, sorting is done. The hairy skin is sent to a factory where hair of different textures are sorted.

Step - 4 - The small-fluffy fibres, called burrs, are picked out from the hair. These are the same burrs which sometimes appear on your sweaters. The fibres are scoured again and dried. This wool is ready now to be drawn into fibres.

Fig 11.2 a. Shearing a sheep

Fig 11.2b Scouring in tanks

Fig.11.2c Scouring by machines

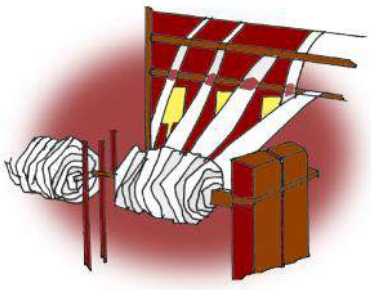


Fig.11.2d Rolling into yarn

Fig 11.2 Steps in the process of getting wool from sheep

Step - 5 - The fibres are dyed in various colour.

Step - 6 - The firbres are straightened, combed and rolled into yarn. The longer fibres are made into wool for sweaters and the shorter fibres are spun and woven into woollen cloth. This process is called rolling.

11.3 Silk -

Silk is a thin, shiny and strong fibre which is made of natural protein. Different types of clothes are made from these fibres. In olden times forest dwellers used to collect naturally formed silk and sell it in the market. This used to be their livelihood. Now-a-days silk production has developed into a major industry. There is a variety of silk moths and silk obtained from them have different texture, commonly they are of two types - mulberry silk and non - mulberry silk.

11.3.1 Mulberry silk -

This is the most common silk. A species of silk worm live on mulberry trees and eat its leaves. So silk produced by these moths are called mulberry silk. To obtain such silk mulberry trees are cultivated. This type of silk is produced in Karnataka, Andhra Pradesh, West Bengal, Tamil Nadu and Jammu & Kashmir, which equals to 90% production of silk in India.

11.3.2 Non-mulberry silk -

Certain species of silkworms live on other trees such as Sal, Arjun, Saja, and eat their leaves. Silk produced from these worms are called non mulberry silk. These silk are eri, mooga silk, tassar silk (kosa). Tasar silk is obtained from, Antheraea mylitta, Antheraea paphia, species of silk worm. Kosa silk is more popular because of its strength.

Kosa silk is very popular in Chhattisgarh. It has taken the form of industry at Korba, Janjgir-Champa, Jagdalpur and Raigarh districts of Chhattisgarh. So plantation of Sal, Arjun and Saja trees in these districts is stressed. Kosa silk of Janjgir-Champa has more strength and is of high quality. Hence it is also exported to other countries.

11.3.3 Life cycle of silk worm -

For obtaining silk, silk worms are reared, this is known as Sericulture. The life cycle of all species of silk worm is completed in four stages.

Egg → Larva → Pupa → Moth

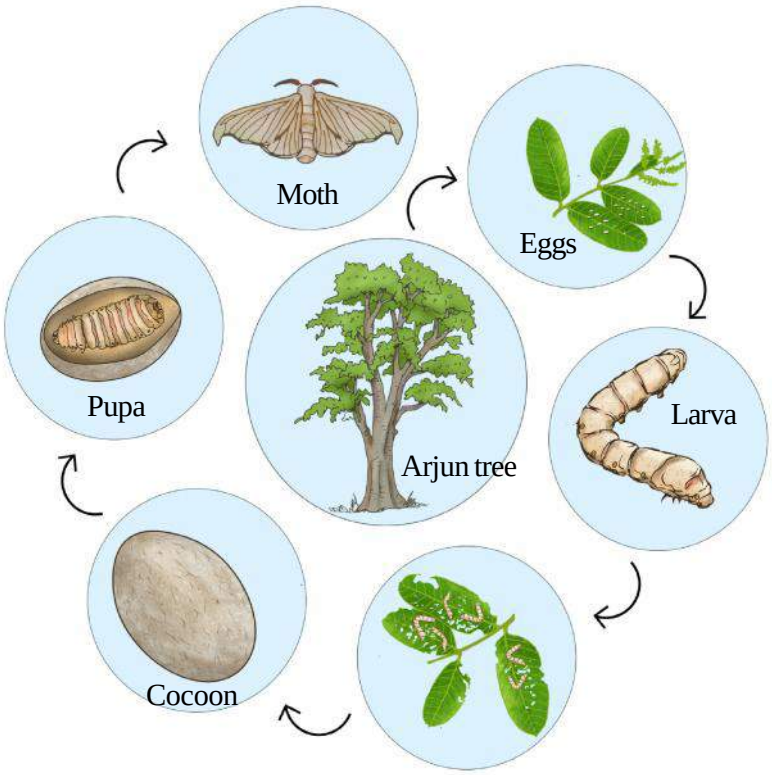


Fig 11.3 Life cycle of kosa silk moth

A female silk moth lays eggs, from which larvae hatch out. These larvae feed on the leaves and increase in number. These larvae secrete a special fluid from its moth which hardens on exposure to air and forms the silk fibre. The larva covers itself with these fibres completely and this stage is known as cocoon. Inside the cocoon the larva changes to pupa (fig.11.3). Silk fibres are obtained from the cocoon of the silk moths. These silk fibres have strength equal to steel wires.

11.3.4 From cocoon to silk cloth -

To obtain silk fibres the cocoons are kept under the sun, boiled or exposed to steam. By this process the silk fibres separate out. After taking out of the fibres, the process of spinning the silk yarn is done. This is known as reeling of the silk. Reeling is done in special machines, which unwind the thread of fibres of silk from the cocoon. Silk fibres are then spun into silk threads, which are woven into silk cloth by weavers.

Activity - 1

Materials required - Threads of artificial silk, pure silk and wool, matches.

Take threads of artificial silk and pure silk now burn them carefully. Do you find any difference in the smell on burning them? Now burn the woollen thread. Does it smell like artificial silk or pure silk and why?

Answer these

1. What is pashmina? From where do you get these fibres?
2. From which animals do we get wool?
3. Name the different types of silk?
4. What is a cocoon?

We have learnt

- Silk is obtained from silk worms and wool from sheep, goat and yak. These are known as animal fibres.
- Hair from the sheep is sheared, then scouring and sorting is done and then after drying it is drawn into wool.
- Silk, mulberry silk, tassar, mooga, eri are different types of silk. Silk is made up of proteins.
- A special fluid secreted from the mouth of the silk worm, hardens on exposure to air and forms the silk fibre.
- The process of spinning the silk yarn from the cocoon is known as reeling of the silk.
- Weavers weave silk cloth from these silk yarns.

Questions for practice

1. Identify the true and false statements -

(a) We get wool from rabbits.

(b) Fibres of silk are made of protein.

(c) The silk worm produces silk at its maturation stage.

(d) Pashmina shawls are made from the hair of camels.

2. Fill in the blanks -

(a) Silk is obtained from .....

(b) Making yarns from fibres is known as .....

(c) The fluid from the mouth of ..... hardens on exposure to air.

(d) Kosa Silk of .....district is imported to foreign countries.

3. Match the following -

1. Food of silk worm	Shearing
2. Sheep	Mulberry leaves
3. Cocoon	Wool producing animal
4. Cleaning of wool	Stage of larva covered with fibres

4. Answer the following questions -

(i) How is wool obtained from fibres ? Explain.

(ii) Write in brief -

(a) Sericulture (b) Cocoon (c) Reeling

(iii) How is silk fibre made by the silk worm?

(iv) What is pashmina?

(v) Draw the diagram of different stages in the life cycle of kosa silk worm.

(vi) Which type of silk is available in Chhattisgarh and in which districts?

Do these also

Collect some leaves having eggs of any butterfly or moth and place it in a cardboard box. Place some more leaves of the same plant in the box. Observe it every day and note the changes. Discuss about it in your class.

Chapter 12

REFLECTION OF LIGHT

12.1 Reflection of light

Whenever light strikes an object, it scatters in all directions and makes it possible for us to see the object. However, when parallel rays of light fall on a polished surface, they go in a definite direction.

To make a mirror, one side of the glass strip is silvered and to protect it, a dark colored layer, is painted over it. (fig. 12.1)

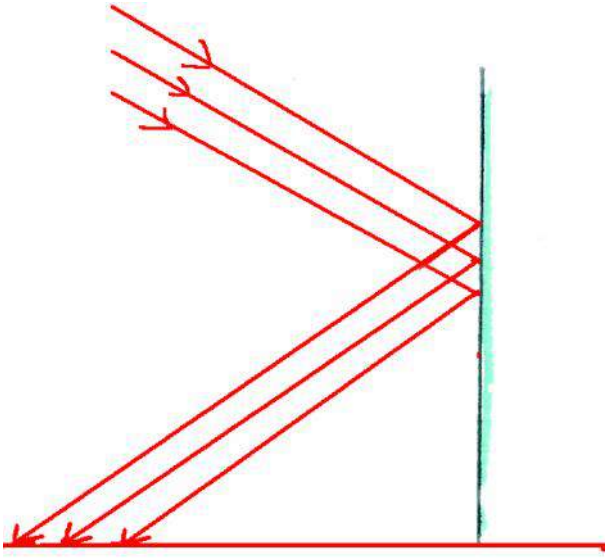


Fig.12.1 Mirror

Activity - 1

Materials required : - Two plane mirrors, one smooth black paper, one white paper, gum, and blade.

Wrap a piece of black paper on the mirror as shown in fig. 12.2 and paste it with gum. On the reflecting side of the mirror make three equidistant parallel slits on this paper with a blade. Put the white paper on a plane surface chosen at a place having both light and shadow. Keep the mirror in your hand in such a way that the slits are towards the sun. Arrange the reflected rays on the paper placed in the shadow. Put another plane mirror in the path of these rays. Ensure that the rays coming from the slits are falling on this mirror. Are the rays falling on this mirror going in the other direction? Observe the path of the incident and the reflected rays. Thus we can see that, when rays of light strike any shining surface they are diverted to a definite direction and this phenomena is called reflection of light (Fig. 12.2). Light rays A,B,C are called the incident light rays and A',B',C' are called the reflected light rays.

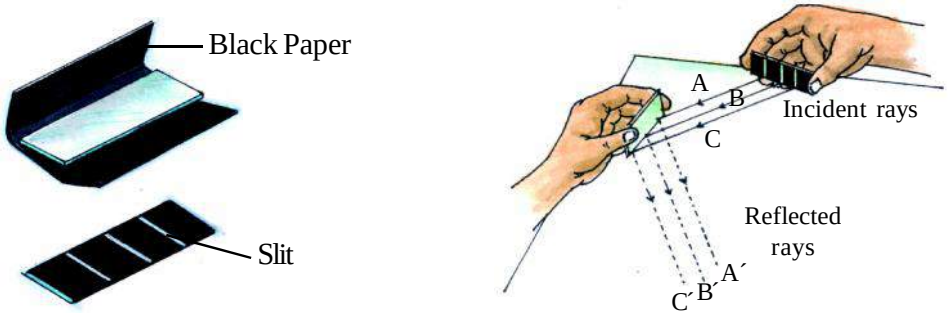


Fig.12.2

Now, let us discuss the conclusions drawn from activity-1.

12.2 Reflection by a Plane Mirror

In fig.12.3, MM' represents the position of the mirror. The incident ray of light is incident on point O, which is known as point of incidence. A perpendicular line 'ON' is drawn at the incident point is called the normal, ∠AON formed between the incident line AO and the normal is known as incident angle, while the angle formed by the reflected line OA´ with the normal is known as angle of reflection ∠A´ON.

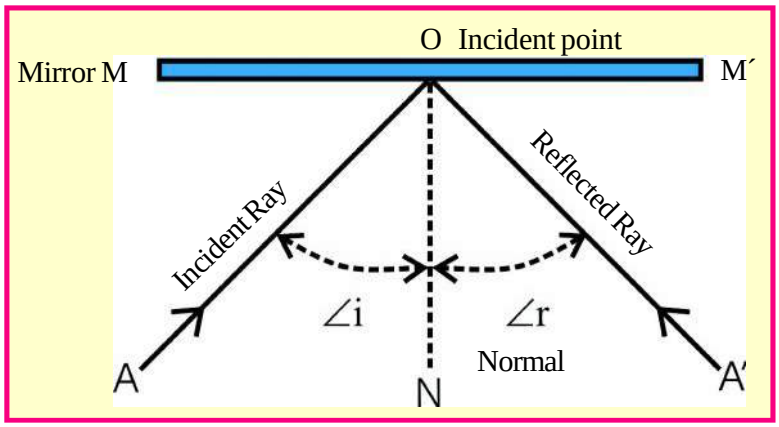


Fig.-12.3. Formation of angle of incidence and angle of reflection by the mirror

Activity - 2

Materials required :- Plane mirror, clip, four drawing pins, four all pins, white paper, scale, protractor, drawing board, and pencil.

1. Fix the white paper on the drawing board with the help of drawing pins.
2. Draw a straight line MM´ on the paper as shown in figure 12.4.
3. Mark the centre of MM´ as point O.
4. Draw a line 'ON' perpendicular to the line MM' at the point O.
5. Make an angle ∠PON = 30° with the help of protractor at point O.
6. Fix two pins at point P and Q on line PO at a distance of 3cm from each other, as shown in figure 12.4.

7. Now fix the plane mirror with the help of clips on the white paper in such a way that the shining surface of the mirror is aligned along the line MM'.

8. See the images of pins on the right side of PO in the mirror.

9. Place two pins in line with the images according to the figure.

10. Now remove these pins. Make small circles around the points and mark these points as R and S. Join R, S and O (Fig. 12.4).

11. Measure angle ∠SON with the help of protractor.

Is the measured angle equal to ∠PON? Are the light ray A incident on O, reflected light ray A´ and normal at the point O in the same plane or not?

Try this experiment with different values for ∠PON say 35°, 40°, 45°. Measure ∠SON, and complete the table 12.1.

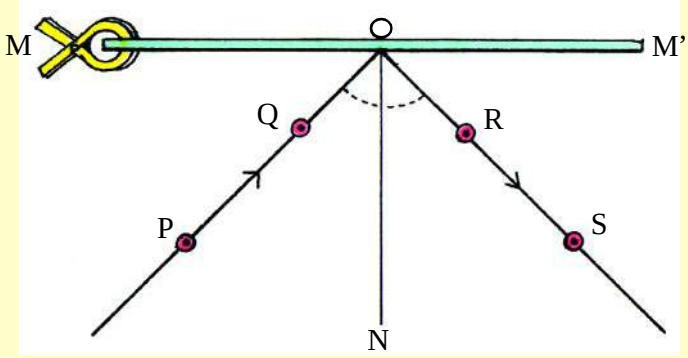


Fig.12.4 Verification of Laws of Reflection

Table - 12.1

S.No.	Angle of Incidence	Angle of Reflection	Difference
1.	30°	30°	0°
2.	35°	----------	----------
3.	40°	----------	----------
4.	45°	----------	----------

Think about the conclusions of activity-2, these are the laws of reflection.

Laws of Reflection

1. The incident ray, the normal at the point of incidence and the reflected rays are in the same plane.

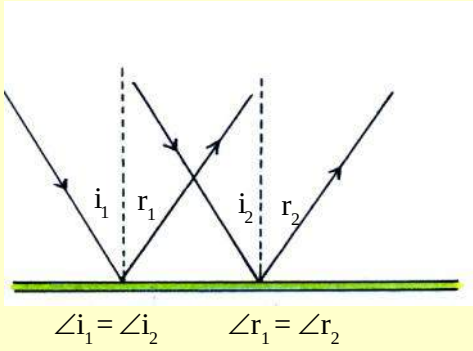
2. The angle of incidence and the angle of reflection are equal.

By using plane mirror, we can also see those objects, which are not in front of our eyes. Let us see how this is possible.

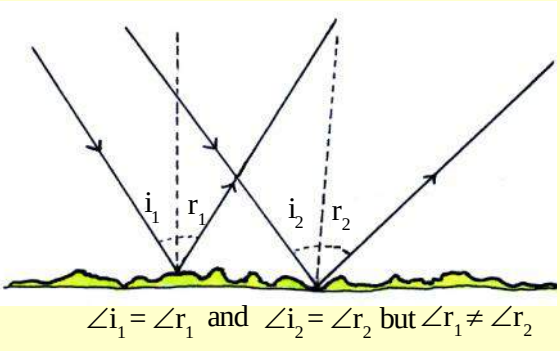
12.3 Regular and Diffused Reflection

When light rays fall on polished plane surface, they change their direction in a well defined manner i.e., reflected rays are also parallel and this phenomenon is known as regular reflection and the image thus formed is clear and sharp (fig. 12.5).

When parallel rays fall on an unpolished or uneven surfaces, they too get reflected but the reflected rays are not parallel i.e., are not in a well defined direction. They scatter in all directions. This is called diffused reflection or scattered reflection and gives rise to deformed and unclear image. (fig.12.6).



(a) Regular Reflection
Fig. 12.5



(b) Diffused Reflection
Fig. 12.6

12.4 Image Formed by Plane Mirrors

We see our image in the plane mirror everyday. Have you ever thought how and where these images are formed! In figure 12.7, an object A is placed in front of the plane mirror. Rays AN and AN' coming from object A get reflected by the plane mirror in NR and N´R´ directions.

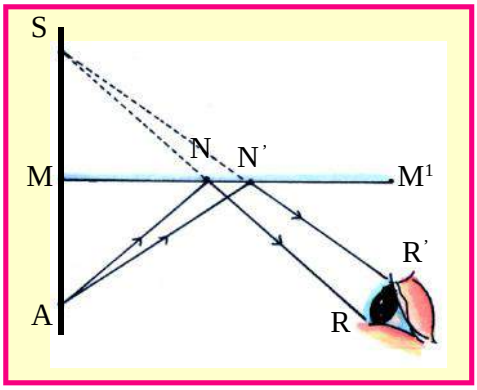


Fig.12.7

When reflected rays enter our eyes, it seems that they are coming from a point S behind the mirror. Thus appears to be the S is the image of object A. Since the light rays are not actually coming from point S but only appear to be coming from S therefore, S is called the virtual image. Virtual image cannot be obtained on the screen because in reality no light rays meet at that place, while real image can be obtained on the screen because it really has light rays converging at that place.

Now it is clear that -

1. Size of the image will be the same as that of the object.
2. The image is formed as far behind the mirror as the object is placed in front of.

12.5 Lateral Inversion

Stand in front of a mirror; you will see your image. Raise your hand, which hand does your image raise? Image formed by the word 'KAMAL' is shown in fig.12.8. This is lateral inversion.

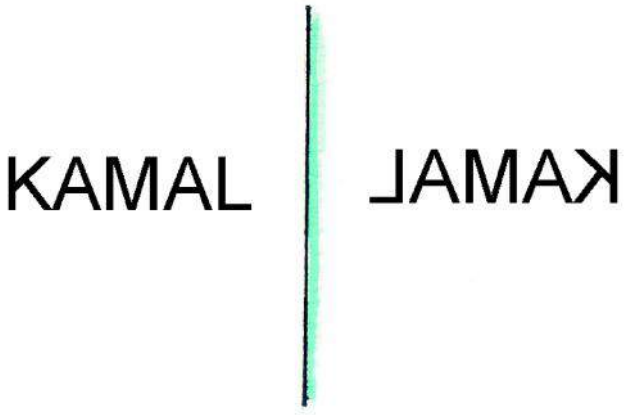


Fig-12.8 Lateral Inversion

In lateral inversion, the left side of the object appears on the right and the right side appears on the left as happens in the image seen in the plane mirror.

Answer these

1. What is the difference between regular and diffused reflection?
2. Write down the laws of reflection.
3. What are the features of images formed by the plane mirror?

12.6 Spherical Mirrors

Try to see your face in a large shining spoon. What do you observe? You will see your own image but bigger in size. If we reverse the side of the spoon then the image becomes smaller. Here the spoon works like a mirror with a curved surface. A spherical mirror is actually a part of a hollow glass sphere (fig 12.9). It has two surfaces or faces. The inner face is called concave and outer face is called the convex.

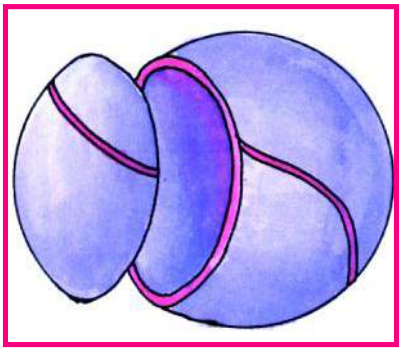
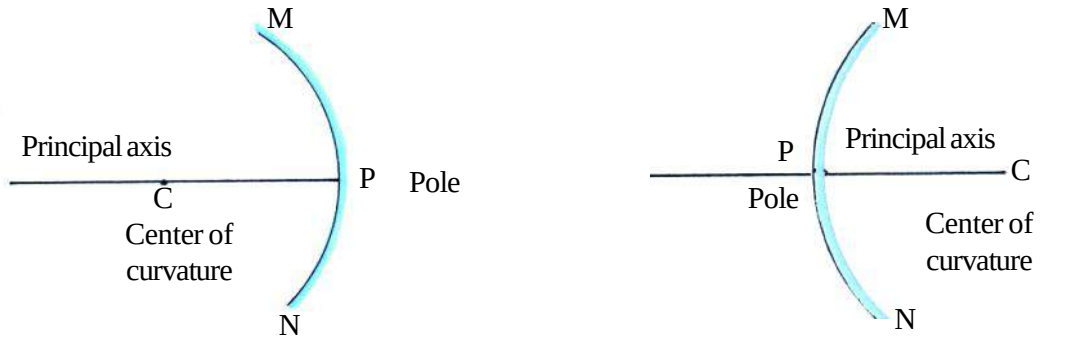


Fig.12.9 Convex Mirror

If the inner side of the spherical mirror is silvered and reflecting then it is called a 'concave mirror' and if the outer side is silvered and reflecting then it is called a 'convex mirror'.

Fig 12.10 shows a concave mirror MN. The central point P is called the pole of the mirror. The centre of the sphere, of which the given spherical mirror is a part is called its centre of curvature, let us call it C. The centre of curvature of a concave mirror is in front of the mirror, whereas that of a convex mirror is behind the mirror. The straight line joining the points C and P is called the principal axis of the mirror.



(a) Concave Mirror (b) Convex Mirror

Fig12.10

Activity - 3

Take a concave mirror and point it towards the sun. The mirror will reflect the sunlight. Try to direct the light reflected by the mirror on a sheet of paper. Move the sheet of paper until you find that the reflected light appears as a bright point on it. Adjust the distance on the paper so that the point is sharpest. If you hold the mirror and the sheet steady for a few minutes the paper would begin to burn. This bright point is infact the image of the sun on the sheet of paper, this point is called as the focus of the mirror (fig 12.11). This image is real since it is formed on the screen (paper).

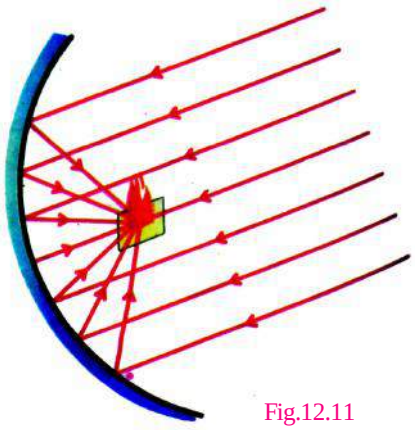


Fig.12.11

12.6.1 Laws of image formation from spherical mirror

Following laws are used to find the position of the image formed by the spherical mirror-

Law 1 :- Any ray parallel to the principal axis, after reflection passes through the focus (fig. 12.12)

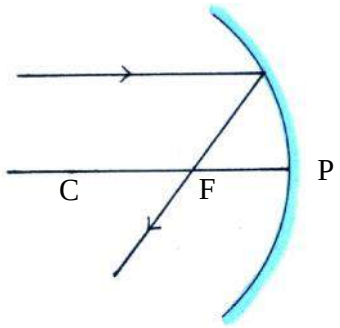


Fig. 12.12

Law 2.: Any ray passing through the focus becomes parallel to the principal axis after reflection (fig. 12.13).

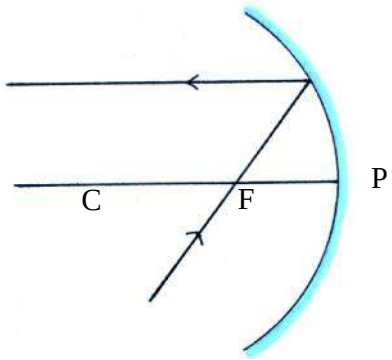


Fig 12.13

Law 3.: Any ray passing through the centre of the curvature is reflected back along the same path (fig. 12.13).

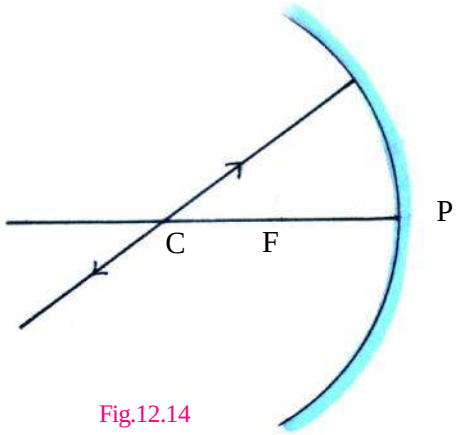


Fig.12.14

Activity - 4

Materials required :- Concave mirror, object (say candle), gum, two wooden blocks, white paper, matchbox, four pins.

Fix the concave mirror on a wooden block with the help of two pins as shown in fig.12.15. Paste a white paper on the other wooden block, so that it works like a screen. Keep a lighted candle on the block with white paper as shown in figure 12.15. Move the blocks carrying the mirror and candle forward and backward in such a way that the image of the candle is adjusted at the brightest. This image is inverted and is of the size of candle (object). In this position, the candle and its image are at the centre of curvature of the mirror. Measure its distance from the mirror; this distance is equal to the radius of curvature. Focal distance is half of the radius of the curvature. Now you also know the focal length.

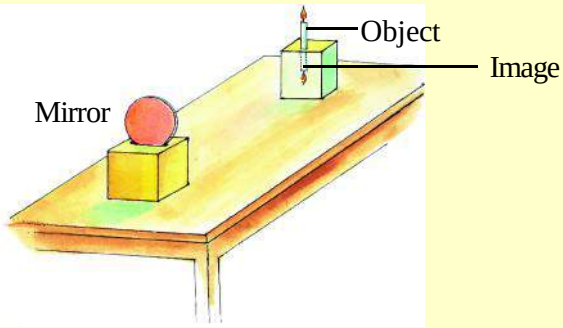


Fig.12.15

12.6.2 Image Formed By a Concave Mirror

Activity - 5

Materials required :- Concave Mirror, Clip, Object (candle), gum, wooden block, white paper, match box.

In the above experiment, put the candle on a block in front of the mirror and on the other block make a screen of the wooden box wrapped in white paper. Put the object in front of the mirror in different positions, move the screen in front of the mirror in such a way that the image formed by the mirror is on the screen. Write in the table: - the position, nature and size of the images of the object formed in different positions. And check these with the following figures (12.16 a, b, and c, d).

