Contents

Chapter- 1 Nutrition in Plants

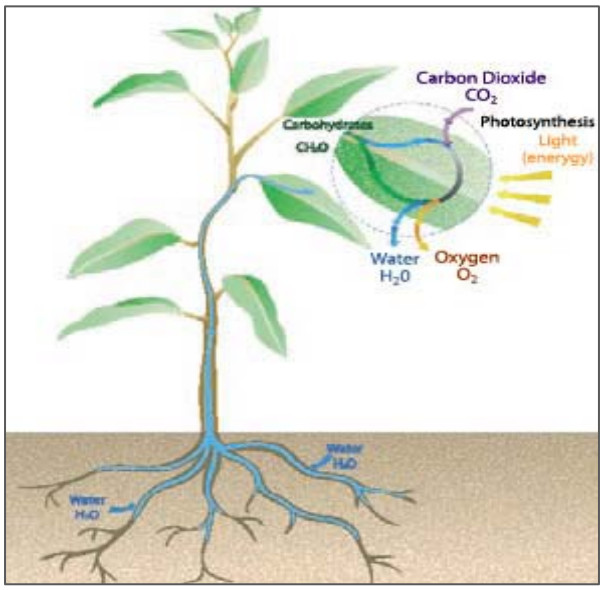
The components of food like carbohydrates, fats, proteins, vitamins and minerals that are necessary for the proper growth and development of living organisms are called **nutrients**. They provide energy which enables them to carry out various body processes.

Mode of Nutrition in Plants

Nutrition is the mode of taking food by an organism and its utilisation by the body. It can be categorized into **autotrophic** and **heterotrophic nutrition**.
The autotrophic implies self nourishment or in other words self dependent like the plants while heterotrophic means dependent on others for nourishment like the animals.

Photosynthesis

The process of synthesizing food by green plants in the presence of **sunlight**, **carbon dioxide** and **water** is called **photosynthesis**. The plants convert light energy from sun and convert it to chemical energy to make **carbohydrates** and gives out **oxygen** in the process. It is prepared in the leaves which are designated as the food factories of the plants.
The carbon dioxide is taken in by the tiny pores on the surface of the leaves called **stomata** that are surrounded by the **guard cells**.
The absorption of water is taken care by the **roots** while the transportation is carried out the **stems**. The stem forms a continuous path or passage for the nutrients to reach the leaf.



Photosynthesis

$$\text{Carbon dioxide + Water} \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \text{Carbohydrates + Oxygen}$$

- All living organisms are made up of **cells**. Some are single cellular while some are multicellular.

- Each cell is surrounded by the cell membrane and contains a centrally located spherical structure called **nucleus**.
- All the cellular components or the cell organelles are embedded in the **cytoplasm**.
- The desert plants have green stem to carry out photosynthesis and even the green **algae** prepare its food by photosynthesis.
- Plants prepare carbohydrates which is a compound made of Carbon, Oxygen and Hydrogen but the proteins which are nitrogenous compounds are obtained from the atmosphere by **nitrogen fixation** with the help of nitrogen fixing bacteria or by addition of fertilizers.

Activity

- Take two potted plants of the same kind.
- Keep one in the dark for 3 days and the other in the sunlight.
- Perform iodine test with the leaves of both the plants. Record your results.
- You will observe that plant kept in dark does not give test for starch but the other kept in sunlight turns blue black with iodine.
- Now leave the pot which was earlier kept in the dark, in the sunlight for 3 – 4 days and perform the iodine test again on its leaves.
- You will find that the leaf of this plant turns blue black on addition of iodine confirming the presence of starch.

Others Modes of Nutrition in Plants

Plants lacking chlorophyll have heterotrophic nutrition like the animals and humans.

Parasitic Nutrition

Plants like *Cuscuta* lack chlorophyll therefore they depend and derive their nutrition from the host plant. *Cuscuta* is called as parasite and this mode of nutrition is called parasitic nutrition.

Insectivorous Plants

Plants which are capable of ingesting the insects like the pitcher plant are called insectivorous plants. They have a pitcher like structure with a lid along with hairs on the inner wall of the pitcher which entangles the trapped insects. It is followed by the secretion of digestive juices by the plant to digest the insect.

Picher Plant

Saprotrophs

The organisms like fungi which feed on dead and decaying matter have saprotrophic nutrition. These saprotrophs release digestive juices on the dead matter and convert it into solution which they later ingest.

Symbiotic Relationship

Organisms that live in association where both get benefited from each other like the lichens are said to exhibit symbiotic relation. In the lichens the fungal partner provides shelter, water and minerals while the algal partner containing chlorophyll prepares food by photosynthesis.

Lichen

Nutrient Replacement in Soil

Plants utilize the nutrients present in the soil resulting in decrease of these nutrients from the soil. To replenish this loss manures and fertilizers are added to the soil.

The nitrogen gas present in abundance in atmosphere cannot be consumed by the plants, therefore to convert it into soluble form the nitrogen fixing bacteria like *Rhizobium* fix the atmospheric nitrogen into nitrates and nitrates. They live in the root nodules of leguminous plants like the peas and gram.

Rhizobium **in root nodules of leguminous plants**

It is also an example of symbiotic relation. The plants provide shelter to the bacteria which in return help in fixing atmospheric nitrogen in soluble form.

Exercises

1.1 **Answer in one word**

1. The food synthesised by the plants through photosynthesis
2. The green coloured pigment that traps solar energy and converts it into chemical energy.
3. An insectivorous plant containing digestive juices to digest insects.

1.2 With the help of an activity show the presence of starch in leaves

1.3 Explain the mode of nutrition in saprotrophs

1.4 Give a brief description about the symbiotic relation in lichens.

1.5 Elaborate the role in *Rhizobium* bacteria in replenishing nutrients back to the soil

Chapter-2 Nutrition in Animals

Animals have a heterotrophic mode of nutrition. They depend on the plants or autotrophs for nutrition. Animal nutrition includes

- Nutrient requirement
- Mode of intake of food
- Its utilisation in the body

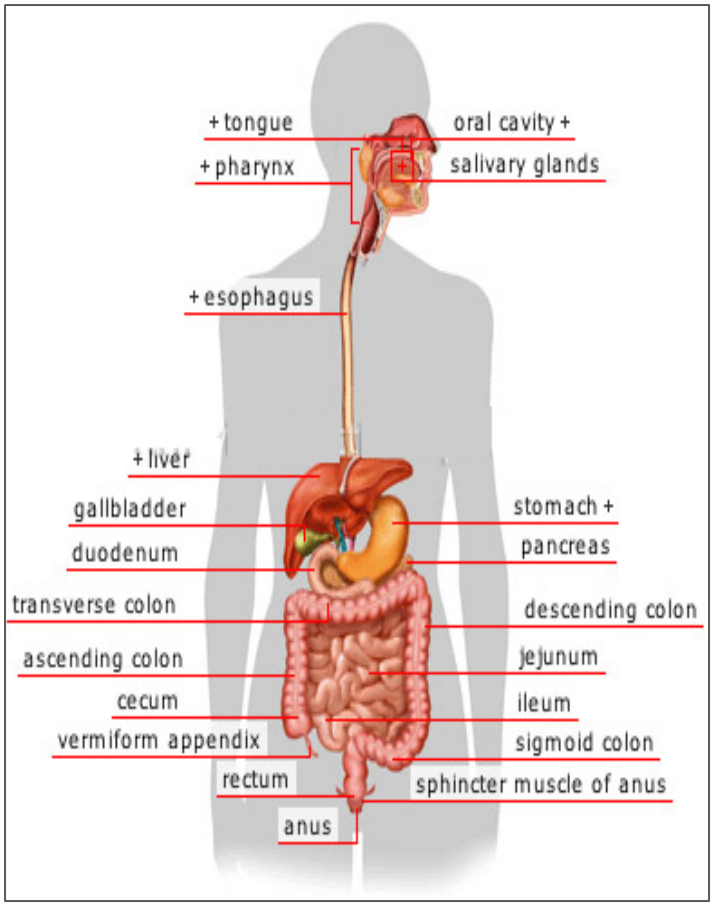
Different ways of taking Food

- Bees and humming-birds suck the nectar of plants.
- Infants of human and many other animals feed on mother's milk.
- Snakes like the python swallow the animals they prey upon.
- Some aquatic animals filter tiny food particles floating nearby and feed on them.

Digestion in Humans

The breakdown of complex components of food into simpler substances is called digestion. The digestive tract and the associated glands together constitute the digestive system. The process of digestion include

- **Ingestion**
- **Digestion**
- **Absorption**
- **Assimilation**
- **Egestion**



Human Digestive System

The human digestive system or the alimentary canal can be divided into various compartments:

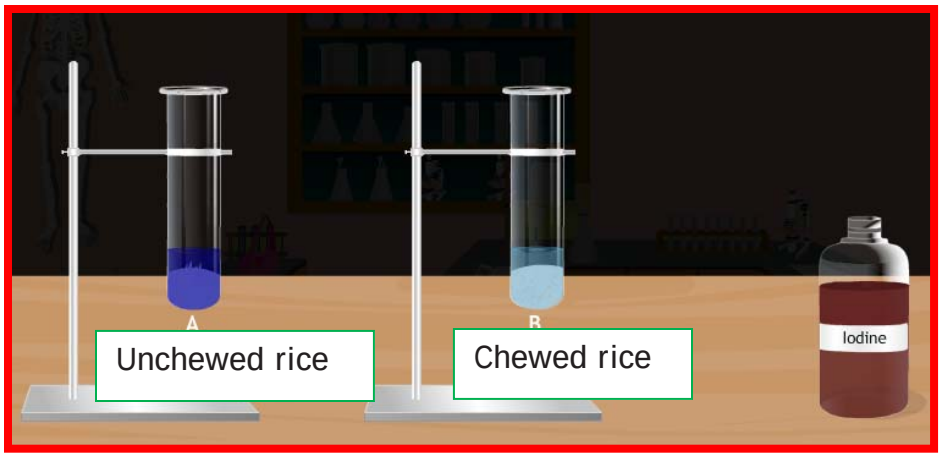
(1) The buccal cavity
(2) Foodpipe or oesophagus
(3) Stomach
(4) Small intestine
(5) Large intestine ending in the rectum and
(6) The anus

The Mouth and Buccal cavity

- The food enters the body through the mouth and this process is called as **ingestion**.
- The salivary glands in the buccal cavity secrete saliva having enzymes which breaks the complex starch molecules into simple sugars.
- The food is chewed by the teeth which breaks it mechanically into smaller pieces.
- Humans have two sets of teeth, the milk teeth and the permanent teeth. The teeth are of four types namely the incisors, canines, pre molars and the molars.
- The tongue is a fleshy muscular organ attached at the back to the floor of the buccal cavity. It mixes saliva with the food during chewing and helps in swallowing food and has taste buds that detect different tastes of food.

Activity

Take two test tubes. Label them 'A' and 'B'. In test tube 'A' put one teaspoonful of boiled rice; in test tube 'B' keep one teaspoonful of boiled rice after chewing it for 3 to 5 minutes. Add 3–4 mL of water in both the test tubes now pour 2–3 drops of iodine solution in each test tube and observe. The chewed rice will not turn blue black by the addition of iodine unlike the unchewed rice. The saliva breaks down the starch into sugars due to which the chewed rice didn't show test for starch.

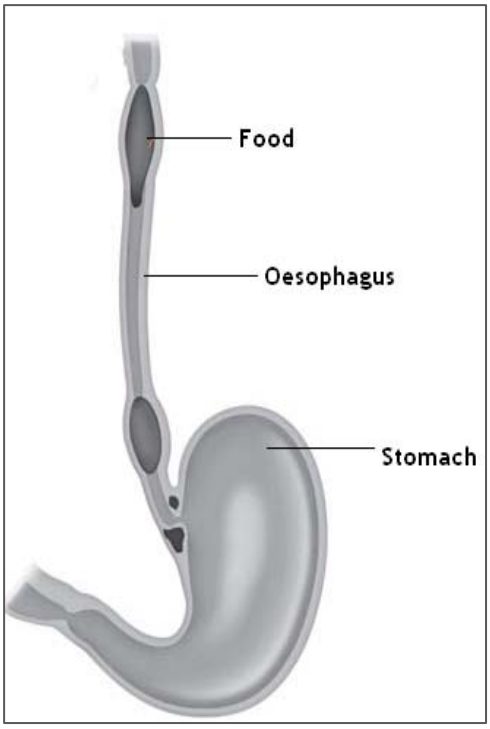


The Food pipe/ Oesophagus

- The food is passed to the food pipe which runs down the neck. The food is pushed to the stomach by the movement of the walls of the oesophagus.
- A flap like structure called epiglottis folds over the glottis while swallowing the food to prevent it from entering the trachea.

The Stomach

- The food then reaches stomach a flattened U shaped bag like structure leading to the small intestine.
- The stomach has an acidic environment due to the presence of hydrochloric acid to kill the microbes entering the stomach with food.



Stomach and Oesophagus

- The inner walls are surrounded by the mucous layer which protects the stomach from acidic medium.
- Stomach also secretes digestive juices and enzymes which act on proteins and simplify it.

The Small Intestine

- It is a highly coiled structure which is about 7.5 m long. The secretions from the small intestine, liver and pancreas further digest the food.
- The liver secretes bile juice that is stored in a sac called the gall bladder which plays an important role in the digestion of fats.
- The pancreas also secretes pancreatic juices that help in the digestion of carbohydrates and proteins.
- The partly digested food now reaches the lower part of the small intestine where the intestinal juice completes the digestion of all components of the food.

Absorption in the Small Intestine

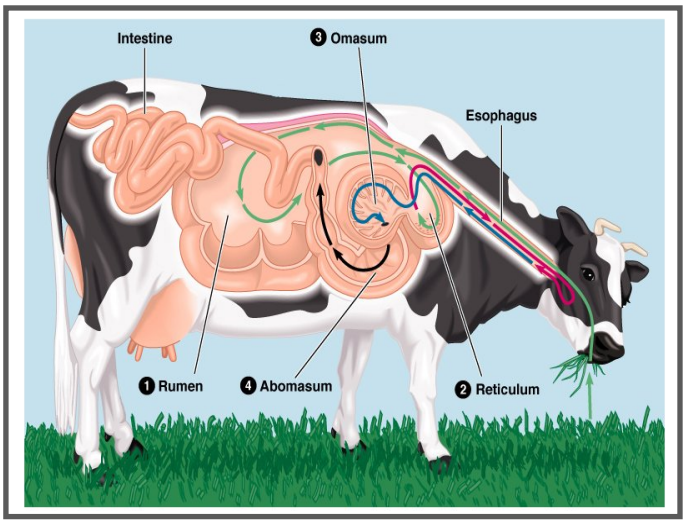
- Now the **absorption** of the digested food takes place as the food passes through the blood vessels in the wall of the small intestine.
- The small intestine has many small finger like projections called villi which increase the surface area for the absorption of the digested food.
- Each villus has a network of thin and small blood vessels close to its surface.
- This food is then transported to each and every tissue of the body where is utilized for synthesizing proteins. This process is called **assimilation**.

Large Intestine

- The undigested food is then transported to the large intestine which absorbs water and some salts from the undigested food material.
- The rest of the waste passes into the rectum and remains there as semi-solid faeces.
- The faecal matter is removed through the anus from time-to-time. This is called **egestion**.

Digestion in Grass-Eating Animals

- Grass-eating animals like cows and buffaloes ingest the food and store it in a separate part of the stomach called rumen where it is partially digested.
- This food is called cud. After sometime they chew this cud which returns to the mouth in small lumps.
- These animals are called as ruminants and this process is called as rumination.
- They have a sac like structure containing certain bacteria which can digest cellulose present in grass.



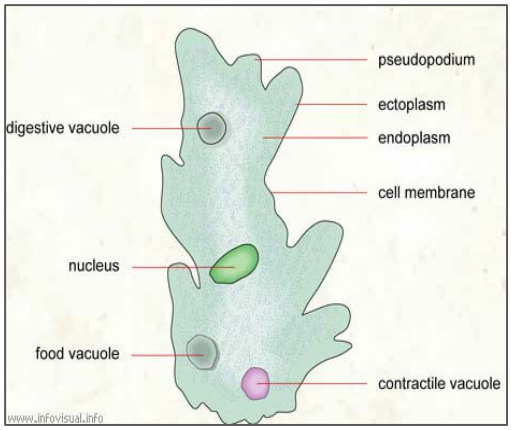
Ruminant

Feeding and Digestion in Amoeba

- Amoeba is a single cellular organism living in ponds with irregular shape which has only a single cell to perform all body functions.

- It has finger like pseudopodia which help in engulfing food which is then taken inside the food vacuole where the digestive juices act on the food and break it down into simpler substances.

- The food is absorbed to gain energy for carrying out various metabolic processes while the undigested food is expelled out.



Amoeba

Exercises

2.1 What is the role in villi in the digestion of food in humans?

2.2 Explain the process of digestion in amoeba

2.3 Write the function of large intestine in the process of digestion

2.4 Why is the stomach environment acidic in nature? How is the stomach lining protected from this acidic medium?

2.5 Can we digest the cellulose? How are the ruminants able to digest the cellulose?

2.6 What is the function of liver in fat digestion?

2.7 Write true or false

1. Amoeba is a microscopic single-celled organism found in pond water.
2. Partially digested in ruminants is called as cud.
3. The faecal matter is removed through the anus by ingestion.

Chapter-3 Fibre to Fabric

The thin strands of thread or yarn used to make fabric are called as **Fibre**. The fibres may be natural or synthetic. The natural fibres can be obtained from plant sources like the cotton and the jute and also from animal sources like the wool and the silk.

Animal fibres — Wool and Silk

Wool

Wool is obtained from the fleece (hair) of sheep or yak. These hairs act as insulators of heat. They trap the heat and keep these animals warm.

The hairy skin of the sheep has two types of fibres that form its fleece:
(i) The coarse beard hair, and
(ii) The fine soft under-hair close to the skin.

Selective Breeding

It is the process of selecting parents for obtaining special characters in their offspring, such as soft under hair in sheep.

Animals that yield Wool

Wool is obtained from a wide range of animals across the country. For example yak wool in Ladakh and angora wool in Jammu Kashmir. The table shows the variety of Indian sheep.

Breed	Quality of wool	Place of rearing
Lohi	Good quality wool	Rajasthan, Punjab
Marwari	Coarse wool	Gujarat
Patanwadi	For hosiery	Gujarat

Nali	Carpet Wool	Rajasthan, Haryana, Punjab
Bakharwal	For woollen shawls	Jammu and Kashmir
Rampur bushair	Brown fleece	Uttar Pradesh, Himachal Pradesh

From fibres to Wool

To obtain wool from fibres the sheep needs to be reared. The hair of the sheep is removed and processed into wool. Some breeds of sheep have thick coat of hair on their body which yields good quality wool in large quantities. These sheep are selectively bred to get better quality of wool in the offspring.

Processing fibres into Wool

The processing of the wool can be categorized into six steps:-

Shearing

The fleece of the sheep along with a thin layer of skin is removed from its body by machines. This process is called shearing. Woollen fibres are then processed to obtain woollen yarn. Shearing doesn't hurt a sheep. It's just like getting a haircut. The wool is removed by following an efficient set of movements.

Shearing

Scouring

After the wool is sorted, it must be washed thoroughly. Some of the foreign substances in the raw wool can be removed simply by washing in water but the grease requires soap. If too much lanolin is left in the wool it will repel the dye in places, resulting in a mottled effect. This process is called as scouring.

Scouring

Sorting

Now the hairy skin is sent to the factory to separate hairs of different textures. There are numerous kinds of wool. Every fleece comprises several kinds of wool. The wool is not uniform over the entire body of the sheep. Some parts are longer than the other, some parts are finer, some cleaner. The fleece must be divided into parts in order to get desired uniform wool.

Sorting

Separation of Burrs

The small burrs or the fluffy fibres are picked out from the hair. They are scoured again and dried. This is the wool ready to be drawn into fibres.

Dyeing

The fibres can be dyed in various colours, as the natural fleece of sheep and goats is black, brown or white. Many subtle dye colors can be extracted from various plants for a natural dye process. On a large commercial scale the use of chemical dyes is more convenient and thus more common.