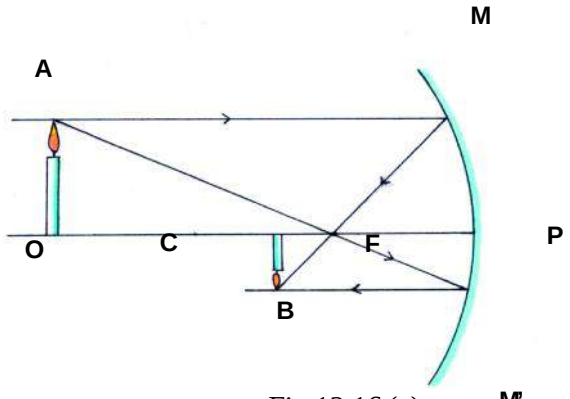


Fig.12.16 (a)

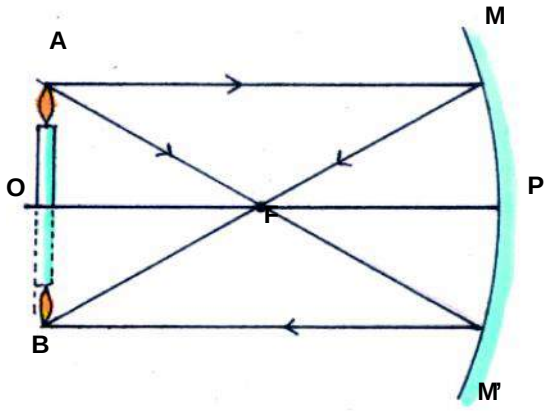


Fig.12.16 (b)

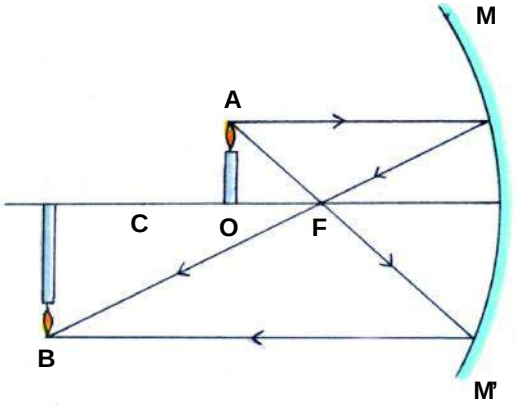


Fig.12.16 (c)

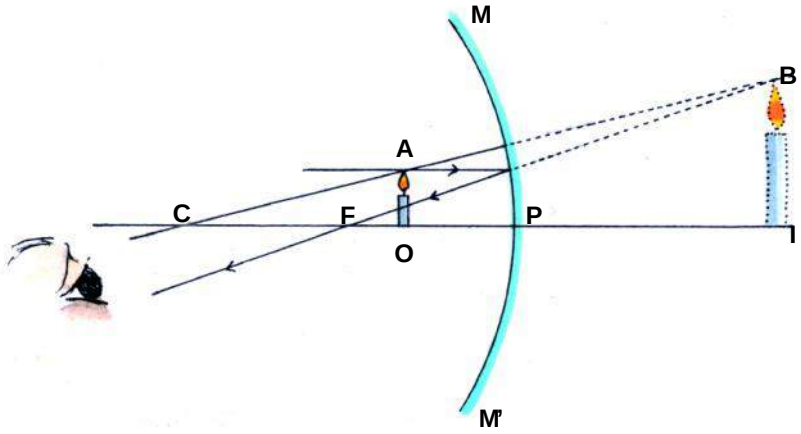


Fig.12.16 (d)

Table - 12.2

S.No	Position of The Object	Position Of the Image	Nature Of the Image	Size of the Image
1.	Away from C (Fig 12.16a)	----------	----------	----------
2.	At C (Fig 12.16b)	At C	Real and Inverted	Equal to the object
3.	In between C & F (Fig 12.16c)	---------	----------	---------
4.	In between F & P (Fig 12.16d)	Formed behind the mirror & can not be obtained on the screen. Therefore see it in the mirror	Virtual	Magnified

12.6.3. Image formed by the Convex Mirror

Convex mirrors always form an image that is smaller, upright and virtual (fig. 12.17).

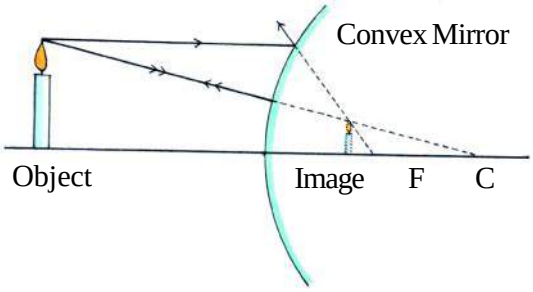


Fig. 12.17

12.6.4. Use of Spherical Mirrors

Although a convex mirror forms a smaller image than the object, it forms image of a larger area. That is why convex mirrors are used in cycles and automobiles to enable the driver to see the vehicles behind them. Concave mirrors are used in torches and search lights to throw the light to a long distance. They are also used by dentists to diagnose by looking at the enlarged image of the teeth.

12.7 Images formed by lenses

You might have seen a magnifying glass. It is used to read very small print. (fig.12.18). You might have also used it to observe the body parts of a cockroach or an earthworm.

Fig. 12.18 Magnifying glass

Lenses are widely used in spectacles, telescopes and microscopes. A transparent medium covered by two surfaces is called a lens. Those lenses which feel thicker in the middle than at the edges are convex lenses (fig 12.19 a) and those which feel thinner in the middle than at the edges are concave lenses (fig. 12.19 b). Lenses are transparent and light can pass through them. Generally a convex lens converges (bends inward) the light falling on it. Therefore, it is called a converging lens. On the other hand, a concave lens diverges (bends outward) the light and is called a diverging lens.

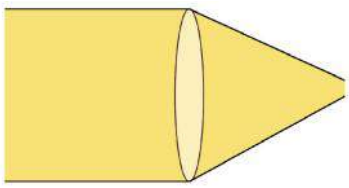
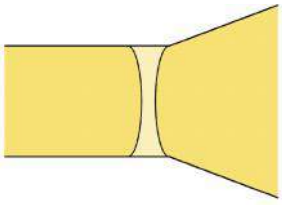


Fig. 12.19 (a) Convex lens



(b) Concave lens

We have seen in the case of mirrors that for different positions of the object the nature and size of the image change. Is it true for lenses also?

Activity - 6

Materials required: - A Convex lens, stand, candle, paper and match box.

Take a convex lens and fix it on a stand. Place it on a table. Place a lighted candle at a distance of about 50 cm from the lens.(fig.12.20). Try to obtain the image of the candle on a paper screen placed on the other side of the lens. You may have to move the screen towords or away from the lens to get a sharp image of the flame. What kind of image did you get? It is real or virtual?

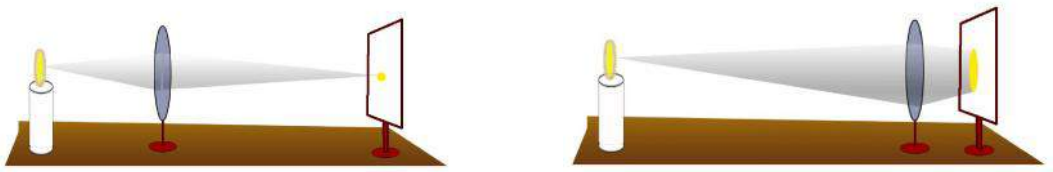


Fig. 12.20 Image formed by a convex lens for the candle flame placed at different distance from it.

Now vary the distance of the candle from the lens. Try to obtain the image of the candle flame every time on the paper screen by moving it. Record your observation and tabulate it. Did you get in any position of the object an image which was erect and magnified? Could this image be obtained on a screen? Is the image real or virtual? In a similar manner study the images formed by a concave lens. You will find that the image formed by a concave lens is always virtual, erect and smaller in size than the object.

12.8 Sunlight-White or Coloured?

Have you ever seen a rainbow in the sky? You might have noticed that is appears usually after the rain, when the sun is low in the sky. The rainbow is seen as a large arc in the sky with many colours (fig.12.21).

Fig. 12.21 A Rainbow

Generally there are seven colours in a rainbow. They are- violet,indigo,blue, green, yellow, orange, red. You might have also seen that when you blow soap bubbles they appear colourful. Similarly, when light is reflected from the surface of a compact disk (CD), we may see many colours. On the basis of these experiences, we could say that sunlight is a mixture of different colours.

Answer these

1. What do you understand by the centre of curvature?
2. Draw a labelled diagram showing the path of the ray reflected from a concave mirror when the incident ray is parallel to the principal axes.
3. State two uses of concave mirrors.
4. Which type of lens always forms a virtual image?

We have learnt

- When a light ray falls on a polished surface, they change their direction in a well defined manner. This is called reflection of light.
- There are two laws of reflection :-
  - (i) The incident ray, the normal at the point of incidence and the reflected rays are in the same plane,
  - (ii) The angle of incidence and the angle of reflection are equal.
- In a plane mirror, the reflected rays appear to come from some object kept behind the mirror. This is called a virtual image of the object.
- Spherical mirrors are of two types: concave and convex.
- The centre of the sphere of which the spherical mirror is a part, is called the centre of curvature of the mirror.
- The point through which the incident rays parallel to the principal axis, pass through or appear to pass through after reflection from the mirror, is called focus of the spherical mirror.
- When the reflected rays actually meet in front of the mirror, they form a real image. A real image can be obtained on a screen.
- Any incident ray that is parallel to the principal axis, after reflection passes through or appears to pass through the focus.

- Any ray passing through the focus or appearing to pass through the focus becomes parallel to the principal axis after reflection.
- Any ray passing through or appearing to pass through the centre of curvature of a concave mirror is reflected back along the same path.
- Convex mirror always forms a smaller and virtual image.
- Image formed by a convex lens can be real or virtual.
- A concave lens always forms erect, virtual and smaller image than the object.
- White light is composed of seven colours.

Questions for practice

1. Choose the correct answer-

1. Angle of reflection is the -

(i) angle between the incident ray and the normal drawn on the surface of mirror

(ii) angle between the reflected ray and the normal drawn on the surface of mirror

(iii) angle between the reflected ray and surface of the mirror

(iv) angle between the incident ray and surface of the mirror

2. Angle of incidence for plane mirror is-

(i) equal to the angle of reflection

(ii) less than the angle of reflection

(iii) more than the angle of reflection

(iv) none of these

3. Nature of the image formed by the plane mirror-

(i) virtual and straight

(ii) equal to the object

(iii) image formed by lateral inversion

(iv) none of these

4. Focal distance of the spherical mirror is-

(i) equal to the radius of curvature

(ii) half of the radius of curvature

(iii) one-fourth of the radius of curvature

(iv) none of these

5. When you drive your vehicle, then to see the objects behind us we use-

(i) concave mirror

(ii) spherical mirror

(iii) convex mirror

(iv) none of these

(2) Match the following:-

Regular reflection	Inverted object
Diffused reflection	Straight image
Real image	Shining surface
Virtual image	Image of same size
Plane mirror	Rough surface

(3) Answer the following questions

1. What do you understand by lateral inversion?
2. What is reflection?
3. How will you find the centre of curvature of a concave mirror?
4. Write two uses of a convex mirror.
5. Focal distance of a concave mirror is 20 cm. Find its radius of curvature.
6. Find the nature, position and size of the images formed by a concave mirror, when-
   (i) object is at the centre of curvature
   (ii) object is in between the focus and the centre of curvature
7. Which mirror will you use if you want of see a magnified image of an object ?
8. You have a concave mirror with 20 cm of radius of curvature. To find a real and equal image of an object, where will you place it.
9. Write two differences between convex and concave lens.

Do these also

1. Make your kaleidoscope

Take three identical plane mirror strips. Join them with rubber bands to make a triangular tube. Remember that the silvered surface of the mirrors should be facing inward. Cover the mouth of the tube with a translucent piece of paper. Tie the paper to the tube with a rubber band. Put a few pieces of coloured glasses (like broken bangles) inside the tube. Lift the tube up so that light can enter it from below. Look inside through the open mouth. What do you see? Can you say why this happens? Shake the Kaleidescope and look again. You can see many beautiful shapes in it.

2. Newton's colour disc :-

Materials required - Piece of cardboard, paints of seven colours, pencil.

Take a circular cardboard disc of about 10 cm diameter. Divide this disc into seven segments. Paint the seven rainbow colours on these segments as shown in fig.12.22 a. You can also paste, coloured papers on these segments. Make a small hole at the centre of the disc. Fix the disc loosely on the tip of a refill of a ball pen. Ensure that the disc rotates freely. Rotate the disc in the daylight. When the disc is rotated fast, the colours get mixed together and the disc appears to be whitish (Fig.12.22 (b)). Such a disc is popularly known as Newton's disc. This can also be made by fixing a marble on a C.D. This activity also concludes that white light is made up of different colours.

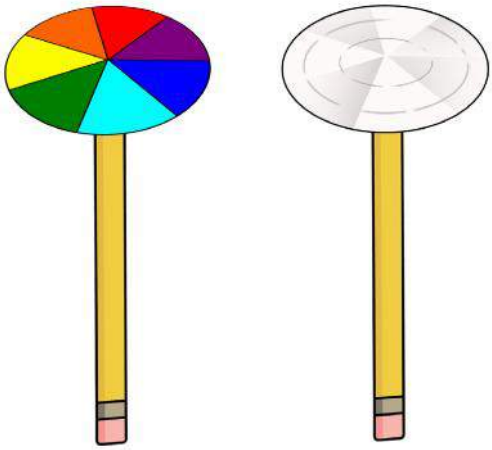


Fig 12.22 (a) A disc with seven colours. Fig 12.22 (b) It appears white on rotating.

Chapter 13

TRANSPORTATION IN LIVING ORGANISMS

13.1 Absorption of Water and Minerals and Transportation of Food in Plants

Water and minerals are absorbed from the soil by the roots of plants. These are transported to different parts of the plant through the stem. You know that in our towns and villages, water is transported through pipelines. Do you think plants have similar pipelines by which, the water absorbed by the roots, is transported to the leaves? You have read about xylem and phloem in plants. Let us see how plants absorb water and how water, minerals and food formed in leaves are transported.

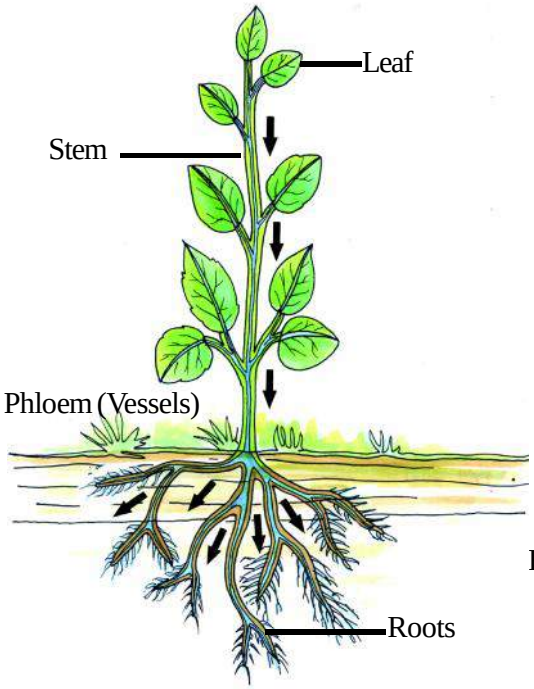


Fig.13.1. Mineral Transportation in Plants

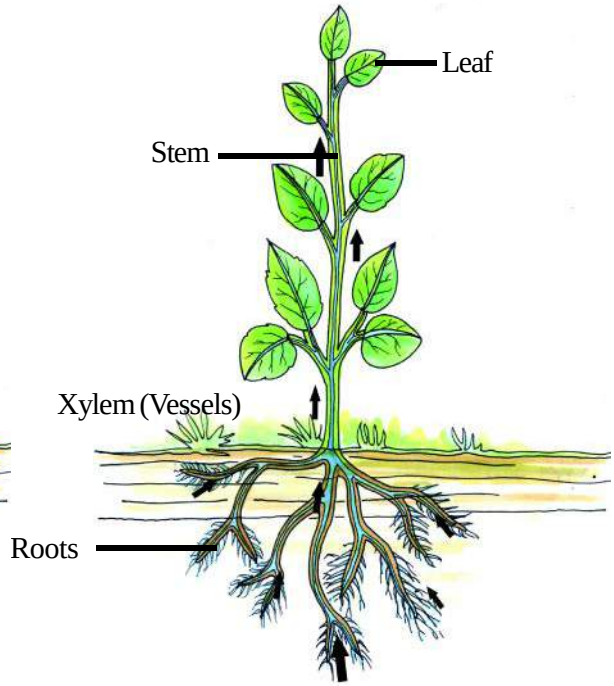


Fig.13.1a. Water Transportation in Plants

Activity - 1

Materials required ::- Glass, saffron colour or eosin or red ink, soft stem of *balsam or chiraiya*, sharp blade, slide, microscope.

Mix some drops of safranin or eosin or red ink in the glass of water. Place the branch of the plant, which has a soft stem like *balsam or chiraiya* in the coloured water. (fig.13.2) After approximately an hour, cut thin sections of the stem, put the thinnest section on the slide, and observe it through a microscope. Which part of the section appears to be red? Compare it with fig.6.4. and identify it.

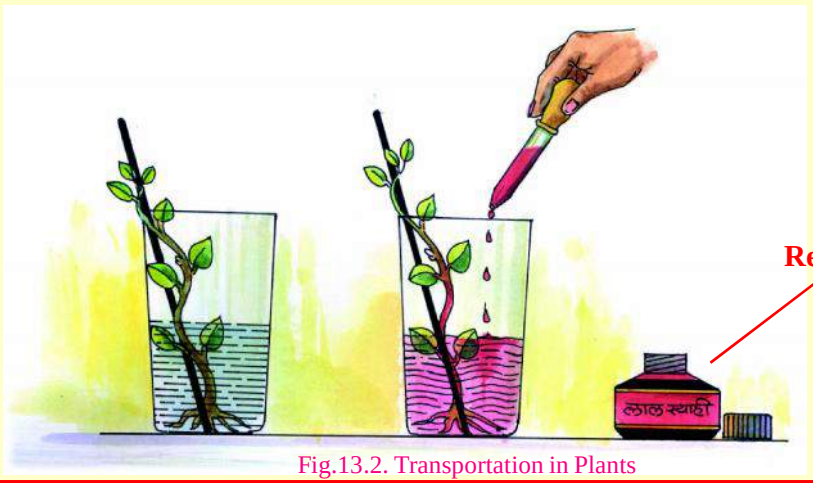


Fig.13.2. Transportation in Plants

Take a leaf from the branch, which had been kept in coloured water, cut thin sections of it and compare it with the coloured portion of the section of the stem. You will see that the coloured part seen in the section of the stem is xylem. Try to locate the position of xylem with the help of fig 6.4.

Activity - 2

Required Materials : - Take Two branches of a plant with hard stem like China rose or peepal, sharp blade or knife, glass bottle.

Cut out the bark of branch 'a' in the form of a ring so that only the inner tissue is left as shown in fig.13.3. With the help of a needle or a pin, destroy the inner tissues of the branch 'b' so that only the bark is left. Now place the two branches in two separate bottles full of coloured water. Observe the branches for 24 hours every 2-3 hours and answer the following questions:

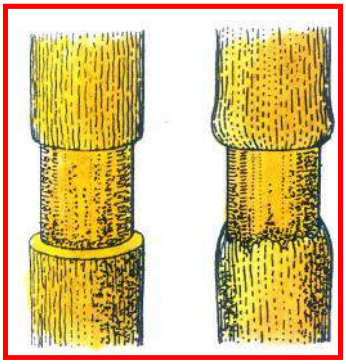
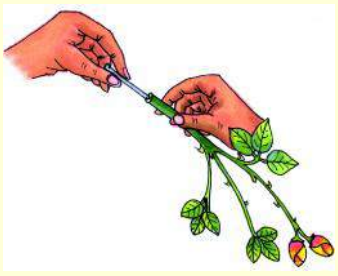


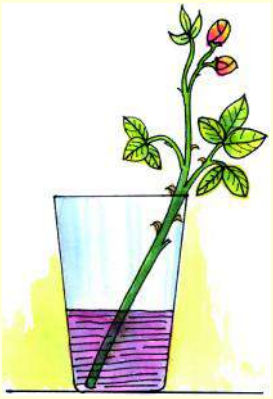
Fig.13.3 Branch 'a'

1. What difference can be seen between the leaves of the two branches?



Branch 'b'

Branch 'a'



Branch 'b'

Fig. 13.3

2. Cut the tops of both the branches and observe the differences between their tissues.

3. Observe the differences between the two branches on the next day.

4. What could be the reason for the difference?

As you can see on the basis of fig.13.3, the phloem lies in the outer region i.e., in the bark, whereas the xylem lies in the inner, hard region. When we damage the bark of the branch 'a' its phloem too gets damaged while the xylem, which is inside, is left intact. Similarly, in branch 'b' phloem remains undamaged in the bark and only the xylem is damaged. This is why the leaves of branch 'a' are fresh on the next day while leaves of branch 'b' are wilted.

Activity - 3

Materials required :- Cut the stems of some weeds, as described in activity 2, study them regularly for 15 days and note the changes.

You might have seen or heard that when the leaves of wheat or rice crops start turning yellow, farmers apply fertilizer and water to save the crops because minerals present in the fertilizer reach to the different parts of the plant with the water and the leaves start making food.

We eat potatoes, carrots, radishes, turnips etc. All these are actually formed from the food materials, manufactured in the leaves. These food materials are transported through the phloem and get stored in the under ground parts of the plant. Now, it must have become clear to you that vascular tissues involved in transportation are in fact the pipelines of the plants. Water travels through the xylem and the food materials are transported to different parts of the plant through the phloem.

Answer these

1. Why is it necessary to water the plants after applying fertilizers to the fields and gardens?

2 In the plants of potatoes and sweet potatoes-

   a. In which part of the plant is the food prepared?

   b. Where is the food stored?

   c. Which part transports the food?

3. What is the importance of transportation in plants?

13.2 Transportation in Animals

All living organisms need energy for their life activities. They get this from food. Food digested by the digestive organs is circulated to all parts of the body. The waste materials are transported to the excretory organs. In the same way, all organs of the body require oxygen for respiration. Carbon dioxide produced in respiration is harmful for the body, so it should be removed from the body. This means that transportation of different materials keeps taking place in the body of living organism in some way or the other. Let us see whether this transportation takes place is the same way for all living organisms or different methods are adopted for this.

You know that some living organism eg. Amoeba, paramecium etc. are so small that they can be only seen under a microscope . Since most of the unicellular micro-organism live in water therefore, different materials are ingested and excreted from their body by diffusion.

13.2.1. Blood Circulation in Human Being

In human beings, blood transports different materials. Let us see what blood is and how it reaches to the different parts of the body.

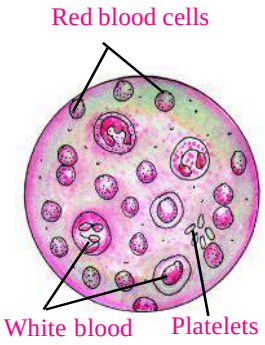


Fig.13.3a. Connective Tissue (Blood)

We know that blood is a connective tissue. It is not merely a fluid. If we spread a drop of blood on a slide and observe it under a microscope, we see many particles in it. Actually these are cells, which float in the plasma. Plasma is the liquid part of the blood that contains 92% of water; remaining 8% is made up of food materials, waste materials and minerals. Which are transported by the blood. Blood cells are of mainly of three types (diagram 13.3a) :-

1. **Red blood corpuscles**: - These cells are red in color, small in size and are very large in number; they impart the red colour to the bood. The red colour of the red blood cells is due to the presence of haemoglobin. If the number of red blood cells in the body is high then it can absorb more oxygen.
2. **White blood corpuscles**: - These cells are colorless, big in size and less in number. If bacteria virus or any other external material enter the body, the white blood cells destroy them. Thus they protect our body.
3. **Platelets**: - You would have seen that when we are injured, blood starts to flow. If the blood drop falls on the floor then it clots after some time. In the same way blood clots on the wound. The reason behind the clotting of blood is the presence of platelets. These are also a type of cells and are less in numbers as compared to red blood cells.

Sometimes, due to an accident or illness, there is a deficiency of blood in the body on such occasions blood is transfused from the body of a healthy person to protect the life of the patient. This is called blood donation or blood transfusion. The person, who donates blood is called donor and who accepts blood is called recepient. But the donation of blood is not easy. The donor and the recepient must have the same blood group.

In the previous classes, you have studied about heart, veins and arteries. Heart is the main part of the transportation (circulation) system. Oxygenated blood flows out of heart through the arteries. As the branches of arteries spread in tissues they becomes narrower and thinner, and are known as blood capillaries. (Fig.-13.4).

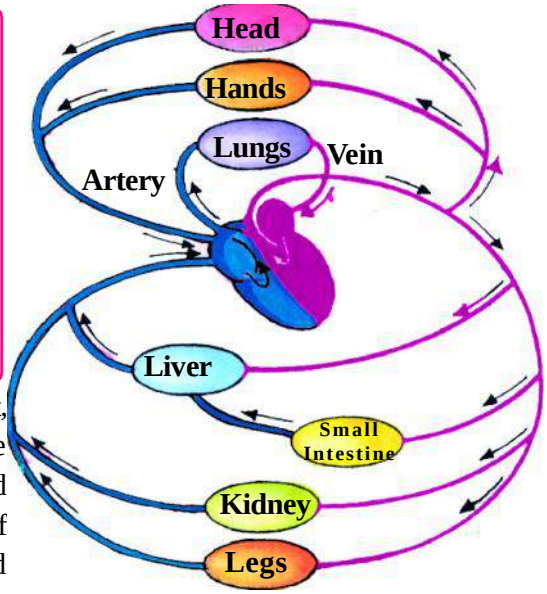


Fig.13.4 Diagram of blood transportation in human being

These blood capillaries, pass between cells and when blood comes in contact with cells. This leads to an exchange of materials. These blood capillaries join together to form thicker pipes, which are known as veins. Veins transport de-oxygenated blood from different parts of the body to the heart.

There are different ways of transportation in multi-cellular and non-chordate animals. Generally, these animals do not have heart and blood vessels like humans. So the blood in these animals is directly in contact with cells. This is called open blood circulatory system. In all chordate animals blood is pumped by the heart and flows in vessels. This is called closed circulatory system.

Let us see, the difference between veins and arteries:-

Difference between Veins and Arteries

Arteries		Veins	
1.	Walls of arteries are thick.	1.	Wall of veins are thin.
2.	These are narrow from inside.	2.	These are wider.
3.	Due to thick walls, they do not collapse even if blood is not present.	3.	Due to thin walls, they collapse when empty.
4.	The blood flows fast and in a jerky manner.	4.	Blood flow is slow and constant.

When the doctor holds your hand to check the pulse, he/she actually counts the number of jerks, caused by the flow of blood in the arteries. You can also feel them. You might have also heard about blood pressure. This is the pressure of blood in arteries and is measured by a special device. High or low blood pressure can be dangerous. Tension, presence of excess fats and lack of physical work and proper exercise can result in change in blood pressure.

Let us perform an activity to study the flow of blood through arteries.

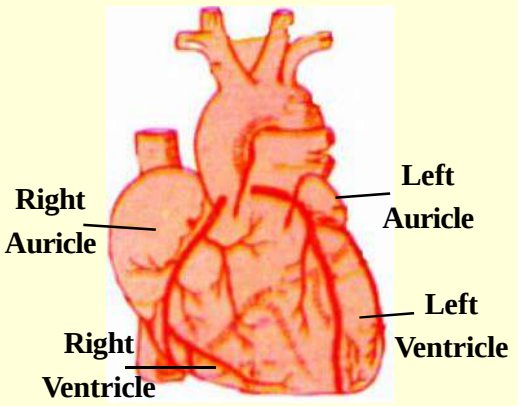
Activity - 4

Place the middle and index finger of your right hand on the inner side of your left wrist (fig.13.5). Can you feel same throbbing movements? This throbbing is called the pulse and it is due to the blood flowing in the arteries. Count the number of pulse beats in one minute. The number of beats per minute is called the pulse rate. A resting person usually has a pulse rate between 72 and 80 beats per minute. Find other places in your body where you can feel the pulse.

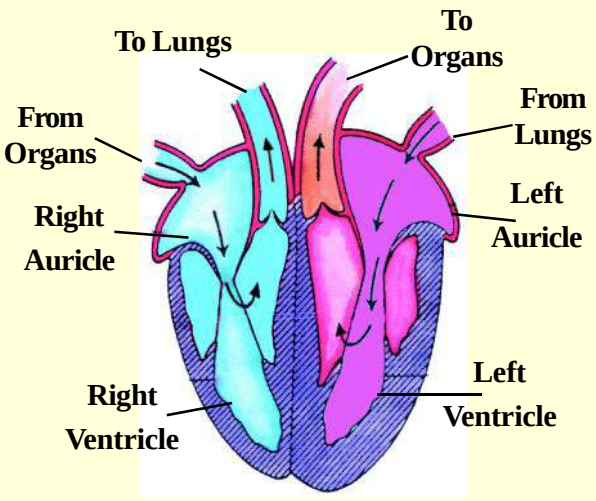
Fig. 13.5 Pulse in the wrist.

Record your own pulse beats per minute and four of your classmates. Compare the values you obtained, and discuss in your class

You know that heart is towards the left side of the chest cavity. The size of heart is nearly equal to the closed first. A double-layered membrane covers the heart. In between these two membranes, there is a liquid, which protects the heart from shock or accident.



(a) External Structure



(b) Internal Structure

Fig.-13.6. The Human Heart

The heart is made up of cardiac muscles and works continuously. It is divided into two parts by a muscular septum. Each part is again divided into two parts; the upper two parts are known as auricle/ atria (singular-atrium) and the lower ones as ventricles (Fig.13.6).

Oxygenated blood coming from lungs is collected in the left ventricle and is circulated to all body parts through arteries. Deoxygenated blood from the whole body is collected in the atrium through veins and is again transported to the lungs for oxygenation.

Answer these

1. How many types of blood corpuscles are there? Write their functions.
2. What do you mean by open and closed blood circulation?
3. What do you mean by blood donation?
4. What are the differences between veins and arteries ?
5. What do you understand by pulse rate?