Dyeing

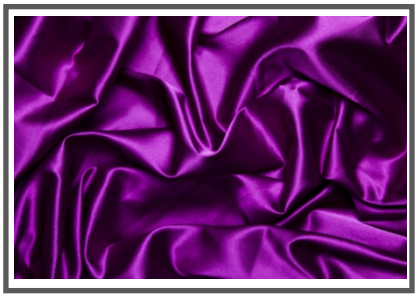
Carding and Combing

The fibres are combed and rolled into yarn. Carding is gently spreading washed and dried wool in preparation for further processing. Combing is done for straightening and stretching the fibers to obtain maximum spinning capacity. The longer fibres are made into wool for sweaters and the shorter fibres are spun and woven into woollen cloth.

Combing

Silk

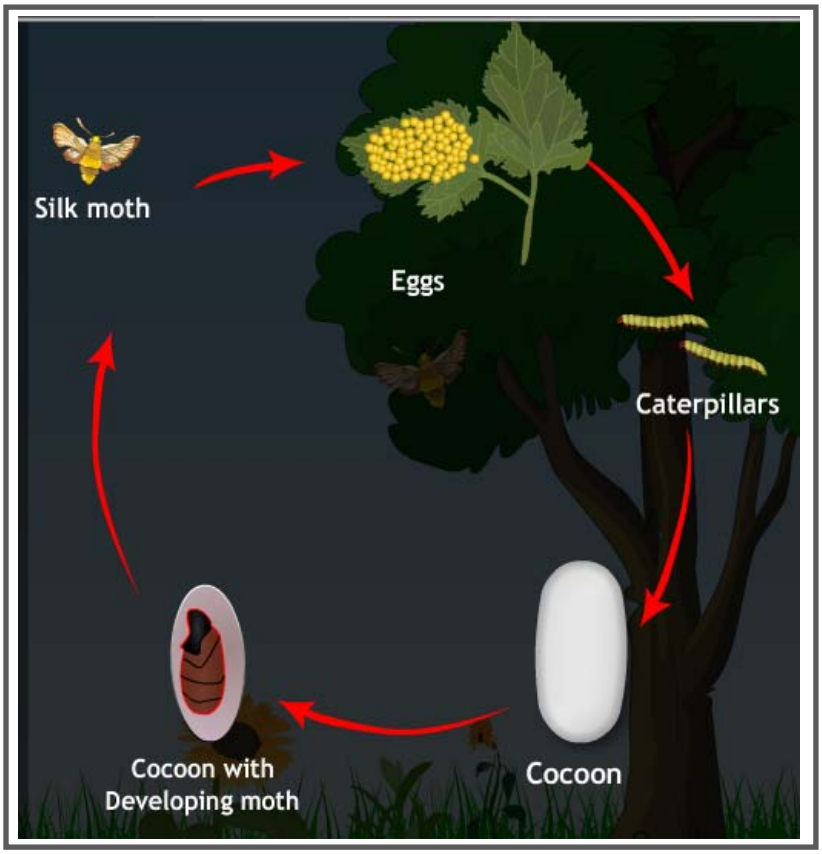
A silk fibre come from cocoons of the silk moth and therefore is an animal fibre. The rearing of silkworms for obtaining silk is called **sericulture**.



Silk fibre

Life history of Silk moth

- The life of a silkworm starts when a female moth lays eggs on the mulberry leaves.
- After sometime, these eggs hatch into larvae or caterpillars.
- Slowly these caterpillars grow in size by feeding only on the leaves of mulberry trees.
- The next stage in the life cycle of a silk moth is a pupa, it starts weaving a net around itself so that it can easily hold net.
- It secretes a fibre made of protein, which solidifies and hardens when exposed to air for some time. This is the **silk fibre**.



Life cycle of Silk moth

- Caterpillars continue to spin silk fibre till they completely get covered by them.
- This silk covering in which a silk moth covers itself is known as a **cocoon**.
- Further development of the silk moth takes place inside the cocoon as it enters the pupa stage.
- After sometime, the pupa enters into the adult stage and emerges out of the cocoon as a moth.
- The whole process thus continues and is known as the life cycle of a silkworm.

From Cocoon to Silk

Rearing Silkworms:

The female silk moth lays eggs on mulberry leaves, which are then transferred to a piece of paper or cloth.

Rearing silkworms

Silkworms in bamboo trays

The eggs are stored under hygienic conditions, in a specific temperature and pressure for the larvae to hatch.

When the larvae hatch, they are placed on clean bamboo trays and are fed on leaves of the mulberry tree.

Caterpillars eat a large amount of leaves and increase in size at a very rapid pace.

The caterpillars stop eating after 25-30 days and move to a chamber in the bamboo tray.

Silkworms on mulberry leaves

Cocoon with Silkworms

There, they spin a cocoon and get attached to the tray.

These cocoons are then collected by farmers and processed to form silk fibres.

Processing Silk

Cocoons are collected and kept under the sun, or boiled, or exposed to steam. This helps in separating out the silk fibres. This process of separating silk fibres from the cocoon is called **reeling the silk.** This is followed by the spinning of silk fibres into threads.

Reeling the silk

Exercises

3.1 Give a brief description of the steps involved in the processsing of wool.

3.2 What is meant by the reeling of silk?

3.3 Give one word for the following

a. Culturing of silkworms to obtain silk

b. The food for silk moth

c. Hair of sheep

d. Fatal blood disease caused by bacterium *anthrax*

3.4 Why is the shearing of sheep done in summers?

3.5 Give an account of the life cycle of a silk worm.

Chapter- 4 Heat

Hot and Cold

Temperature is a measure of the degree of hotness of an object. It can be measured by a device called thermometer.

Measuring Thermometer

Thermometers are of three types the **clinical thermometer, the laboratory thermometer and the maximum – minimum thermometer**.

Clinical Thermometer

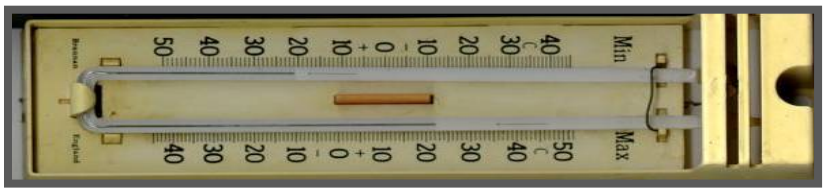
Clinical thermometer is used to measure our body temperature.

The range of this thermometer is from 35°C to 42°C. This is because the normal temperature of human body is 37°C and never goes below 35°C or beyond 42°C. A clinical thermometer consists of a long, narrow, uniform glass tube. It has a bulb at one end. This bulb contains mercury. The kink near the bulb of the thermometer prevents mercury level from falling on its own.

Clinical thermometer

Laboratory Thermometer

Laboratory thermometer is used to measure the temperature of all objects and its range is generally from –10°C to 110°C. The temperature of the object should be taken while the thermometer is dipped in the solution whose temperature is to be measured because when the thermometer is out of solution, the level of mercury begins to fluctuate.



Laboratory thermometer

Maximum and Minimum Thermometer

The maximum and minimum thermometer is used to measure the maximum and minimum temperatures of the previous day as reported in weather reports. This type of minimum and maximum thermometer uses a U shaped tube. Both sides should measure the same temperature. However, the scale is inverted. As the temperature drops, the mercury pushes the left hand side needle upwards. This then measures the minimum temperature because a magnet at the back holds the needle in position. As the temperature increases to a maximum, the right hand side needle is pushed upwards to record a maximum when it stops.

Fahrenheit to Celsius:

There are two main temperature scales:

- °F, the Fahrenheit Scale (used in the US), and
- °C, the Celsius Scale (part of the Metric System, used in most other countries)

They both measure the same thing (temperature!), but use different numbers:

- When you freeze water, it measures 0° in Celsius, but 32° in Fahrenheit
- When you boil water, it measures 100° in Celsius, but 212° in Fahrenheit

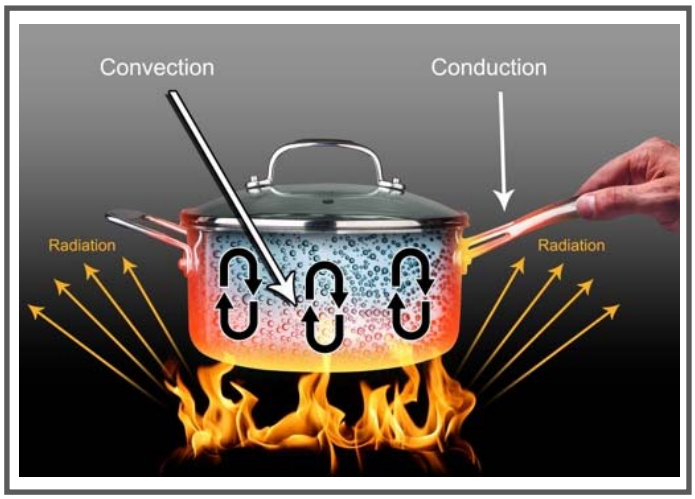
Unit Conversion of temperature scales:

Fahrenheit to Celsius: (°F - 32) x 5/9 = °C
Celsius to Fahrenheit: (°C × 9/5) + 32 = °F

Convert 20° Celsius to Fahrenheit
[20 x (9/5)]+32
36+32= 68° F

Transfer of Heat

The heat flows from a body at a higher temperature to a body at a lower temperature. There are three ways in which heat can flow from one object to another. These are conduction, convection and radiation.

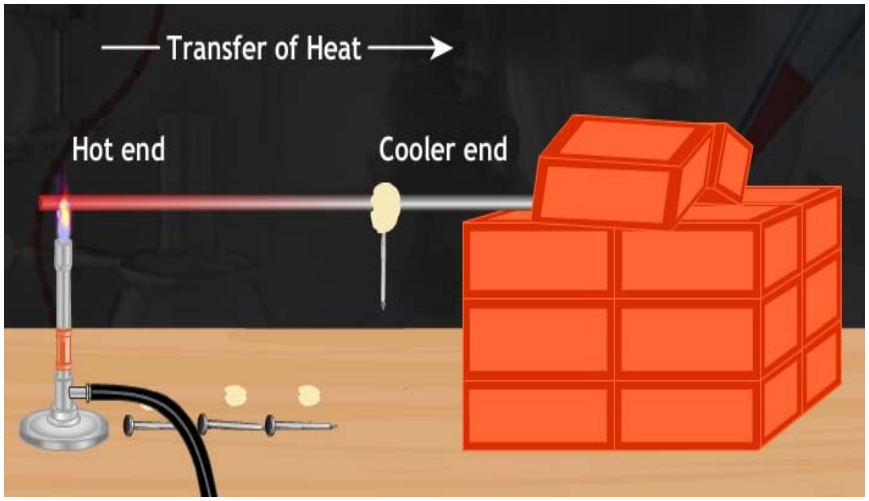


Conduction

The process by which heat is transferred from the hotter end to the colder end of an object is known as conduction.

Activity

Take an iron rod fix it between some bricks. Attach few iron nails on this rod with the help of wax. Now burn a Bunsen burner at the other extreme end of the rod. Observe what happens to the iron nails. The nails fall down one by one starting from the one nearest to the burner. This is because the heat generated by the burner is passed through the iron rod which makes the wax melts.

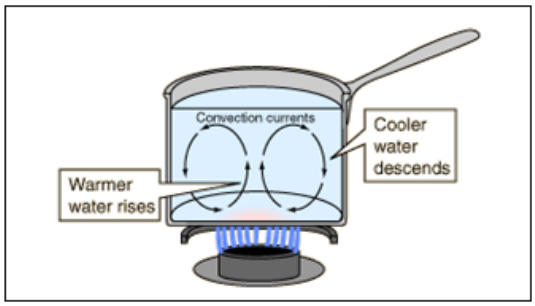


The materials like metals which allow heat to pass through them easily are called as **conductors** while materials that do not allow heat to pass through them are called as **insulators** for example plastics and rubber.

Convection

The transfer of heat by the movement of the heated parts of a liquid or gas from one region to another is called convection.

Activity



Convection

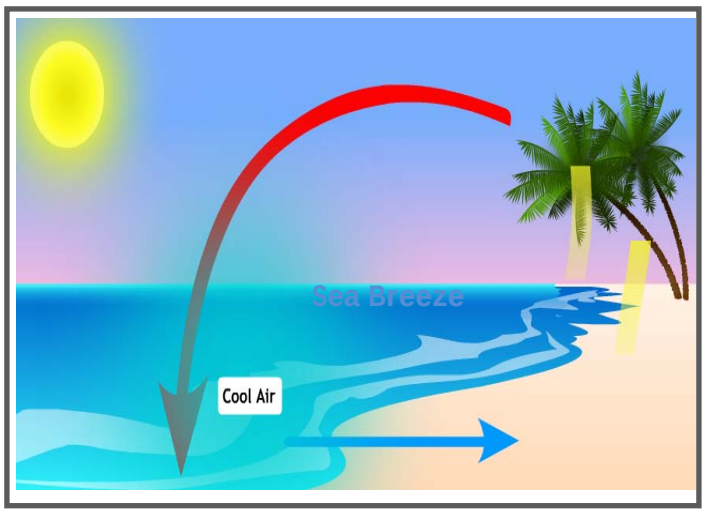
Take some water in a vessel and heat it on flame. Let the water boil. Observe the process. When water is heated, the water near the flame gets hot. Hot water rises up. The cold water from the sides moves down towards the source of heat. This water also gets hot and rises and water from the sides moves down.

This process continues till the whole water gets heated. This mode of heat transfer is known as convection.

Radiation

The heat transfer between two bodies without change in the temperature of the intervening medium is known as radiation. The heat energy reach the earth surface from the sun by the process of radiation.

Sea Breeze and Land Breeze



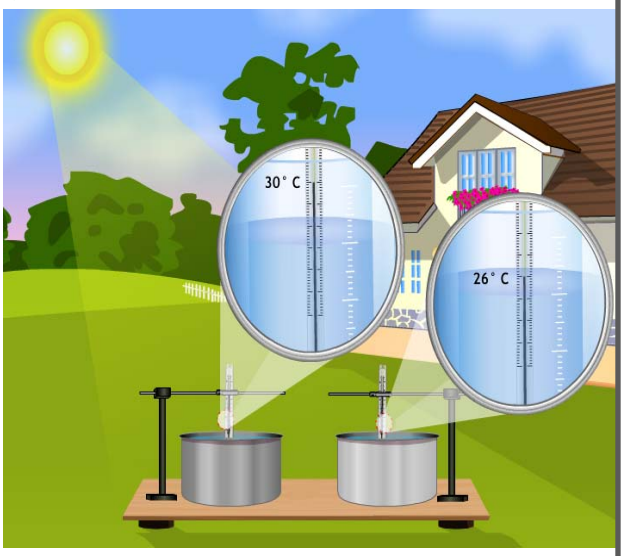
During the day, the land gets heated faster than the water. The air over the land becomes hotter and rises up. The cooler air from the sea rushes in towards the land to take its place. The warm air from the land moves towards the sea to complete the cycle. The air from the sea is called the sea breeze. To receive the cooler sea breeze, the windows of the houses in coastal areas are made to face the sea. At night it is exactly the reverse. The water cools down more slowly than the land. So, the cool air from the land moves towards the sea. This is called the land breeze.

Kinds of Clothes in Summer and Winter

Dark surfaces absorb more heat and, therefore, we feel comfortable with dark coloured clothes in the winter. Light coloured clothes reflect most of the heat that falls on them and, therefore, we feel more comfortable wearing them in the summer. Wool acts as an insulator which traps the hot air. This air prevents the flow of heat from our body to the cold surroundings and hence makes us warm.

Activity

Take two identical metallic containers; one painted Black and other painted White. Pour equal amounts of water in each and leave them in the mid-day sun for about an hour. Measure the temperature with thermometer in both containers. What do you observe? Temperature of water present in black container is more than the white container. It happens because Black colour absorbs all the radiation that falls on it. On the other hand, white colour does not absorb radiation at all. Rather, it reflects radiation.



Exercises

4.1 An iron ball at 50°C is dropped in a bucket containing water at 50°C. What do you think will happen to the temperature of the water?

4.2 How do the woollen clothes keep us warm in winters?

4.3 Convert 20° Celsius to Fahrenheit

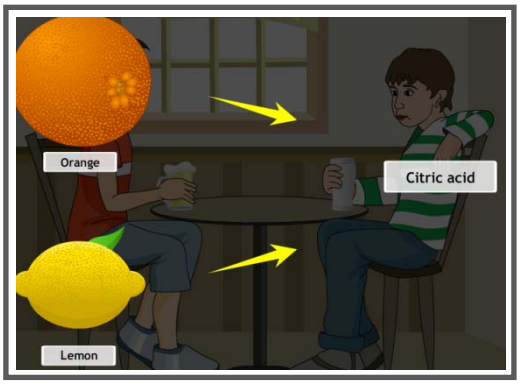
4.4 What are the ways by which heat can be transferred? Explain one with the help of an example.

4.5 Why are digital thermometers preferred over conventional mercury thermometer?

4.6 What prevents mercury level from falling on its own in a clinical thermometer?

Chapter-5 Acids, Bases and Salts

Acids



The word acid came from the word '*acere*' which means sour. Substances like vinegar, citric acid and curd are sour in taste and hence acidic in nature. Such substances are called acids. Lime juice and curd are examples of natural acids.

Properties of acids:

- Are generally sour in taste. (For example, the sour taste of lemon juice is due to citric acid)
- Strong or concentrated acids or their fumes often produce a stinging feeling on mucous membranes.
- Blue litmus paper turns red.
- Conduct electricity, depending on the degree of dissociation in aqueous solution

Bases

Substances like baking soda and lime water which are bitter in taste and feel soapy on touching are basic in nature or called as bases.

Properties of Base:

- Slimy or soapy feel on fingers, due to saponification of the lipids in human skin.
- Concentrated or strong bases are caustic (corrosive) on organic matter and react violently with acidic substances.
- Aqueous solutions or molten bases dissociate in ions and conduct electricity.
- Red litmus paper turns blue.

Indicators

Special types of substances which are used to test whether a substance is acidic or basic are known as indicators. These indicators change their colour on addition of an acid or base. China rose, phenolphthalein, methyl orange are examples of indicators.

Natural Indicators

Litmus: A natural dye

Litmus is extracted from lichens and has a mauve (purple) colour in distilled water. It gives red colour with acids and blue colour with bases. Litmus may be in solution form or in the form of strips.

Activity

Take two test tubes and add citric acid in one and soap solution in another. Now dip a strip of blue litmus paper in citric acid and observe the colour change. Now do the same with red litmus paper. Do vice-versa for soap solution and observe the difference.
Acidic solutions (citric acid) turn blue litmus red and basic solution (soap solution) turn red litmus to blue.

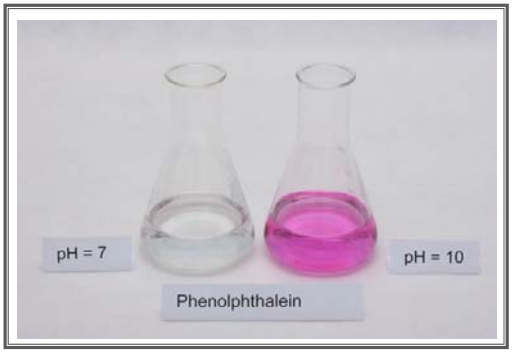
The solutions which do not change the colour of either red or blue litmus are known as neutral solutions. These substances are neither acidic nor basic.

Turmeric

Turmeric can also used as a natural indicator. Turmeric paste (in water) gives red colour with basic solution and remains yellow when acidic solutions are added.

China Rose as Indicator

China rose indicator turns acidic solutions to dark pink (magenta) and basic solutions to green.



Synthetic Indicator

Synthetic indicators or laboratory indicators are chemicals that are used to check the presence of acid or base. Some synthetic indicators are phenolphthalein and methyl orange.

Activity

Take small amount of hydrochloric acid in a test tube and sodium hydroxide in another. Add drop by drop phenolphthalein solution in both the test tubes one by one. You will observe that sodium hydroxide solution turns pink while hydrochloric acid does not change in colour. Hence, we conclude that phenolphthalein gives pink colour in basic medium.

Neutralization

The reaction between an acid and a base is known as neutralization. Salt and water are produced in this process with the evolution of heat.

Acid + Base → Salt + Water

Let us learn neutralization reaction with help of experiment.

Take a conical flask filled with 20 milliliter sodium hydroxide in it. Now add two or three drop phenolphthalein solution in it. What do you observed? You find the sodium solution turns pink. What is concluded from this? This mean sodium hydroxide is basic in natured. Now take dilute hydrochloric acid in a burette. Now add this acid drop by drop into conical flask with constant shaking. Stop adding hydrochloride acid when pink colour solution completely disappears. We conclude that, when the solution turns colourless, sodium hydroxide is completely neutralized by hydrochloric acid.