We have learnt

- In plants the transportation of water and minerals takes place through vascular tissues.
- Water and minerals absorbed by the roots of plants, are transported to different parts of the plant through xylem.
- Food manufactured by the leaves, is transported to different parts of the plant through phloem.
- Transportation of materials in unicellular organisms takes place by diffusion.
- Multi-cellular, non-chordate animals have open blood circulation.
- All chordate animals have closed blood circulation system.

- Human heart is divided into four chambers with the help of muscular septum. Upper two chambers are called atria and lower two chambers are called ventricles.
- Heart is made of cardiac muscles, which work continuously.
- If there is deficiency of blood in the body due to some accident or illness, then blood is transferred from some other person. This is called blood transfusion.
- Pressure of blood in arteries is called blood pressure.

Questions for practice

1. Choose the correct answer-

1. Transportation in unicellular animals is

(a) by closed transportation (b) by absorption

(c) by diffusion (d) by distillation

2. Transportation in human beings is

(a) through water (b) through muscles

(c) through nerves (d) through blood

3. Main part of blood transportation system in human beings is

(a) heart (b) Capillaries

(c) Arteries (d) Veins

4. In non-chordate animals, circulation of blood is

(a) closed circulation (b) open circulation

(c) Both open and closed circulations (d) none of these

5. The meaning of deficiency of blood in the body of a human being is-

(a) deficiency of blood in the body

(b) deficiency of plasma in blood

(c) deficiency of white blood cells in blood

(d) deficiency of haemoglobin in red blood cells

2. Fill in the blanks:-

1. When we cut the bark of a stem then with it ……..is also destroyed along with it.
2. Blood is a ……tissue.
3. …….help in clotting of blood.
4. Oxygenated blood is circulated to all body parts through ……..
5. ..... blood is brought to the heart from all body parts through veins.

3. Write the answers to the following questions:-

1. What is the role of lungs in the blood circulatory system?
2. What will happen if the capacity of the cardiac muscles to contract and relax gets weakened?

3. What will be the effect of the following situations on the growth of the plant? If

   1. Xylem of plant A is damaged.

   2. Bark of plant B is infected.

   3. Appropriate fertilizer and water are provided to plant C.

4. Appropriate fertilizer and water are sprinkled only over the leaves of plant D.

4. Correct the following statements :-

1. Chordate animals have open blood circulation.
2. Blood donation is required for saving the life of a healthy man.
3. Pressure of blood in veins is called blood pressure.
4. Capillaries join together to make small vessels.

Do these also

Visit, along with your parents or teachers, the blood donation camps organized in your school, locality or in different health centers. Collect information from newspapers, magazines etc. about blood donation. Paste this in your scrapbook, and discuss it in your class.

Chapter 14

EXCRETION IN LIVING ORGANISMS

You know that as a result of metabolic activities in living systems, many useful as well as waste products are formed in the body. The waste products are toxic for the body if they remain inside it for a long time. Therefore, it is necessary to remove them from the body. The process of removal of waste products from the body is called excretion.

14.1 Excretion in animals

Make a list of substances that our body naturally removes. Urine is one of the important excretory substances in this list. There are special organs in our body which help in removing urine; these are collectively called the urinary system (Fig.14.1). Let us see which organs make up this system.

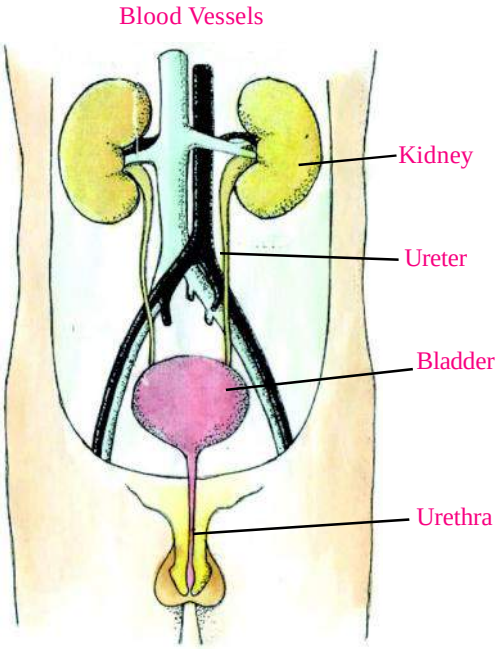


Fig 14.1 Human excretory system

1. **A pair of kidneys-**

   Kidneys are situated just below the diaphragm, inside the abdomen on either side of the vertebral column. They are bean-shaped and deep red in colour.

2. **Blood vessels -**

   Two blood vessels are connected to the inner part of each kidney. Out of these, one brings blood to the kidney and the other takes away the filtered blood from the kidney.

3. **Ureter -**

   A tube called ureter comes out from the inner margin of each kidney. This carries the filtered urine from the kidney to the urinary bladder.

4. **Urinary bladder and urethra –**

   Urinary bladder is a sac like structure made of muscles. Urine is collected in this bladder and once the bladder is full, urine is removed from the body through the urethra.

14.2 How is urine formed in the body?

Ammonia gas is formed as a result of digestion in the small intestine, (especially digestion of proteins). It is necessary to remove this gas since it is harmful. This gas cannot be removed directly from the body. It

reaches the liver along with blood, where it forms urea after combining with carbon dioxide. Urea is less harmful than ammonia. Urea reaches the kidneys along with the blood, where it is filtered and removed from the body as urine. Urine thus consists mainly of urea and water.

$$\text{Ammonia} + \text{Carbon dioxide} \xrightarrow[\text{(in the liver)}]{} \text{Urea}$$

Apart from urine there are other excretory products in our body which are formed as a result of various processes. It is also necessary to remove these products from the body. Some harmful substances are removed through the intestine in the form of faeces, while carbon dioxide and moisture are removed through the process of breathing out. Some unwanted minerals are removed in the form of sweat through the sweat glands present in the skin. Let us see how excretory products are removed in other organisms—the majority of terrestrial organisms remove urea through urine but there are certain organisms who do not produce liquid urine. In organisms living in dry environments— such as lizards, snakes, pigeons, cockroach, etc., ammonia is converted to solid uric acid. These organisms excrete solid uric acid. You must have seen bird-droppings. These are white and black in colour. The white part in bird droppings is uric acid, and the black part consists of undigested food.

Aquatic organisms like fishes remove the ammonia from their body directly through the skin which then gets dissolved in the surrounding water. In micro organisms like—Amoeba, Euglena, paramecium, Hydra etc., ammonia is formed as an excretory substance. Their body is simple and the entire body is surrounded by water so that as ammonia gas is formed, it comes out of the body and passes into the surrounding water.

14.3 Excretion in plants

You must have observed that the leaves and the bark of many trees dry up and fall off. The unwanted metabolic products are stored in these leaves and barks and as they fall, the waste products are also removed. Thus, plants also excrete like other organisms but they do not have special organs for excretion.

In some plants, excretory products formed as a result of metabolic activies accumulate in the cells in the form of calcium oxalate or calcium carbonate crystals. These remain in the cells throughout the life of the plant.

It is a common experience that eating yam (jamikand) and leaves of Colocasia*(arvi)*, can cause irritation in the throat. The reason for this is that the sharp ends of crystals which are present in the cells of the leaves prick the inside of the throat. These are called Raphides. Similarly, calcium carbonate crystals acumulate in the leaves of Banayan trees in the form of bunches.

Activity - 1

Materials required :- Banyan leaf, glycerine, water, slides, a new blade, red ink, microscope.

Put a part of the Banyan leaf in a piece of potato or pumpkin. Cut thin uniform sections out of it with the help of a new blade. Put the sections in a watch glass containing water and add two drops of red

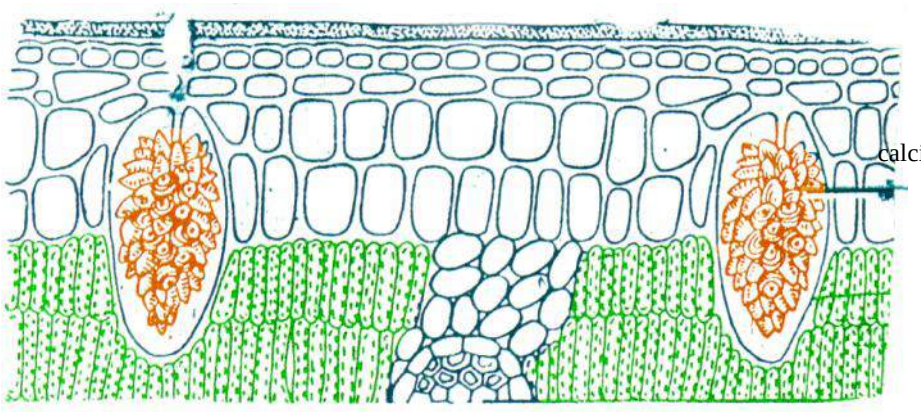


Fig 14.2 V.S. of a Banyan leaf

ink to it. Observe a thin section under the microscope and compare it with Fig 14.2. Could you identify the calcium carbonate crystals in the section?

Repeat the same activity using Nerium *(kaner)*, Ziziphus *(ber)*, Money-plant and Arum *(arvi)* leaves and identify the crystals under the microscope. Certain excretory products of plants like gum, rubber, etc. are useful for man.

We have learnt

- The process by which unwanted metabolic products are removed from the body is called excretion.
- Kidneys, Ureter, Urinary bladder and Urethra together form the excretory system in man.
- Ammonia is converted to urea in the liver.
- Kidneys filter out unwanted substances from the blood.
- Organisms, living in dry environments produce solid uric acid as an excretory product.
- In simple micro organisms excretion takes place through the body surface.
- Special organs are present for excretion in animals but not in plants.
- In some plants, unwanted substances are accumulated in the leaves, bark, stem, etc. Rubber, Gum, Raphides are examples of such unwanted substances.

Questions for practice

1. Choose the correct answer

1. Unwanted substances are filtered from the blood by-

a) Heart b) Lungs c) Kidney d) Stomach

2. The main excretory substance in man is-

a) Uric acid b) Urea c) Water d) Sweat

3. In bird droppings the colour of uric acid is-

a) Black b) White c) Green d) Green & White

4. In our body, which organ is responsible for conversion of ammonia to urea-

a) Liver b) Kidney c) Lungs d) Heart

5. In which organism does ammonia get directly dissolved in water through the body surface-

a) Mosquito b) Parrot c) Lizard d) Amoeba

2. Answer the following questions:

1. Why it is necessary to remove unwanted metabolic products from the body?
2. Where are the kidneys situated?
3. How is urine formed?
4. Name some of the excretory substances formed in plants.
5. How does excretion takes place in birds and insects?
6. Draw a labelled diagram of the excretory system in human beings.

Do these also

1. Make a list of various organisms found around you like lizard, snake, bird, cockroach, cow, cat, fish, squirrel etc. and write the main excretory substance they produce:—

S.no.	Name of the organism	Main excretory substance
1.	Fish	Ammonia
2	Pigeon	Uric acid
3.	_____	_____
4.	_____	_____

2. With the help of your friends and teachers identify some of the plants around you which produce rubber, gum, raphides , etc. as excretory substances.

Chapter 15

STATIC ELECTRICITY

Electricity has an important place in our life. Without it we cannot even imagine the existence of the modern world. Bulbs, fans, radios, televisions etc. all run on electricity. The flow of charges is called electric current. To know electric current more clearly, it is necessary to know the basic nature of electric charges.

In previous classes we have studied that when a plastic comb is rubbed with dry hair and brought near small pieces of paper it attracts the paper pieces. Similarly while switching the television on or off if we bring our hand near the screen a crackling sound is produced. All these events occur because of electric charges.

Activity - 1

Materials required :- Drinking Straw, balloon, comb and paper.

Rub the straw on a sheet of paper 5 to 7 times and place it on the wall. Similarly rub an air filled balloon on a paper sheet 5 to 7 times and place it on the wall. What happens in the two situations? You will find that the straw as well as balloon stick to the wall. Combing dry hair or rubbing straw or balloon on paper makes them develop a charge.

15.1 Charged and neutral objects

The objects around us do not show the presence of charge in normal conditions. Some of them get charged when rubbed with paper or any other matter. Let us do an activity to understand this.

Activity - 2

Materials required :- Scales made of plastic and wood, pen, comb, balloon, iron nails, cotton cloth, candle and a polythene bag.

Rub each object with the polythene bag and bring them near the small pieces of paper one by one. Make Table 15.1 in your notebook and categorize objects on the basis of your observations.

Table - 15.1

S. No.	Objects that attract the paper pieces (charged objects)	Objects that do not attract the paper pieces (Neutral objects)
1.	Plastic scale	Wooden scale
2.	…….....	…….....
3.	…….....	…….....
4.	…….....	…….....

Some objects develop charge on being rubbed with some other specific materials. The objects, carrying charge, are called charged objects.

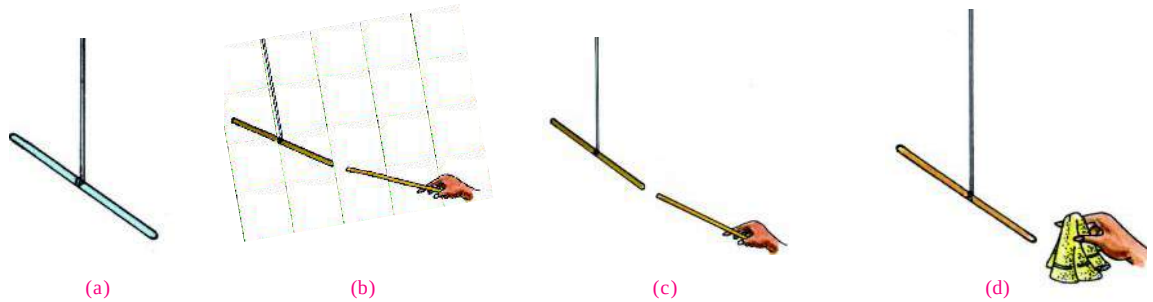
15.2 Nature of charges

We saw in the above activity that charged objects attract small pieces of paper. Now we will see what happens when two charged objects are brought close to each other?

Activity - 3

Materials required :- Two straws, thread, glass rod, silk cloth.

Rub straw with your dry hair. Now hang the straw with a thread (fig. 15.1 (a)). Take another straw, rub it with dry hair. Bring it near the hanging straw. What do you see (fig. 15.1 (b))



(a) Hanging charged straw

(b) On bringing the charged straw close to the charged straw

(c) On bringing the charged glass rod close to the charged straw

(d) On bringing the charged slik cloth close to the charged straw

Fig. 15.1

"When two objects with similar charges are brought close to each other, they repel each other." Now rub a glass rod with the silk cloth and take the glass rod and silk cloth near the hanging charged straw, turn by turn. (fig. 15.1 (c), 15.1 (d)) what do you see? You would see that in one situation there is attraction and in the other situation, there is repulsion. That means opposite charges/develop on the two objects (glass rod and silk) when they are rubbed with each other.

"When two objects with opposite charges are brought near each other they attract each other."

It was on the basis of experiments of this type that the scientists concluded :

Charges are of two kinds – positive charges (+) and negative charges (-).

We must remember that it is only a convention to represent one kind of charge with a positive sign and the other kind of charge with a negative sign.

The charge developed on the straw when it is rubbed with paper is assumed to be negative. Similarly the charge developed on the glass rod when rubbed with silk is assumed to be positive, while the silk becomes negatively charged.

Activity - 4

Materials required :- Two straws, a glass rod, paper, a piece of silk cloth and cotton thread.

1. Hang a straw with the help of the cotton thread. Rub the straw with paper.
2. Take a glass rod and rub it with the silk cloth.

3. Bring the glass rod and silk near the hanging charged straw one by one. You will see that straw is attracted towards the glass rod and is repelled by silk.

4. Rub another straw with paper and bring this straw and the paper near the hanging straw one by one. Both straws repel each other and there is attraction between the paper and the hanging straw.

5. Since it is assumed that when we rub the straw with paper, then the straw gets negatively charged, therefore the glass rod would have a positive charge. Similarly identify the charge on the other objects on the basis of whether they attract or repel the hanging straw and write it in table 15.2.

Like charges repel each other and unlike charges attract each other.

"Repulsion between two objects can prove that both objects are charged."

Table - 15.2

On rubbing the glass rod with silk cloth		On rubbing the straw with paper	
Charge on glass rod	Charge on silk	Charge on straw	Charge on paper
Positive (+)	……	Negative (-)	……

15.3 Properties of charged objects

The properties of charged objects are given below –

1. Each charged object attracts the neutral object towards itself.
2. Like charges repel each other.
3. Un-like charges attract each other.

Electric tester

Electric tester is used to know the presence of current in an electric circuit. It contains a metallic rod whose central portion is covered with a plastic or rubber tube. At one end of the metallic rod a carbon resistance is attached.

A neon bulb, a spring and a brass cap are attached to the other end of the resistor.

The open end of the metallic rod of the tester is connected to the electric circuit and the brass cap is connected to the hand. In this situation electric charge flows to the Earth after passing through the metallic rod, the resistance, the bulb, the spring and then our body. In the situation when charge flows through the instrument the neon bulb inside, starts glowing and shows the presence of current in the circuit.

Fig. 15.2 a
(Electric tester)

The price of a electric tester is between Rs. 5 to 10. Request your teacher or guardian to show you the flow of current using a tester and observe it.

15.4 Different methods of charging objects

(1) Charging by friction -

We have learnt to charge different objects by rubbing them with each other. We know that when two objects are rubbed together, then both objects get charged. This method is called charging by friction.

Activity - 5

Materials required :- One plastic chair, woollen sweater or shawl or cotton cloth electric tester.

The boy sitting on the chair with charge on him (charging by friction)

Fig. – 15.2 b

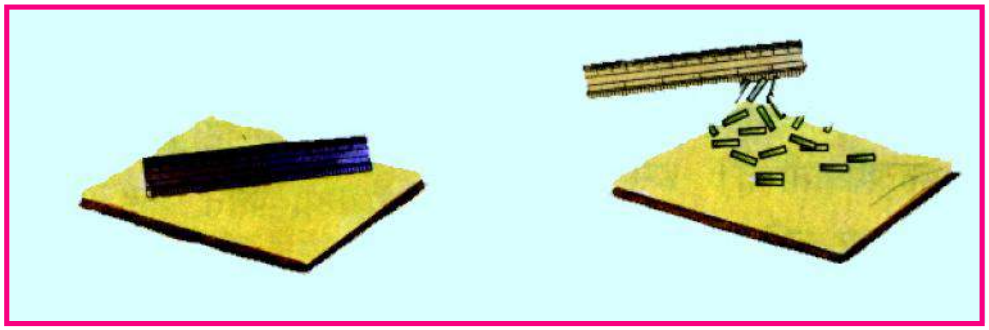
In dry atmosphere make a boy sit on a plastic chair. Ensure that the feet of the boy do not touch the ground. Rub the back of the chair with a woollen sweater or a shawl or cotton cloth eight to ten times. Now touch the tester on the body of the boy sitting on the chair (fig. 15.2). What do you see?

On touching the boy sitting on the chair we get an electric shock. The reason is that charge is generated by rubbing the plastic chair with the woollen sweater or the shawl or cotton cloth.

(2) Charging by contact -

Activity - 6

Materials required :- Two plastic scales.



a b

Fig. – 15.3 **Charging by contact**

Rub one plastic scale with paper 5 to 6 times (fig. – 15.3 a). Touch this scale with the other plastic scale. Now place the other scale near small pieces of paper (fig. -15.3 b). See what happens?

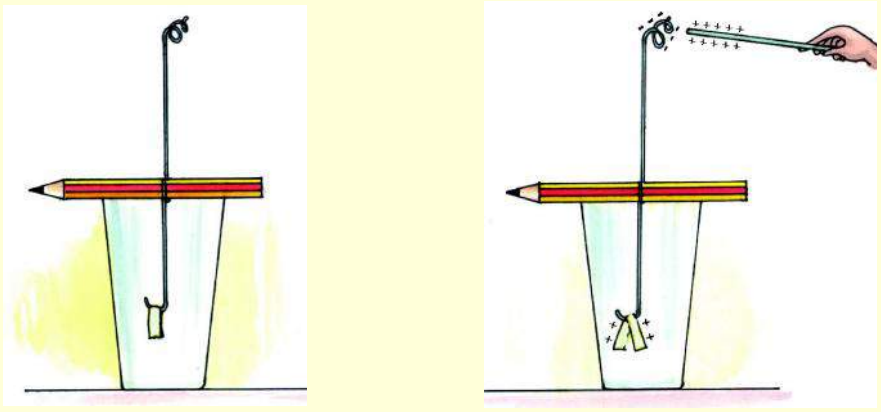
Any object, on being touched with an object having charge, gets charged. This is called charging by contact. If an object is charged by contact then it develops a charge of the same kind as is possessed by the object with which it is touched. It is difficult to charge the objects made up of metals because the charge developed in them flows to the Earth through the human body. If a metal piece is placed on an insulated stand and then charged by friction then the charge developed is maintained.

(3) Charging by induction -

Activity - 7

Materials required :- A glass tumbler, thick copper wire, a glass rod, silver foil used on sweets (2 cm long and 1/2 cm wide), silk cloth and pencil.

Remove the insulator coating of the copper wire, Take a 5 inch long piece of this wire. Roll this over the pencil in such a way that one end of the wire becomes perpendicular and points in the upward direction while the other end points downward, in line with the first end. Fold the lower end of the wire to be inside the tumbler and make a hook. Now fold the silver foil from its mid point and place it over the hook such that it hang on the hook. (fig. 15.4a)



a. hanging neutral foil b. Leaves of foil spread out due to the effect of induction

Fig. – 15.4 Electroscope

Keep this arrangement inside the glass tumbler such that the foil does not touch the walls.

Now rub the glass rod with the silk cloth and bring it close to the upper end of this apparatus without touching it. See what happens? You will find that on bringing the charged rod close to this apparatus, the upper end of the wire becomes negatively charged and the other end gets positively charged. Because of this both leaves of the silver foil move away from each other. Since the silver foil and the copper wire are in contact, when a charged object comes close to the copper wire the silver foil receives charge developed due to induction. Both leaves move away from each other because they have the same charges and are spreadout (fig. 15.4 b). This is called charging by induction.

Answer these

1. How can we check whether an object is charged?
2. How many types of charges are there? Write their names.
3. How many ways can be used to charge an object?

15.5 Gold leaf electroscope

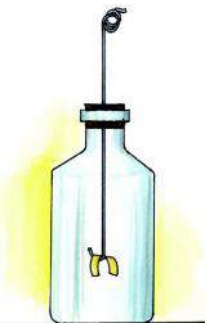


Fig. – 15.5
Golden leaf Electroscope

Gold leaf electroscope is a sensitive instrument. With its help the presence of charge in any object can be detected. The electroscope generally contains a metallic rod placed in a glass jar. One end of the rod is connected to a metal coil above the mouth of the jar. The other end of the metallic rod has a golden foil with two leaves placed on it. These leaves are inside the jar (fig. 15.5).

When a charged object is brought close to the upper end of the gold leaf electroscope, its gold leaves move away from each other. This is because the foil get charged due to induction. On removing the charged object, the leaves collapse and come close to each other. It would be appropriate to perform the above experiment in a dry atmosphere.

15.6 Charge in the atmosphere -

Thundering clouds and lightening are known to people since the primitive ages. Around 250 years ago Benjamin Franklin proved that lightening is a natural event occurring due to charged particles.

Through some experiments it has been observed that the tiny drops of water in the clouds develop positive charge. Bigger and heavier drops have negative charge. Positively charged tiny drops, due to their light weight move towards the upper part of the cloud with air and the negatively charged drops move towards the lower part.

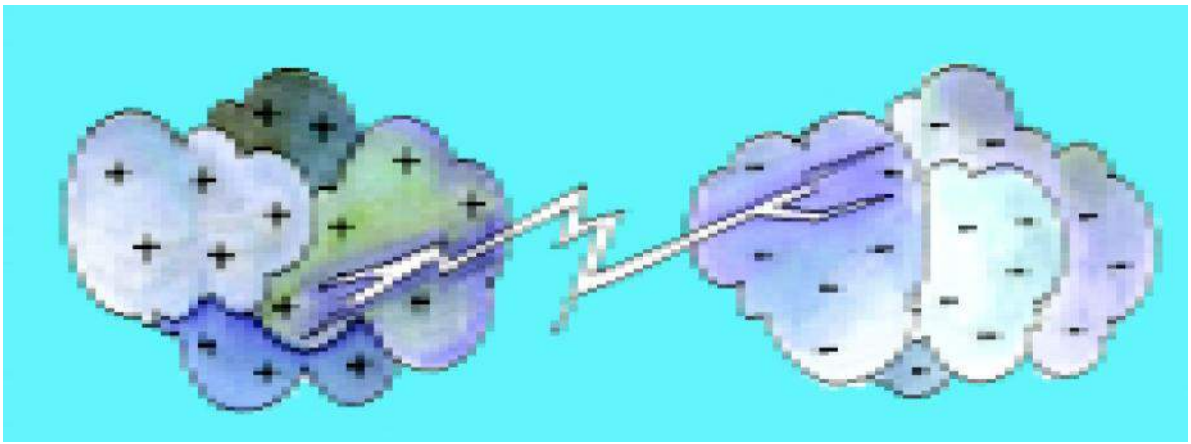


Fig. – 15.6 Electric discharge between clouds with opposite charge

A large force of attractions exists between the opposite charges on the clouds. But the air between clouds prevents the charges from coming closer and neutralize each other. When the amount of charge is very large, the electric insulation can break. In such a situation electric charge can flow through air. When this happens the air gets heated to a very high temperature due to the electrical energy and starts luminescencing (fig. – 15.6). This process is called electrical discharge. We see the luminescence of air in the form of lightning in the sky. This sustains for a very short duration. The cracking sound produced by the lightning discarge can be very intense and we hear it as the thundering cloud.

Sometimes at the time of the lightening, the discharge flows to the ground through tall trees, buildings or other structures and damages them (fig. – 15.7). When this happens, we say that lightning has struck. Lightning can hurt human beings and animals. Sometimes it even causes their death. In mountainous regions lightening is more common than in plains.

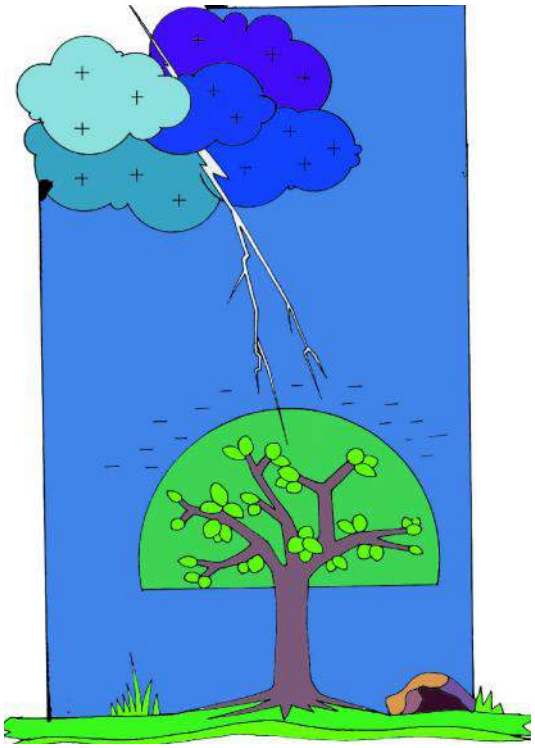


Fig. – 15.7
Lightning between a tree and charged clouds

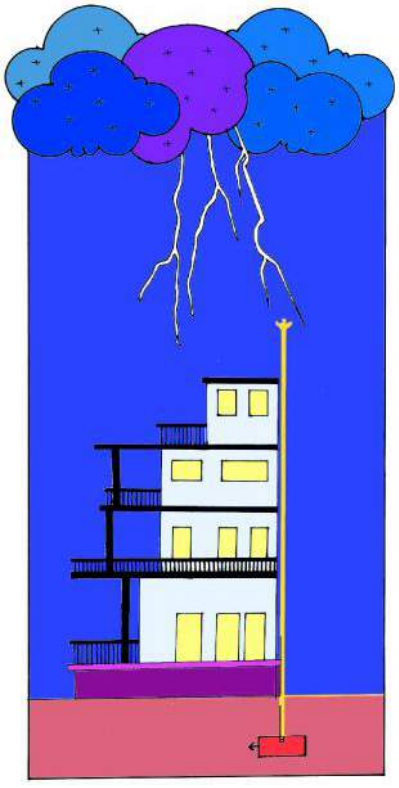


Fig. – 15.8 Lightning Conductor

Advantages of lightening –

Many natural events occur at the time of lightning. Out of these, some are useful.