NaOH +	**HCl**	⟶	**NaCl +**	**H_2O + Heat**
Sodium	Hydrochloric		Sodium	Water
Hydroxide	acid		Chloride	

Neutralization in Everyday Life

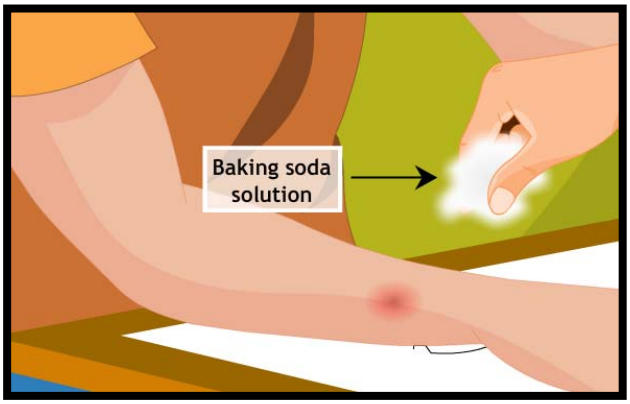
Neutralization reaction is also useful in our day to day life.

Indigestion

Hydrochloric acid present in stomach is essential for the digestion of food. Sometimes, our stomach produces excess acid, which causes pain and irritation. This condition is known as acidity or indigestion. To get relief from this condition, milk of magnesia is used as an antacid. Milk of magnesia contains magnesium hydroxide, which is a mild base. It reacts with excess acid present in the stomach, and neutralizes it.

Ant bite

When an ant bites, it injects formic acid into the skin, which causes pain and irritation. To neutralize the effect of formic acid, baking soda (sodium hydrogen carbonate) or zinc carbonate can be applied on the skin for relief.



Soil treatment

Soil becomes acidic or basic when an excess of chemical fertilizers are used. Plants are unable to grow well in acidic or basic soil. Hence, to neutralize the acidity of soil, quick lime (calcium oxide) or slaked lime (calcium hydroxide) is added to soil. To neutralize excess basicity, soils are treated with organic matter, containing organic acids.

Factory wastes

The wastes of many factories contain acids. If they are allowed to flow into the water bodies, the acids will destroy the aquatic habitat. The factory wastes are, therefore, neutralised by adding basic substances.

Tooth enamel, which is made of calcium phosphate, is the hardest substance in the human body. It does not dissolve in water. However, it breaks down, or disintegrates, or decays on reacting with acids. These acids are produced in the mouth due to degradation of sugar and food particles by certain bacteria.

Toothpaste, which we use daily for cleaning our teeth, is generally basic. Hence, it can neutralize excess acid present in the mouth and prevent tooth decay.
The wastes of many industries contain acids. This waste, when thrown directly into the water bodies, harms the aquatic life. Hence, this waste is first treated with basic chemicals to neutralize the effect of acids present in it.

Exercises

5.1 What is the source from which litmus solution? What is the use of this solution?

5.2 What is the nature of distilled water? Is it acidic or basic? Give reasons
5.3 Why are toothpastes basic in nature?
5.4 What is it required to add bases in the factory wastes?
5.5 Three liquids are given to you. One is sulphuric acid, another is sodium hydroxide and third is a sugar solution. How will you identify them? You have only China rose indicator.
5.6 Vinegar is added to pickles to prevent it from spoilage. What is the nature of vinegar?
5.7 Define neutralization reaction with the help of an example

Chapter-6 Physical and Chemical Changes

Physical Change

A physical change is a change, in which shape, size, appearance or state, of a substance is altered, but its chemical composition remains same. Only a physical change of matter takes place. No new substance is formed. It is usually reversible that is why the original substance can be obtained. There is no change in mass of substances.

Examples:

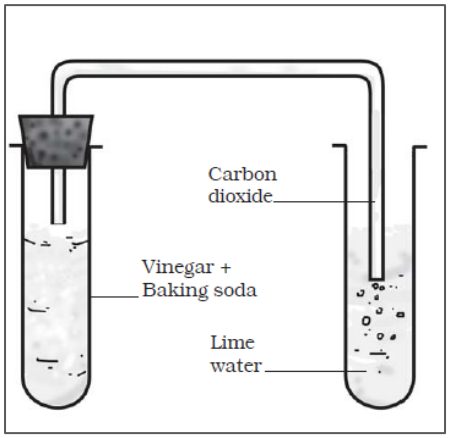
1. Dissolution sugar, salt etc in water
2. Interchanging state of water: Ice $\leftrightarrow$ Liquids $\leftrightarrow$water vapours
3. Boiling of water (any liquids)
4. Melting of solids

Chemical Change

A change in which one or more new substances are formed is called a chemical change. A chemical change is also called a chemical reaction. It is irreversible in nature. There is change in mass of substances.

Activity

Take about a teaspoonful of vinegar in a test tube. Add a pinch of baking soda to it. You would hear a hissing sound and see bubbles of a gas coming out. Pass this gas through freshly prepared lime water. What happens to the lime water? When carbon dioxide is passed through lime water, calcium carbonate is formed, which makes lime water milky.
The turning of lime water into milky is a standard test of carbon dioxide.



Let us study another example of a chemical change
Get a thin strip or ribbon of magnesium. Clean its tip with sandpaper. Bring the tip near a candle flame. It burns with a brilliant white light. When it is completely burnt it leaves behind a powdery ash.
The change can be represented by the following equation:

$$\text{Magnesium (Mg)} + \text{Oxygen } (O_2) \rightarrow \text{Magnesium oxide (MgO)}$$

Collect the ash and mix it with a small amount of water. Stir the mixture (aqueous solution) well. Test the mixture with blue and red litmus papers. It will turn red litmus blue. This is because magnesium hydroxide formed is basic.

This change can be written in the form of the following equation:

$$\text{Magnesium oxide (MgO)} + \text{Water } (H_2O) \rightarrow \text{Magnesium hydroxide } [Mg(OH)_2]$$

Magnesium hydroxide is the substance formed by mixing magnesium oxide with water.

Some examples of chemical change

- Explosion of firecrackers
- When food gets spoiled,

Rusting of Iron

Iron when exposed to moist air for a long time acquires a brown flaky coating. This substance is called rust. This process requires presence of air and water. Rust is a general term for iron oxides formed by the reaction of iron with oxygen. It is extremely slow process.

The chemical formula: $Fe_2O_3.nH_2O$ (n= no. of water molecules)

The process of rusting can be represented by the following equation:

$$\text{Iron (Fe)} + \text{Oxygen } (O_2 \text{ from the air}) + \text{water } (H_2O) \rightarrow Fe_2O_3.nH_2O \text{ (Rust)}$$

Conditions for Rusting of Iron

- The presence of water and oxygen are essential for the rusting of iron.
- Impurities in the iron, the presence of water vapour, acids, salts and carbon dioxide hastens rusting.
- Pure iron does not rust in dry and carbon dioxide free air. It also does not rust in pure water, free from dissolved salts.
- Metals like chromium, zinc and magnesium prevent rusting to a great extent and alkalis also help to prevent rusting.

Prevention

Prevent iron articles from coming in contact with oxygen or water.

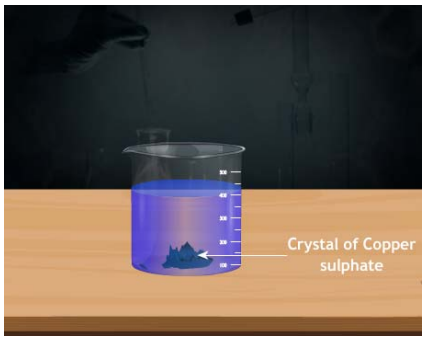
- Apply a coat of paint or grease.
- Deposit a layer of a metal like chromium or zinc on iron. The process of depositing a layer of zinc on iron is called galvanization.
- Stainless steel is an alloy which is made by mixing iron with carbon and metals like chromium, nickel and manganese. These can be used instead of metals as these alloys have properties of the metals from which they are made.

Crystallization

It is a slow precipitation of crystals from a solution of a substance. It can also refer to solids-liquids separation of substances.

Activity

Take a beaker and add one fourth of the beaker with water and a few drops of dilute sulphuric acid. Heat the water. When it starts boiling add copper sulphate powder slowly while stirring continuously. Continue adding copper sulphate powder till no more powder can be dissolved. Filter the solution. Allow it to cool. Do not disturb the solution when it is cooling. Look at the solution after some time. You will see the crystals of copper sulphate.



Exercises

6.1 When baking soda is mixed with lemon juice, bubbles are formed with the evolution of a gas. What type of change is it? Explain.

6.2 When a candle burns, both physical and chemical changes take place. Identify these changes. Give another example of a familiar process in which both the chemical and physical changes take place.

6.3 How would you show that setting of curd is a chemical change?

6.4 How will you prepare copper crystals by the process of crystallization?

6.5 Give two methods to prevent rusting of Iron.

6.6 Classify the following into physical or chemical change

a. Burning of candle
b. Cutting of wood
c. Folding of paper
d. Preparing dough from flour

Chapter-7 Weather, Climate and Adaptations of Animals to Climate

Weather

The day to- day condition of the atmosphere at a place with respect to the temperature, humidity, rainfall, wind-speed, etc is called the weather at that place. The temperature, humidity, and other factors are called the elements of the weather. The weather of a place changes day after day and week after week.

Elements of weather

Humidity is the amount of moisture present in the atmosphere. The **wind speed** can be measured with the help of an **anemometer**.

The **rainfall** is the quantity of water, expressed in inches, precipitated as rain, snow, hail, or sleet in a specified area and time interval. Rainfall can be measured by an instrument called **rain gauge** which consists of a measuring cylinder with a funnel at the top to collect rain water.

The hotness or coldness of an object or environment is called its **temperature**. The maximum temperature is recorded in the afternoon and the minimum temperature recorded in the early morning with the help of maximum and minimum thermometer. It signifies about the weather of that place.

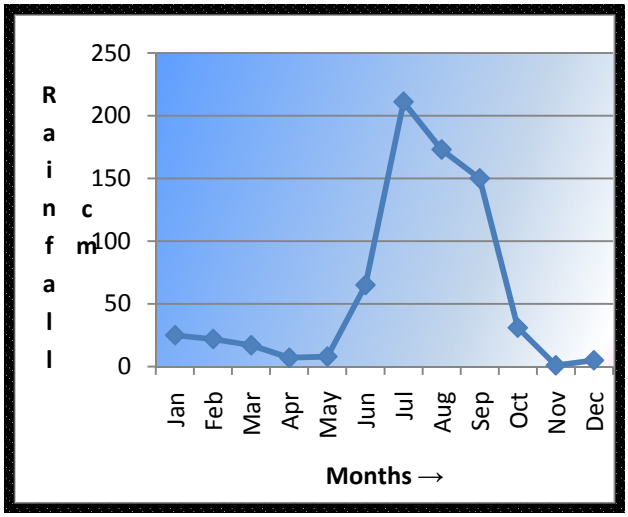
The **sun** is the ultimate source of energy on earth and causes changes in the weather. Energy absorbed and reflected by the earth's surface, oceans and the atmosphere play important roles in determining the weather at any place.

Climate

The average weather pattern taken over a long period of time is called the climate of the place. For example the climate of Rajasthan is hot and dry due to the high temperature most of the year whereas north eastern regions have a wet climate. The below given data interprets the maximum and minimum temperature and

rainfall of Delhi. The graph shows the variation in the rainfall in Delhi throughout the year.

ANNUAL TEMPERATURE & RAINFALL CHART			
Months	Max	Min	Rainfall
January	21	07	25
February	24	10	22
March	30	15	17
April	36	21	07
May	41	27	08
June	40	29	65
July	35	27	211
August	34	26	173
September	34	25	150
October	35	19	31
November	29	12	01
December	23	08	05



Climate and Adaptation

The climate influences the plants and the animals also. The plants and animals adapt according to the climatic conditions prevailing in that region.

Features and habits that help plants and animals to adapt to their surroundings as a result of the process of evolution are called adaptation.

The effect of climate on the animals living in a particular region and the adaptation of these animals to that climate is described below.

The Polar region

Climate

Polar Regions are the ice-covered regions around the far south and north ends of the globe. These two freezing global terminal points are recognized as the North and South Pole.

The Polar Regions remain wrapped up in thick ice-blanket throughout the year. The weather is very cold, far below freezing temperatures, all year.

Weather plays a wild game in the Polar Regions. During the winter, the sun never rises for six months at a stretch and in the summer the sunshine, no matter how much gleam, refuses to put off for next half of the year.

Animals

Polar bears, penguins, seals, whales, and walrus, many types of fishes, musk oxen, reindeers, foxes and birds are a few of the wildlife that live in these very cold regions.

Adaptation of polar bear

Many of the adaptation seen in polar bear help to regulate body temperature, make hunting easier and increase the efficiency of movement both in and out of the water.

- A polar bear has a layer of fat under its skin which helps it stay warm. It also has a thick layer of fur.
- The wide, large paws help a polar bear to walk in the snow and the thick claws are frequently used to tear away the flesh of preyed upon organisms and to navigate through the carcasses of the dead animals.
- When a polar bear swims under water it closes it nostrils so no water can get in. Their distinct swimming abilities probably source from their joined toes (webbed feet).
- They have a strong sense of smell so that it can catch its prey for food.
- The white fur helps them blend in with the snow and makes it difficult for its predator and prey to recognize them.

Adaptation of penguin

- The penguins are white and merge well with the white background.

- They huddle together which keeps them warm.
- They have thick skin and a lot of fat to protect it from cold.
- Their bodies are streamlined and their feet have webs, making them good swimmers.
- Penguins have almond shaped glands beneath their skin above the eyes that enable them to filter excess salt from the ocean.

The migratory birds like the Siberian cranes fly almost 15000 km every year to escape extreme cold conditions. The cold conditions allow them to disperse the heat generated by their flight muscles.

The Tropical Rainforests

Climate

In an average year in a tropical rain forest, the climate is very humid because of all the rainfall, which amounts between 150 cm to 250 cm per year.

The rain forest has lots of rain because it is very hot and wet. This climate is found near the equator. There is no dry season.

The relative humidity is always high. This type of climate in the tropical rain forest is known as equatorial climate.

The temperature during the day is around 30ºC - 35ºC. At night it drops to between 20ºC - 25ºC.

Tropical rainforests are found in Western Ghats and Assam in India, Southeast Asia, Central America and Central Africa.

Plants and Animals

About half of the world's plant **species** can be found in the rain forest. Since it is warm and rains the whole year, forests stay green.

Trees lose their leaves and **immediately** grow new ones. The rain forest is the home of many plants: lianas, ferns, orchids and many kinds of tropical trees.

Fish, reptiles, birds and insects also live in the rain forest and its rivers. Plants and animals need each other to **survive.**

Since a wide range of animals inhabit the rainforest there is a severe competition for the resources.

Adaptation of animals living in tropical rainforest

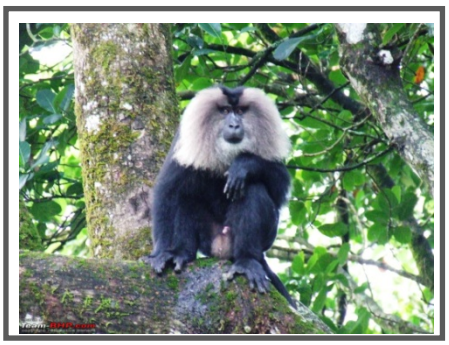
The animals have sensitive hearing, sharp eyesight and thick skin.
Their skin colour helps them to camouflage by blending with the surroundings.

Red-eyed frog

- Red-eyed frog has developed sticky pads on its feet to help it climb trees on which it lives.
- They have long tails for grasping branches.
- Their hands and feet are such that they can easily hold on to the branches.

The bird Toucan possesses a long, large beak that helps it to reach the fruits on branches which are otherwise too weak to support its weight.

The lion-tailed macaque



- Its silver-white mane surrounds the head from the cheeks down to its chin.
- It is a good climber and spends a major part of its life on the tree.
- This animal also searches for insects under the bark of the trees.

Elephant

- It uses its trunk as a nose because of which it has a strong sense of smell.
- The trunk is also used by it for picking up food.
- Its tusks are modified teeth which can even tear the bark of trees.
- Large ears of the elephant help it to hear even very soft sounds.

Exercises

7.1 The tropical rainforest has a large population of animals. Explain why it is so.
7.2 Explain, with examples, why we find animals of certain kind living in particular climatic conditions.
7.3 How do elephant living in the tropical rainforest adapt itself?
7.4 Fill in the blanks:
1. The average weather taken over a long time is called _____.

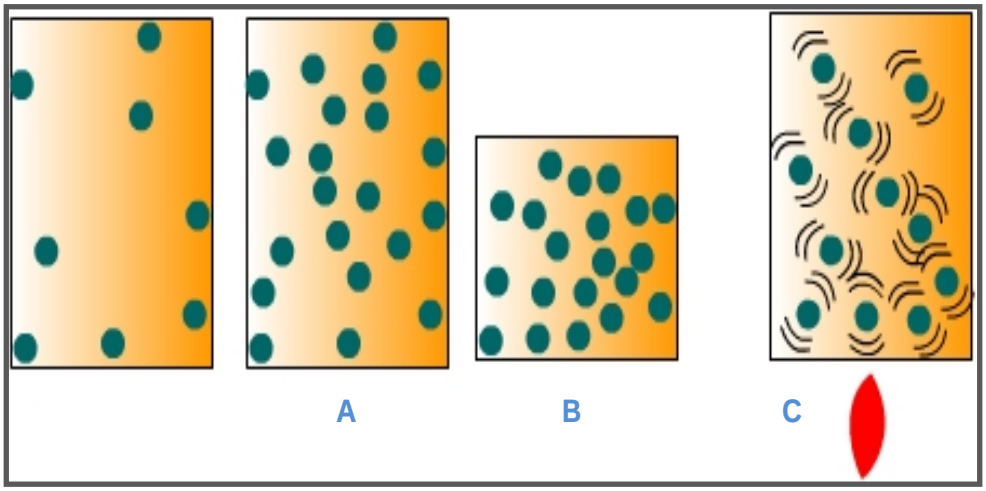
2. A place receives very little rainfall and the temperature is high throughout the year, the climate of that place will be _____ and _____ .
3. The two regions of the earth with extreme climatic conditions are _____ and _____.

Chapter- 8 Winds, Storms and Cyclones

Air Pressure

Air pressure is the force exerted per unit area of surface by the air that is directly above that surface.

Imagine a sealed container full of air as shown below. When the molecules of air collide with the inside surfaces of the container they exert a pressure. The amount of pressure they exert depends on the number of collisions that occur between the molecules and the inside surface of the container. We can change the pressure in two ways. First, we can increase the density of the air by either putting more air molecules into the container (**A**) or reducing the volume of the container (**B**). Secondly, we can increase the temperature of the air (**C**) to make the molecules move faster and thus collide with the sides more often. Therefore, changes in air pressure can come about by changes in air density or temperature.



Air pressure is measured using a *barometer*.

Some applications of Air Pressure:

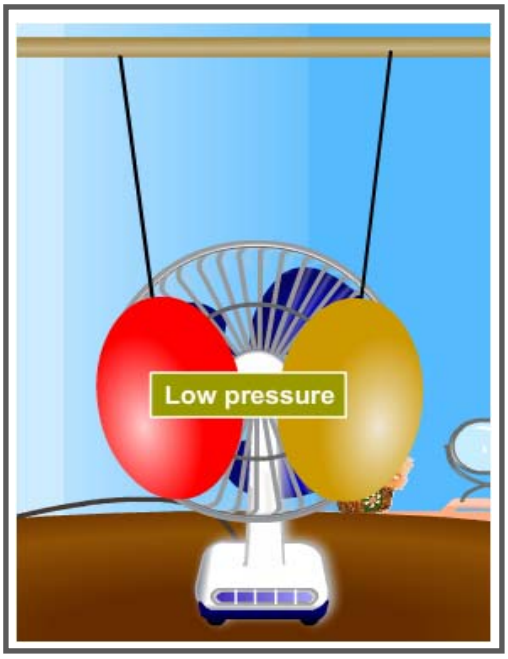
- Cycling against the wind is difficult because of the pressure exerted by air.
- The tires of vehicles are filled with air, thereby exerting pressure. This makes it easy for them to hold and carry the weight.