1. The intense heat generated in lightening helps in the formation of oxides of nitrogen from oxygen and nitrogen. These oxides dissolve in water to make very dilute solution. These solutions provide our Earth with nitrogen compounds, necessary for the growth of plants.

2. During lightning, oxygen gas gets converted to ozone gas. The layer of ozone gas prevents the ultraviolet radiations from the Sun to reach the Earth's surface.

Lightning Conductor

It is not that electric discharges can occur only between clouds having opposite charge. Sometimes the discharge also occurs between charged clouds and the Earth. For example if a charged cloud comes close to the Earth and passes over some tall building or tree, then an opposite charge is induced in them. Consequently an electric discharge occurs between the cloud and that building. This discharge can damage the building.

To prevent tall buildings from getting struck by lightning, lightning conductors are used. These conductors consist of a thick and flat metallic rod with the upper end shaped like a trident. This conductor is fixed at the highest point of the building and the lower end of the rod is connected with a copper plate buried deep inside the ground (fig.–15.8).

When charged clouds pass over the building, then a large opposite charge is produced in the upper part of the conductor by induction. At this time an electric discharge takes place between the cloud and the lightning conductor. The whole charge goes to the ground through the rod and there is no damage to the building.

Benjamin Franklin (1706 - 1790)

In the year 1752 Franklin together with his son William did his experiment of flying kites, and showed that lightning is a natural event. He made his kite with a silk cloth and sticks of Devdar tree. A thin metal wire was connected to a wooden stick in such a way that one of its ends pointed to the upper part of the kite and the other end remained connected to the thread of the kite. When Franklin flew his kite on a stormy day with repeated lightening and thunder. The kite began to fly in the sky, then they observed that due to the transfer of charge from the clouds to the kite, its thread became taut. They connected the metallic wire, which was touching the clouds, to the ground, this grounded the charge on the thread. This produced a spark. Their observation showed lightning is electric in nature.

बैंजामिन फ्रेंकलिन (1706-1790)

Answer these

1. What is a lightening conductor?
2. On what principle does the electroscope work?

We have learnt

- An object can be charged by rubbing it with another object. This is called charging by friction.
- Charged objects attract small pieces of paper.
- It is difficult to charge objects made of metals.
- There are two kinds of charges in nature: (+) positive charges and (-) negative charges.
- Like charges repel each other and unlike charges attract each other.
- Objects can be charged by friction, by contact and by induction.
- With the help of an electroscope we can test whether an object is charged or not.
- Lightning is due to the electric discharge of charges from the clouds.
- Lightning conductor helps in protecting life and property of human beings.

Questions for practice

1. Choose the correct answer –

1. **On rubbing two objects (a) and (b) if (a) attains negative (-) charge then (b) will have–**
   (a) negative charge (b) negative and positive charges both
   (c) positive charge (d) none of these
2. **Out of the following, which one can not be easily charged by friction?**
   (a) glass rod (b) ball of wool
   (c) copper rod (d) balloon filled with air

3. **Human body for electric current is –**
   (a) an insulator (b) sometimes a conductor / sometimes an insulator
   (c) a conductor (d) none of these
4. **When two objects are rubbed together, then they develop –**
   (a) opposite charge (b) same charge
   (c) No charges (d) some times opposite some times same charge
5. **Lightning conductors are made –**
   (a) of metal (b) of non-metal
   (c) by painting the walls (d) of wood

2. **Fill in the blanks –**
   (a) The materials that allow electric current to pass through them are called …….. of electric current.
   (b) Like charges……..each other, while unlike charges ……. each other.
   (c) The mechanism used to protect the buildings from lightning is called ……..
   (d) When two objects are rubbed with each the nature of the charges produced on them is ……

3. **Write the names of two conductors and two insulators for electricity.**
4. **Why does the charge on an object vanish when the object comes in contact with our body?**
5. **What precautions should we take to protect ourselves from lightning?**
6. **Give reasons –**
   (a) It is unsafe to stand under trees while it is raining and lightning.
   (b) The feather of a peacock stretches on being rubbed between two papers.
   (c) When the television is switched on or off, a crackling sound is produced if a hand is placed on the screen of the television.

Do these also

1. Take two empty boxes of camera reels, wrap them in silver foil and hang them close to each other with the help of silk thread as shown in fig. – 15.9. Touch these boxes with a polythene bag after rubbing it with dry hair for one minute. What happened? Why did it happen? Find the reason.

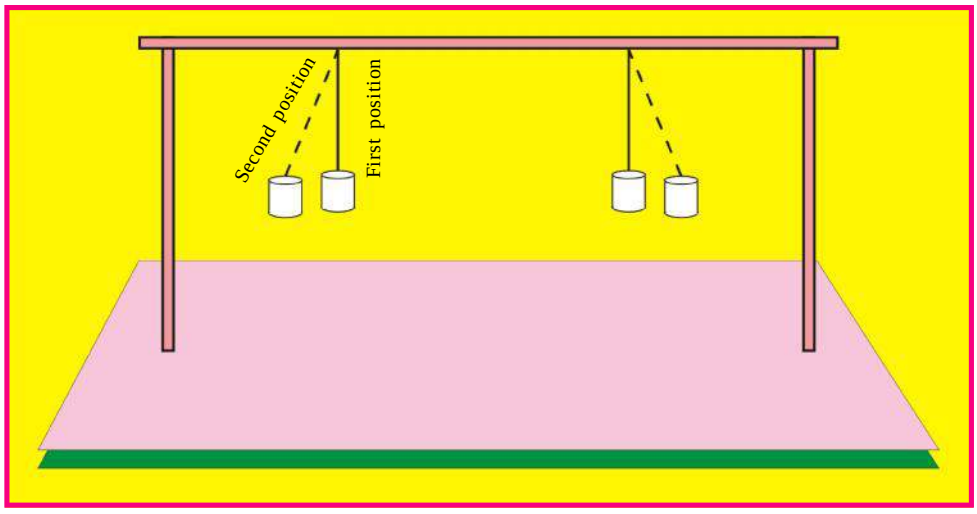


Fig. – 15.9

2. Rub mustard or seaseme seeds kept inside a polythene bag for some time, then keep them in a Plastic or paper plate. What happens? Why does this happen? Discuss it with friends in your class.

Chapter 16

CONTROL AND COORDINATION IN LIVING ORGANISMS

You have read about various systems of the human body. Just imagine how our body would have been affected if there would have been no coordination between these systems. We can compare the human body with a big factory. A factory has various departments - each having its own job to perform. There is a manager to ensure coordination between all the departments which is necessary for the smooth functioning of the factory. Similarly, various functions of the body like walking, breathing, digesion of food, etc. need control and coordination. This control is brought about by two mechanisms :

1. the nervous system 2. chemical substances

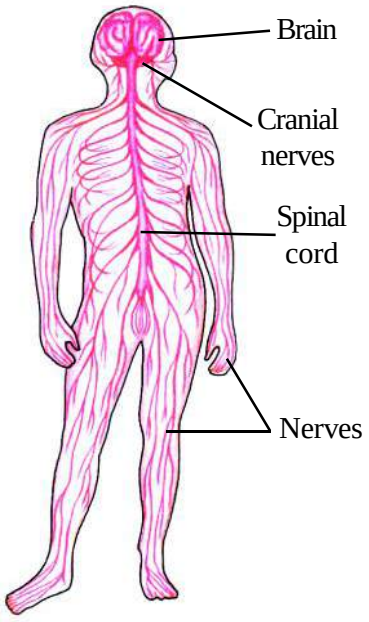


Fig. 16.1 : Human Nervous System

16.1 Nervous system

Its main parts are

1. Brain 2. spinal cord
3. nerves 4. sense organs

1. Brain- It is the most delicate and most important part of the body. It is protected by the skull. It controls functions like speech, hearing, touch, taste, smell, recognition, etc. All processes and functions taking place in our body are registered in the brain (Fig 16.2).

2. Spinal cord- The back side of the brain tapers into a long tube which is called the spinal cord. It is protected by a bony column, the vertebral column. Numerous nerves arise from the spinal cord and reach all parts of the body. Thus, it keeps getting all the information about the processes taking place in the body. We will see later how brain and spinal cord come to know about the processes taking place in the body.

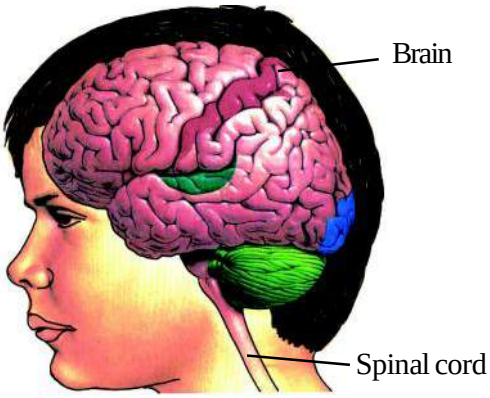


Fig. 16.2 : Human Brain

3. Nerves- Fig. 16.1 shows the nerves, which are thread-like and are spread like a net throughout the body. These nerves connect each part of the body with the brain and the spinal cord. The nerves are of two types:

1. Afferent nerves 2. Efferent nerves

Those nerves which conduct nerve impulses from various parts of the body to brain and spinal cord are called afferent nerves. Those nerves which carry the nerve impulses from brain and spinal cord to various parts of the body are called efferent nerves.

If our foot happens to suddenly touch a hot surface, we tend to immediately move it away from the source of heat.Thus, our body senses the changes taking place around us and reacts to them. All these changes happening around us are called stimuli (singular: stimulus). The change taking place in our body in reaction to the stimulus is called response. In the above example, the hot surface is the stimulus and immediate removal of the foot is the response. Fill up table 16.1 according to the given conditions.

Table - 16.1

S.No.	Condition	Stimulus	Response
1.	Starting due to sound of a blast	Sound of a blast	Starting
2.	Feeling of apprehension due to examination	_____	_____
3.	Trembling due to cold	_____	_____
4.	Watering of mouth at the sight of good food	_____	_____
5.	Turning the head in the direction of sound	_____	_____

In each of the above examples, stimulus is being provided from outside the body and hence, it is called an external stimulus. Apart from this, some stimuli (internal stimulus) come from within the body, like secretion of gastric juices after the food reaches the stomach etc.

16.2 Reflex Action

There are certain activities in our body which are not under our control, for example, trembling due to excessive cold, sneezing, watering of mouth, blinking of eyes etc. These are called involuntary actions. Certain activities of our body are under our control, like standing up, sitting down, walking, turning the head, bending, etc. These are called voluntary actions. Sometimes involuntary actions take place instantaneously and save us from dangerous situations. Let us understand this by taking two examples from our daily life. (This is not an example of an involuntary action). We automatically raise our hands in protection when we apprehend a blow.Our eyelids get half closed in bright sunlight. These actions take place as a result of changes in our environment and are controlled by the spinal cord. These are called reflex actions.

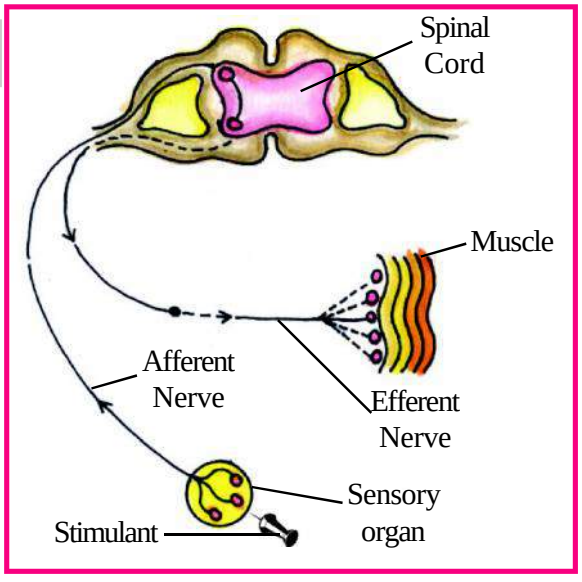


Fig 16.3 Reflex Arc

During reflex action, the afferent nerves take the message to the spinal cord and the return message is taken to various parts of the body by efferent nerves. In this way, an arc is formed which is called the reflex arc. (Fig 16.3) . The brain gets information about the reflex action after it is completed.

Some activities are given in Table 16.2. Write the name of the organs involved in these activities.

Table - 16.2

S.No	Activity	Organ involved
1.	Pin prick	Skin
2.	Smell of flower	_____
3.	Taste of food	_____
4.	Recognition of colour	_____
5.	Hearing sounds	_____
6.	Touching a hot object	_____

Our skin, nose, tongue, eyes and ears are the organs which sense the outer stimuli. Therefore, they are called sense organs.

Answer these

1. Name the organs present in the nervous system of man.
2. What are efferent nerves?
3. What are the functions of the nervous system?
4. Name a stimulus which you observe in your daily life.
5. What happens when your finger gets suddenly pricked?

16.3 Coordination due to chemical substances

Besides the nervous system, there are some special glands in our body which help in control and coordination. These are called endocrine glands. These glands secrete different types of chemical substances called hormones. These hormones control various processes like growth, development etc.

You know that digestive juices secreted by digestive glands are taken to various parts of digestive system with the help of special ducts. The special character of endocrine glands is the fact that the hormones secreted by these glands are transported without the help of any ducts. Therefore, they are also called ductless glands. These hormones are secreted directly into the blood stream from where they reach various organs of the body.

Let us try to understand some of these important glands.

Pituitary Gland

This gland is situated just below the brain. It is a pea-shaped gland and secretes a number of hormones. These hormones influence the secretion of hormones of other glands. Therefore, this gland is called the master gland. The main hormone secreted by this gland is the growth hormone. It controls our height. You must have seen dwarfs in circus or films. Can you guess the reason for their dwarfness? If growth hormone is secreted in excess , there is excessive increase in height, while a deficiency of this hormone leads to dwarfness.

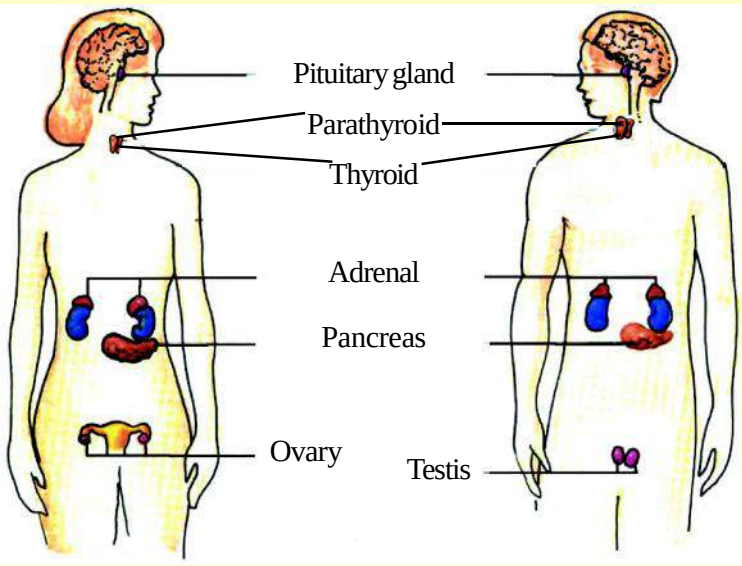


Fig 16.4 Endocrine Glands in Human

Thyroid Gland

You must have heard about a disease called ‘ Goitre’. A person suffering from this disease has a swollen throat. This swelling is due to increase in the size of the thyroid gland. This gland is situated in the throat. The hormone secreted by this gland controls the metabolic rate of the body. Iodine is necessary for the smooth functioning of this gland. Can you guess why doctors advise us to take iodized salt in our food?

Pancreas

You have read about the the role of pancreas in digestion. One part of this gland functions as an endocrine gland and the hormone secreted by this gland controls the amount of glucose present in the blood. A shortage of this hormone leads to the disease called diabetes. You must have seen some people around you who avoid taking sugar and sugary foods. Such people are affected by this disease and are called Diabetic.

Testis and Ovaries

Hormones secreted by these glands are responsible for secondary sexual characters. For example, testis are responsible for facial hair, heavy voice and development of body muscles in males. In females, hormones formed in the ovaries are responsible for the development of feminine characters.

16.4 Control and coordination in plants

Do you know that plants, like animals, are also sensitive towards external stimuli? They do not have a nervous system but still they react towards light, presence of moisture, touch, gravitational pull, etc.

Like animals, plants also secrete hormones; these are called plant hormones. They mainly control the growth of plants and are called growth substances. Some of the important plant hormones are given in table 16.3

Table - 16.3

General plant hormones and their functions-

Hormone	Function
Auxin	Influences growth in plants
Gibberellin	Influences flowering
Cytokinin	Influences cell division
Abscisic acid	Stops growth after reaching the full size

Answer these

1. What are endocrine glands?
2. What are hormones?
3. Write the name and functions of any two plant hormones.

We have learnt

- In living systems, control and coordination is undertaken in two ways: a) by the nervous system b) by chemical substances.
- Main organs of the nervous system are : a) Brain b) Spinal cord c) Nerves d) Sense organs
- Nerves are of two types : a) Afferent nerves- these nerves conduct message from various parts of the body to brain and spinal cord. b) Efferent nerves- These take messages from brain and spinal cord to various parts of the body.
- Reflex action is controlled by the spinal cord.
- Skin, nose, ears , tongue and eyes are our sense organs.
- Endocrine glands secrete hormones.
- Hormones control the slow activities of our body.
- Pituitary, thyroid, parathyroid, adrenal, pancreas, ovaries and testis are various endocrine glands present in man.

Questions for practice

1. Which of the following are reflex actions :

a) Immediate removal of hand just after it touches a hot surface.

b) Carrying a thing from one place to another.

c) Thinking before performing some task.

d) Amazed after a sudden blast

e) Trembling due to excessive cold.

2. Fill in the blanks :-

a) Reflex action is controlled by _____.

b) Nerve which takes the message to the brain is called _____ nerve.

c) Touch is felt by _____.

d) We grow in height due to _____ hormone.

e) Level of sugar in the blood is controlled by a hormone secreted by _____ gland.

f) _____ hormone is responsible for flowering in plants.

3. Match the following :-

Ovaries and testis	——	Controls the level of sugar in blood
Pancreas	——	Secondary sexual characters
Pituitary gland	——	Plant hormone
Gibberellin	——	Master gland

4. Answer the following questions :-

a) How is chemical control and coordination done in living systems?

b) Write the function of an efferent nerve. What are sense organs?

c) Why are endocrine glands called ductless glands?

d) Write the functions of plant hormones?

Do these also

1. With the help of your classmates, make a list of the various activities taking place in your body and classify according to the following criteria:

S.No.	Voluntary activities	Involuntary activities
1.	Bending	Beating of heart
2.	_____	_____
3.	_____	_____

2. Contact a doctor and find out the symptoms and precautions to be taken during diabetes. Discuss the same in your classroom.

Chapter 17

SKELETON, JOINTS AND MUSCLES

17.1 Skeleton

The frame of our body is made of bones and is known as the skeleton.

Figure 17.1 Imagine what would have happened if your body did not have a skeleton?

Bones of our body help in its movement, maintain its shape, and protect the soft organs such as brain, heart and lungs from injury.

Let us now identify the various bones found in our body. A large picture of the human skeleton has been given at the end of this book. By moving different parts of your body, and with the help of this picture, try to identify the different bones and colour them one-by-one.

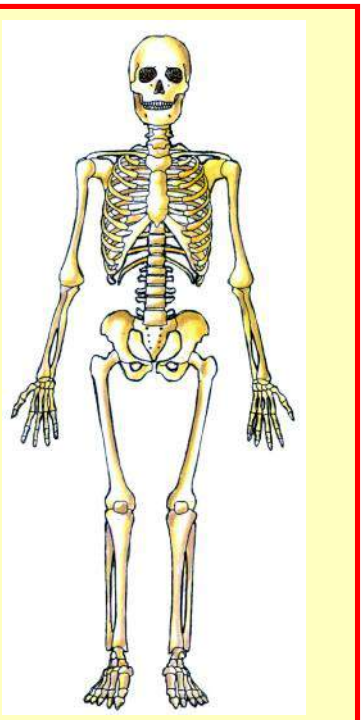


Fig. 17.1 : Human Skeleton

17.1.1 Skull

The skull is made up of a number of bones which are attached to each other. The skull is hollow from the inside. The brain is protected in the cavity of the skull.

Activity - 1

Move your lower jaw. Do the bones of the upper jaw also move in a similar way? Feel the bones of your skull, nose , ear , forehead and jaw by touching them.(figure 17.2)

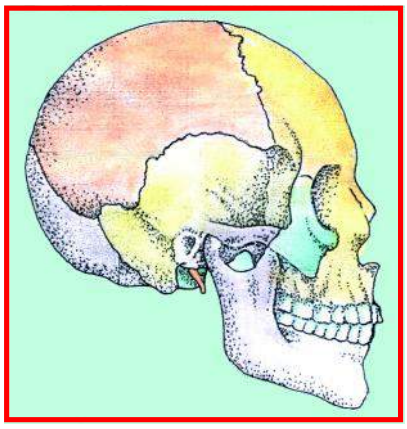


Fig. 17.2 : Humans Skull

17.1.2 Backbone (Vertebral Column)

Activity - 2

Ask your friend to stand, then bend forward and try to touch the ground with both hands. Press a finger just behind his/her neck and move it backwards to feel the vertebral column.(Figure 17.3)

In man, the backbone is made up a number of small ring-like bones. Each of these rings is called a vertebra. Young children have 33 vertebrae. As they grow older, the 9 vertebrae in the lower part of the spine fuse together, to form a single triangular bone. The hollow spaces of the vertebrae form a canal in which the spinal cord lies protected. Imagine what would have happened if you had a single long back bone instead of separate vertebrae!

17.1.3 Ribs

You have already read that the lungs and heart are situated in the chest in a cage of bones that keeps them protected. Let us now find out which bones form this cage. The bone situated in the centre at the front of the chest is called the Sternum. Towards the back of the rib-cage there are bones connecting the sternum to the vertebrae. The ribs cover the chest on both right and left side (Fig. 17.1).

Ask your friend to draw in a deep breath and hold it for some time. You can now count his ribs. How many ribs could you count?

Fig. 17.3 : Feel the Vertebral column

17.1.4 Shoulder Bones (Pectoral Girdle)

Activity - 3

Tell your friend to press against a wall as shown in the figure 17.4. Can you see two projecting bones below both the shoulders on doing so? Both these projecting bones are called the Scapular bones.

Fig. 17.4 : Feel the shoulder bones or pectoral girdle

17.1.5 Clavicles

The bone located in the upper part of the chest, which stretches from the neck to the shoulder is called the Clavicle. Try and find this projecting bone by moving your finger from below your throat towards the shoulder. Similarly, try to find the clavicle on the other side of the throat.

Scapula and clavicle together make up the pectoral girdle. Bones of the upper arms on both sides are joined to the pectoral girdle.

17.1.6 Hip Bone (Pelvic Girdle)

Activity - 4

Press your fingers just below your waist (Figure 17.5). Do you find two similar bones, one on each side? These bones are the ends of a much bigger girdle called the hip girdle bone or pelvic girdle. Each part of the pelvic bone is made up of three separate bones. The Pelvic Gardle is attached to the backbone and the thigh bone.

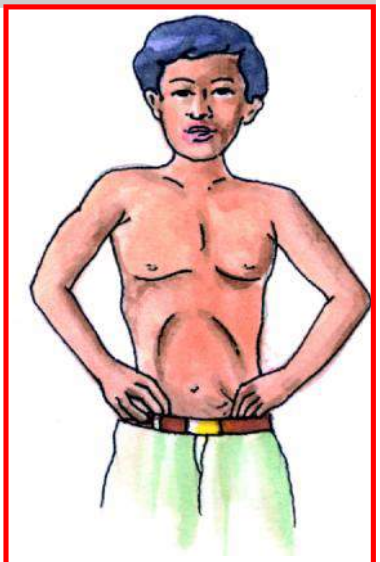


Fig. 17.5
Feel the pelvic girdle

17.1.7 Bones of the Hand

Activity - 5

Move the different parts of your arm and hand in different ways and try to identify the various bones with the help of Fig.17.1. There is a single bone from the shoulder to the elbow, two bones from the elbow to the wrist, and the hand is made up of many small and big bones.

17.1.8 Bones of the Leg

Look at Figure 17.1. You will notice that like hands, the legs are also made up of many big and small bones. The uppermost is the thigh bone. This is the longest and the strongest bone of our body. There are two bones below the knee. Move the foot and toes and notice that they are also made up of many small bones.

17.1.9 The knee

Activity - 6

Straighten your leg, hold the knee with your fingers and move it. Can you feel a cap-shaped moving bone? Identify the bone in figure 17.1.

17.2 Flexible Bones (Cartilage)

Activity - 7

Feel the bone between your wrist and elbow by pressing it with your fingers. This is a hard bone. Now touch your ears and notice how some parts of your ear are soft and others are hard. The soft part of your ear is made up of a flexible bone known as cartilage. You can also now identify the cartilage in your nose. Cartilage is also found in other parts of the body including between the vertebrae, in the backbone and between the ribs and the chest bone.

By now you must have coloured the figure to show all the bones identified by you. Show this figure to your friends and find out which additional bones they have marked. If you have left out then find these bones in your body and show them in your figure too.

17.3 Joints

Our skeleton is made up of many small and large bones. The places where these bones are joined are called joints. Joints are very important because they enable us to move different parts of our body. Identify different joints in your hands, legs, neck, elbow and knee by bending these parts. Some of the important joints are –

1. Ball and Socket Joints

Activity - 8

Material required :- a fused bulb, coconut shell

Let us perform an experiment to explore the joint between the shoulder and the bone of the upper arm..

Put the fused bulb into the coconut shell and move it around—notice how the round bulb gets supported while it moves in the shell surrounding it. This type of joint is called a ball and socket joint. This type of joint allows for movement in all directions. These joints are found in the thigh and Pelvic Girdle as well. Look at figure 17.6 and identify which bone acts like the bulbs and which acts like the coconut shell. Stretch your arm out straight ahead and rotate it to be able to feel the ball and socket joint in your shoulder.

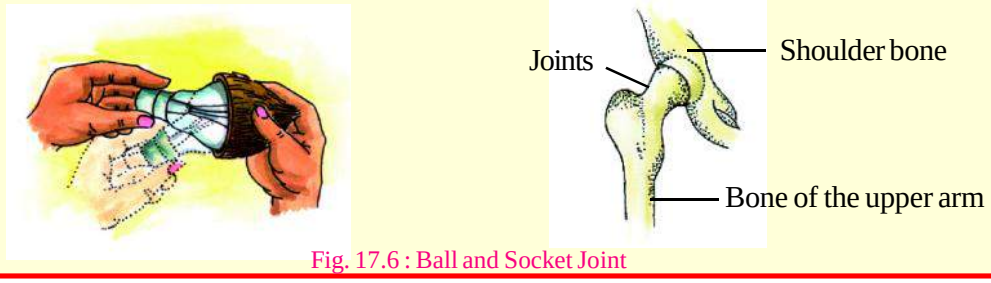


Fig. 17.6 : Ball and Socket Joint

2. Elbow Joint (Hinge joint)

Try to rotate your arm at the elbow. Are you able to rotate this joint in the same manner in which you could rotate your shoulder? There is a difference between the shoulder and the elbow joints. The elbow joint allows the arm to move only up and down, whereas the shoulder joint lets it rotate all round. The elbow joint is similar to the hinges of a door because the hinge allows the door movement in only one direction. Similar joints are found in the fingers.

The body has other kinds of joints in addition to the ball and socket and hinge joints. These include sliding joints in the backbone and wrist. It is because of these sliding joints that we can move our wrists and neck. A pivot joint is present between the first vertebra and the base of the skull. It is because of this joint that the neck can move forward and backwards as well as right and left.

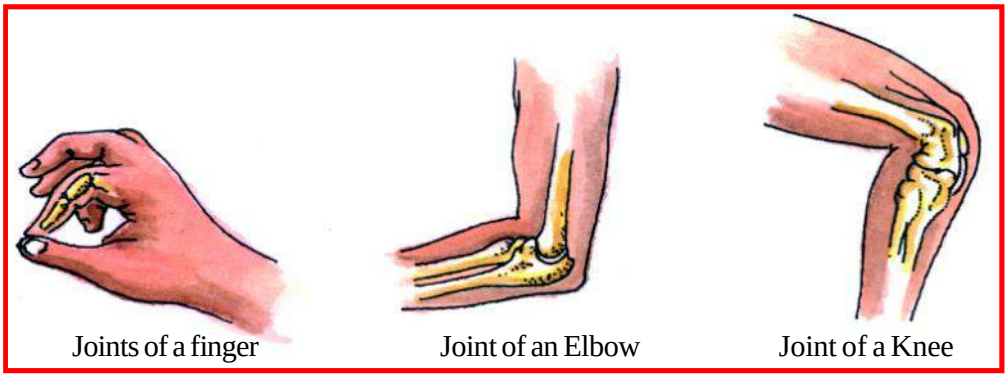


Fig. 17.7 : Hinge Joint

17.4 Muscles

You have so far read that getting up, sitting down, walking around, bending down and rotating the neck require the movement of bones. But bones cannot move on their own—for this there are some parts which can be seen moving just below the skin. These parts are known as muscles. You have already read about muscular tissue. Let us now understand how muscles help in the movement of our body.

Activity - 9

Close the fist of your right hand and touch your shoulder with it. Observe the change in the upper part of your arm as you move your fist. With your left hand press the upper part of your right arm and notice how it becomes hard and bulges (figure 17.8). This hardness is due to the

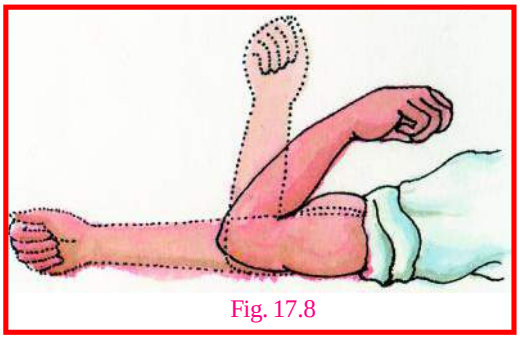


Fig. 17.8

contraction of muscles. Bring your right hand back to its original position. What change ocurred in the muscles? The movement of the bones is made possible by the contraction and relaxation of muscles. In this manner, different body parts can move with the bones and muscles working together. Even the beating of the heart takes place due to the contraction and relaxation of muscles. Various muscles present in different parts of the body together make up the Muscular System.

Activity - 10

Stretch your arm and then bend and straighten your fingers one by one. Observe the movement of the muscles. Could you see separate muscles moving different fingers? Stand up and hold tight your right thigh with both hands. Now lift your knee up, move your leg forwards and backwards and feel the muscles of your thigh. Try to move your leg without moving the muscles (figure 17.9). Could you do it?

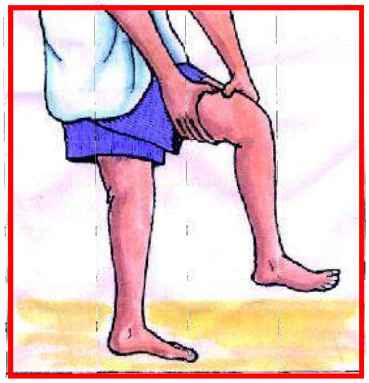


Fig. 17.9
Feel the movement of muscles of the thigh

Move other parts of your body like your knees, fingers, toes etc. and feel the movement of the muscles. Now fill the Table 17.1

Table - 17.1

S.No.	Activity	Muscle movement felt/not felt
1.	Chewing food	
2.	Breathing in and out	
3.	Lifting weight	
4.	Clenching and unclenching the fist	
5.	Moving the toes	
6.	Moving eyelids	

We have learnt

- Our body is made up of a frame of bones which is called the skeleton.
- The brain is protected by the skull.
- The backbone is made up of a series of bones called the vertebrae.
- The ribs in the chest make up a cage.
- The bones of arms are attached to the pectoral girdle and those of the legs to the pelvic girdle.
- Cartilage is soft and flexible. It is found in the ear, nose, between the vertebrae and between the ribs in the chest.
- The places where bones are joined together are called joints.
- The joint between the shoulder and the arm and that between the pelvic girdle and the thigh bones is called a ball and socket joint.
- Hinge joints are found in the elbows.

- The movement of bones is made possible by the contraction and relaxation of muscles.
- Various muscles present in different parts of the body together make up the Muscular System.

Questions for practice

1. Choose the correct answers.

1. Ball and Socket joint is found in

a) Shoulder and arm bone b) Elbow
c) Upper jaw d) Wrist

2. Vertebrae are found in

a) Skull b) Hands
c) Backbone d) Fingers

3. Cartilage is found in

a) Hands b) Ear
c) Foot d) Skull

4. Hinge joint is found in

a) Upper jaw b) Elbow
c) Lower jaw d) Shoulder

2. Correct and rewrite the following sentences

a) Cartilage protects soft organs like brain and lungs from injury.
b) Bones of the hand are connected to the Pelvic girdle
c) The brain is protected by the rib cage
d) Bones and muscles together form the muscular system.

3. Answer the following questions

a) In which part of the body is the longest bone located in your body found?
b) What is the use of the backbone in the body ?
c) Explain the joints found in the fingers and knee.
d) Why can't earthworms stand up straight like human beings?
e) Make a list of all the organs in the body by touching or moving which we can feel the muscles.
f) What would happen if there were no joints in our fingers ?
g) What is the difference between bone and Cartilage ?
h) What do you think would have happened if there were threads instead of muscles in your body?

Do these also

1. Try and obtain an X-Ray films of bones from a hospital or from persons who have such films. Try to identify the bones seen in the X-Ray by comparing them with the figure of the skeleton given in the book.

Chapter 18

MOVEMENT AND LOCOMOTION IN LIVING ORGANISMS

18.1 Movement in Plants

To a person in a moving train, everything around appears to be rapidly moving backwards, including houses, trees, bicycles and people. But do the plants really move ? Can plants move at all? In fact, most plants remain stationary at one place. However, different parts of the plants like roots , leaves , branches and shoots move in the direction of stimuli. In an experiment in the previous class, you had seen that the stem moves in the direction of light, while the leaves of the touch-me-not plant close when touched. Thus, various parts of the plant show reactions to various stimuli and this process is called tropism. We shall now observe movements of plants which occur as a result of external stimuli.

Activity - 1

Materials required :- Plastic or glass pot or tumbler, channa (gram) seeds.

Take a plastic or glass pot and germinate the chana (gram) seeds in it ((figure 18.1).

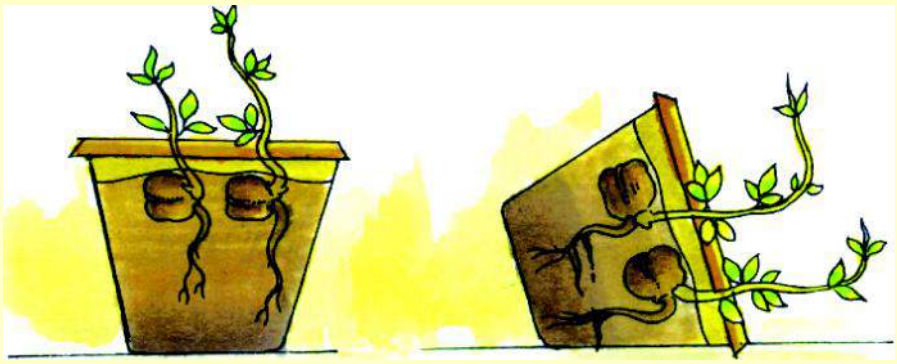


Fig. 18.1 : Geotropism and Phototropism

Observe the direction of the emerging roots. Now keep the pot horizontal for 2-3 days and examine it again. Even in this position the roots try to grow down towards the earth. This happens because the roots are attracted towards gravity. This process is called geotropism.. Now let us see if any part of the germinating seeds moves towards light. The stem grows towards light, and this process is called phototropism.

Activity - 2

Materials required :– Strainer, gram seeds, soil and water

Take a strainer filled with soil and put 8 – 10 chana (gram) seeds in it. Moisten the soil with water. Hang the strainer on a hook in a tilted manner with the help of string. Water it everyday. After 4–5 days

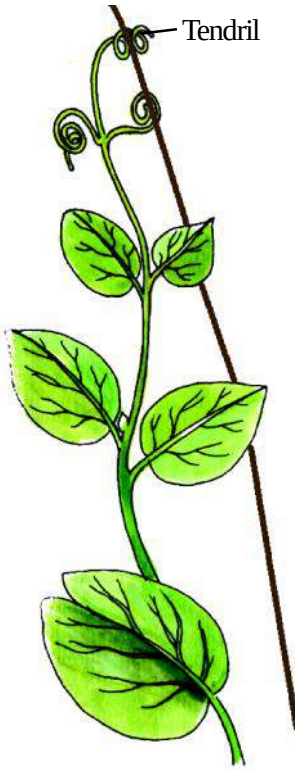


Fig. 18.3 : Thigmotropism

observe the direction of the roots. Keep observing this for another two or three days. Change the direction of the strainer again for 2 – 3 days and observe the direction of movement of roots and how it changes. Are the roots affected by only gravity or is some other stimulus also acting upon them?

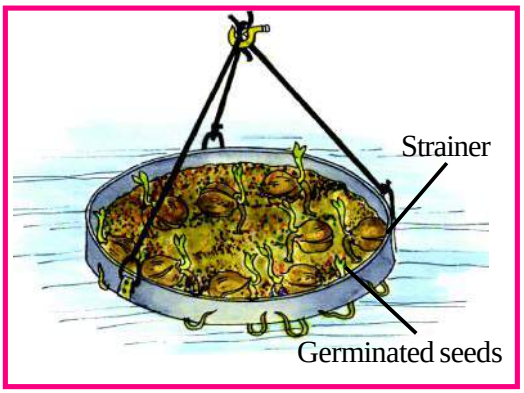


Fig. 18.2 : Hydrotropism

We observe that initially the roots come out of the strainer following gravity and grow downwards, but then they turn back towards the strainer as there is water in the strainer which the roots require. This movement towards water is called hydrotropism (figure 18.2).

You are aware of the special property of touch-me-not plants. The leaves of the plant close on touching it and reopen after a short while. This movement in response to the touch is called seismonasty.

Observe different creepers like Pumpkin (Kumhra), Pea and Bottle gourd (Lauki). Do these display tropism? The tendrils of these climbers immediately twist around a solid object like a spring the moment they come in contact with it. This type of sensitivity to touch is called thigmotropism.

18.2 Locomotion in Animals

You see many animals around you; some of these animals walk, some fly, some crawl and others swim. Movement of animals from one place to another is called locomotion.

Fill up Table no. 18.1 on the basis of locomotion of different animals

Table - 18.1

S.No.	Movement	Animal
1.	Crawling	Snake, Earthworm
2.	Walking	---------, ----------
3.	Flying	---------, ----------
4.	Swimming	---------, ----------

You must have seen from the table 18.1 that different animals use different means of locomotion. Just like plants, animals also react to external stimuli. Earthworms are sensitive to light. They move away from light and towards darkness. Moths get attracted towards light at night and hover around lights. Cockroaches run away from light and animals like bats do not usually move around in the daytime. What could be the use of locomotion for animals ? It is this ability to move that allows animals to find food and water, and also helps them to escape their enemies. Besides these uses, finding a partner, laying eggs and finding a safe place to bring up the young are all possible only because of locomotion.

Activity - 3

Materials required :- Microscope, Slides, Pond water

Take a drop of pond water on a glass slide and observe it under a microscope. You will be able to see the methods by which different microscopic animals are able to move (figure 18.4). Amoeba is a single-celled animal which moves by forming pseudopodia. In Euglena there is a single thread-like structure which is used for movement. This is called the flagellum, and it helps Euglena in swimming. Like Amoeba and Euglena, Paramoecium is also a single-celled animal. The entire surface of its body is covered with structures called cilia. These help the animal in swimming.

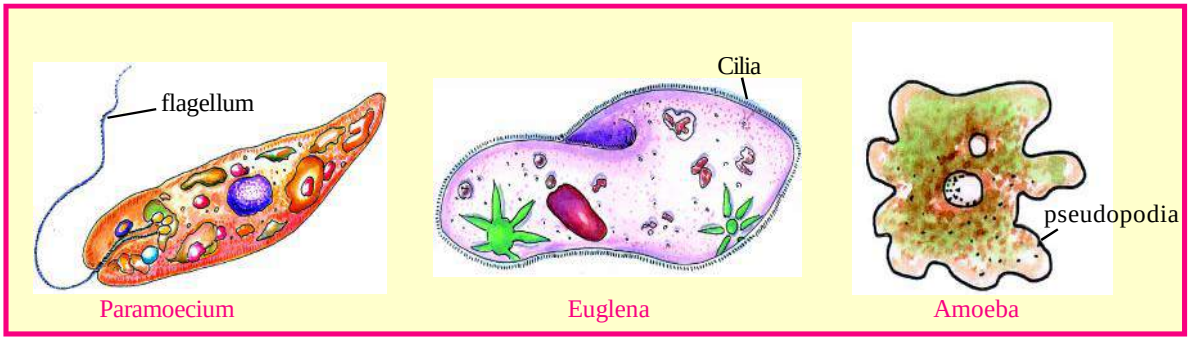


Fig. 18.4

Activity - 4

Materials required :- Live earthworm, white paper

Place an earthworm carefully on a paper and observe its movement closely. First the front part of the body contracts and moves forward. At this time, the back portion remains thick and small. This happens because of the contraction and relaxation of muscles (figure 18.5).

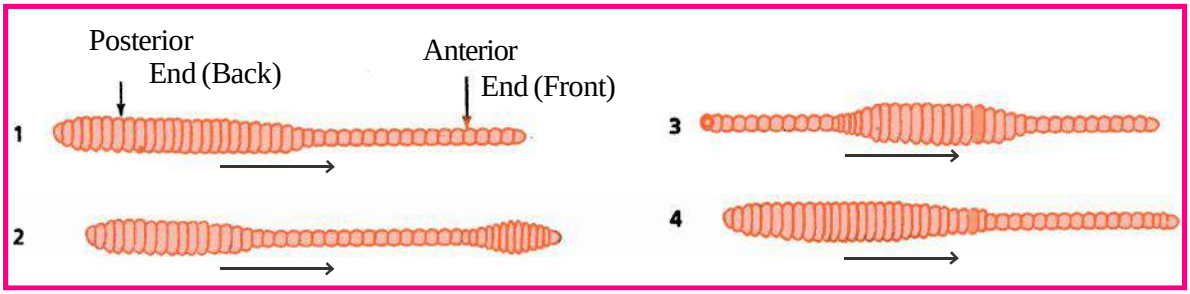


Fig. 18.5 : Locomotion in Earth worm

The wave of contraction of the muscle travels to the back of the body as well, so that the middle and end portions of the body also successively become thin and elongated. This whole sequence is then repeated over and over again. When one portion is thin and elongated, the other part becomes thick and small due to the relaxation of muscles.

You have seen mosquitoes and flies flying around. They fly with the help of their wings. The wings move due to the movement of muscles attached to them. Vertebrates, the animals with backbones, move with the help of their skeletal and muscular systems even though each animal has a different method of locomotion. You must have seen fish swimming. They move their fins and tails to be able to swim in the water.

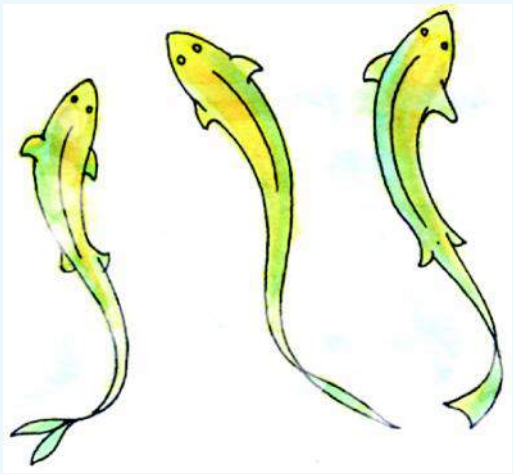


Fig. 18.6 : Locomotion in fish

As snakes do not have legs, they use their backbone and muscles to crawl. If you observe lizards moving, you will notice that they have special type of pads on their feet. These pads keep their feet attached to the walls. Birds can fly in the air or hop around on the ground, or use their feet to perch on wires. Their bodies are covered with feathers. Their front feet become modified into wings and they use these for flying (figure 18.7).The bones of the birds are connected to special muscles which are specially adapted to flying.

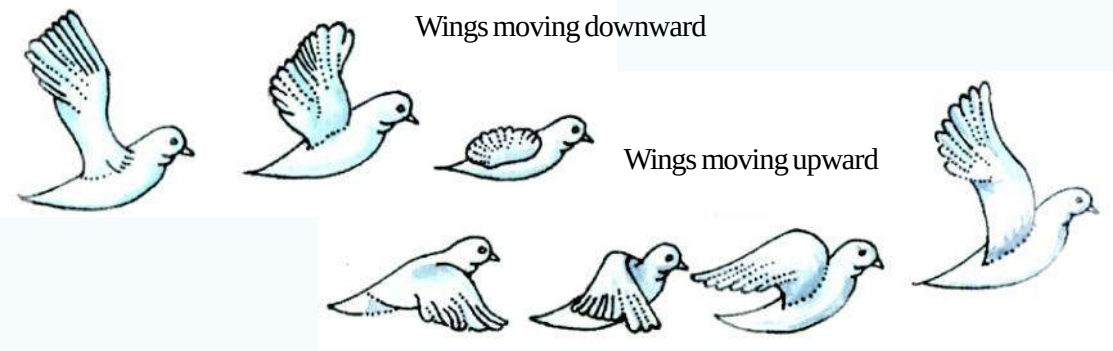


Fig. 18.7 : Flying process in birds

Do you know that Kiwi and Ostrich are birds which cannot fly since they do not have strong muscles like other flying birds. They can only walk and run.

Bats are flying mammals.Their membranous skin stretches between the fore- and hind limbs. This acts like a wing and helps the bats to fly.

Our body has well developed skeleton and muscles which help us in moving. Muscles are attached to bones by long, white string-like tissues called tendons. Every bone has two types of muscles attached to it—a muscle which helps it to move by contracting, and a second muscle which pulls it back to the original position by relaxing.

Heart, lungs, intestines and kidneys keep on doing their work regularly because the muscles in these organs work regularly on their own without our having to consciously control them.

We have learnt

- Various parts of a plant show movement due to external stimulation.
- The root is attracted by gravity towards the earth, and this is called geotropism.
- The root is also attracted towards water and this is called hydrotropism.
- The stem moves towards light due to phototropism
- The leaves of touch-me-not plant close on being touched and this is called seismonasty.
- Organisms travel from one place to another and this is called locomotion
- Locomotion in the earthworm is due to the contraction and relaxation of muscles.
- The locomotion of flies and mosquitoes takes place due to the muscles attached to their wings.
- Snakes crawl with the help of their backbone and muscles.
- Birds fly with their wings. Their wing muscles are strong and specially designed for flying.
- Our body has well developed muscular and skeletal systems for locomotion.

Questions for practice

1. Identify the wrong statements in the following, correct and rewrite them

. a) The movement of bones is due to contraction and relaxation of muscles.

b) The movement of plant stems is called positive geotropism.

c) Rose plant shows seismoplasty.

d) The movement of roots towards light is called hydrotropism.

2. What is tropism ?

3. Plant roots move towards the earth. Give reasons.

4. Write about the movement of the leaves of Touch-me-not.

5. Briefly explain the movement of different kinds of microorganisms.

6. Write down the uses of muscles in the locomotion of animals.

Do these also

1. Try this interesting experiment at home. Make four holes in the bottom of the inner box of a match box with the help of a nail. The holes should be small enough to prevent mustard seeds from falling out. Place one seed on each hole. Put a thin layer of soil on it and sprinkle some water on the soil. Place the box on two pebbles or pieces of wood so that the bottom of the box does not touch the ground. Sprinkle water on it for 4 – 5 days . Examine the seeds and answer the following questions in your notebook.

   (1) In which direction are the emerging roots moving?

   (2) Have any of the roots come out of the hole and turned back?

   (3) What external stimuli are affecting the root ?

2 Carefully observe the various parts used in the locomotion by animals found in a garden, pond, zoo etc. Note down your observations in a scrap book.

Chapter 19

SOIL

19.1

Along with air and water, soil is also a basis of life. It is interminable with life in such a way that we cannot think of a life without it. All of you make a list of the different uses of soil and discuss about them in the class. Also discuss whether the soil used for different purposes is the same. Can any type of soil be used to make pictures and toys? Are all type of crops grown on the same type of soil?

Come we will try to know more about different types of soil. For this we will have to collect samples of soil from different places as fields, ponds, roadside, garden, grounds etc. Therefore when you read this chapter go on a tour to a nearby area of the school with your teacher.

Activity - 1

Before going on tour with your teacher's guidance, make groups of six students each. Take with you, some soil digging equipments as a pickaxe and plastic or metal bowls to carry the soil. For studying different properties of the soil , about 250 g of soil is needed. Decide which group will collect soil samples from which place. Soil samples must be collected on the same day when the activity is to be done. Place a label with the name of the place from where the sample of soil is collected.

Soil can be examined through out the year but it is better if the soil sample is collected during summer.

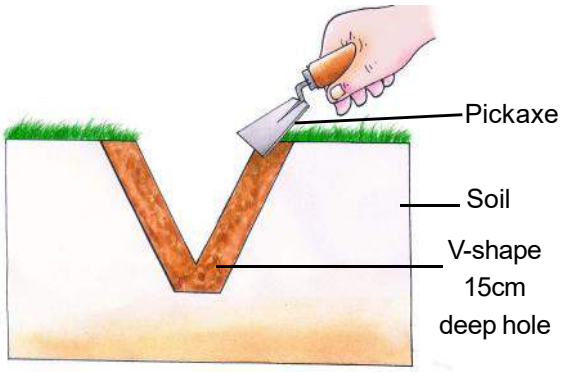


Fig 19.1 Collecting soil sample with pickaxe.

When collecting the soil sample from the selected area, the upper layer of carbonic compound which is not decayed as waste, stones, etc. should be removed but do not remove the soil. Now with the pickaxe dig a hole in V shape of about 15cm deep. Collect a layer of it carefully.(fig-19.1)

19.2 COMPOSITION OF SOIL

Let us perform an activity to know about the constituents of the soil.

Activity - 2

Materials Required- Soil, glass or beaker, spoon.

Fill three-fourth of the glass or beaker with water. Now add a portion of the collected sample of soil into it. Stir and mix with a spoon. Keep this glass or beaker aside without disturbing it for two hours. Now observe the different layers formed in the beaker . The

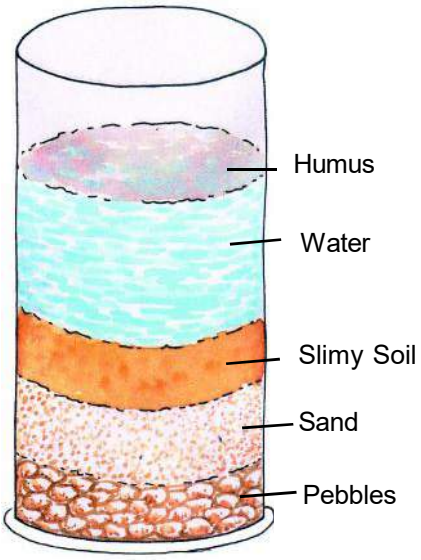


Fig 19.2 Composition of the Soil

effervescence produced in the soil is give to air present in the soil. (fig -19.2) and write them in the table (19.1) given below :

table 19.1

S.N.	Layers	Constituents of the layer	Colour
1.	First Layer (bottom)	pebbles	_____
2.	Second Layer	_____	_____
3.	Third Layer	_____	_____

You have seen that layers are formed of particles which are differently sized. The heaviest particles form the lowest bottom layer and the lightest particles like humas, dead decaying matter of plants and animals form the the upper most layer. Do the experiment with all the samples of soil collected by the other students of the class. Do you find any difference? Discuss it in the class.

19.3 SOIL - PROFILE

If we want to know about the profile of the soil, we have to go to a place where ground has been dug for the purpose of building road, bridge, well or the foundation of a house. In its depth we can see the different layer.(fig 19.3). We find each layers different in colour, compositon ,depth and chemical composition. These layers are called stratas. Now draw a picture of the cut portion of the ground. Also if you can , try to write the width, size of the particles and colour of each strata.

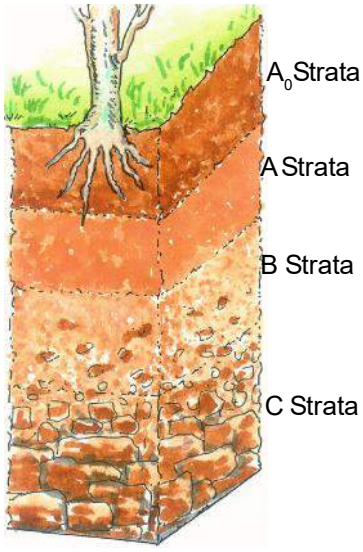


Fig 19.3 Profile of the Soil

You have seen that soil has different stratas. The main ones are:-

A_0 Strata — The topmost layer is called the Carbonic Strata. It is formed by the plants and other carbonic organisms present in the ground. In this strata the decomposition of the carbonic compounds goes on and so this strata has a dark colour.

A Strata — This lies below the A_0 strata. It is the living place of many organisms as earth-worms, fungi and bacteria. This strata is full of humus. It is soft, porous and retains much water.

B Strata — This strata is hard. Its colour is mild and has less carbonic compounds. Minerals are plenty in this strata.

C Strata — This strata contains small pieces of rocks. It has no humus but it does have minerals. Below this strata we find the rocks.

19.4 COMPONENTS OF THE SOIL.

There are four components of soil. They are air, water, minerals and carbonic compounds (humus).

These four components of soil are mixed so close together that it is difficult to separate them. Such soil where plants grow easily as per its volume has about 50% water and air.The rest 45% of minerals, and 5% is of carbonic compounds (humus).

The minerals of the soil comes from the rocks, from which the soil is formed. Some soil gives a distinct colour to the soil. For example soil rich in iron is red in colour. Humus is found on the topmost layer. This helps in providing nutrients to the plants and also helps in binding the soil particles together.

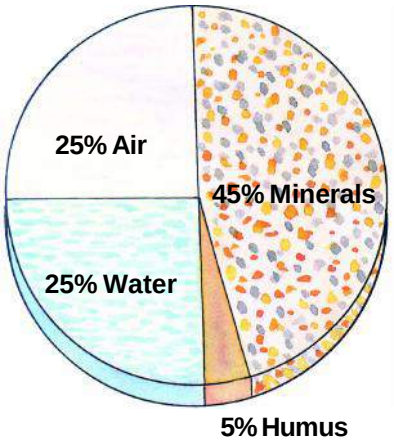


Fig 19.4 Components of Soil

POROSITY OF THE SOIL- Even though the particles of the soil are binded together, here are small vacant spaces in between them. They are called the pores. These pores are filled with air and water. It is due to these pores that soil has the quality of porosity. The porosity of the soil plays an important role for plants and animals.

- Plants and animals use air and water present in the pores of the soil.
- It is due to porosity that soil can retain water and air .
- Roots of the plants can grow properly only when there is sufficient porosity in the soil.
- There are different types of bacteria present in the pores which by their reactions enhance the fertility of the soil.

Now write in your copy why marshy soil is not good for the growth of the plants.

Answer these

1. Name the main components of the soil.
2. Draw a diagram of the soil profile.
3. Which strata of the soil contains the humus in the profile of the soil?
4. How does soil with porosity help in the growth of plants?

19.5 HOW IS SOIL FORMED

The shape of the soil which you see now ,was not so from the beginning. Let us see how the soil is formed. You can understand this by a simple activity. Rub two pieces of small stones with each other. You will get powder of the stones. In the same way the rocks of the earth, due to some physical, chemical and biological causes, break into small pieces or very minute particles. This is called weathering of rocks.

On the earth,flowing water, wind, temperature, volcanoes, earthquakes, and other physical processes cause the breaking up of the rocks.

The minerals present in the rocks are transformed by many chemical reactions. These make the rocks weak and break them. Come, let us see how biological factors help in the formation of soil. Bacteria , algae and many microbes, decompose dead plants and animals and wastes of food materials. This process forms a dark brown product. This combines with the soil and forms the main constituent of the soil

– the humus. The combination of the carbonic compounds (humus) with the soil is the last step of soil formation. Humus makes the soil fertile and plants are able to get nutrients continuoesly from the soil.

Therefore soil has a composition made of mineral and carbonic products having air ,water, along with plants and animals. The minerals present in the rocks are transformed by a number of chemical reactions.