High Speed Winds are accompanied by Reduced Air Pressure

Changes in air pressure bring changes in the weather and make winds blow. Air usually moves from areas of high pressure to areas of low pressure and this produces winds. High air speed causes low pressure and low air speed causes high pressure.

Activity

Take two balloons and fill a part with water and rest with air. Place the balloons in front of the electric fan with some distance between them. Switch on the fan at lower speed. You will notice that the distance between balloon decreases slightly. Switch off the fan you will see that the balloons come back to their original place. Why did that happen? When air blew between the balloons the pressure between the balloons reduces and pressure outside the balloons is higher and it pushes them closer. Can you think what will happen if, speed of the fan is further increased? The balloons will come even closer to each other. We conclude that high air speed causes low pressure and low air speed causes high pressure.

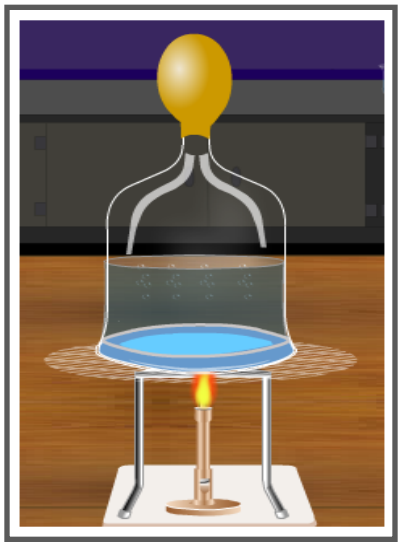


Air expands on Heating

Air condenses as it is cooled and hence requires less space. That means air contracts on cooling. Warm air therefore takes up more space than the same amount of cold air; it also weighs less than cold air occupying the same space. On heating, the molecules begin to move faster and move apart from each other leading to expansion.

Activity

Air expands on heating and contracts on cooling



Take a glass bottle and a balloon. Now fill half the bottle with water and the balloon has to be fixed over the mount of the water bottle, with the help of rubber band. Now place a flame under the bottle for heating the water. What do you see? The balloon expands. This is because when you heat the air inside the bottle, it expands. When it expands it needs more space to fill out. This expanding hot air finds empty space inside the balloon, so the air moves inside the balloon and hence the balloon expands. Let us put this bottle into a jar having ice cubes. What will you see? The air inside the balloon moves toward the bottle and the balloon

contracts. Air condenses as it is cooled and hence requires less space. That means air contracts on cooling. The continuous contraction of air inside the balloon will result in a completely deflated balloon.

Some applications

- Smoke from a fire moves upward. This is because fire heats the air above it, and this hot air moves up. The air carries the smoke along with it, thereby making it rise up.
- In a hot air balloon, there is a balloon fixed over a basket and a flame just below the balloon. As the air inside the balloon gets heated up, it becomes lighter and rises up.

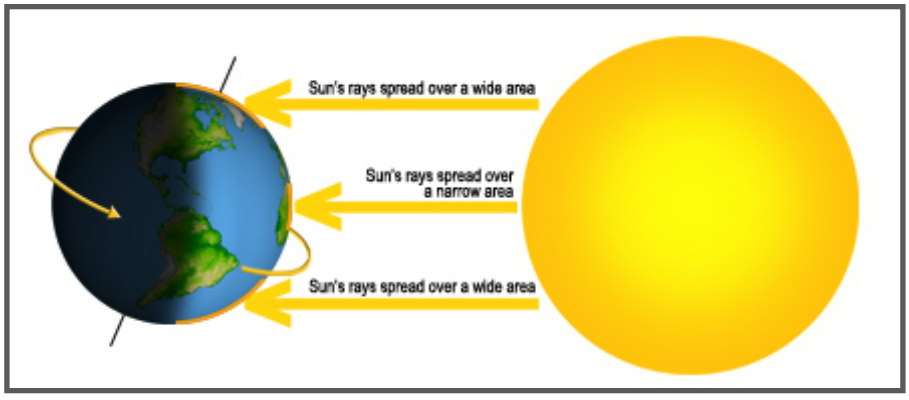
Wind Currents Are Generated Due To Uneven Heating on the Earth

The winds blow from a region of low temperature to a region of high temperature because of a difference in the atmospheric pressures.

A region with a high temperature has a low-pressure condition because of low air density. That means when a place is hot, air above the place will also get heated up and hence will rise up thus decreasing the air density at that place whereas a region with a low temperature has a high-pressure condition because of high air density.

The pressure differences are caused due to following reasons:

(a) Uneven heating between the equator and the poles land and water.



Because of the tilt of the Earth, both the poles receive least amount of sunlight as compared to equator region and hence are very cold. Due to this air in these regions also remains cool forming a High-Pressure region.

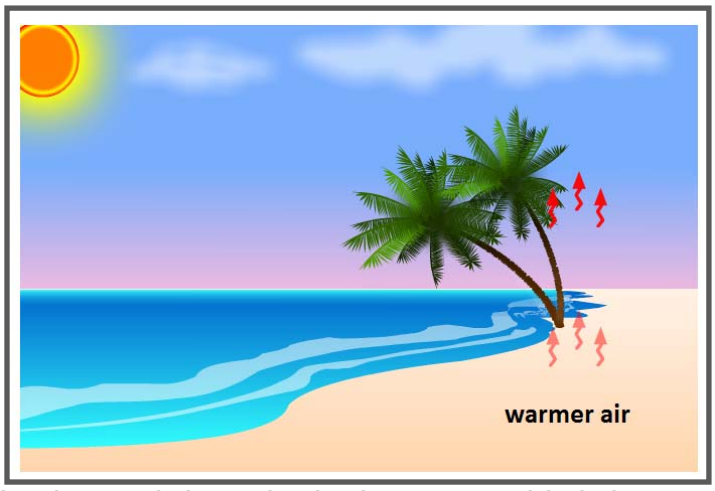
The air between the 30° to 60° latitude belts is warmer in comparison to the air near the poles. Hence, this warm air rises up and cold air from the Polar Regions rush in to fill the empty space.

(b)Uneven heating of land and water.

Sea breeze

In day time, the surface of the land is warmer than the surface of sea. The warm air over the land moves upward. Once it does that. There is decrease in air pressure here. So, there is vacant space. The air from the sea blows toward the land to occupy the space. This blowing air is called a sea breeze. Now this sea breeze brings cold air from the sea. So, it reduces the temperature of the surrounding area.

Land breeze



In night time, exactly the reverse happens. The land absorbs the heat in the day and releases it very quickly in the night as compared to water which absorbs the heat late and releases it late! The air over the land is cooler and denser than the air over the sea. So now the reverse is happening, the warm air over the sea moves upward. So there is a low pressure area here and it is waiting for the air from the land to rush in and take its space. This is known as the land breeze. That is the wind blowing from the land toward the sea. This is the reason that the temperature of the beach is neither too hot and nor too cold.

During the summer months, the land at equator absorbs heat and the temperature of the land becomes higher than that of the oceans. This makes the hot air from the land to rise up and the cold air from the oceans blow towards the land. This results in the formation of the **monsoon winds**.

During winter months, the temperature of the land becomes less than that of the oceans. As a result, winds start blowing from land to the oceans.

Monsoon rain

Monsoons are seasonal winds that change their direction with changing seasons. They blow from the oceans towards land in summer and from the land to oceans in winter. When blowing from oceans to land, these winds carry water droplets with them and are responsible for the rains in India.

Thunderstorms and Cyclones

A thunderstorm is a high-speed wind that is accompanied by heavy rain (or hail), lightning, and thunder.

Causes of Thunderstorms

Thunderstorms

In hot, humid and tropical areas, the temperature of the air over the land is very high. This causes the air to move upward and forcefully carry the water vapour present in the air, to a higher altitude. At high altitudes water vapour freezes to form water drops or hail which falls on the Earth. This sudden rise and fall of hot air and cold-water droplets causes lightning and thunder, and results in what is commonly called as a thunderstorm.

Cyclones

Water on the surface of the Earth absorbs heat and changes to vapour. As water vapour moves up higher in the atmosphere, it carries this heat along with it. The higher regions of the atmosphere are cooler. This condenses the water vapour into water drops.

When vapour cools down, it releases the absorbed heat into the atmosphere. The heat thus released warms up the air, which once again causes it to rise up. A low-pressure area is thus formed and the air from the surrounding areas rushes in. This sequence of events is repeated continuously.

Thus, this cycle is the result of the formation of a very low-pressure system with high wind speeds revolving around it. This weather phenomenon is known as a Cyclone.

The low-pressure centre of a cyclone is known as the eye of the cyclone. It is very calm i.e. the centre of the storm is actually free from storm and rain.

Formation of a cyclone depends on the factors like **wind speed, wind direction, humidity and temperature.**

Destruction Caused By Cyclones

Cyclones can cause a lot of destruction to our lives, property, communication systems, and facilities. They cause floods and make the soil infertile. The rainfall caused during a cyclone is so strong that a human cannot overcome it.

Safety Measures and precautions against these cyclones:

1 Never ignore the warning given by media against cyclones.

2. Avoid driving on a road filled it water, it might have got damaged because of cyclone.

3. Do not touch fallen and broken power lines.

4. Do not drink contaminated water in a cyclone hit area.

Advanced technologies like RADAR & satellites have helped a lot in giving early warning against cyclones, so that people can have enough time to evacuate their homes and shift to a safer place. Also we have Anemometer to measure the speed of the wind, so whenever there is a remarkable hike in the wind speed we get an Alert!

Tornadoes

In some countries Tornadoes are seen which are actually a dark cloud having a funnel shape and travelling at an average speed of 300 Km/Hour. But most of the tornadoes are weaker and sometimes these are formed within the Cyclones.

Tornadoes

Exercises

8.1 You want to buy a house. Would you like to buy a house having windows but no ventilators? Explain your answer.
8.2 Explain why holes are made in hanging banners and hoardings.
8.3 What are the precautions taken in case cyclone approaches your village/town?
8.4 Fill in the blanks
1. Winds are generated due to……..heating on the earth.
2. Near the earth's surface ……air rises up whereas ……. air comes down.
3. High-speed winds and air pressure difference can cause cyclones.
Air expands on …… and contracts on ……..
8.5 Why is Chennai more vulnerable to cyclones than Delhi?

Chapter-9 Soil

Soil Teeming with Life

Soil is the source for plants to get nutrients with the help of their roots which go down and anchor the plants. Soil is made up of minerals, organic matter, liquids (water) and gasses (such as CO_2).

Functions of Soil

- Soil is a vital component of nutrient cycling. It can take in nutrients in forms, which other organisms cannot use and processes them into usable forms.
- Soil helps to manage water by holding moisture, controlling the flow and drainage.
- Soil is like a sponge soaking up water and when plants need it, the water is squeezed out.

Top soil

- Soil provides homes for many different organisms and plants.
- Organisms living in the soil range from microscopic bacteria to small animals such grasshoppers.
- Soil helps to filter pollutants from the water and air to keep the quality of our air and water.

The soil is formed by the breaking down of rocks by the action of wind, water and climate. This process is called **weathering**.

Soil Profile

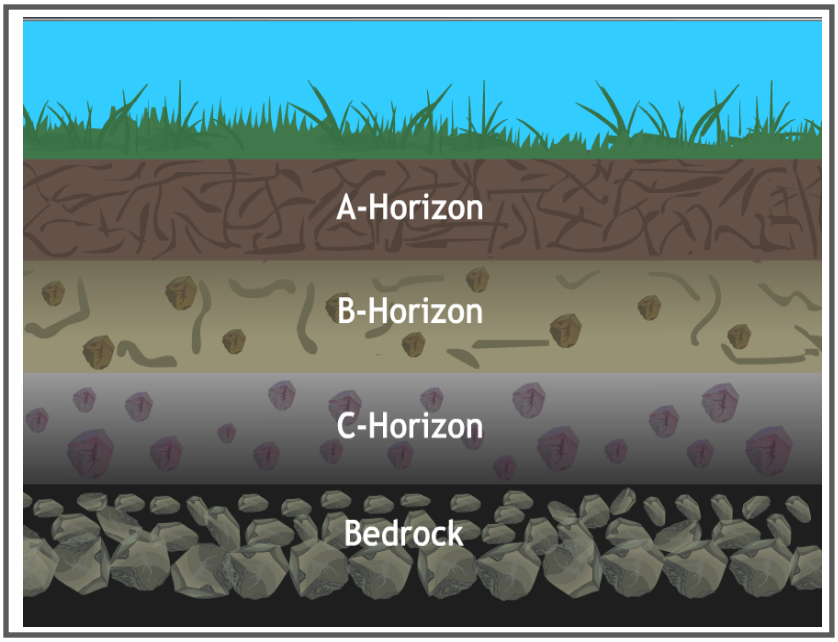
A vertical section through different layers of the soil is called the soil profile. Each layer differs in texture, colour, depth and chemical composition.

The top layer is the **A-Horizon** or often called topsoil as it supports the greatest amount of root activity and therefore is the most productive as it provides shelter for many living organisms such as worms, rodents, moles and beetles. The roots of small plants are embedded entirely in the topsoil.

Horizon B is harder and compact zone vital for the filtration of nutrients and minerals. It contains less of humus and more of minerals.

C-Horizon produces the soil as it breaks down the parent material of the soil. It is composed of small lumps of rocks with cracks and crevices.

The **bed rock** provides stability and parent material for the soil. It is hard and difficult to dig with a spade.



Soil profile

Types of Soil

The mixture of rock particles and humus is called the soil. The soil is classified on the basis of the proportion of particles of various sizes.

Sandy soil

This soil type has the biggest particles with better aeration and drainage of the soil. Sand particles are quite large. They cannot fit closely together, so there are large spaces between them filled with air. The soil is granular and comprises of small rock and mineral particles. The texture of this soil is gritty.

Sandy soil

Clayey soil

Clayey soil is very fine and has very less air spaces and hence drainage in this soil is low. Water can be held in the tiny gaps between the particles of clay. The proportion of fine particles is relatively higher in clayey soil.

Clayey soil

Loamy soil

Loamy soil is a mixture of sand, clay and another type of soil particle known as silt. Loamy soil has same amount of large and fine particles and is basically formed by the accumulation of dead and decaying organic matter. It has the right water holding capacity for the growth of plants.

Loamy soil

Properties of Soil

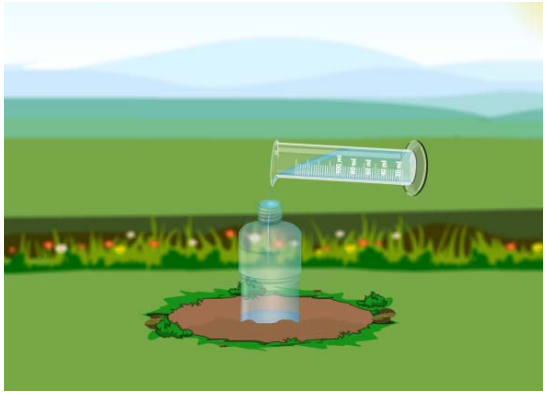
Percolation rate of water in soil

Water percolation rate of the soil refers to the rate of the movement of water through the soil as it passes through the small holes or spaces between the particles of the soil.

Percolation depends up on:

- **Climate:** If the rainfall is more than evaporation, then there will be appreciable amount of percolation. In dry region, percolation is almost negligible.
- **Nature of soil:** Sandy soils permit more percolation as these occupy large number of macro-pores. The macro-pores serve as the main channels of the gravitational flow. However, clayey soil permits less water to percolate.

Activity

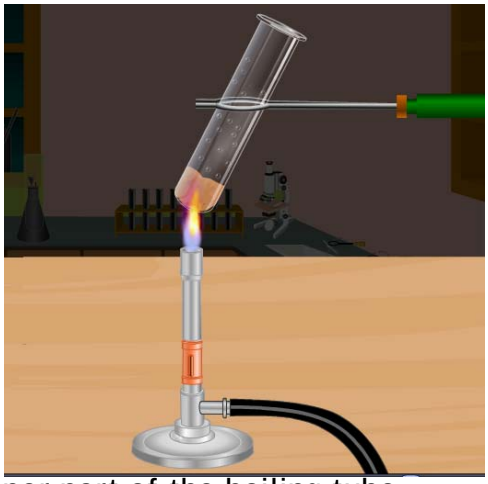


Let us understand the percolation rate of the soil this with the help of an activity. Dig 50 by 50 centimeter deep hole in soil. Cut the bottom portion of an empty plastic the bottle. Place the bottle in the hole. Fill the bottle with 100 ml of water. Note the time when all the water has percolated leaving the bottle empty. Percolation rate = Amount of water (milliliter)/Percolation time (minutes), putting the value and simplifying them, we can get percolation of soil.

Moisture in Soil

Soil also contains moisture. The amount of moisture present in a particular soil can be measured with the help of an activity.

Activity

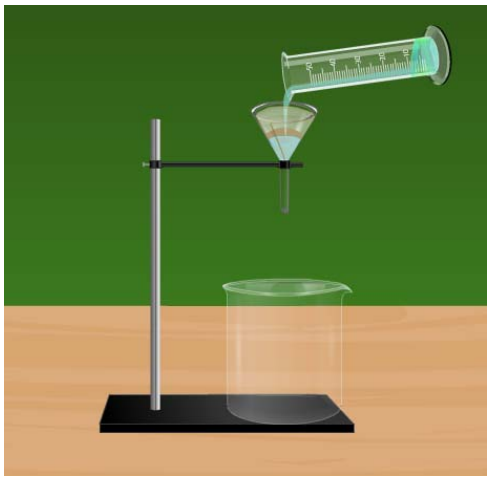


Take an empty boiling tube. Weight it on a digital balance. Note the reading. Put some soil sample in it. Weigh again and note the reading. Heat it on a flame and observe it. What do you observe? You will see water droplets are formed on the inner walls of the upper part of the boiling tube. Now, again weigh the boiling tube on balance. You will be surprised to know that the weight of the soil decreases. On heating, water in the soil evaporates, moves up and condenses on the cooler inner walls of the upper part of the boiling tube.

Absorption of Water by Soil

When determining water absorption, two factors are considered: permeability, or how easily the soil is penetrated with water, and retention, or how well it holds water. Since sandy soils have very loose particles, they have high water permeability, but they do not retain water for very long. Clay soils, on the other hand, have low permeability and high water retention. Loam soils have medium permeability and absorption.

Activity



Take a paper and weigh it on a balance and note the reading. Now, add 50 grams of soil sample and weigh again and note the reading again. Take 10 ml of water and fix the funnel on an iron stand. Take a filter paper, fold it and place it on the funnel. Put the soil into the funnel and pour the measured 10 ml of water drop by drop on the soil. Finally, measure the amount of water collected in the beaker. This will give the absorption percentage. We can calculate the water absorption percent of soil by using the following formula. We get, % of water absorbed = (U-V)/ 50 X 100, where U represents initial volume of water in the container and V represents final volume of water dip out from the container.

Soil and Crops

Different crops need different soil type for its proper growth. Soil is affected by wind, rainfall, temperature, light and humidity. The following table gives the soil type suitable for particular crop.

Crop	Soil type
Wheat and gram	Clayey and Loamy
Paddy	Clayey
Lentils (masoor) and other pulses	Loamy
Cotton	Sandy-loam or loam

Soil erosion

The removal of land surface by water, wind or ice is known as erosion. Plant roots firmly bind the soil. In the absence of plants, soil becomes loose. So it can be moved by wind and flowing water.

Causes

Soil erosion potential is increased if the soil has no or very little vegetative cover of plants and/or crop residues. Plant and residue cover protects the soil from raindrop impact and splash, tends to slow down the movement of surface runoff and allows excess surface water to infiltrate.

Soil erosion

Prevention

Soil erosion can be reduced by building terraces on hillsides, irrigation schemes to overcome droughts, planting more trees to bind the soil together and make wind breaks, and using fertilizers in overpopulated areas to make the soil more fertile. It is very important that the farming techniques used do not damage the structure of the soil, as this makes it easily eroded.

Exercises

9.1 Explain how soil is formed.
9.2 How is clayey soil useful for crops?
9.3 List the differences between clayey soil and sandy soil.
9.4 Sketch the cross section of soil and label the various layers.
9.5 With the help of an activity show which soil retains more water.
9.6 Give one word for the following
1. In desert soil erosion occurs through.
3. Clay and loam are suitable for cereals like.
4. This type of soil can hold very little water.
5. Collective name for layers of soil.

Chapter-10 Respiration in Organisms

Respiration and Its Types

All biological systems require constant supply of energy in order to carry out manifold activities of the living organisms. To ensure this constant supply of energy, many macro-molecules of the cells namely, proteins, carbohydrates or fats are needed to be oxidized to release the locked energy inside the systems.

Respiration is the process of breakdown of food in the cell with the release of energy. Cellular respiration takes place in the cells of all organisms.
The food is the glucose which is broken down to yield carbon dioxide, water and energy. Respiration may be classified into two types:-

- Aerobic respiration
- Anaerobic respiration

Aerobic respiration

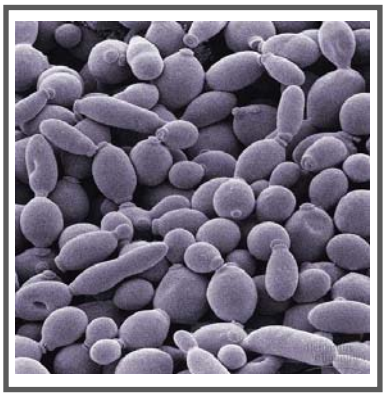
When the glucose is broken down in the presence of oxygen, it is considered as aerobic respiration. In our tissues glucose can be broken down to release energy. The energy is used to make a substance called Adenosine Tri-Phosphate or ATP as it is usually called. ATP can provide energy for other processes such as muscle contractions.

$$\text{Glucose} \xrightarrow{\text{Presence of } O_2} \text{Carbon dioxide} + \text{Water} + \text{Energy}$$

Anaerobic respiration

Anaerobic respiration occurs in the absence of molecular oxygen and it is also called fermentation. In this, the food is only partially oxidized because only a part of energy is released rest of the energy remains trapped in the intermediate compounds. It is found in lower organisms like yeasts, anaerobic bacteria, in certain parasitic worms like *Ascaris*.

Yeast which is a single cellular organism derives energy through anaerobic respiration.



Yeast

These anaerobes utilize glucose in the absence of oxygen to produce alcohol and carbon dioxide along with the production of energy.

$$\text{Glucose} \xrightarrow{\text{Absence of } O_2} \text{Alcohol + Carbon dioxide + Energy}$$

These yeasts are used in industries for manufacturing alcohol, beer and wines.

After a heavy work out session we get cramps in our muscles. This is due to anaerobic respiration occurring in our muscle. During exercise demand for energy increases and to satisfy this need the glucose breaks into lactic acid in the absence of oxygen. This lactic acid gives rise to cramps. It can be overcome by a massage for a hot water bath. As the supply of oxygen is increased the cell again switches to aerobic respiration and converts the lactic acid to carbon dioxide and water.

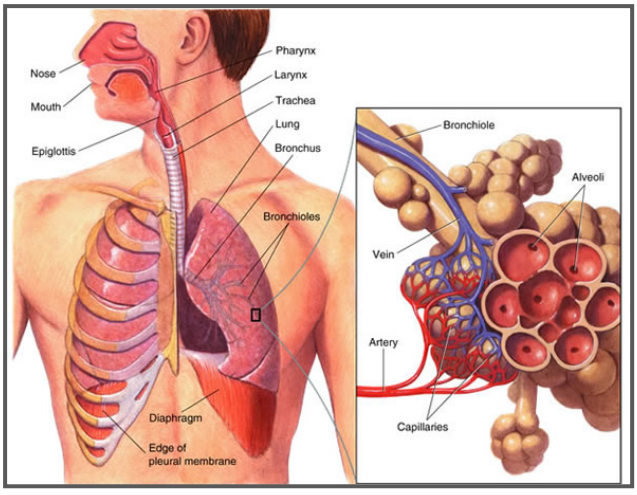
Breathing

The process of gaseous exchange i.e. intake of oxygen rich air and giving out carbon dioxide through respiratory organs is called breathing.
When we take in oxygen through our nostrils into the alveoli of lungs it is termed inhalation or inspiration while breathing out of carbon dioxide is called exhalation or expiration. The number of times a person breathes in a minute is termed as the breathing rate. One inhalation along with one exhalation makes up one breath.

Breathing in human beings

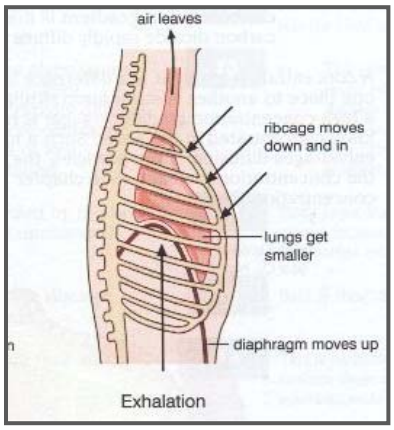
The passage through which the oxygen from the atmosphere reaches the lungs is described below.

- Human beings normally take in air through their nostrils.
- From the nostrils this air enters the nasal cavity.
- From the nasal cavity the air reaches our lungs through the windpipe or trachea.
- The lungs which are the respiratory organs are present in the chest cavity. This cavity is surrounded by ribs on the sides.

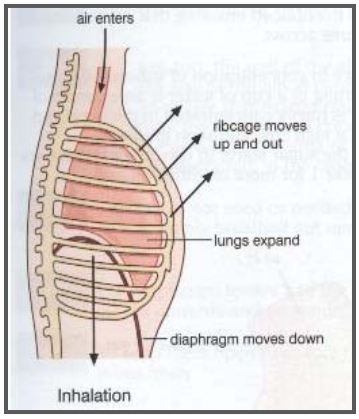


Human respiratory system

- A large muscular sheet called diaphragm forms the floor of the chest cavity.
- Breathing involves the movement of the diaphragm and the rib cage.



As the external intercostals & diaphragm contract, the lungs expand. The expansion of the lungs causes the pressure in the lungs (and alveoli) to become slightly negative relative to atmospheric pressure. As a result, air moves from an area of higher pressure (the air) to an area of lower pressure (our lungs and alveoli). During expiration, the respiratory muscles relax and lung volume decreases. This causes pressure in the lungs (and alveoli) to become slightly positive relative to atmospheric pressure. As a result, air leaves the lungs.



Activity

Cut off the bottom 1/4 of an empty plastic bottle and make a small hole in the centre of the cap of the bottle. Tape a balloon over one end of the straw so that no air can escape between them. Feed the straw through the lid of the bottle and screw the lid on it. Now cut off the top part of another balloon and discard it. Fix the bottom part of the balloon to the bottom of the bottle. Stretch the balloon over the bottom of the bottle. This model shows the method by which our lungs work. The balloon at the bottom acts like the diaphragm.

What do we breathe out?

The carbon dioxide gas given out during exhalation can be confirmed by a simple test. Take a test tube with fresh lime water and breathe out air into it through a straw. It will observe that the lime water turns milky. The calcium hydroxide turns into calcium carbonate. It is a standard test for carbon dioxide.

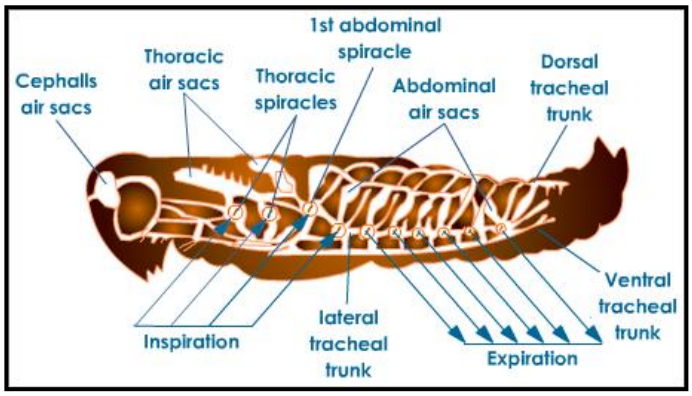
Breathing in other Animals

Mammals like cows, horse have respiratory system similar to humans. They also breathe by the same mechanism as in humans.

Breathing in Cockroach

Respiration in cockroach is quite different from humans. They have an open system. A cockroach body is divided into three sections, the head, thorax and the abdomen. This is the internal structure of a cockroach. It has small opening on the body called spiracles through which exchanges of gases takes place. The body possesses a network of air tubes called tracheae for gas exchange.

Oxygen rich air rushes through spiracles into the tracheal tubes, diffuses into the body tissue, and reaches every cell of the body. Similarly, carbon dioxide from the cells goes into the tracheal tubes and moves out through spiracles.



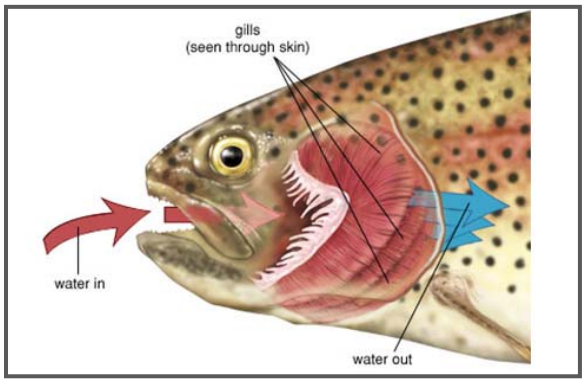
Respiration in Cockroach

Earthworm

An earthworm does not possess a respiratory organ. It takes in oxygen directly through its skin and gives off carbon dioxide. Its skin is always moist. The skin is protected by a thin cuticle secreted by the outer layer and kept moist by slimy mucus. A moist surface is necessary for oxygen to be absorbed and carbon dioxide to be given off. Though frogs have pair of lungs like human beings, they can also breathe through their skin, which is moist and slippery.

Breathing under Water

The aquatic animals like fishes have gills for exchange of gases. The oxygen gas is present in the dissolved form in water. Gills are projections of the skin. Gills are well supplied with blood vessels for exchange of gases. The fish draws in water by closing the lid over its gills and opening its mouth. When the fish closes its mouth and opens the gill lid the water is forced out over the respiratory surfaces of the gill filaments.



Respiration in Fish

Respiration in plants

Plants take in carbon dioxide and give out oxygen by the process of photosynthesis but like other living organisms plants also respire. They also utilize oxygen for respiration in order to generate energy and release carbon dioxide as product. The root cell also needs oxygen to generate energy. Roots take up air from the air spaces present between the soil particles.

Exercises

10.1. Enumerate the similarities and differences between aerobic and anaerobic respiration.

10.1 Why do we often sneeze when we inhale a lot of dust-laden air?

10.2 Explain the anaerobic respiration in muscle cell

10.3 Briefly describe the respiration in cockroach

10.4 How do plants respire? explain

10.6 Write true or false

i. Plants carry out photosynthesis only during the day and respiration only at night.

ii. Frogs breathe through their skins as well as their lungs.

iii. The fishes have lungs for respiration.

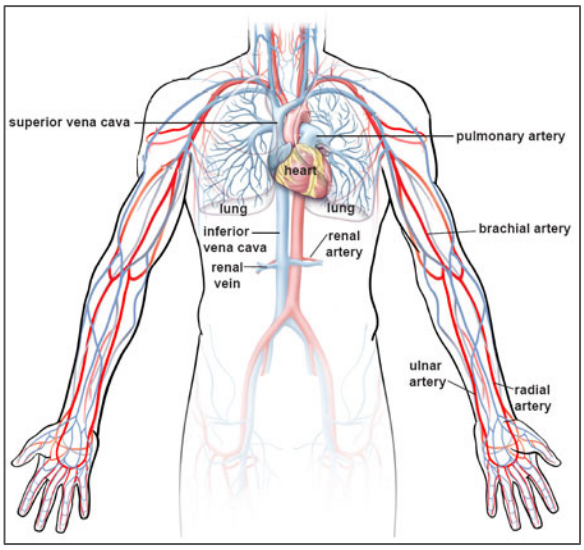
iv. The size of the chest cavity increases during inhalation.

Chapter-11 Transportation in Animals and Plants

All organisms need food, water and oxygen for survival. This needs to be transported to all the cells of the body. Multicellular organisms have several organ systems to carry out the vital functions. Transportation in our body occurs with the help of the circulatory system. This system comprises of the blood with blood cells, blood vessels and one of the most important organ of the human body, the heart.

Circulatory System

The circulatory system as the name indicates circulates various substances throughout the body. These include oxygen and carbon dioxide for respiration, absorption and assimilation of the digested food. Humans have a closed system in which the blood stays in the circulatory system as it circulates, and the chemicals are exchanged by diffusion.



Human circulatory system

Blood

The blood is a liquid that flows through the body. The blood has numerous functions

- All the nutrients that we obtain from the digested food are transported by the blood to the tissues.
- Even the oxygen is transported through the blood to the heart which then further transfers it to rest of the body.
- The waste material that needs to be removed out of the body is also transported through the blood.
- The hormones are also secreted through the blood to their target site.

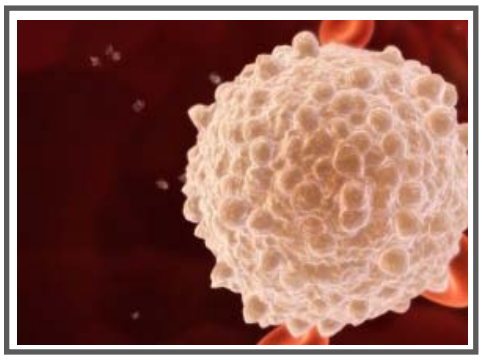
The blood is a fluid that contains blood cells and plasma. The plasma is the fluid part and the blood cells are embedded in it. There are three types of blood cells, the red blood cells, white blood cells and the platelets.

Red blood cells

The red blood cells appear red due to the presence of a red colour pigment called haemoglobin which is the oxygen carrier. The oxygen enters the body and as gas

Red blood cell

reaches the lungs, gets dissolved into plasma which is then is taken up by red blood cells. It then binds to the hemoglobin in the red blood cells which is then transported to all parts of the body.



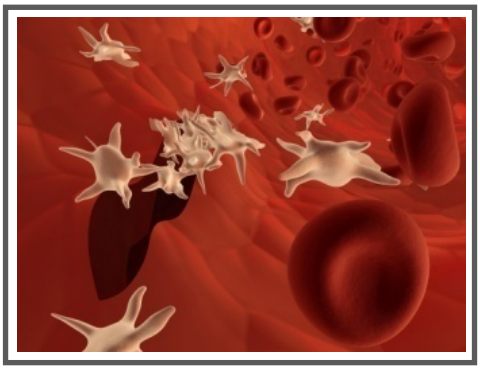
White blood cell

White blood cells

Their function is to protect the body against the germs. When we get injured or get cuts in our body, germs enter our body. The white blood cells are the soldiers of the body which fight against any invading microorganisms like bacteria and protozoa.

Platelets

The platelets help in the blood clot formation. The platelets adhere to damaged blood vessel walls and a series of reaction occurs inside the body which leads to a blood clot.



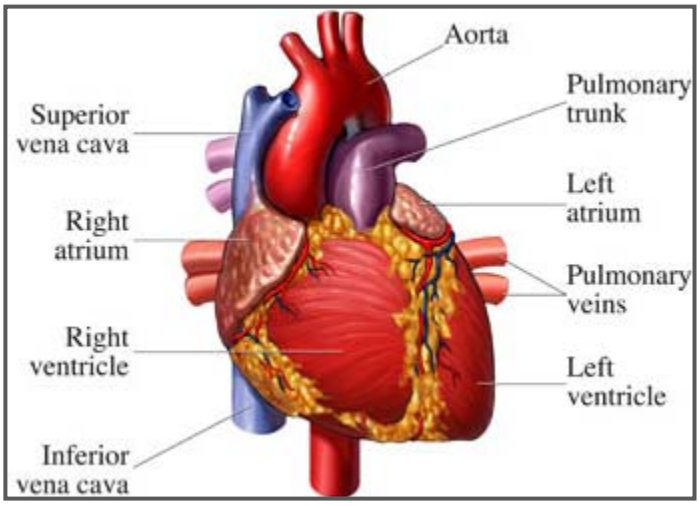
White blood cell

Blood vessels

The body has a network of blood vessels through which the blood is transported. The red coloured vessels contain blood rich in oxygen and are called the arteries. The artery walls are thick and elastic to allow rapid flow of blood at high pressure. The blue coloured vessels are the veins carrying the blood rich in carbon dioxide with other waste to the heart. These have thin walls and posses valves to prevent back flow of blood.

Heart

The human heart is a fist sized, muscular organ possessing four chambers. Every minute, the heart re-circulates the body's entire blood volume (about 5 liters). The two thin-walled artia act as receiving chambers and fill with blood as the heart relaxes to avoid mixing of blood. Contraction of the thicker-



Human Heart

walled ventricles pushes blood out of the heart.

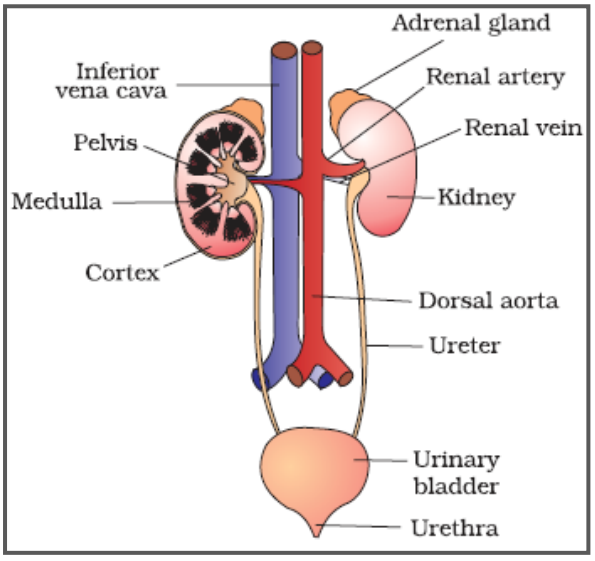
It acts as a pump which transfers blood to all parts of the body. The deoxygenated blood enters the right atrium from the pulmonary artery and then goes into the right ventricle from where it goes back to the lungs. The oxygenated blood enters from the lungs through the pulmonary vein to the left atrium and then to the left ventricle. This blood is then transported to all the cells of the body. There are valves present in heart to avoid back flow of blood from the ventricle to the atrium.

Heartbeat

The walls of the chambers of the heart are made up of muscles. These muscles contract and relax rhythmically. This rhythmic contraction followed by its relaxation constitutes a heartbeat. A **stethoscope** is an instrument used to amplify the sound of the heart. It consists of a chest piece that carries a sensitive diaphragm, two ear pieces and a tube joining the parts.
Pulse is "Rhythmic dilation of an artery, produced by the increased volume of blood thrown into the vessel by the contraction of the heart.

Excretion System in Human

All the food we eat is not used by the body, some of it after digestion is not required and thus needs to be removed out of the body as these may be toxic to the body. Like the impure blood or the carbon dioxide rich blood is exhaled out of the body. The waste materials are also removed. This process of getting rid of wastes produced in the cells of the living organisms is called excretion. The parts involved in excretion forms the excretory system.

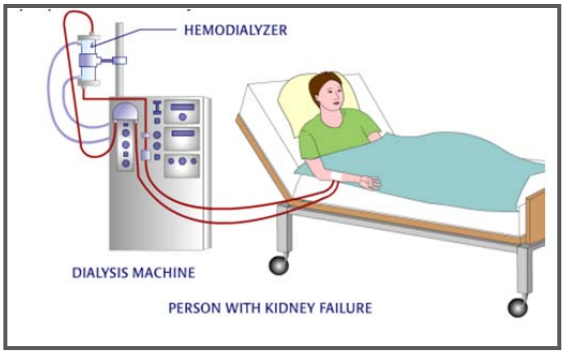


Human excretory system

Human excretory system

The **kidneys** are the filters that filter the blood to remove the harmful substances in it. The useful components are then reabsorbed. The wastes dissolved in water are removed as **urine**. From the kidneys, the urine goes into the **urinary bladder** through tube-like **ureters**. It is stored in the bladder and is passed out through the urinary opening at the end of a muscular tube called **urethra**.

Dialysis is an artificial method to purify the blood. When a person's kidneys stop functioning his or her blood is purified with the help of dialysis machine. It takes out blood from the body filters it externally and then pumps inside the body.