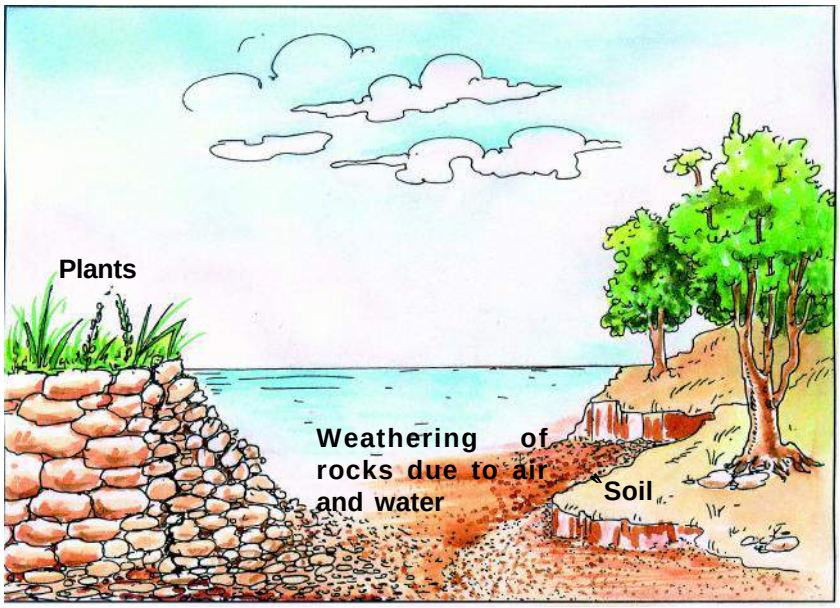


Fig 19.5 Formation of soil due to weathering of rocks

19.6 TYPES OF SOIL

In the activity you have seen the different layers having many different constitutents.

Mainly there are four type of particles in the soil.

1. **Gravel or Pebbles –** The particles which are of the biggest in size settle down at the bottom. Their size are bigger than 2 mm.
2. **Sand –** The particles of size between 0.05mm and 2mm are called sand. They form the layer above the gravel.
3. **Silt -** The particles of size between 0.005mm and 0.05mm are called silt.
4. **Clay –** These particles are of the smallest size. It can only be seen under the microscope. Its size is less than 0.002mm and feels very slimy to touch.

Soil is made of these constituents. Different types of soil have different amount of these particles. The soil is classified according to the amount of particles present.

A. **Sandy soil –**If the amount of bigger particles is more, then it is the sandy soil.

B. **Slimy soil –**If the amount of minute particles are more , then it is called slimy soil.

C. **Loamy soil –** The soil having equal amount of small (clay) and big (sand) particles, (fig 19.6) called loamy sail. Loamy soil is formed by sand, slimy soil and humas.

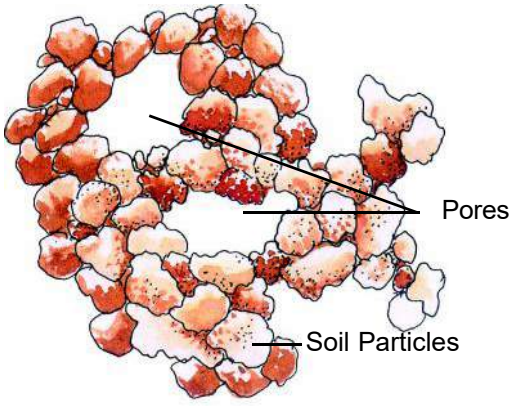


Fig 19.6 Structure of loamy soil

It contains small and big particles. Pores are also present in the soil. Therefore it can retain sufficient water and air. This is the best soil for the growth of the plants.

19.7 PROPERTIES OF THE SOIL

Now you have sufficient knowledge of soil. Let us see to the characterstics of the samples of soil collected and write the observations in table 19.2, drawn in your copy.

Table - 19.2

S.	CHARACTERSTICS	OBSERVATIONS
1.	Colour	black/brown/blackish-brown/reddish-yellow/ —
2.	Odour	odorous/foul-smelling/odourless/ — — — —
3.	Feels on touch	minute/powder/lumpy/ — — — —
4.	When pressed between fingers	stiff/soft/crisp/sticky/ — — — — —
5.	Seen with a lens (if needed)	— — — — — — — — — — — — — — — — —

One of the main property of soil is its ability to retain water. Come let us see which soil has the maximum ability to retain water.

Activity - 3

Materials Required: - 3 funnels, 3 measuring cylinders, glasses, slimy soil, sandysoil, and loamy soil (if not avaliable , prepare by mixing equal quantity of slimy and sandy soil) filter paper, and cotton.

Fold the filter paper and place it in the funnel, put cotton on it. Put 50 g of slimy, sandy, loamy soil each in different funnels and place these funnels as shown in fig 19.7 on glasses or measuring cylinders.

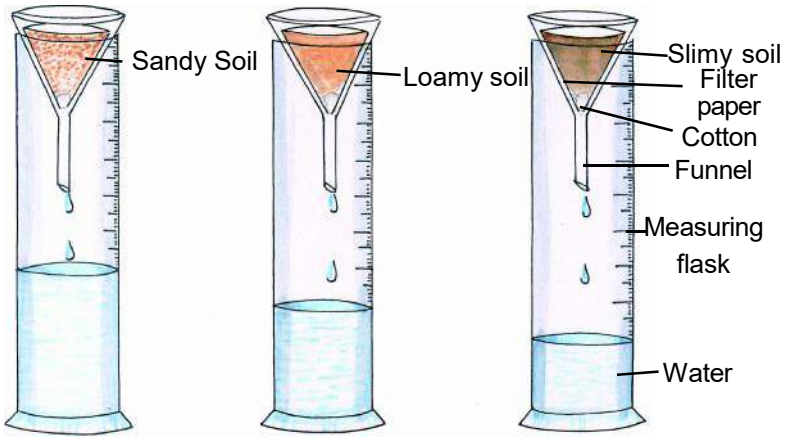


Fig 19.7 Water retaining property of soil

Pour 50 mL water in each sample of the soil slowly on the upper suface. Donot pour the entire water at the same place. After sometime when the water-drops stop falling in the measuring cylinders ,measure the quantity of the water collected in the cylinder. If you have used glasses for the activity then pour the water into the measuring cylinder and measure it. This actvity must not be done after the rains or after irrigation, it must be done only after 48 hours or the results may not be accurate.

Answer these

1. In which of the measuring cylinders is the maximum amount of water collected?

2. From the observations, what can you conclude about the water retaining capacity of each of the soil samples?

3. Which type of soil is suitable for the growth of plants and why?

4. Which tpye of soil is not suitable for the growth of plants and why?

5. The level of the water in the well increases even eight to ten days after the rains. Why?

Come , we will perform some other activities with the collected samples of soil.

Activity - 4

Materials required:- Test tube of hard glass, dry soil, heating apparatus, matches.

Take the soil in the test tube of hard glass and heat it. Do you find water drops on the walls of the test tube? If yes , from where did this water come? Now remove the soil to a plate. Compare this with the unheated soil and answer the following questions in your copy.

1. Are both of the samples of soil same?

2.Which qualities are enhanced in the soil by the presence of water in the soil?

3. What is the importance of this quality for the plants?

Activity - 5

Materials required:- Two bottles with lids, cotton, thread, two samples of soil collected from different places.(sand and soil from garden, farm or any other place near a waterbody) phenolphthalein, caustic soda and water.

Label the two bottles with lid as 'A'and 'B'.Put some damp soil in bottle 'A'and some sand in bottle 'B'.

Take two threads of about 20 to 30cm length. Dip balls of cotton in alkaline phenolphthalein solution and tie them to the ends of the threads. Place one end of the thread (with the balls) inside and the other end (along with the ball) lies outside. Tighten the lids of the bottles.

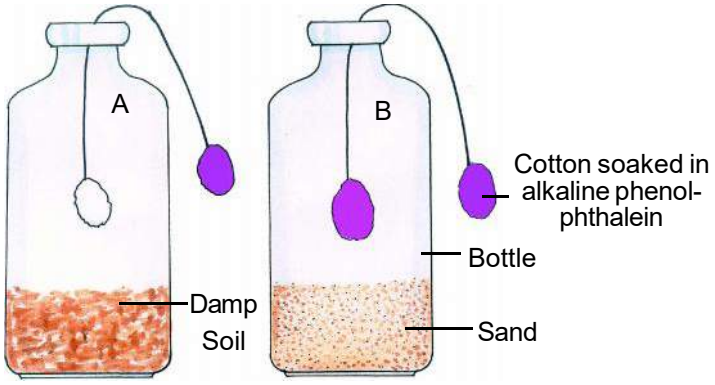


Fig 19.8 Microorganisms are present in the soil

After 4-5 hours observe the changes and answer the following questions :-

1. Observe the colour of the cotton balls inside and outside the bottles.

2. What are the changes in colour of the cotton balls in bottles 'A' and 'B'?

3. What is the cause of the change in colour of the cotton ball inside bottle 'A'?

From this activity we can say that, there are micro-organisms in the soil which release carbon-di-oxide through respiration.

19.8 SOIL AND CROPS

Different types of soils are found in different parts of India. The components of soil, determine the various types of vegetation and corps that might grow in any region.

• Clayey and loamy soils are both suitable for growing cereals like wheat, rice and gram. Such soils are good at retaining water. For lentils (masoor) and other pulses, loamy soils, which drain water easily, are required. For cotton, sandy loam or loam, which drain water easily and can hold plenty of air are more suitable.

• Crops such as wheat are grown in the fine clayey soil, because they are rich in humus and are very fertile. Find from your teachers, parents and farmers the type of soils and crops grown in your area. Enter the data in the following table 19.3 and note in your notebook.

Table -19.3

S.No.	Type of soil	Crop grown
1.	Clayey	Wheat .....
2.	……	……
3.	……	……

Answer these

1. What is weathering of rocks?
2. Name the different components of the soil?
3. In which type of soil will most of the rainwater flow away?
4. What will be the effect on the crops, if there is no porosity in the soil ?

19.9 SOIL EROSION

Activity - 6

Materials required:- Two small flowerpots or baskets, seeds of bengalgram, mustard or wheat and water.

Fill both the flowerpots or basket with garden soil. In one of them germinate some seeds. Donot sow seeds in the other pot. In six to seven days the plants in the first pot will grown more. Now tilt the pots such that soil washed away may be collected near the pot or in plates(fig 19.9). Now slowly pour equal amount of water in each flowerpot. Observe and find out from which pot less soil is washed of and why?

The roots of the plants hold fast the soil. Most of the nutrients in the soil is in its upper layer. Due to which the soil becomes fertile. Strong wind and rains wash away or erode this fertile layer. Loss or destruction of this upper fertile layer is known as soil erosion.

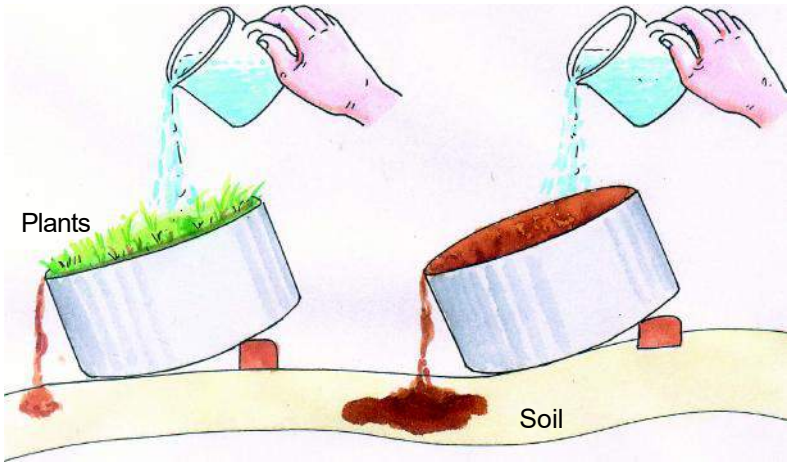


Fig 19.9 Plants stop soil erosion

Due to soil erosion ,there are losses other than destruction of the fertile layer. Soil eroded by wind and water get collected in ponds, rivers and lakes as silt. This lessens the depth of the water source and increases the danger of floods. Erosion of soil can also lessen the absorbtion of water by the ground which increases the dangers of droughts.

Now you can know how to stop soil erosion.

Human being with some of his activities has increased soil erosion. Deforestation, cutting of forests, over grazing, digging earth for constrution, excessive agriculture, mining for man's selfish use (mining for gravels, sand, bricks and minerals) also increases the dangers of soil erosion.

19.9 SOIL A NATURAL RESOURCE

You all know that we get food, clothes, medicines, minerals, fuels, construction materials and fresh air directly or indirectly from the soil. It forms the foundation of houses buildings and roads. Many utensils and toys are made from this. It is the habitat of many organisms as bacteria fungus, insects ,earthworms , snakes ,rats etc and plants. It is difficult to amend its loss. This natural resource is being polluted by human activities so it is necessary to save or preserve this.

19.10 POLLUTION OF SOIL

As water and air ,soil also gets polluted.

Activity - 7

From the dustbin of your house collect all the skins of fruits and vegetables and leftover food in one bag, waste papers in a second bag and all the plastics, glass pieces, and metal pieces in the third bag. Remove all these from the bags and burry them at three different places and mark them. After 8-10 days dig out all these and observe their state. What are the findings? Discuss them in your class.

You must have seen garbage heaped up at many places in your village, town or city, which has wastepapers, torn clothes, old leather bags and shoes etc. All that can be decomposed by micro-organisms or we can say they decay. These increases the quality of the soil.

But along with these, things which are made of metals, glass pieces, polythene bags, and things made of plastic as buckets, bottles, boxes etc are also there. Decomposition of these things by the micro-

organisms is very slow or even negligeble. This is a cause of pollution and such waste products make the soil polluted.

Another major problem in the cities, as you all know is the disposal of the sewage. When all this sewage mixes with the soil, it closes the pores in the soil, and this hinders the propogation of air and water in the soil. In such a soil, plants cannot grow properly.

Mixing of the sewage with the soil creates one more problem , that is germs of many diseases as typhoid, diarrohea, T.B. etc get mixed in the soil. Which makes it clear that such soil is the cause of the spread of these diseases. Even though agriculture is the basis of life, excessive spraying of the germicides and fungicides on the crops is a cause of soil pollution. Continuous excessive use of chemical fertilizers, and use of hard water for irrigation continuously, can also cause soil pollution. Waste product from the factories can also pollute the soil.

19.12 PRESERVATION OF SOIL

Soil is a renewable resource, although it develops slowly and by gradual weathering of rocks. You have seen that the formation of soil is not possible. Its formation is by nature. Therefore it must be used carefully, so that the soil is not destroyed.

- Plants and trees are the best protectors of soil. That part of soil which is covered by plants and trees are safe from erosion. So we must plant trees in lands where farming is not done.
- In the sloping hilly areas and mountainous areas, by terracing of the land or by making bunds on slopes between the fields of crops, soil can be preserved.
- All carbonic waste(cowdung, leaves, leftovers of crops, kitchen and market waste of vegetables and fruits) must be returned to the soil as biological manure.
- Discarded faeces, wasteproducts of factories must be disposed of very safely. So that the soil can be saved from their ill effect or pollution.
- Un-necessary cutting of trees in forests must be stopped.
- Pits dug for the extraction of minerals must be filled afterwards.

19.13 Soil Testing and Remediation

In agriculture, a soil test commonly refers to the analysis of a soil sample to determine nutrient content, composition and other characteristics such as the acidity or pH level, salinity, nutrient deficiency and the necessary remediation are taken accordingly.

Answer these

1. What is known as soil erosion?
2. Write three causes of soil pollution?
3. How will you preserve soil of your neighbourhood?
4. What is the effect of the cutting of trees, on soil?
5. Why is soil-testing necessary? Explain.

We have learnt

- Soil is also a basis of life as air and water.
- If you dig the earth deep you will find different layers. This is the profile of soil.
- Various physical, chemical and biological activities lead to the breaking of rocks into powder or dust, which when mixed with decaying, dead, organic matter (humus) forms the soil.
- There are mainly four types of constituents in soil;-gravel, sand, silt and clay.
- Loamy soil is a mixture of sand, clay and humus. This soil is much useful for the growth of plants.
- There are pores in between the particles of the soil , so that the soil becomes porous.
- Wheat and gram are grown is clayey and loamy soil while cotton is best grown is sandy loamysoil.
- Soil testing refers to the analysis of a soil sample and gives information about the quality of soil and its fertility.
- Loss of the upper fertile layer of the soil is called soil erosion.
- Along with strong wind, flowing water, cutting forests, excessive grazing and excessive ploughing for agriculture also adds to soil erosion.
- Waste products, sewage and excessive use of insectiside, fungiside, fertilizers may pollute the soil.
- Soil is a valuable natural resource.

Questions for practice

1. Fill in the blanks :-

1. The biggest particles of the soil is ——————————————.
2. ——————— soil has the maximum property of water retention.
3. Breaking up of rocks into small particles is called———————.
4. Loss of the upper fertile layer of the soil is called———————.
5. ---------- soil is good for growing cotton.

2. Write true and false for the statements given below and also correct the false statements.

1. The soil with humus is not fertile.
2. Loamy soil has gravel and clay particles in it.
3. All types of soil have the same property of water retention.
4. Soil must be porous for a good crop.
5. Plants and trees increase soil erosion.

3. Answer the following questions.

1. How can you prove that soil has micro organisms in it?
2. How can you stop soil from being polluted ?
3. Explain the profile of soil of your area with a labelled diagram of it?
4. How will you test the capability of water retention in red sandy soil, red loamy soil and black soil found in Chhattisgarh?
5. What will happen if soil disappears from the earth?
6. Which type of soil is suitable for rice crop?

Do these also

1. Collect informations from potters of your village or city who make clay toys and utensils, about the types of soil they use.
2. Prepare fertilizer for plants of your house/school with your friends.

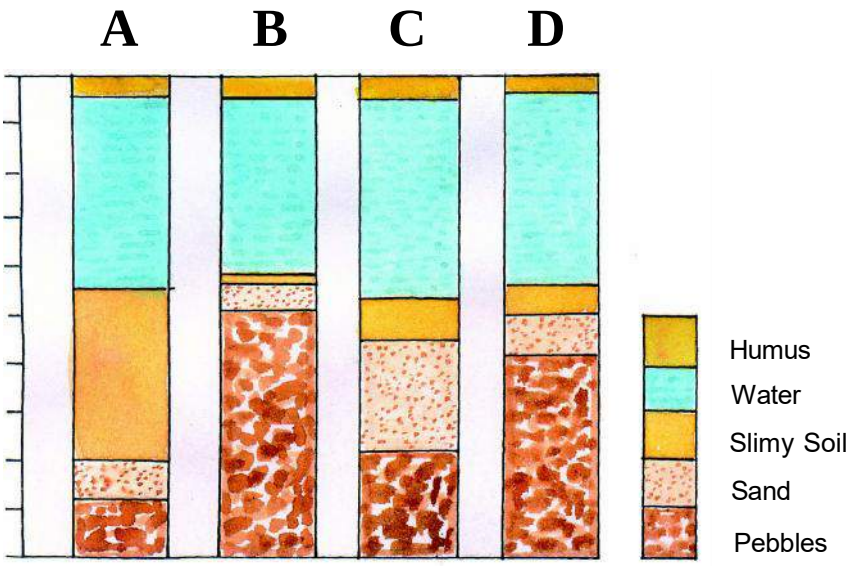


Fig 19.10 Sample of soil

3. Four equal quantities of soil samples were collected from four (A,B,C,D) places and equal amount of water was mixed in each and left for sometime. The results where as per fig.19.10.

Can you say -

1. Which soil has maximum humus?
2. Which soil has the least pebbles?
3. B sample has very less earthworms.Why?
4. Out of these which soil is a good garden soil?
5. How can you change the soil of the D sample to be a better soil ?

4. In which other fields the soil is used other than agriculture ? Is the soil type used is same for all the work areas. Discuss with your teacher.

Chapter 20

REPRODUCTION IN LIVING ORGANISMS

20.1

You must have seen farmers and gardeners sowing seeds, and new plants coming up from these seeds. You know that a chickpea seed gives rise to a chickpea plant, bean seeds sprout into a beanstalk and a mango seed gives rise to a mango tree. Similarly, a cow gives birth to a calf, a goat gives birth to a kid (baby goat) and chicks hatch from the hen's eggs. All living beings give rise to offspring of the same kind, and this process is called reproduction.

20.2 Reproduction in Plants

You have already read that fruits develop from flowers, and seeds are formed in the fruits. We also know that seeds germinate to give rise to new plants. Let us now find the association between flowers, fruits and seeds.

Activity - 1

Materials required :- Two flowers and fruits each of lady finger, brinjal, gulmohar, pea etc., razor blade.

Choose flowers with big and prominent ovaries. The fruits should also be available at the same time as the flowers.

Observe the flowers carefully and draw their diagrams in your notebook (fig.20.1).

Identify the different parts of the flower and dissect out the calyx, corolla, androecium very carefully, taking care not to damage the gynoecium. Now only the gynoecium will be left in the flower. It is made up of ovary, style and stigma. Draw the gynoecium and the fruit in your notebook (fig.20.2).

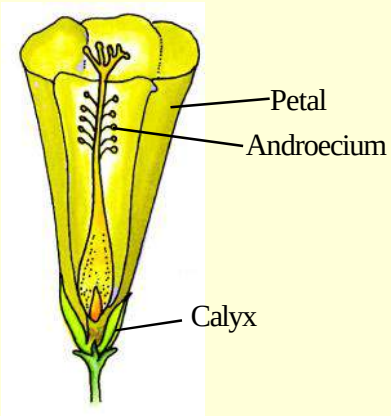
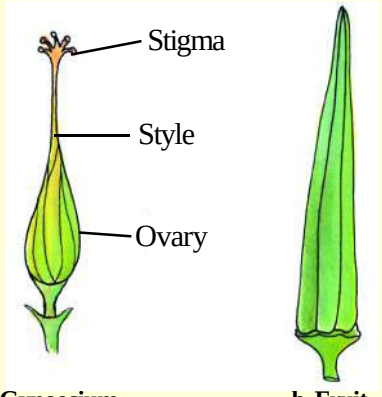


Fig. 20.1 Flower of Ladyfinger



a. Gynoecium b. Fruit

Fig. 20.2

Observe the ovary of the flower and the fruit very carefully and enter their characteristics in table 20.1.

Table - 20.1

Characteristics	Ovary	Fruit
Size	Small/Big	Small/Big
Shape	Long/Round	Long/Round
Surface	Smooth/Hairy Flat/Ribbed	Smooth/Hairy Flat/Ribbed

To observe the internal structure of the ovary and the fruit, cut them transversely and longitudinally. Draw the diagrams of the sections in your notebook.

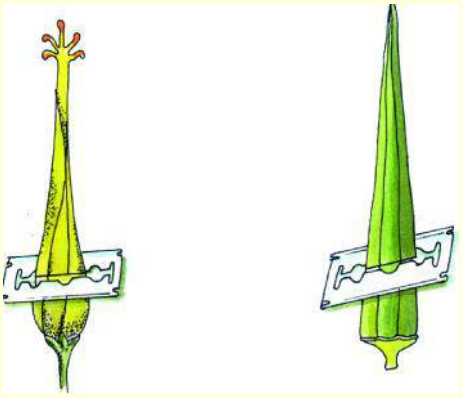


Fig. 20.3 a. Cutting the gynoecium and fruit transversely

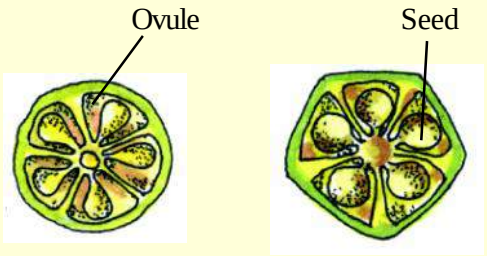


Fig. 20.3 b. Transverse sections of ovary and fruit

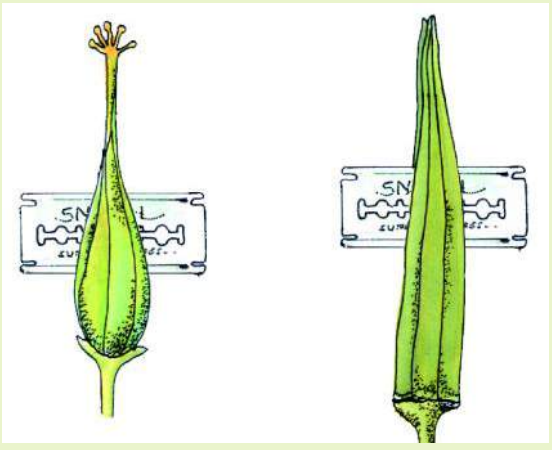


Fig. 20.4.a. Cutting the gynoecium and fruit longitudinally

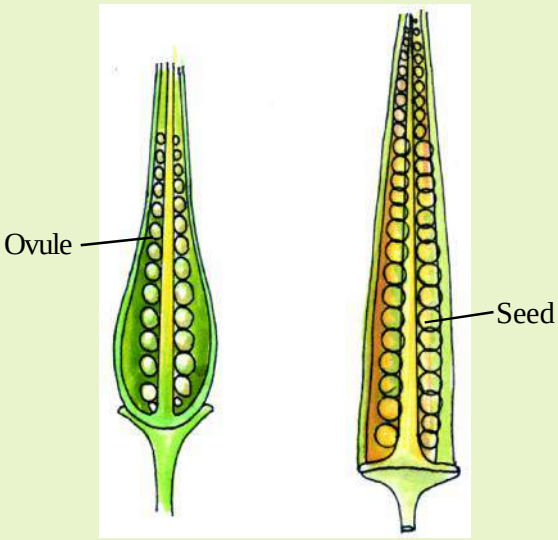


Fig. 20.4 b. Longitudinal sections of ovary and fruit

Answer the following questions on the basis of these sections and diagrams:

What are the similarities between the transverse section of an ovary and a fruit?

What is the shape?	Elongated/ circular/ angled
What is the type of wall?	Thick/ Thin
What is the surface like?	Smooth/Rough
How many chambers are in the ovary?	_____
Which part of ovary are the ovules attached to?	Wall/centre
Which part of fruit are the seeds attached to?	Wall/ centre

We can conclude on the basis of these similarities that fruits are formed from the ovary and seeds are formed from the ovules.

Now, do you think a plant can bear fruits if it does not have flowers?

Activity - 2

Materials required :- China rose, papaya, maize, bottle gourd flowers.

Identify the position of androecium and gynoecium in these flowers and complete the table 20.2. Also, observe the other flowers found in your neighbourhood and enter your observations too in the table.

Table - 20.2

S. No.	Name of Flower	Position of Androecium and gynoecium in flowers growing on the same plant		Androecium and gynoecium in different flowers on different plants
		In the same flower	In different flowers	
1	China rose			
2	Papaya			
3	Maize			
4				
5				

See Fig. 20.4(c).The majority of plants have both androecium and gynoecium in the same flower. Such flowers are called bisexual flowers. On the other hand, some flowers have only androecium or only gynoecium. These are the unisexual flowers. Unisexual flowers can grow on different parts of the same plant or on different plants. Unisexual flowers having only androecium are called male flowers and those bearing only gynoecium are called female flowers.

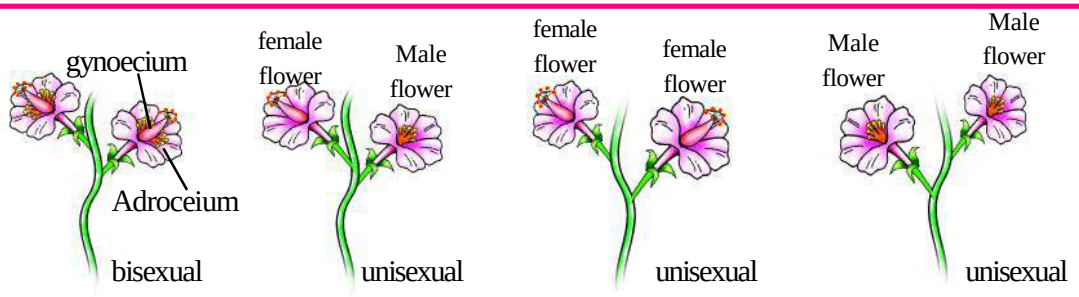


Fig. 20.4 (c) : Symbolic pictures of the situation of androecium & gynoecium

Activity - 3

Materials required :- Flowers of Besharam or *Datura*, razor blade, magnifying lens

Identify the androecium in these flowers and draw its diagram in your notebook. Label the anther, filament and the connective. Feel the anther with your finger. What happened? Did a powdery substance stick to your finger. Observe it under a magnifying lens. What did you observe? Anther contains a large number of small rounded structures called the pollen grains. Cut the anther transversely (Fig. 20.5 a,b). Pollen grains are the male gametes of the plant.