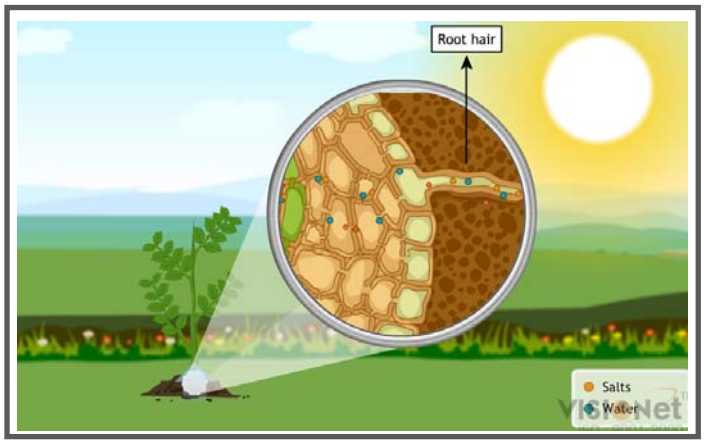
Dialysis

Waste products in animals

The urine comprises of 95% water, 2.5 % urea and 2.5% other waste products. Sweat is also a waste product that contains salts and water.
The excretory product is not similar in all animals. We excrete waste product in the form of urea and the birds in the form of uric acid while the fishes excrete ammonia gas that dissolves in water.

Transport of Substances in Plants

We know that water is required by the plants to synthesize their food but how do they get water and nutrients. The plants obtain water and nutrients from the soil through the roots. There are root hairs present which increase the surface area for the absorption of water and nutrients.
In plants the transport takes place through special tissues called the vascular tissue. Xylem and phloem are the vascular tissues of plants.



Root cell

Transport of water and minerals

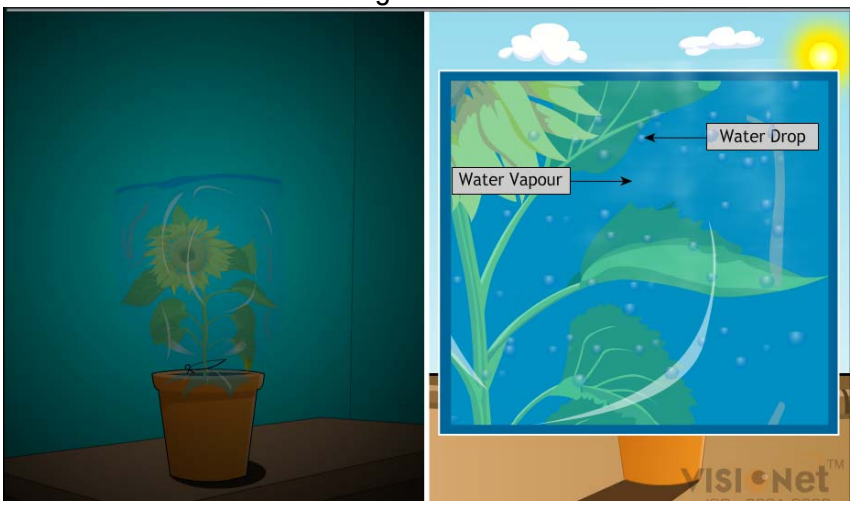
Xylem has pipe-like vessels that transport water and nutrients from the soil.
The xylem forms a continuous network of channels that connects roots to the leaves through the stem and branches and thus transports water to the entire plant. The glucose prepared by the leaves need to transported to all the parts of the plant. This is done by another kind of vascular tissue called the phloem.

Transpiration

The loss of water from the leaves to the atmosphere in the form of water vapour is called as transpiration.

Activity

Take two branches, or pieces of a branch with large leaves on them. The two branches need to be approximately the same size and preferably from the same plant. Immediately put one branch into one of the plastic bags and the other into the second bag. Seal the bags tightly using the elastic bands. Place the one branch in a bag in a cool and dark place. Place the other in sunlight. Leave for one hour. Can you guess what will happen to leaves? The branch in a bag that was left in the sun will have a fair amount of moisture inside the bag and the leaves are wilted and dry, whereas the branch in a bag that was left in the dark will have hardly any or possibly no moisture in the bag and the leaves are still fresh.Why this happen? Water was evaporated out of the plant via the leaves through transpiration. Plants release a lot of water into the air through this process.



Exercises

11.1 Fill in the blanks

1. The main excretory product in birds is ……..
2. Kidneys eliminate the waste materials in the liquid form called ……..
3. The rhythmic expansion and contraction of the heart is called ……..

11.2 Give three functions of blood
11.3 Enlist the components of blood with their functions
11.4 Draw a sketch of the human excretory system.
11.5 Explain the circulation of blood in the heart.

Chapter-12 Reproduction in Plants

All living organism reproduce its same kind and this is a typical feature of all, be it plants or animals. The production of new individuals from their parents is known as reproduction.

Modes of Reproduction

The reproduction can be classified into two types

- Asexual Reproduction
- Sexual Reproduction

Asexual reproduction involves the production of offspring without the seeds or spores.

Vegetative Propagation

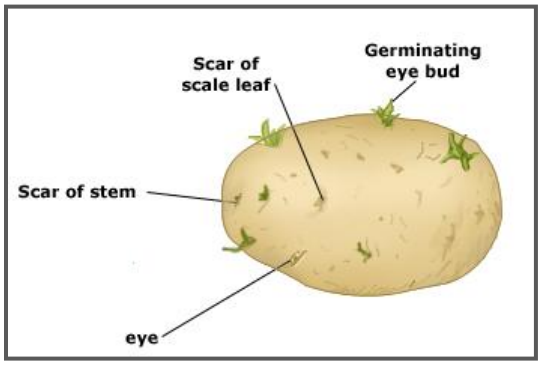
When the plants reproduce from the vegetative parts like stem, roots and leaves it is called **vegetative propagation**. The **stem, roots** and the **leaves** are the **vegetative parts** of the plant while the **flowers** are the **reproductive parts**.

Leaves – In some plants the new plant grows from the leaves and detaches itself from the parent plant like the cacti or the small plants called the plantlets grow on the edge of their leaves as in *Bryophyllum*.

Roots - The roots of some plants can also give rise to new plants. Sweet potato and dahlia are examples.

Buds – The scars or the 'eyes' of potato can also give rise to new plant. Other examples are ginger and turmeric.

Vegetative buds - Apart from flower buds, there are buds in the axil (point of attachment of the leaf at the node) of leaves which develop into shoots. These buds are called vegetative buds.

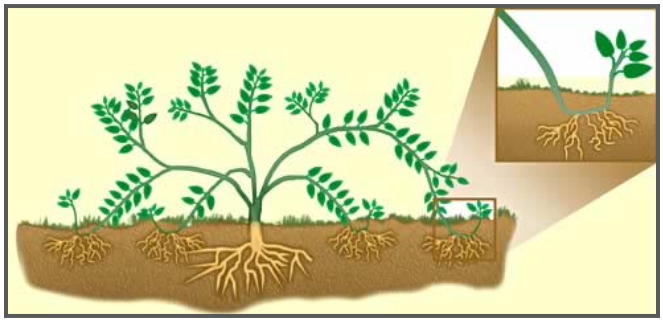


Buds

Horticulturists and farmers use artificial means to produce plants that are identical to the parent plant. Some the methods used are:

Cutting – Cutting is a part of the plant or branch with a node which is cut off of the parent plant. New leaves and roots grow from these cuttings.

Layering – The shoot of a parent plant is bent until it can be covered by the soil. The tip of the shoot remains above the ground. New plant with new roots starts growing which later can be separated.



Layering

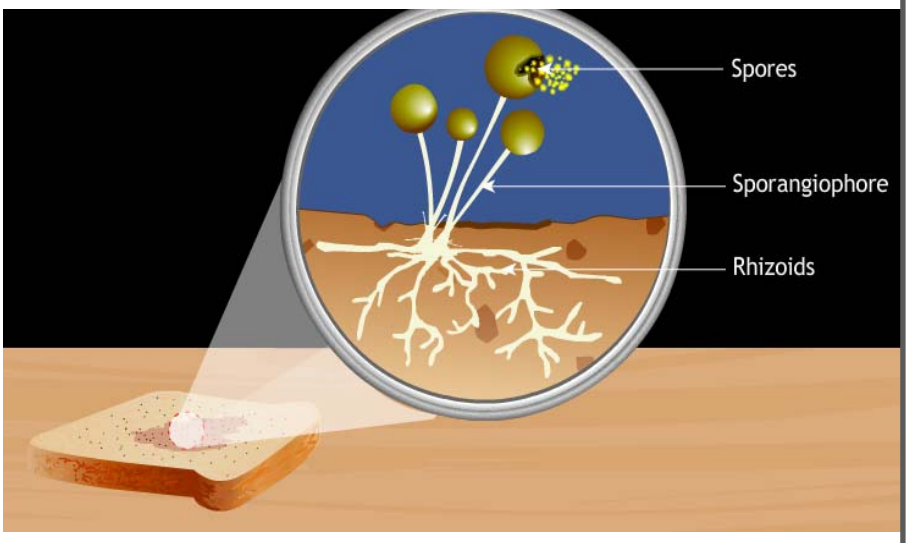
Grafting – In grafting the two plants are used to develop a new plant with combined traits from the two parent parts. The **scion** which is the above ground part is attached to the **stock** that is the rooted part of the second plant.

Budding

It is a mode of reproduction found in yeast, a single cell organism. A small bud or chain of buds bulges out of the yeast cell that grows and eventually separates from the parent yeast cell.

Activity

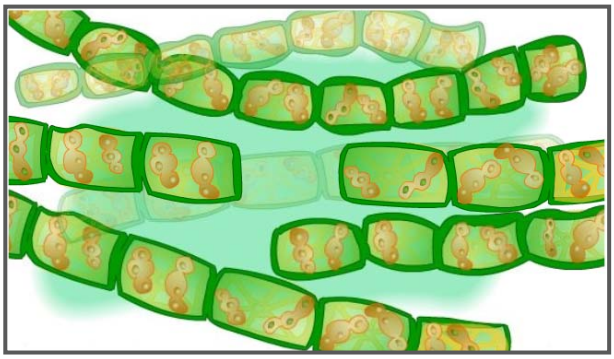
Take a slice of bread in a petridish and keep it in open air for five days. You will observe that the bread gets rotted. Now take a small portion of the rotted bread with the help of a forceps and place it on a slide. Cover the slide with a cover slip and observe it under a microscope.



You can see fungus *Rhizopus* growing on the bread. This fungus is also called as the bread mould.

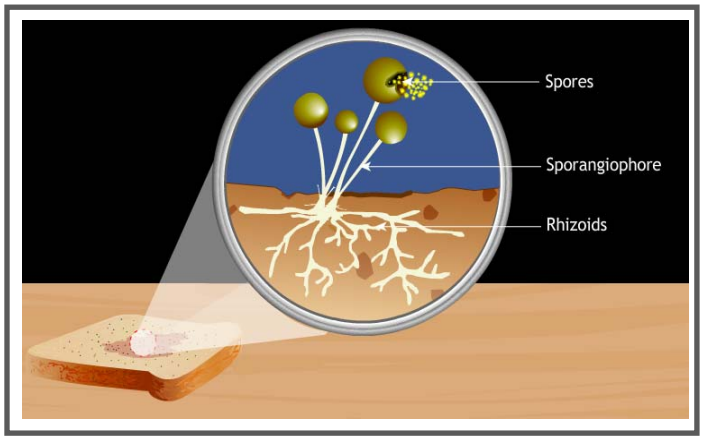
Fragmentation

Spirogyra which is an alga breaks up into two or more fragments. These fragments or pieces grow into new individuals. This process continues and they cover a large area in a short period of time.



Fragmentation

Spore Formation

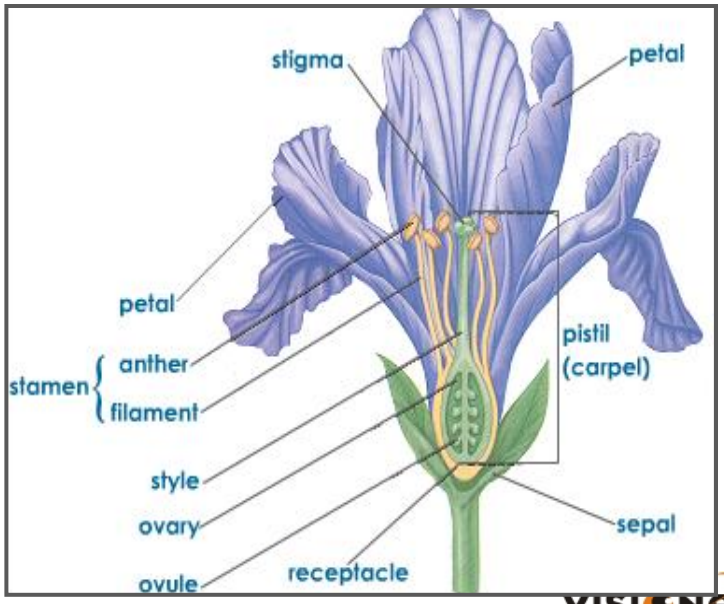


Spore Formation

The spores are asexual reproductive bodies. Each spore is covered by a hard protective coat to withstand unfavourable conditions such as high temperature and low humidity. When favourable conditions arrive, a spore germinates and develops into a new individual. Plants such as moss and ferns also reproduce by means of spores.

Sexual Reproduction

The flowers are the reproductive parts of a plant. It contains the **stamens** which is the male part and the **pistil** which is the female part. Some plants contain either the stamen or the pistil that is they behave like either male or female flowers. Such flowers are called as unisexual flowers for example papaya whereas plants like rose and



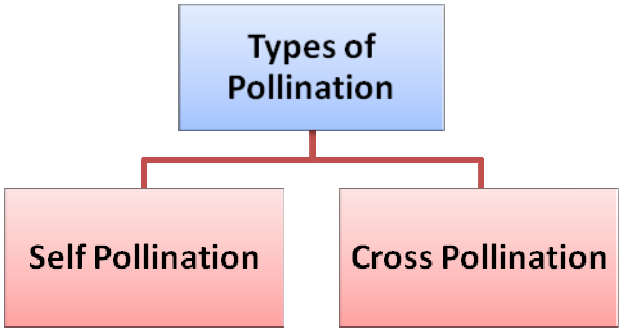
Parts of a Flower

mustard have both stamen and pistil hence they are called as bisexual flowers. Both the male and female unisexual flowers may be present in the same plant or in different plants.

The stamen is the male reproductive part. It has a stalk called **filament** and anther on the top. These **anther** contain the pollen grains that produce male gametes.

The pistil is the female reproductive part that has **stigma** and **style** along with a swollen bottom portion called **ovary** which contains the **ovules**. The formation of female gametes or the egg occurs inside the ovules.

Pollination The transfer of pollen from the anther to the stigma of a flower is called pollination.



If the pollen lands on the stigma of the same flower it is called **self-pollination**. When the pollen of a flower lands on the stigma of another flower of the same plant, or that of a different plant of the same kind, it is called **cross-pollination**.

Self Pollination

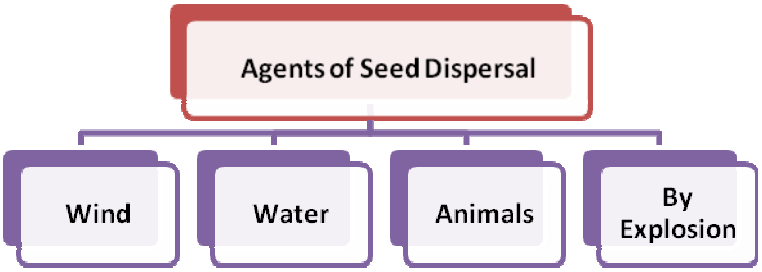
Fertilization

When the pollen grains reach the stigma of the pistil, it develops a pollen tube. The pollen grains enter the pistil through this tube reaches the egg cell in the ovule and fuses with it. This fusion of male and female gamete leads to the formation of zygote and this process is called as fertilization.

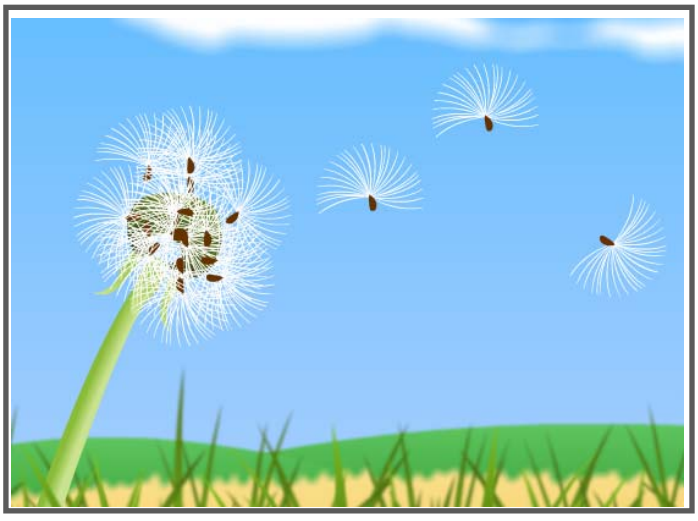
Fruits and Seed Formation

This zygote eventually develops into an embryo. The seeds are the ovules, and the ripened ovary develops into the fruit. The seeds contain embryo enclosed within a seed coat.

Seed dispersal



- The seeds of maple and dandelion are winged. These get dispersed by winds. Other examples are drumstick and sunflower.
- Some get dispersed through water like the coconut. These have spongy and fibrous coating to float in water.
- While some like *Xanthium* and *Urena* get transmitted through the animals. These seed are spiny and get hooked to animal body which then eventually gets brushed away to distant places.
- Some get dispersed by explosion. They burst out and scattered away from the parent plant like castor and balsam.



Seed Dispersal by Wind

If they all germinate close to each other there would be severe competition for sunlight, water, minerals and space. As a result the seeds would not grow into healthy plants.

The advantages of seed dispersal

- It prevents competition between the plant and its own seedlings for sunlight, water and minerals.
- It also enables the plants to invade new habitats for wider distribution.
- Prevents overcrowding

Exercises

12.1 Draw a diagram showing the reproductive parts of a flower.
12.2 Describe the process of fertilisation in flowers
12.3 How does seed dispersal takes place with the help of animals? Explain with an example
12.4 Elaborate the asexual reproduction in yeast.
12.5 Enumerate the differences between self-pollination and cross-pollination

12.6 State whether the statement is true or false

4. Bryophyllum can reproduce by its roots.
5. Ferns reproduce asexually by producing spores
6. The process of fusion of the male and the female gametes is called pollination

Chapter-13 Motion and Time

Motion

Motion is often described as 'relative.' This implies that in a given situation the same activity may appear as stationary to one observer while another observer might see it differently. For example: let's take the case of an aeroplane speeding along the runway about to take off!! For two co-passengers sitting next to each other each one appears stationary with respect to the him/ herself and to the plane. This is because both are moving together within the same plane at the same speed. However, both find themselves moving with respect to the airstrip/ground outside the plane with considerable speed. Likewise, an outside observer finds the people within the plane moving very fast.

Distance: The distance covered by a moving object is the actual length of the path followed by the object. Distance is a scalar quantity. SI unit of distance is meter.

Displacement: It is the shortest distance covered by a moving object from the point of reference (initial position of the body), in a specified direction.

Speed

The distance covered by an object in a unit time is defined as speed.

$$\text{Speed} = \frac{\textit{Total distance covered}}{\textit{Total Time taken}}$$

Objects are said to be in fast or slow motion depending upon the speed of their motion. Speed varies from object to object.

The basic unit for time is second, and it can be calculated in minutes and hours, too, depending on the need. The basic unit for distance is metre. So, the unit for speed is metres per second (m/s).

Large speeds are measured in kilometre per hour (km/h). The symbols for units are written in singular form only.

For example, the speed of the cheetah is 112 km/h, and Speed of giant tortoise = 0.27 km/h.

Types of Speed

Slow speed: An object said to be moving slowly if it covers less distance in a given time.

Moving Fast speed: An object is said to be moving fast if it covers more distance in a given time.

Uniform Speed: An object is said to be moving with uniform speed if it covers equal distances in equal intervals of time.

Non-uniform Speed: An object is said to be moving with variable speed or non-uniform speed if it covers equal distances in unequal intervals of time or vice-versa.

Average speed: When we travel in a vehicle the speed of the vehicle changes from time to time depending upon the conditions existing on the road. In such a situation, the speed is calculated by taking the ratio of the total distance travelled by the vehicle to the total time taken for the journey. This is called the average speed.

The average speed of a moving object is defined as the total distance covered by it divided by the total time taken.

Instantaneous speed: The speed of a moving body at any particular instant of time is called instantaneous speed.

For example:

When we say that the car travels at an average speed of 60 km/h it does not mean that the car would be moving with the speed of 60 km/h throughout the journey. The actual speed of the car may be less than or greater than the average speed at a particular instant of time.