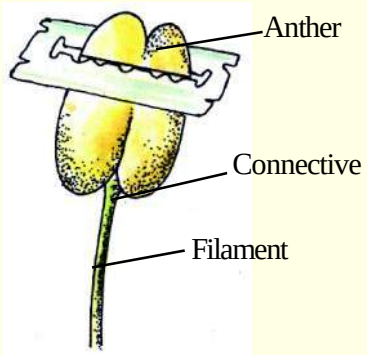


Fig. 20.5(a) Cutting the anther lobe transversely

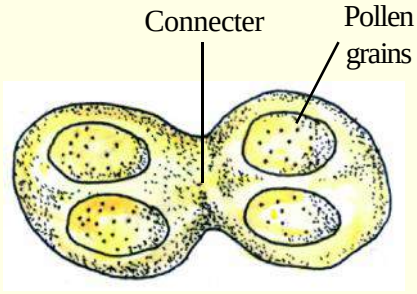


Fig. 20.5 (b) Transverse Section of anther

Cut the longitudinal section of the gynoecium and observe it under a magnifying lens. Gynoecium has a long, hollow tube connecting the stigma and the ovary. This is the style. Ovary contains the ovule and ovule is the female gametes of the plant.

Fusion of the male and female gametes of the plant is necessary for the formation of seeds. This takes place when the pollen grains reach the stigma from the anther. The transfer of pollen grains to the stigma is called pollination. Various agencies like wind, insects, birds, bats, ants etc carry out pollinations in different plants. What happens after pollination? Let us try to understand this through an exercise.

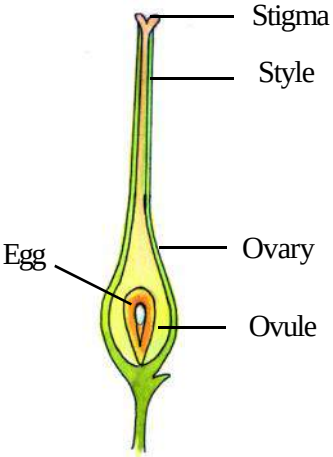


Fig. 20.6
Vertical Section of gynoecium

Activity - 4

Materials required :- Flowers of *Datura*, Lady's finger, slides, water, sugar and microscope

Put a drop of water on the slide and tap the anther of the flower over this slide. Observe this under the microscope. You will see a large number of rounded pollen grains. Add a few grains of sugar to the water put on the slide. Observe the slide after an hour or so under the microscope. (Make sure that the water on the slide does not dry up.)

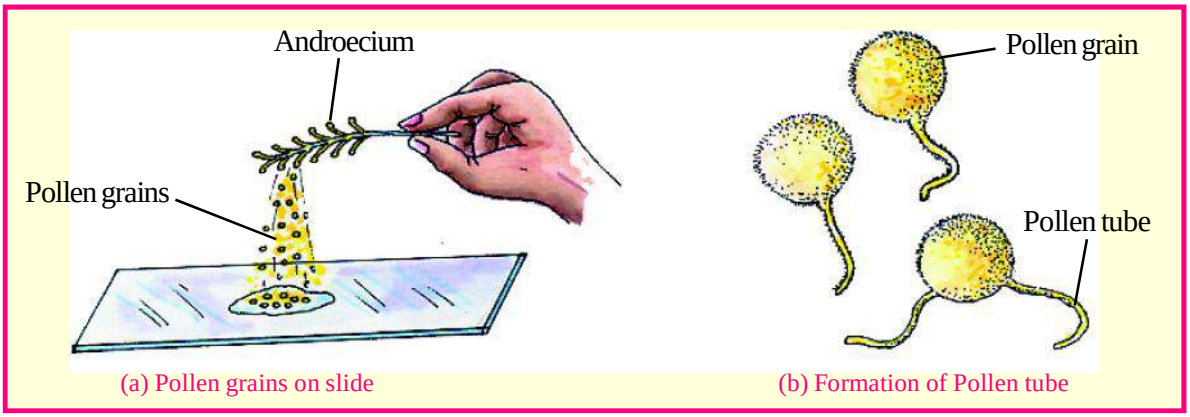


Fig. 20.7

Long, thin tubes emerging from the pollen grains are the pollen tubes. Pollen tube formation takes place after the pollen grains reach the stigma. Presence of a sugar-like substance on the stigma and in the style guides the pollen tube into the ovary. You can now figure out why we put sugar on the slide.

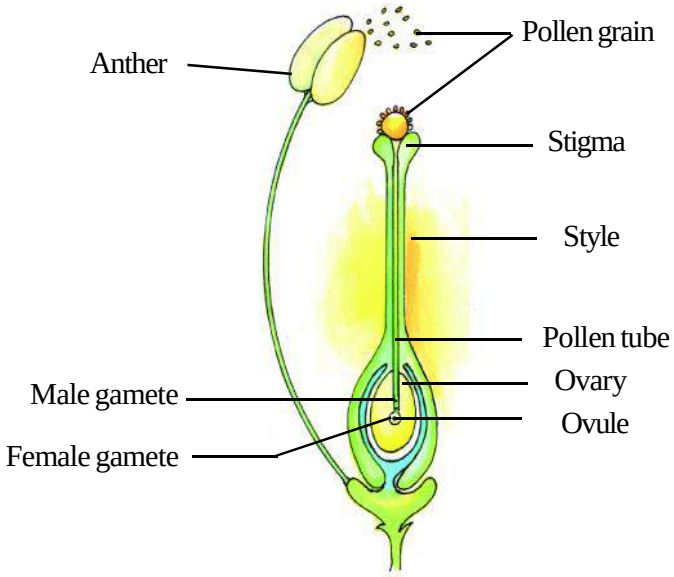


Fig. 20.8 : Fertilization in Plants

After reaching the ovary, the pollen tube enters the ovule. This is where the fusion of the male and the female gametes takes place. This process is called fertilization. The fertilized ovule develops into an embryo. The ovules are converted into seeds and ovary into fruit. Seeds give rise to new plants. This process of formation of new plants is called sexual reproduction.

Do all plants arise from seeds? Have you ever seen new plants arising from parts of plants other than the seeds?

Discuss this in your class and fill in table 20.3 indicating which part of plant gives rise to a new plant.

Table - 20.3

S.No.	Example	Part of plant from which arising
1.	Garlic	.....
2.	Yam	.....
3.	Bryophyllum	.....
4.	Sweet potato	.....
5.	Rose	.....
6.	.....	.....

Activity - 5

Materials required :- Potato, razor blade, two plastic bags, soil, water

Cut the potato into small pieces. Take two of these pieces, one with its eye intact and other without an eye. Fill the two plastic bags with soil and put one piece of potato in each of these bags. Cover the potato pieces with soil and ensure that the soil remains wet. Observe this set-up everyday.

What do you observe after 4-5 days? Which piece of potato gives rise to a new plant? The one with the eye or the one without it?

Actually, potato is an underground stem and the eyes are the nodes. Since it is an underground stem, there are no leaves on the surface but there are buds present in these eyes which, on getting favourable temperature, moisture and air give, rise to new plants (Fig 20.9).

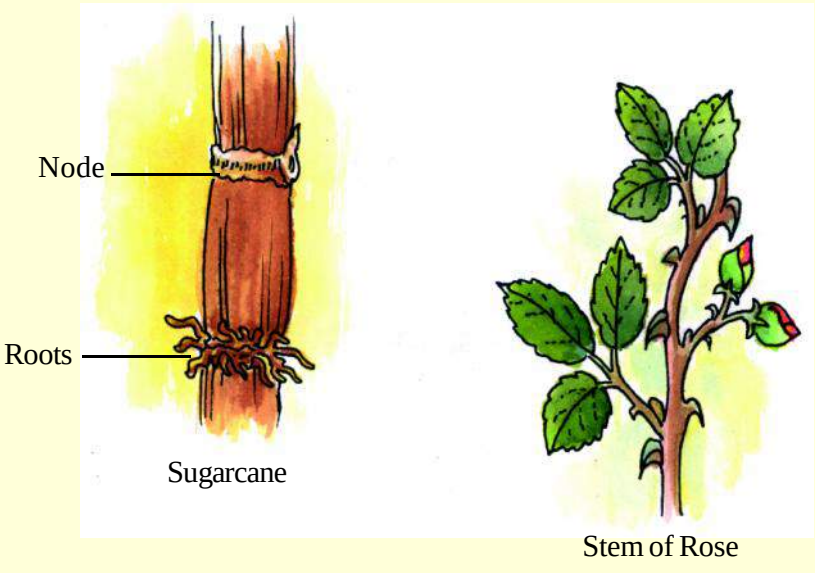
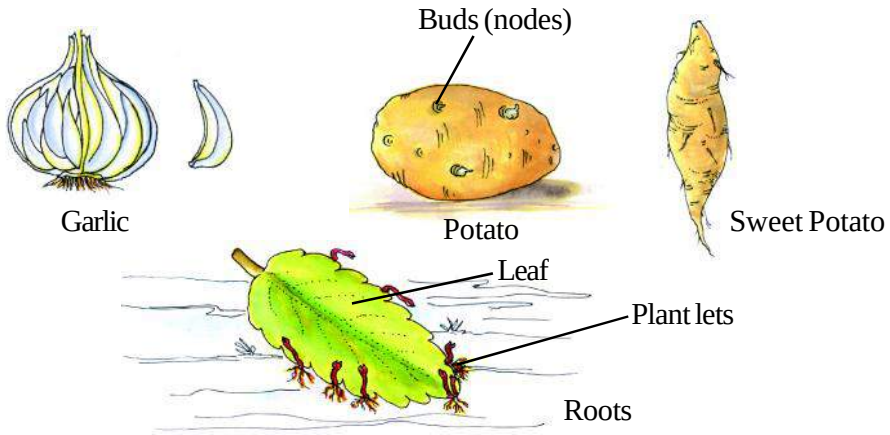


Fig. 20.9 (a) : Asexual reproduction in plants



Bryophllum leaf

Fig. 20.9 (b) : Asexual reproduction in Plants

Now we have learnt that new plants can arise even without the fusion of male and female gametes,. This is called asexual reproduction. By this method we can grow more plants in a short duration. This is the main type of reproduction in those plants where seeds are either not formed at all or take a long time to form.

20.3 Reproduction in Animals

You must have seen earthworms coming out of wet soil after rains. Similarly, when water accumulates in puddles and ponds, you suddenly see many frogs, insects, fish and many types of plants in them. Where do these organisms come from? Let us try to understand this by means of an activity.

Activity - 6

Materials required :- Two transparent plastic boxes A and B, fresh cow dung, paper to cover the boxes, rubber bands, and magnifying lens.

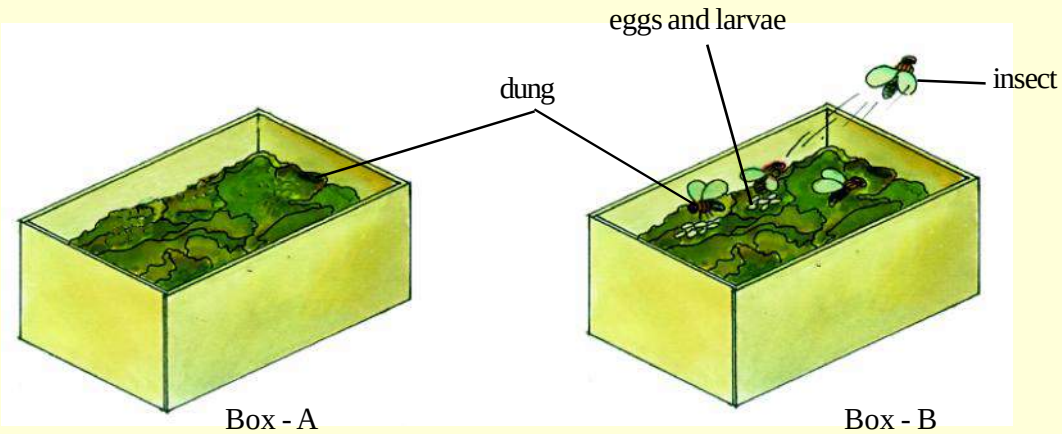


Fig. 20.10

Put fresh cow dung in boxes A and B. Cover the box A in such a manner that no insect can sit on the cow dung in it. Leave the cow dung in the box B open. You will find insects sitting on it. Observe both these boxes carefully for two or three days. You would see that after a few days there are depressions in the cow dung kept in box B. If you scratch the depressions a little, you will see larvae in them. Where did these larvae come from? They have come from the eggs of the insects which sat on the cow dung. These larvae develop into insects. On the other hand, no larvae are seen on the cow dung kept in box A. You would have now understood that no organism arises on its own. For a new individual to arise, it is necessary that individuals of its own kind already exist.

You have read about sexual reproduction in plants. Like plants, animals too have male and female sex organs. When these are found in separate individuals, the animal is called unisexual, for example, man, cow, cat etc. If both types of sex organs are found in the same individual, then the animal is called bisexual. Earthworm and leech are examples of bisexual animals.

Apart from the sex organs, do you think there are any other features on the basis of which you can distinguish between male and female animals?

On the basis of external characteristics, try to differentiate between a cow and a bull, a he-goat and a she-goat, a hen and a cock. In many organisms like lizards, insects etc., one cannot distinguish between male and female on the basis of external characters.

You would observe that external sexual characteristics are more prominent in those animals that give birth to young ones. There are well-defined sex organs in higher organisms like humans, cow etc. The main reproductive organ in males is the testis. Sperms are produced in the testis. These are the male gametes.

Fig. 20.11
Structure of a Sperm

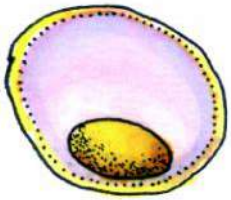


Fig. 20.12

Structure of an Egg

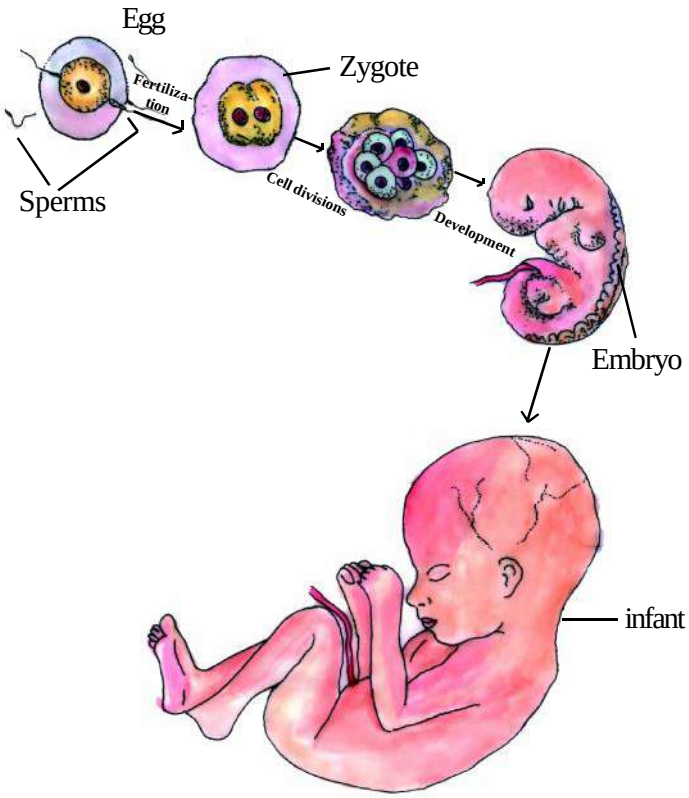


Fig. 20.13

Fertilization and development in Human

The main female reproductive organ is the ovary, where the eggs or female gemetes are produced. Compared to sperms, the eggs are much bigger, immobile and rounded in shape. After coming out of the ovary, the eggs enter the fallopian tubes, which are parts of the oviduct. This is where the sperm and the egg fuse. This process is called fertilization. In majority of organisms, fertilization takes place inside the female body and is called internal fertilization, for example in man. You would have seen the eggs of lizards and birds. These are the fertilized eggs.

Fertilization in aquatic and amphibious animals like fish and frogs takes place in water. The female frog drops its eggs in the water and the male drops its sperms over the eggs. These keep floating in water for a while and then get fused. This type of fertilization is called external fertilization.

After fertilization the egg is called the zygote. After several divisions, the zygote is transformed into an embryo. Differentiation and development take place slowly in the embryo, and it then gets converted into the young organism. This process is called development.

In mammals the development of the young takes place in the uterus and they give birth to a fully developed offspring. Such animals are called viviparous. Fish, frog, snakes, birds etc lay eggs and are called oviparous.

In many oviparous animals the offspring do not resemble the parents. The young animal which comes out of the egg is called a larva. The larva develops into a pupa and the pupa develops into an adult. This process is called metamorphosis and occurs in mosquitoes, flies etc.

Answer these

1. Make a list of five oviparous and five viviparous animals and answer the following;

Oviparous animals	**Viviparous animals**
1. ----------	1. ----------
2. ----------	2. ----------
3. ----------	3. ----------
4. ----------	4. ----------
5. ----------	5. ----------

2. Name two oviparous animals where the young ones resemble their parents.
3. Name two oviparous animals where the young ones do not resemble their parents.
4. Name two animals whose offspring can start moving immediately after birth.
5. Name two animals whose offspring can start moving or swimming immediately after coming out of the eggs.

You have read about asexual reproduction in plants where new organisms arise from some part of the organism. In some micro-organisms like Amoeba, the animal divide into two parts and each part becomes a separate individual (Fig 20.14). This is called division (binary fission). But if an organism gets

divided into many parts as a result of an accident, and each part becomes a new individual, the process is called regeneration (fig 20.15).

In animals like *Hydra*, under favourable conditions, a small protuberance called a bud appears on the surface of the body (fig 20.16). On further growth and development, this bud separates from the parent and becomes a new individual. This process is called budding.

You must have seen the tail of a lizard separating from the body. Do you think that a full-fledged lizard arises from the tail or does the lizard grow a new tail? When broken parts or organs develop again, it is called repair.

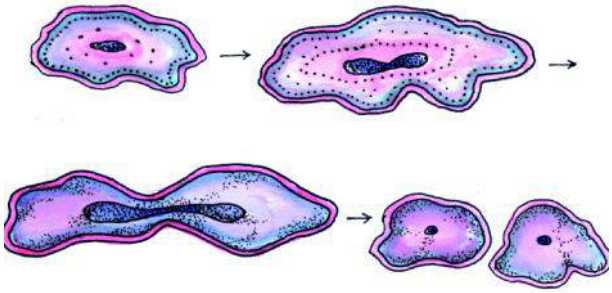


Fig. 20.14 : Binary Fission (Division) in amoeba.

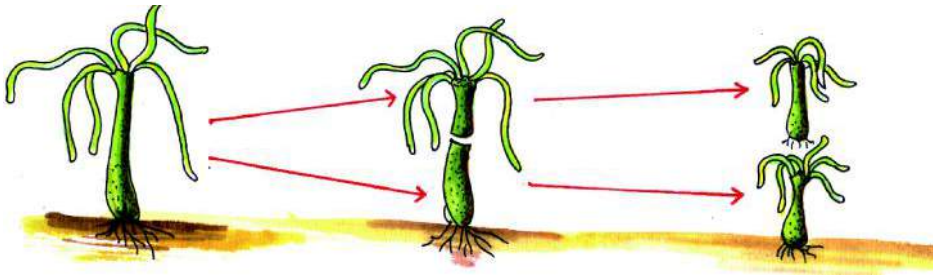


Fig. 20.15 : Regeneration in Hydra

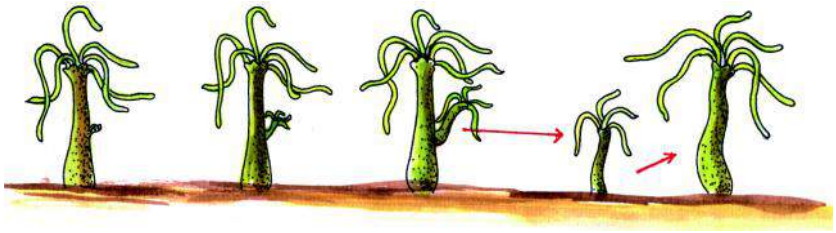


Fig. 20.16 : Budding in Hydra

We have learnt

- Reproduction is the process by which organisms produce individuals of their own kind.
- Reproduction is of two types - sexual and asexual.
- Male and female gametes are required to carry out sexual reproduction.
- In plants, androecium is the male reproductive organ and gynoecium is the female reproductive organ.

- Androecium contains pollen grains and gynoecium contains ovules.
- Transfer of pollen from anther to stigma is called pollination.
- In asexual reproduction, new plants arise from any part of the parent plant other than the seed.
- Most animals exhibit sexual reproduction but some microorganisms and lower animals exhibit asexual reproduction.
- In higher organisms, the main reproductive organ in males is testis and in females the ovary.
- Sperms are produced in the testes and eggs are produced in the ovary.
- External fertilization occurs in some animals and internal fertilization occurs in others.
- Animals which give birth to young ones are called viviparous and those which lay eggs are called oviparous.
- Transformation of zygote into embryo and embryo into young animal is called development.
- Development of new individuals through fragmentation is called regeneration.

Questions for practice

1. Choose the correct answer :

I These are the reproductive organs in a flower:

(a) Calyx and corolla (b) Calyx and androecium

(c) Gynoecium and androecium (d) Corolla and gynoecium

II A seed is formed from:

(a) Egg (b) Ovary

(c) Anther (d) Ovule

III Sperms are produced in :

(a) Ovary (b) Testes

(c) Uterus (d) Seminal vesicle

IV In human beings, the eggs are fertilized in :

(a) ovary (b) uterus

(c) fallopian tubes (d) out side the body

2. Fill in the blanks :-

1) The fusion of male and female gametes is called ……..

2) After fertilization of flowers the ovary gets converted into…….

3) The reproduction in sugarcane is usually through ……..

4) *Amoeba* reproduce asexually through ……

5) The structure formed during asexual reproduction in *Hydra* is called ……

3. Identify whether these statements are correct or incorrect. Correct the statements that are incorrect.

1) The flowers of pumpkin are unisexual.

2) Embryos and seeds are produced during asexual reproduction.

3) Rose plants are usually grown from seeds.

4) Sexual reproduction requires the fusion of the sperm with the egg.

5) *Amoeba* usually reproduce sexually.

6) There is internal fertilization in fishes.

4. Explain the following:

1) Oviparous 2) Viviparous 3) Fertilisation

5. Write short answers to the following questions.

1) What is reproduction?

2) Explain briefly:

a. Sexual reproduction

b. Asexual reproduction

c. Pollination

3) Draw a diagram of a bisexual flower and label the various parts of androecium and gynoecium.

4) Write the main differences between sexual and asexual reproduction.

5) Explain asexual reproduction in *Amoeba* through illustrations.

6) Explain what is regenerative reproduction using an example.

Do these also

1. Find out whether these plants have flowers or not – grass, maize(corn), chillies, Tulsi, Shisham, Peepal, Banyan (Bargad), Mango, Jamun, Guava, Pomegranate, Papaya, Banana, Lemon, Sugar cane, Potato, Peanuts and other plants around you. In the list of plants given above were there any in which you could not see the flowers but could see the fruits? Make a list of such plants and discuss them with the help of your teachers and guardians.

2. Collect five unisexual flowers and five bisexual flowers and place them between the sheets of an old thick book and dry them. Stick them on your collection file and label the various parts of the flowers. Display your collection files on special occasion in your school.

Chapter 21

ELECTRIC CURRENT AND ITS EFFECT

In previous class you have developed an electric circuit with the help of torch bulb, cell and electric wire in various activities. You also have checked the conductivity of various materials like wood, cloth and metals, by connecting them in electrical circuits and have classified them as good and poor conductors of electricity. You might have seen such kind of arrangements in the books also. Have you ever wondered, if there could be an easier way to represent these electrical components in a circuit?

21.1 Symbols for components of electric circuit

Some common electric components can be represented by symbols. In table 21.1 some electric components and their symbols are shown. In the symbol of electric cell, there is a longer line and a shorter but thicker parallel line. Do you recall that an electric cell has a positive terminal and a negative terminal? In the symbol of electric cell, the longer line represents the positive terminal and the thicker, shorter line represents the negative terminal. For some of the activities we may need more than one cell, so we connect two or more cells together by connecting positive terminal of one cell to the negative terminal of the second cell. Such a combination of two or more cells is called a battery. Many devices such as torches, transistors, toys, T.V. remote controls, use batteries. However, in some of these devices the electric cells are not always placed one after the other. Sometimes the cells are placed side by side, inside the battery compartment of any device. There is usually a thick wire or a metal strip connecting the positive terminal of one cell to the negative terminal of the next cell. In the battery compartment '+' and ' - ' symbols are usually printed there (fig. 21.1). For a switch the 'ON' position and 'OFF' position are represented by the symbols as shown. The wires used to connect the various components in a circuit are represented by lines.

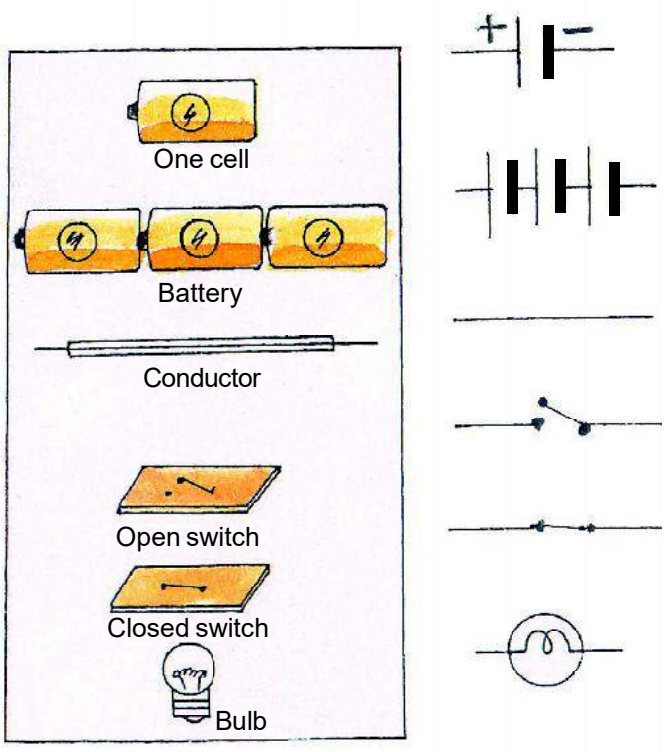


Table 21.1 Symbols for components of electric circuit

Let us do an activity to learn more about an electric circuit:-

Activity - 1

Material required - Torch, bulb (with holder), dry cell (with holder), a key, and some pieces of connecting wires.

Make the electric circuit shown in fig 21.2 a. Notice that the key or switch can be placed anywhere in the circuit.

When the switch is in the 'ON' position as in (fig. 21.2 b closed circuit), the circuit from the positive terminal of the battery to the negative terminal is complete or closed, the current flows through the circuit which makes the bulb glow.

On the other hand, when the switch is in the 'OFF' position the circuit is incomplete or 'Open'. No current flows through the circuit, hence the bulb doesn't glow. (fig, 21.2(a).

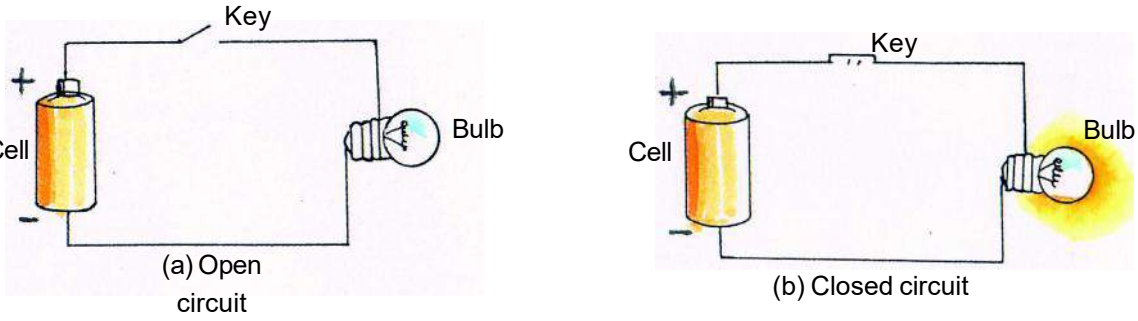
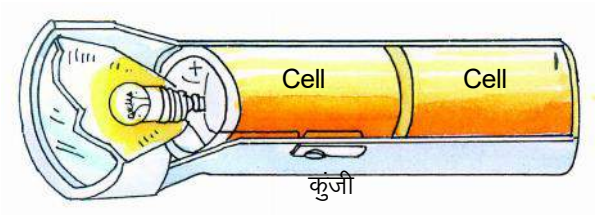


Fig 21.2 a and b Various circuits



(c) Circuits in a torch

Fig 21.2 c Circuit in a torch

In an electric circuit, the following are necessary -

1. The source of electricity i.e. - cell/battery.

2. The device which needs electrical energy i.e.- bulb.

3. Connecting wires which are made of conducting material such as copper.

4. A key or switch by the circuit which can be opened and closed.

21.2 Electric Conductors and Insulators

Conductors are the materials which allow electric current to pass through them. All metals, alloys, graphite and electrolytes are conductors of electricity. Insulators are those which do not allow electric

current to flow through them. Non metals (except graphite) wood, glass, plastic, dry air and most of the gases are insulators. With the help of an activity let us classify certain objects as conductors and insulators.