Uniform Motion

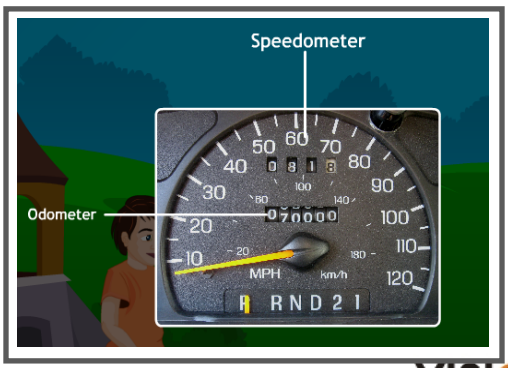
Objects that move in a straight line and maintain the same speed throughout the distance covered are said to be in uniform motion.

Non-Uniform Motion

Objects that move in straight line and whose speed varies are said to be in non-uniform motion.

Measurement of Speed

Speedometer: An instrument used in vehicles to show speed. Not all moving vehicles have a speedometer. The speedometer has a needle that indicates the speed.



For example, a bicycle does not have a speedometer, whereas a car has one.

Odometer: An odometer is a device in vehicles to track the distance covered.

Graph

Graph is a pictorial representation of two sets of numerical data.

Distance-time graphs

Motion of an object can be represented by its distance-time graphs. It gives information about the nature of the motion of an object like uniform or uniform motion.

Uses of Graph

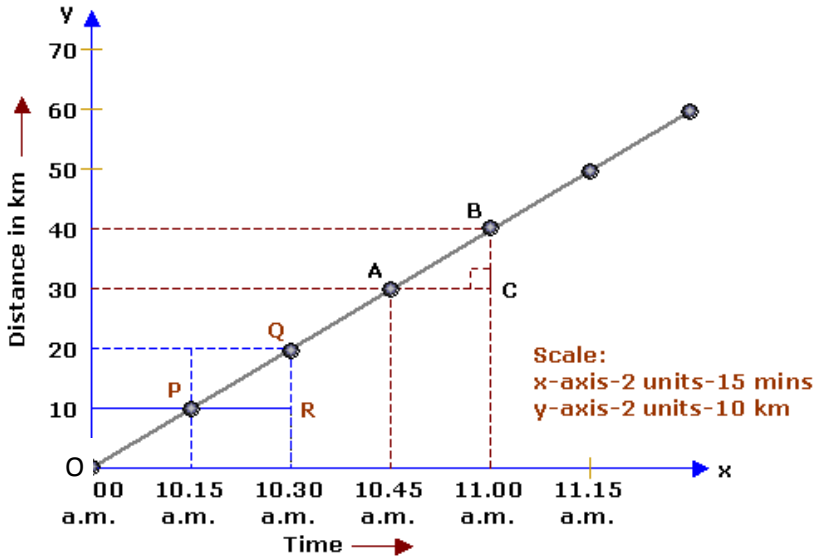
Graphs are used for better understanding. For example, using these graphs, the performance of two batsmen can be compared, performance of two bowlers can also be observed in a cricket match. Also, in population studies, these graphs are used to compare the birth and the death rate, and other kinds of data.

Plotting of Graph

Draw a graph as given data

Distance (In Km)	0	10	20	30	40
Time (in hr)	10.00 am	10.15 am	10.30 am	10.45 am	11.00am

- Take a graph paper. At the centre of the paper, draw two lines perpendicular to each other. Mark the point of intersection of the lines as ‘O’.
- The horizontal line is called the X-axis, while the vertical line is called the Y-axis. The point of intersection of the two axes is called the origin, ‘O’.
- Take one quantity along the X-axis and the other along the Y-axis, after choosing suitable scales for both. Place the all values on X-axis and Y- axis with a points
- Join the all points, and your graph is ready.

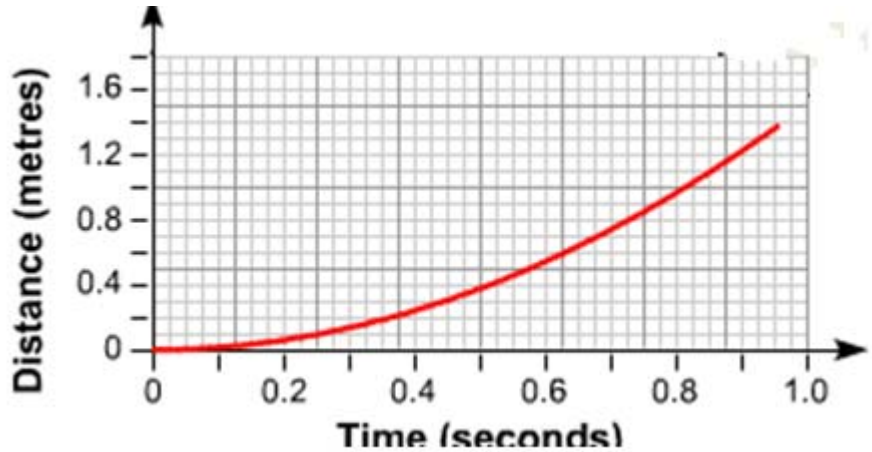


Body in uniform motion:

The graph for a body in uniform motion will be straight line making angle horizontally.

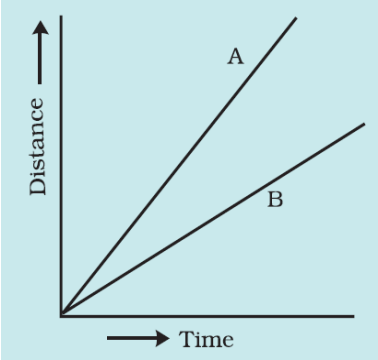
Body in non-uniform motion:

For a body in non-uniform motion, the graph is not a straight line.



Exercises

13.1 The following graph shows the distance-time graph for the motion of two cars A and B. Which one of them is moving slower?



13.2 A bus moves with a speed of 45 km/h for 20 minutes and then with a speed of 60 km/h for the next 20 minutes. What is the total distance covered by the bus?

13.3 Vivek takes 15 minutes from his house to reach his school by walking If he walks with a speed of 0.5 m/s, calculate the distance between his house and the school.

13.4 A simple pendulum takes 25 s to complete 15 oscillations. What is the time period of the pendulum?
13.5 Differentiate between uniform and non uniform speed.
13.6 Fill in the blanks

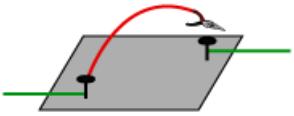
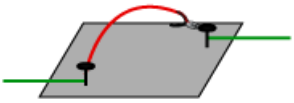
1. When the distance covered by an object is directly proportional to time, it is said to travel with _____.
2. Motion along a straight line is called _____ motion.
3. The physical quantity describing motion and whose measure is the product of distance travelled and the time taken to travel that distance is _____.

Chapter-14 Electric Current and its Effects

Electric Components and Their Symbols

An electric current is the movement of electric charges along a definite path. Current flows in a conductor when negatively charge (electrons) is transferred from one point to another in the conductor.

Some electric components can be represented as symbols in order to make it convenient to draw a circuit diagram. Electric components and their symbol are as follow:

S. No.	Electric component	Symbolic representation
1.		
2.		
3.		
4.		
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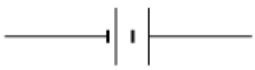
6.		

Heating Effect of Electric current

The electrical energy is converted into various forms of energy such as heat energy, light energy, chemical energy or mechanical energy. When an electric current is passed through a metallic wire like filament of an electric heater, oven or geyser, the filament gets heated up and here electrical energy is converted into heat energy. This is known as 'heating effect of current'.

Many electrical devices work on the phenomena of heating effect of electric current.

Electric bulb- The filament of the bulb heated on flowing current through it and hence produces light.

Electric Heater- The nichrome coil of the heater heats up rapidly as current flows through the heater and this heat is radiated to the surroundings to keep the room warm.

Electric Heater

Electric iron- The electric iron consists of thin metal plates which get heated on passing current through the iron. Thus it can be used to iron the clothes.

Electric fuse is a safety device in an electric circuit which prevents short circuits.

Working of Electric fuse:

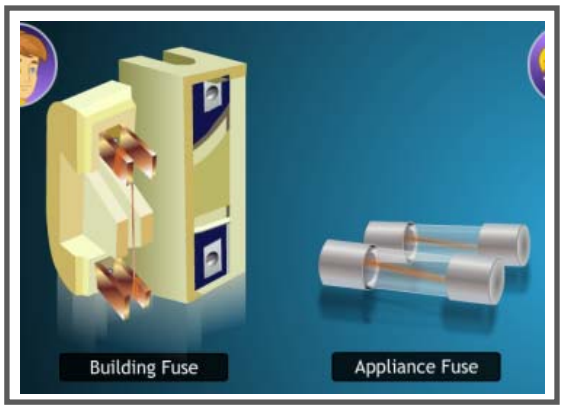
Electric Fuse

It consists of a very special material filament which melts on high heating.

When electric current flowing through the fuse exceeds the maximum limit, the filament of electric fuse melts due to excessive heating and breaks off. The circuit becomes incomplete and flowing of current in the house stops, thus preventing the burning of electric appliances.

Based on the usage, fuses are of two types

1. Fuse used in building
2. Fuse used in an appliance



Miniature Circuit Breakers (MCB)

Instead of fuses, MCBs are used nowadays because these are switches that turn off automatically when there is an overload or a short circuit. After solving the problem in the circuit, the switch can be turned back on, and then the current flows as usual.

CFLs

Compact fluorescent lamps (CFLs) are simply smaller versions of full-sized fluorescent lighting.

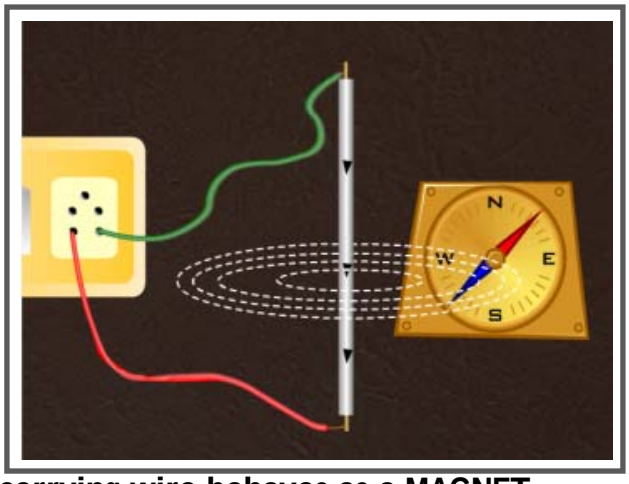
Compact fluorescent lamps

Advantages of CFLs

- Use less energy – up to 75% less than standard incandescent light bulbs.
- Produce less heat – by using energy more efficiently less heat is emitted with CFLs
- Protect the environment – using less energy decreases the amount of greenhouse gasses emitted into the atmosphere which is a contributor of global warming.

The Magnetic Effect of Electric Current

The magnetic effect of electric current was first observed by a scientist called Hans Christian Oersted. He observed that when current passes through a wire, it behaves like a magnet. This is explained as the magnetic effect of electric current.



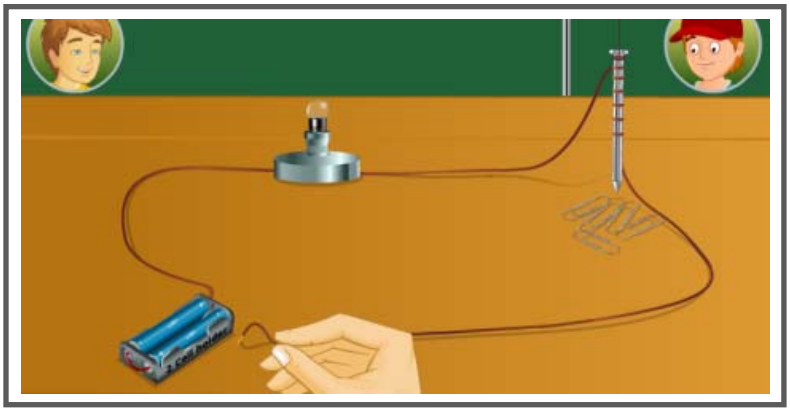
Make an electric circuit which consists of a battery, a switch and keep the switch in off position. Take a magnetic compass near to the wire tied in between nails. Now turn on the switch and look at the needle of the compass. As we switch ON the circuit, magnetic compass needle changes its direction. It is because when we switch ON the circuit, current flows through the circuit a magnetic field is created around the wire which causes change in direction of needle of magnetic compass**. It means the current carrying wire behaves as a MAGNET.**

Electromagnet

When an electric current is passed through a wire wound around an iron bar, the bar behaves as a magnet, and this magnet is called **electromagnet**.

Construction of an electromagnet

- To make an electromagnet we need some insulated copper wires, a bulb, a nail, battery, and some paper clips of iron.
- Remove the plastic coating from the copper wire at both the ends and wound one copper wire on the nail in one direction.
- Make sure that the copper wounding does not overlap.
- Now connect one end of copper with the one terminal of the battery. And the other end of the copper wire with the terminal of bulb.
- Connect other terminal of the bulb to the battery. Our electromagnet has been made.
- Now let's place the paper clips near the iron nail. You will find that the iron made paper clips gets clanged on the iron nail. If we disconnect the battery the nail is no more an electromagnet.
- That means an electro magnet is not a permanent magnet. This is the principle used in electromagnet.



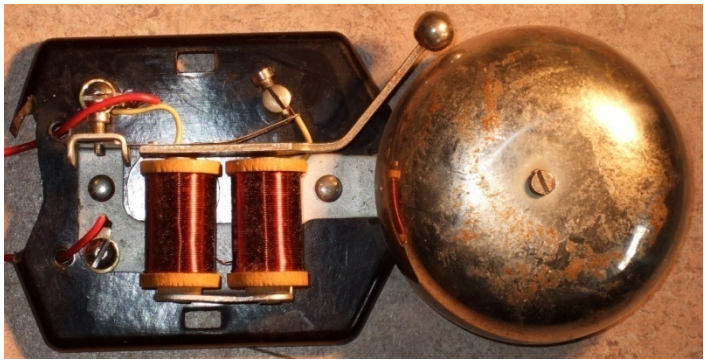
Applications of Electromagnet

1. Very strong electromagnets are used to carry heavy loads.
2. They are also used to collect iron from scrap.
3. They are also used in toys.

Electric Bell

Electric bell is a device which works on principle of electromagnet.

When the switch is 'ON' electric current flows through the coil and the iron core behaves as an electromagnet. Now this iron core or electromagnet attracts the hammer towards it. The hammer hits the bell and produces a sound. When the hammer moves towards the iron core, the circuit breaks at the screw contact. At this point, the iron core stops behaving like an electromagnet. The spring action of the steel rod pulls the hammer back to its original position and then the contact screw again to complete the circuit. Current flows through the coil again, and hammer strikes the bell again. The process continues over and over again, until switch is released.



Electric bell

Exercises

14.1 Can you replace a fuse by a piece of wire? Give reasons to support your answer.
14.2 Write true or false

1. When the electric current through the fuse exceeds a certain limit, the fuse wire melts and breaks.
2. An electromagnet does not attract a piece of iron.
3. An electric bell has an electromagnet.

14.3 Can an electromagnet be used for separating plastic bags from a garbage heap? Elaborate

14.4 Give examples of heating effect of electric current.

14.5 Why does a compass deflect it is placed near a current carrying wire?

Chapter-15 Light

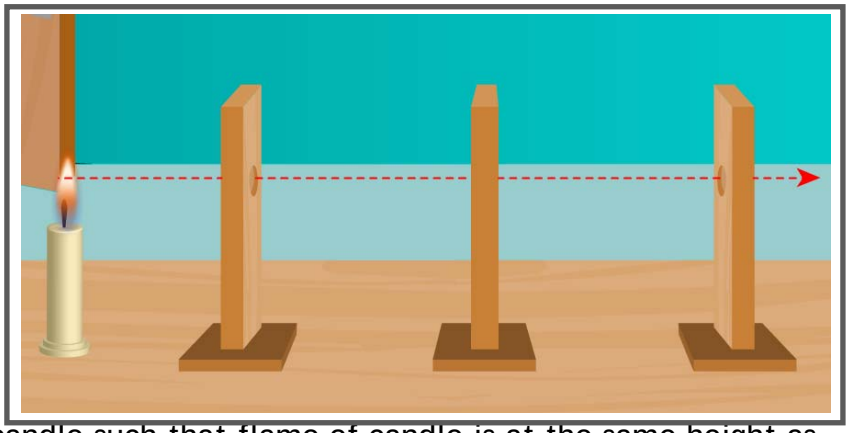
Light and Its Properties

An object capable of emitting light is a source of light. There are natural and artificial sources of light. The sun, the stars and the fireflies are the natural sources while electric bulb, candle and oil lamps are artificial sources of light.
The sun and the stars that can emit light of its own are called luminous objects while the objects like wood and plastic that do not emit light are known as non-luminous objects.

Rectilinear propagation of light

The light travels in a straight line and this property is called as rectilinear propagation of light.

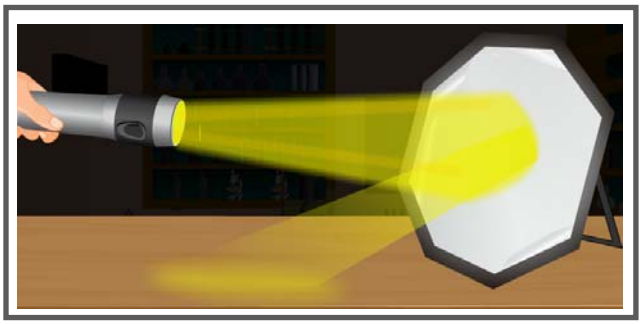
Activity



Place three cardboards upon one another. On the uppermost cardboard draw diagonals. Make a hole with the help of a sharp pin at the point of intersection of diagonals through all the cardboards. Arrange the cardboard A, B and C in straight line along the edge of table. Towards the cardboard A, place a lighted candle such that flame of candle is at the same height as the hole in cardboard. Now, look from the side of cardboard C. You notice the candle flame is visible. Now displace the cardboard B sideways. Again look from the side of cardboard C. you notice that candle flame is not visible. Why is candle flame not visible? It is because the light travels in straight lines. Thus, the light passing through the hole of cardboard A cannot bend and then pass through the holes of B and C.

Reflection of Light

When a ray of light hits a surface, it bounces off or reflects and then reaches our eyes. This phenomenon by which a ray of light changes the direction of propagation when it strikes a boundary through which it



Reflection through a mirror

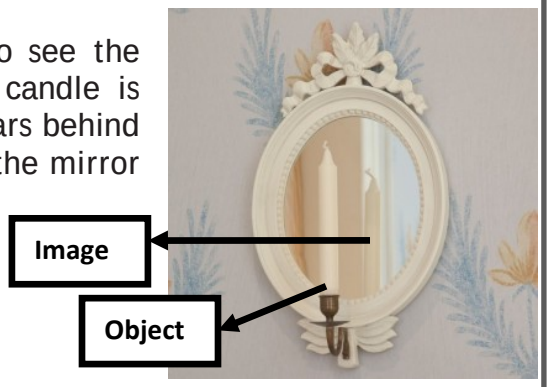
cannot pass is known as reflection of light.
Reflection of any object is just the image of the object in any shining surface such as water, stainless steel spoon and mirror.

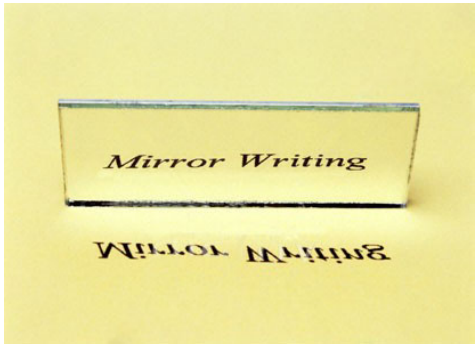
Plane mirror

The image formed by the plane mirror is of same size and shape as that of object and is also erect. Also the image is formed at the same distance away from the mirror, as the object itself. A plane mirror makes images of objects in front of it, these images are formed behind the plane in which the mirror lies. This image formed is always virtual i.e. it cannot be caught on the screen.

Activity

Place a candle in front of a plane mirror. Try to see the candle in the mirror. It appears as if a similar candle is placed behind the mirror. The candle, which appears behind the mirror, is the **image** of the candle formed by the mirror while the candle itself is the **object**.