Activity - 2

Materials required - Dry cell, bulb of a torch, two paper clips and different materials as paper, chalk pieces, straw, match stick, rubber, beakers filled with salt water, lime juice water, kerosene, coconut oil etc.

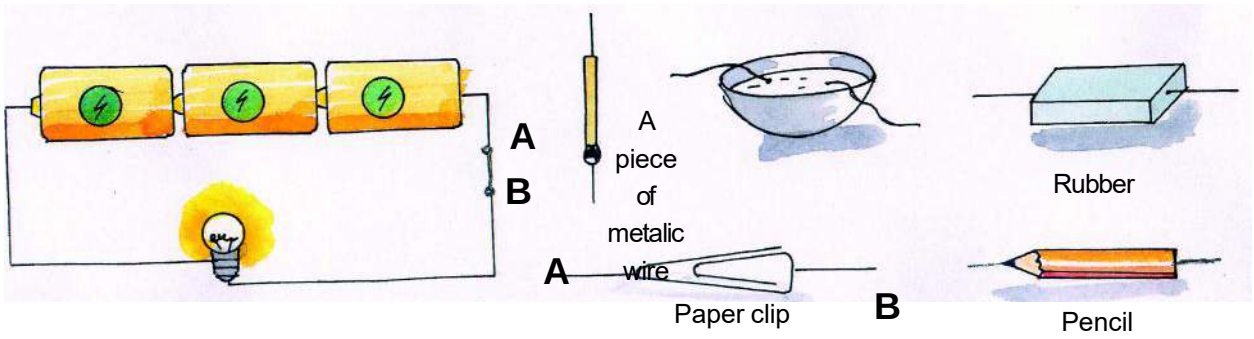


Fig 21.3 Conductors and insulators

Make an electric circuit as shown in fig 21.3. When A and B ends are connected then the electric bulb lights up. Disconnect the ends A and B. This would leave you with two free ends of wires. Now place, one by one each of the samples which are to be tested between the free ends A & B. If the bulb lights up then that material is a conductor and if it doesn't then it is an insulator. For the beakers, remove the clip connecting A and B and dip both the free ends in the solution, keeping them apart. What do you find? The bulb does not glow when the free ends of the wires are in contact with some of the materials you have tested while for some it does glow. Now record your observation in the given table 12.1.

Table - 21.1

S.No.	Material	Bulbglows/not	Conductor/Insulators
1	Match stick	.....	.....
2.	Plastic	.....	.....
3.	Rubber	.....	.....
4.	Paper	.....	.....
5.	Graphite of a pencil	.....	.....
6.	Tap Water	.....	.....
7.	Coconut oil	.....	.....
8.	Lemon juice with water	.....	.....
9.	Salt water	.....	.....

Conductors and insulators are equally important for us. Switches, electrical plugs and sockets are made of conductors. On the other hand, rubber and plastics are used for covering electrical wires, plug, switches etc.

Your body is a conductor of electricity. Be careful.

Answer these

1. In the symbol of electric cell what does the longer line and a shorter but thicker parallel line represents?

2. What do you understand by battery?

3. Give two examples each of conductors and insulators.

21.3 Effect of electric current

When an electric current passes through a conductor, mainly three effects are seen.

1. Heating effect
2. Magnetic effect
3. Chemical effect

In this chapter we will learn only about the heating and magnetic effects of electric current.

21.4 Heating Effect of Electric Current

Whenever current passes through a material then part of its energy is converted into heat energy and the material gets heated. This is due to the resistance offered by the conductor to the flow of current. This is a quality of a conductor to resist the flow of current. The resistance of the conductor controls the quantity of the electric current flowing through it. In an electric circuit this is indicated by sign. Let us perform an experiment to explain the heating effect of electric current.

Activity - 3

Materials required - Battery, key, thin copper wire, nichrome (an alloy of nickel and chromium) wire.

Remove the plastic covering on the piece of electric wire. Take a very thin copper wire from it and attach it as shown in fig 21.4 to a battery made of two dry cells. After ten seconds touch the wire, what do you feel?

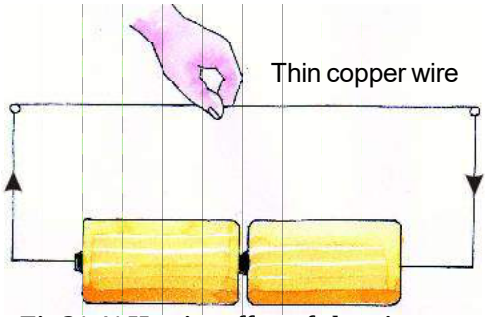


Fig 21.41 Heating effect of electric current

Repeat the same experiment using the nichrome wire in place of copper wire. Do you find this wire hotter?

Try to repeat this experiment using different number of cells (i.e. varying the quantity of electric current) and for different duration. You will find that the amount of heat produced depends on -

1. Quantity of electric current (number of cells used)
2. Material of the wire
3. Duration for which the electric current flows.

21.4.1 Uses of the Heating Effect of Electric Current-

The use of the heating effect of electric current is of great advantage and in our day to day life. Household gadgets such as electric bulb, heater, electric iron, soldering iron etc. are based on the principle of heating effect of electric current.

When electric current passes through the filament of an electric bulb (made of tungsten wire), the filament heats up to such a high temperature that it starts to glow and emits light. Similarly, the wires in an electric heater, electric press and immersion rods gets heated to a very high temperature and become red hot when electric current passes through it. All these appliances contain a coil of wire called element fig 21.5. These coils have very high melting point and are made of an alloy called nichrome.

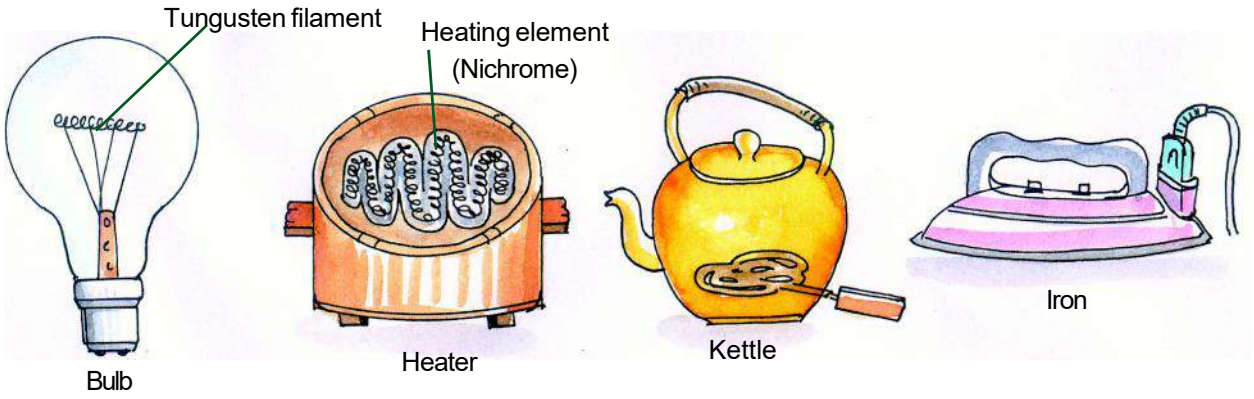


Fig 21.5 House hold articles which are based on heating effect of electric current

21.4.2 Safety fuse

In an electric circuit, when large electric current flows, due to high resistance, the electrical gadgets (as fan, bulb, heater etc.) attached to it may get damaged. This is caused due to short circuit (positive and negative ends being connected) because of which a large amount of electric current, more than required flows and the circuit becomes much hotter which may sometimes cause fire. If the fire spreads then there is a danger of greater damage. That is why safety devices (safety fuse) are used.

A fuse is a safety device which prevents damages to electrical circuits and possible fires. This is made of zinc or an alloy of lead and tin, which has a very low melting point. These are packed in glass tubes or insulating cutouts made of china clay. They are inserted in all electrical circuits. There is a maximum limit

on the current which can safely flow through a circuit. If by accident the current exceeds this safe limit, the wire in the safety fuse will blow off and break the circuit. Thus, we can prevent possible fires and damage of electrical appliances by using a safety fuse. (Fig. 21.6).Whenever the heat increases in the circuit, the fuse wire melts and breaks off. This way we can stop accidents.

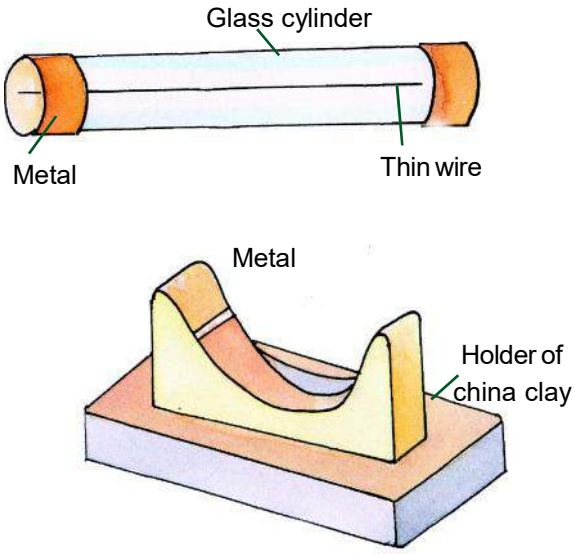


Fig 21.6 Safety fuse

21.5 Magnetic effect of electric current

It was in year 1820, that a physicist Hans Christian Oersted noticed that when the current flows through a nearby wire the compass needle gets deflected every time. Let us try to find out ourselves with the help of an activity.

Activity - 4

Materials required - Dry cell, long copper wire, connecting wires, key and magnetic needle (compass).

As given in the fig 21.7 make an electric circuit. The magnetic needle is suspended freely and the wire is placed above it and by closing the key the circuit is completed. As the current flows through the circuit the magnetic needle gets deflected. Now the key is opened and the current flow is broken. What do you observe? Dose the magnetic needle come back to its initial position? What does this experiment indicate? When electric current passes through a wire, it behaves like a magnet. This is the magnetic effect of the electric current.

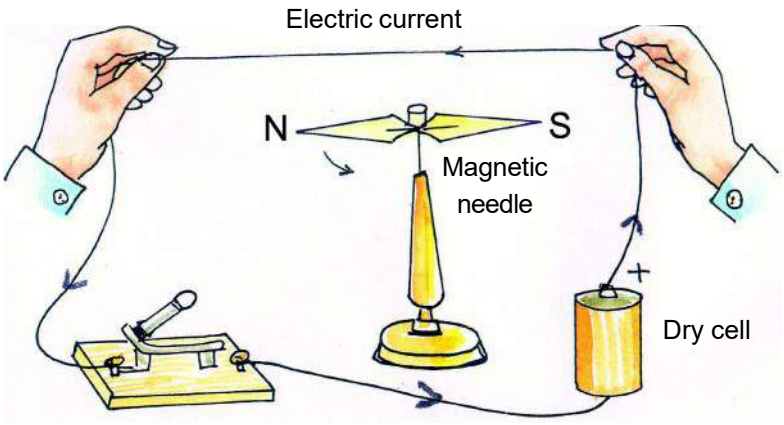


Fig 21.7 Magnetic effect of electric current

The magnetic effect of electric current is used in making electromagnets. For this an iron rod is taken and a piece of copper wire is tightly wound around to form a coil. When electric current is passed through this coil, the iron rod acts as a magnet and it is called electromagnet. Let us make an electromagnet.

Activity - 5

Material required - Long iron nail (about 6-10cm), long copper wire, a battery of three dry cells, key and some pins.

Wind the copper wire tightly on the iron nail to form a coil. Connect the free ends of the wire to the terminals of a cell through a switch as shown in fig 21.8 (a). Close the key and bring the pins near the end of the nail. What happens? Why the pins stick to the nail?

Now open the key and break the circuit. Are the pins still sticking to the end of the nail?

In place of the nail repeat the experiment with a U shaped iron piece. (fig 21.8 c & d) What do you find? Discuss about your observations and give reasons for it.

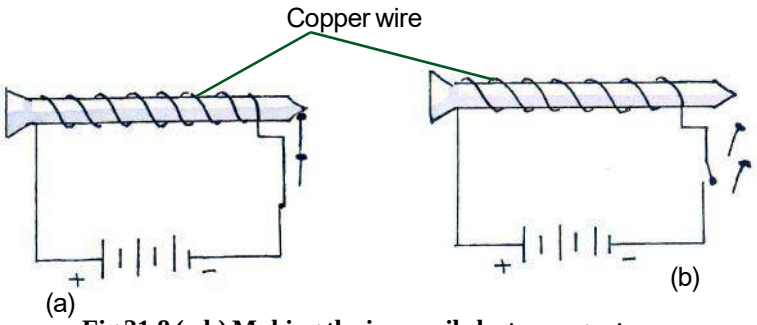


Fig 21.8 (a,b) Making the iron nail electromagnet

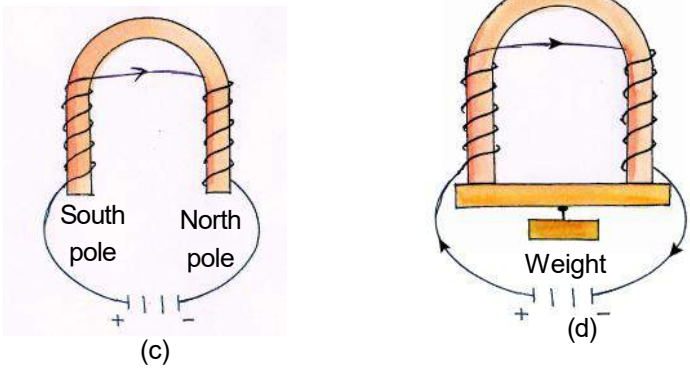


Fig 21.8 (c and d) Making U shaped electromagnet

To make a powerful magnet the flow of current is increased.

Electromagnets have many uses as follows:-

1. In electric bells, telephones, telegraph and in loudspeakers.
2. In cranes, to lift heavy objects.
3. To separate iron from garbage.
4. In electric motors, electric trains, electric generator etc.

21.5.1 Electric bell

Electric bell is a device which is based on the magnetic effect of electric current. It has an electro magnet in it. Let us see how it works? Fig. 21.9 shows the circuit of an electric bell.

In this 'M' is a electromagnet in which the two ends of the coil are attached to screws 'P' & 'Q' which are in turn attached to the electric source - the cell. When electric current passes through the coil, the electromagnet becomes magnetic and attracts the thin iron sheet armature 'A' towards itself. This armature is attached to a spring 'C'. In its normal state this spring is attached to the armature 'A'. The other end of armature is attached to a hammer 'H' & 'B' is a metallic cap or bowl.

When the battery is joined to P and Q, the electromagnet attracts armature A which makes the hammer strike the bowl 'B' and makes a sound. When this process is repeated the electric bell rings.

When electric bells are used then in the electric circuit instead of normal key, push button is used. The bell continues to ring as long as the button is pressed. When the pressure of the push button is released, the ringing stops.

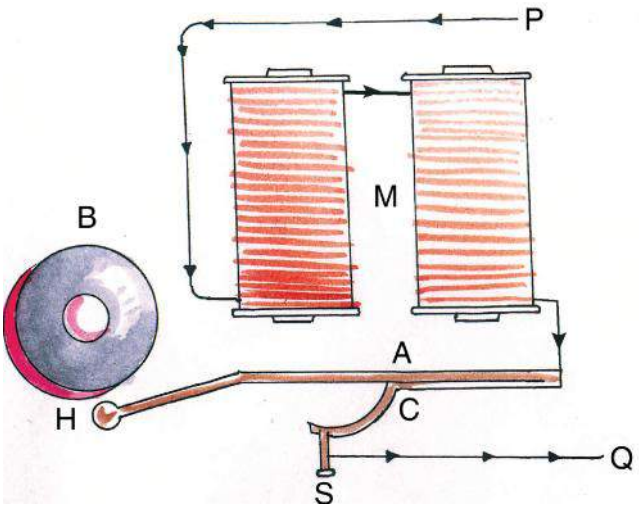


Fig 21.9 Electric bell

Answer these

1. From which alloy are the heating elements of electric heater and electric press made of?

2. What is the safety device used in an electric circuit called?

3. Why is the fuse wire made of a material which has low melting point?

4. Write two uses of the electromagnet.

21.6 Hazards of Electric Current & the Safety measures

In our daily life electricity is the most important and easily available source of energy. If proper safety measures are not taken while using electricity, it can be very dangerous. For example if we accidently touch a high voltage open wire, we get a very strong electric shock, which can destroy our cells. Sometimes this electric shock can also lead to death.

Sometimes the electric connections which have been used for a long period gets loose or the protective insulation cover is damaged, touching such wires is very dangerous. In the same way, sometimes there is short circuit due to which sparks fly out and can cause fire. To avoid such accidents we should use fuse, about which we have learnt in this chapter. Apart from these some other precautions are given here which are to be followed while using any electric gadgets.

1. All the switches, plugs, and connections in an electric circuit must be tightly screwed or fixed.

2. If the insulating cover of the connecting wire is broken or removed then it must be covered by insulation tape.

3. Fuse wire must be made of adequate strength and suitable conductor.

4. All the electrical gadgets such as, refrigerator, heater and washing machines must have earthling i.e. a wire connecting to the earth.

5. Whenever any repairing is done on electrical gadgets or electric circuit, the main switch must be put-off. While working rubber boots and gloves must be worn so as to avoid electric shocks.

6. If there is a fire or any other accident, the key of the electric current must be cut off or the switch must be put off.

7. If any person accidently gets an electric shock and is stuck to the circuit then don't try to remove the person with naked hands, but remove him with the help of an insulator as dry wood, rubber or plastic thing. Otherwise the person trying to save will also get the electric shock.

We have learnt

" The substances which allow electric current to pass through them are called conductors while those that do not allow electric current to pass through them easily are called insulators.

" There are three effects of electric current - heating effect, chemical effect and magnetic effect.

" Bulb, heater, electric irons, immersion rods are examples of appliances where the heating effect of electric current is observed.

" Fuses are devices which are attached to the circuit for safety. This is made of zinc or an alloy of lead and tin, which has a very low melting point.

" When a piece of iron is wrapped in a coil carrying electric current it becomes a magnet and is called an electromagnet. Electro magnets are used in electric bells, cranes, electric motors, electric trains, electric generators etc.

Questions for practice

1. Choose the correct alternative:

1. The materials which allow electric current to pass through them are called-

(a) Conductor (b) Insulators

(c) Semi conductor (d) Sometimes conductor, Sometimes insulators.

2. The following is not a good conductor of electricity -

(a) Copper (b) Brass (c) Graphite (d) Glass.

3. Filament of electric bulb is made up of -

(a) Nichrome (b) Tungsten (c) Chromium (d) Tin

4. Electric heater shows following effect of electric current -

(a) Heating effect (b) Magnetic effect (c) Chemical effect (d) All of these

5. Which appliance is made on the basis of magnetic effect of electric current -

(a) Electric bulb (b) Electric bell (c) Electric iron (d) Soldering iron

2. Fill in the blanks -

1. In the symbol of electric cell, the longer line represents the ------- terminal.
2. Combination of two or more electric cells is called ----------.
3. Electric bulb shows ---------- effect of electric current.
4. In loudspeakers ---------- effect of electric current is used.
5. Melting point of fuse wire is very ----------.

3. Answer the following questions -

1. What are the important components necessary for an electric circuit?
2. Explain the heating effect of electric current.
3. Write two uses of magnetic effect of electric current.
4. Write three uses of an electromagnet.
5. Write the working method of an electric bell with the help of a labeled diagram.
6. Write two important methods from preventing electric shocks.

Do these also

1.Make a Railway Signal-

You can make a railway signal with the help of an electromagnet-

1. First of all make a wooden stand on which the signaling plank can move up & down. Hang a weight on the shorter arm and a nail on the longer arm of the horizontal plank of wood.
2. As for the stand, fix with cardboard cylinder which has a spring of copper wire wound on it with nails. Inside the cardboard cylinder place a iron rod of the same length.
3. Attach both the ends of the wire to the cell passing through a key.
4. Carefully check that the nail hangs directly above the spring of wire.
5. When the key is closed, the electric current passes through the wire which in turn make the iron rod magnetic, such that the suspended nail is attracted towards the magnet and this makes the signal plank bend down.

6. When the key is open, the electric circuit is broken and the flow of current will stop, as a result the iron rod loses its magnetic property and its attraction to the nail is cut off. So the signal plank becomes horizontal.

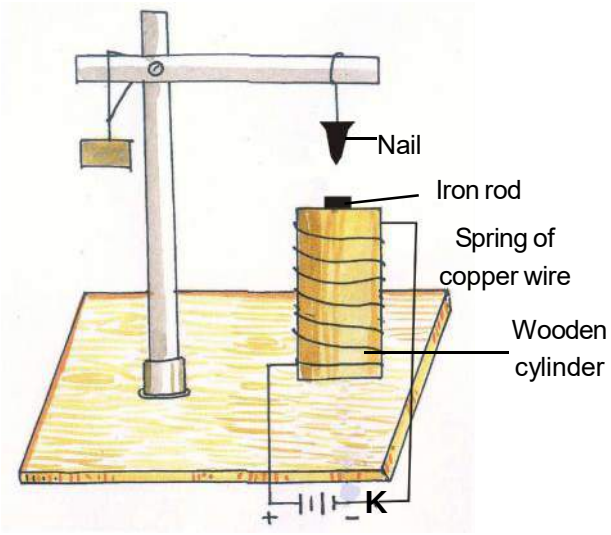


Fig 21.10 Making of railway signal

2. Make your own Electric Swing -

1. Take a long piece of copper rod (conductor) and connect both its end to a copper wire in an electric circuit by connecting it to the cell key and resistance wire, according to the figure 21.11 given below.
2. Now place a U-shaped magnet in such a way that the conductor lies between its poles as in the figure.
3. Press the key and try to see the swing of the conductors.

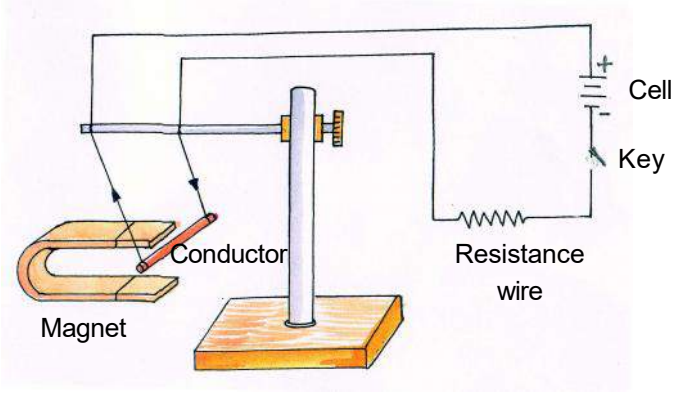
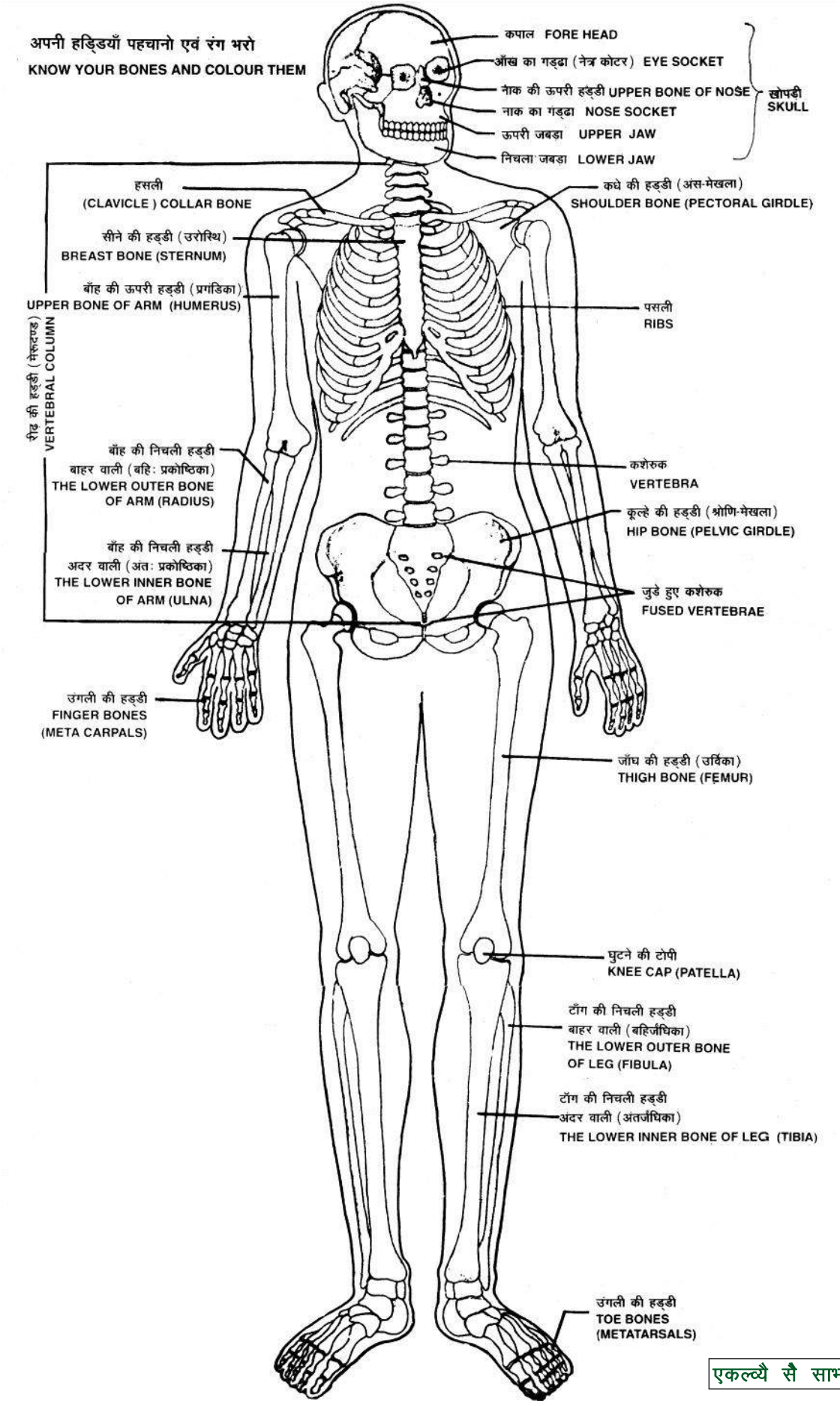
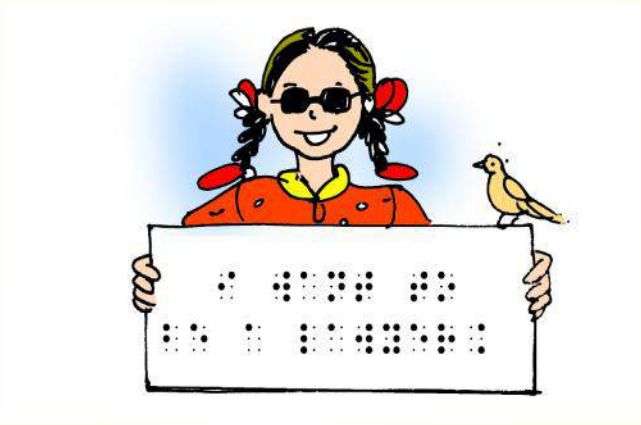


Fig 21.11 Making of Electric Swing



एकल्व्यै से साभार

Braille An Introduction



Do you know what is written here?

It is: I want to be a lawyer.

Like devnaagri and Gurumukhi etc. Braille is also a script. Braille script is used by Blind persons to read and write. Braille was invented by Louis Braille in 1829. Braille script is based on six dots. These six dots are referred as the Braille cell. Each cell comprises of one Braille character. To write Braille script Blind person uses Stylus and Braille slate. Braille slate consist essentially of two metal or plastic plates hinged together to permit a sheet of paper to be inserted between the two plates. While writing on a Braille sheet (drawing sheet) it is to be written from right to left and then reverse the normal numbering of the Braille cell. Blind person reads these raised (embossed) dots with the help of their finger tip.

Braille cell

Total 63 combinations are possible using these 6 dots.
Some combinatios given below:

Braille Chart

a	b	c	d	e	f	g	h	i	j
k	l	m	n	o	p	q	r	s	t
u	v	w	x	y	z				

A Number sign (⠼) is used before the alphabets 'a' to 'j' to convert them to numbers.

1	2	3	4	5	6	7	8	9	0