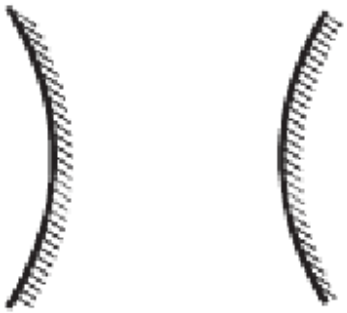
Lateral inversion

Another property of plane mirror is lateral inversion which is the reversal experienced by the image formed in a plane mirror. Lateral Inversion has many applications in our day-to-day life. In the front part of an ambulance, the word '**AMBULANCE**' is written inverted. So when the driver of a vehicle ahead of an ambulance looks in her/his rear view mirror, she/he can read 'AMBULANCE' written on it and gives way to it.

Spherical Mirror

A spherical mirror is a polished, reflecting surface part of a hollow sphere. All the shiny and curved surfaces, which act as a mirror, serve as a spherical mirror.

For example stainless steel spoons, bowl, vehicle headlights. In general any mirror having a bulging out surface is called Convex Mirror and any mirror having a bulging in surface is called Concave Mirror.



A concave and a convex mirror

Images formed by Concave Mirrors

Image formed by concave mirror

1. Concave mirror forms Real, Inverted and diminished image when object is placed far off the mirror.

2. Concave mirror forms a Real, Inverted and highly Magnified image when the object is placed nearer to it.

3. Concave mirror forms Virtual, Erect and highly Magnified image when the object is placed very close to Concave mirror.

Applications of Concave mirror:-

1) Concave mirrors are used as reflectors in the headlights of automobiles.
2) Concave mirrors are also used by doctors to examine ear, nose, throat and eyes.
3) Dentists also use concave mirrors to see enlarged images of teeth.

The image formed by convex mirror is Virtual, erect and always small or diminished.

Images formed by Convex Mirrors

The image formed by **convex mirror** is Virtual, erect and always small or diminished.

Applications of Convex mirror:-

1) Convex mirrors can be used to view a much larger area than would be possible with a plane mirror.
2) They are used in rear view and side view in cars and scooters.

Images Formed By Lens

A lens is a piece of transparent material (plastic or glass) which has one or two spherical surfaces.

Lenses are of following types

Convex lens

A converging lens or convex lenses are thicker at the centre than at the edges. These form real and virtual images.

Image formed by convex lens

Images formed by convex lens

1. Convex lens forms Real, Inverted and diminished image when object is placed far off the mirror.

2. Convex lens forms a Real, Inverted and highly Magnified image when the object is placed nearer to it.

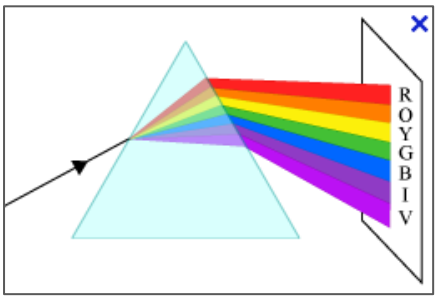
3. Convex lens forms Virtual, Erect and highly Magnified image when the object is placed very close to **it.**

Concave lens

A diverging lens or concave lenses are thinner at the centre than at the edges. These form virtual, erect and diminished images.

Sunlight — White or Coloured?

A rainbow is formed when white light from the sun passes through tiny prism-like water droplets and splits into different colors. This phenomenon of splitting of white light into several different colors is called dispersion of light.



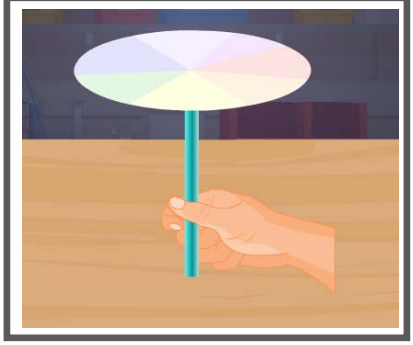
Prism

The speed of light is slower in various materials than it is in vacuum.

When the light passes into a material at an angle, the light beam is bent or refracted. Each wavelength is reflected at a slightly different angle when passing through a material.

Activity

Take a white cardboard and cut a circle. Now divide this circle into 7 equal parts. Color these seven parts such that each part is representing one color of VIBGYOR in sequence. Make a hole in the center of the disc and fix a rod at the center point. Now hold the rod from one end and rotate the circular cardboard very fast. What do you observe? You will observe that all the seven colors seem to disappear and the disc appears white. It means if we mix all the seven colors of VIBGYOR, it appears white. It is called Recombination. It was first observed by Newton and that is why this seven color disc is called "Newton's disc".



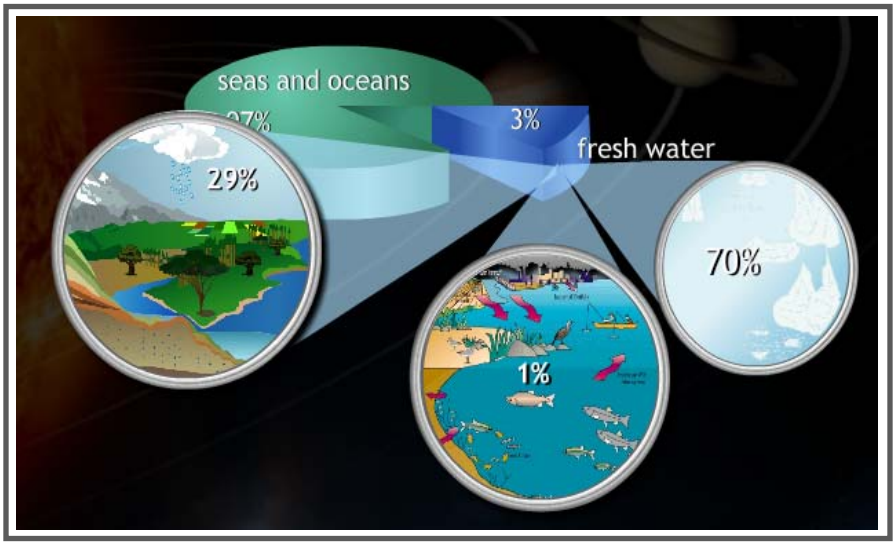
Exercises

15.1.State the characteristics of the image formed by a concave mirror.
15.2 What is meant by lateral inversion?
15.3.Which type of lens can form real image?
15.4.Give two applications of convex mirror
15.5.Rashmi is observing his image in a plane mirror. The distance between the mirror and his image is 5 m. She moves 2 m towards the mirror. What is the distance between Rashmi and her image?
15.6 The rear view mirror of a truck is a plane mirror. A driver is reversing at a speed of 15 m/s. The driver sees in his rear view mirror the image of a bus parked behind his truck. What is the speed at which the image of the bus appears to approach the driver?

Chapter-16 Water: A Precious Resource

Availability of Water on earth

Water is present in abundance on earth but the water which is usable is actually very little. Most of the water (about 97%) is in the seas and oceans as salt water.
But only a tiny fraction (about 3%) of the earth's abundant water is available to us as fresh water.



Distribution of water

70% of this fresh water is locked up in the ice caps or glaciers, 29% of it is buried so deep that costs too much to extract, remaining only 1% of fresh water is easily available to us as groundwater, rivers, lakes, stream, soil moisture, and water.

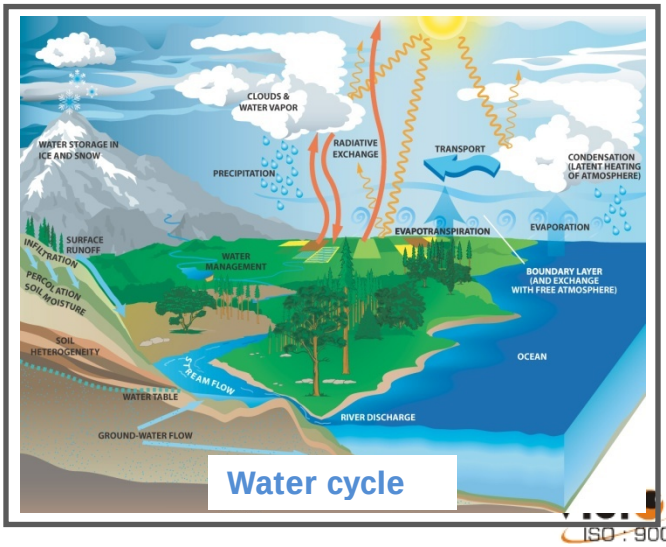
Forms of Water

Water can be found in all the three forms, i.e., solid, liquid and gas on earth.

The **solid** form, snow and ice, is present as ice caps at the poles of the earth, snow-covered mountains and glaciers.
Liquid water is present in oceans, lakes, rivers, and even underground.
The **gaseous** form is the water present in the air around us.

Water cycle

The water circulates through the water cycle and is found in all the three forms. The circulation of water between ocean and land is known as the water cycle. This cycle is made up of a few main parts:

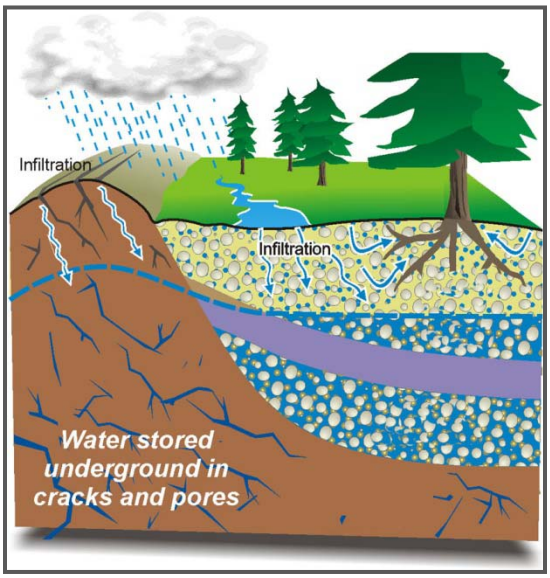


Water cycle

- **Evaporation (and transpiration)**
- **Cloud formation**
- **Condensation**
- **Precipitation**
- **Water collection**

The Sun's heat provides energy to **evaporate** water from the Earth's surface (oceans, lakes, etc.). Plants also lose water to the air by **transpiration**. The water eventually **condenses**, forming tiny droplets in clouds. When the clouds meet cool air over land, **precipitation** (rain, sleet, or snow) is triggered, and water returns to the land (or sea). Some of the precipitation soaks into the ground. Some of the underground water is trapped between rock or clay layers; this is called **groundwater**. But most of the water flows downhill as runoff (above ground or underground), eventually returning to the seas as slightly salty water.

Groundwater - Important Source of Water



Groundwater: It is the water stored beneath the ground surface in the soil pore spaces and in the fractures of the lithosphere.

When 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**. Water table level of the areas affected by scarcity of water is low due to which they face problem. This level is not same at all places.
The ground water gets recharged with rain water, lakes and ponds.
The water percolates through the soil and fills the crevices and cracks deep below the ground. The process of seeping of water into the ground is called **infiltration**.
The groundwater is stored between layers of hard rock below the water table. This is known as an **aquifer**.

Reasons for depletion of the Water Table

- Increase in population

- Industrial and Agricultural activities
- Scanty Rainfall
- Deforestation
- Decrease in the effective area for seepage of water

Increasing population

With increasing population the demand for water also increases. Houses, schools, hospitals, sports complex, markets and many other essential amenities are constructed by clearing forests and agricultural land.

Increasing industries

All the products which we use day to day are manufactured in the industries. They also require water and this water is drawn from ground. Earlier farmers used to depend on rainfall for irrigating their crops but nowadays even the rainfall is uneven due to which the farmers use the ground water. Multipurpose projects are also been constructed to meet the water demands.

Water used for irrigation

Therefore, some regions in our country may have floods while others may suffer from droughts at the same time.

Scantly rainfall

Less of rainfall will leave lesser amount of water for seepage by the ground and ultimately decrease the level of the water table.

Deforestation

Due to deforestation, the balance of the nature is disturbed. This ultimately affects the water cycle. Urbanization has caused reduction in the rainfall. Forests influence the rainfall through a recycling of moisture back into the atmosphere through transpiration. Deforestation breaks this natural water cycle.

Decrease in the effective area for seepage of water

In cities the roads are concreted while in village it is just the opposite. There is no effective area left in cities for the rainwater to get absorbed. Result is water logging and flooding of drains. The concrete is unable to seep rainwater unlike the roads of village.

Distribution of Water

The distribution of water over the globe is quite uneven due to a number of factors. Some places have good amount of rain and are water-rich. On the other hand, there are deserts which have scanty rainfall.

India is a country where there are places like Rajasthan having scanty rainfall and even places like *Cherrapunji* blessed with good rainfall. The distribution of rainfall is uneven with some region having floods and some drought ridden.
Excessive rains cause floods, whereas the absence of rains results in droughts.

Water Management

The objectives of the water management efforts should include:-

Sustainability:- To ensure availability for future generations, the withdrawal of fresh water from an environment should not exceed its natural replacement rate.

Energy conservation:- Water pumping, delivery, and wastewater treatment facilities consume a significant amount of energy. In some regions of the world (for example, California) over 15% of total electricity consumption is devoted to water management.

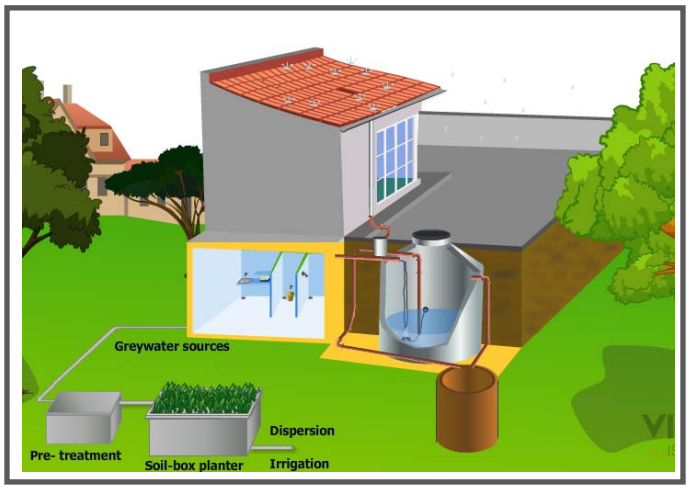
Habitat conservation:- Minimizing human water use helps to preserve fresh water habitats for local wildlife and migrating waterfowl, as well as reducing the need to build new dams and other water diversion infrastructure.

Methods of water conservation

The water can be conserved by minimizing the unwanted usage. The rainwater can be used to recharge the groundwater. This is referred to as water harvesting or rainwater harvesting.

This can be done by two ways

1. Rooftop rainwater harvesting
2. Direct collection of rainwater into drains which gets absorbed into the ground.



Rain water harvesting

In rooftop rain water harvesting the water from the rooftops is collected into tanks which after filtration becomes fit for use or goes into pits from which it seeps into the ground.

The water collected is then treated to remove the impurities and then made available for use.

Another method is to allow the rainwater to directly make it absorbed in the ground.

Many places in India store water in a traditional way like the *bawris*. It is an age old practice of recharging water.

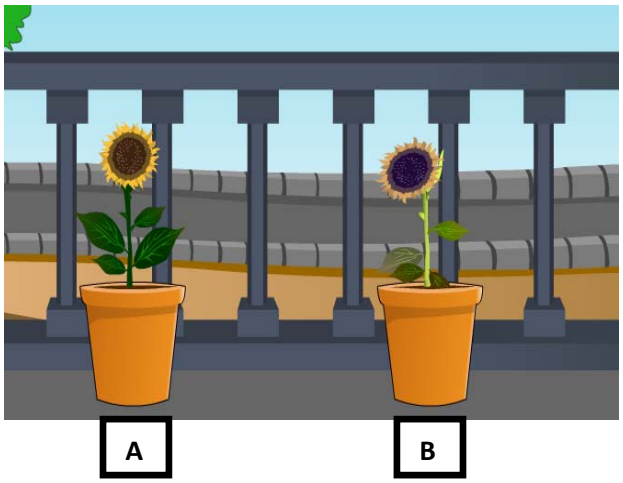
Farmers have also become wise. They follow **drip irrigation** to water the fields. Drip irrigation is a technique of watering plants by making use of narrow tubings which deliver water directly at the base of the plant.

Effect of Water Scarcity on Plants

Like us plants also require water for their survival. They derive water along with nutrients from the soil. If they do not get enough water they won't be able to synthesize food and gradually the oxygen level would decrease. This would ultimately affect all the living organisms.
If you don't water plants twice on a hot summer day, they wilt and ultimately dry up.

Activity

Take two sunflower plants and expose both the plants to sufficient light. Provide water to plant 'A' regularly, and no water to plant 'B'. Make observation after 5-6 days. Observation: Plant 'A' which was given water regularly remains healthy, while the plant 'B' does not show normal growth. Its leaves become yellowish and droop (wilt).



Exercise

16.1 How does the groundwater gets recharged?

16.2 Enumerate the factors responsible for depletion of water table.

16.3 How is the balance of the water maintained in nature?

16.4 What are the measures taken to conserve water?

16.5 Distribution of water is not even. Explain

16.6 Fill in the blanks

1. …….. is a technique of watering plants by making use of narrow tubings which deliver water directly at the base of the plant.

2. The process of seeping of water into the ground is called …….

Chapter-17 Forests: Our Lifeline

Introduction to Forest

The forests are the habitat for a multitude of living organisms. Animals like monkey, boar, bison, jackals, porcupine, and elephants live in the deeper areas of the forest.
The animals living in these forests vary according to the climatic conditions of the forest. These forests are a thick cover of trees. These also have various types of shrubs, trees, creepers and climbers.
The forest floor provides favourable conditions for them to germinate and develop into seedlings and saplings.

Stratification of the forest

The branches of the tall trees look like a roof over the other plants in the forest. This is called a canopy. The branchy part of a tree above the stem is known as the crown of the tree.
The different horizontal layers in the forest are known as understoreys. Sal, teak, Semal, Sheesham, Neem, Palash, fig, khair, amla, bamboo and Kachnar are some of the examples of plants in a tropical forest.

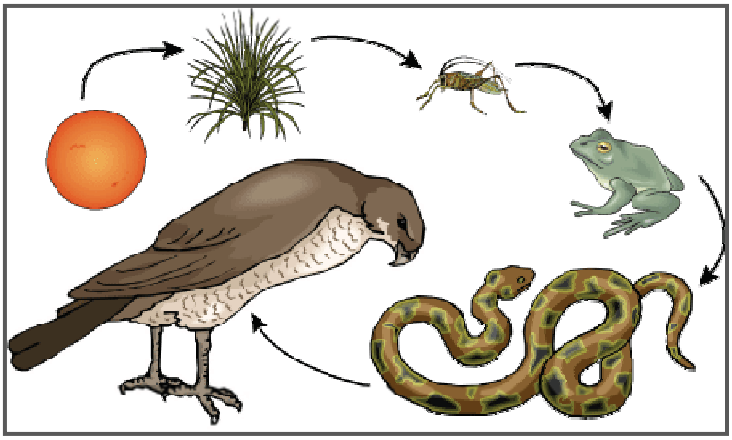
Giant and tall trees constituted the top layer followed by shrubs and tall grasses, and herbs formed the lowest layer.

Importance of Forest

Nutrition

All animals directly or indirectly depend on the plants for their survival. These plants also called as autotrophs or the producers are the source of food for all living organisms. All herbivores depend on them which are further eaten up by the carnivores. The saprotrophs eventually feed on the dead remains of these plants and animals.

A **food chain** is a feeding hierarchy in which organisms in an ecosystem are grouped into trophic (nutritional) levels and are shown in a succession to represent the flow of food energy and the feeding relationships between them. The interlinking of the food chains forming a network is called as a **food web.**



Decomposers

Mushrooms

In the soil the microorganism convert the dead remains into a dark coloured substance called **humus**. These organisms are called decomposers.
The presence of humus ensures that the nutrients of the dead plants and animals are released into the soil. From there, these nutrients are again absorbed by the roots of the living plants.

Forests: The Green Lungs

Plants release oxygen through the process of photosynthesis which is used by the animals for respiration. They also maintain the balance of oxygen and carbon dioxide in the atmosphere. That is why forests are called as lungs.

Trees take in water from their roots and release water vapour into the air through evaporation. If there were fewer trees, there would be less of evaporation!

Uses of Forests

- These provide food, shelter and water for tribals inhabiting forests.
- The dense bushes and the tall grass provide animals with the food and shelter. They also protect them from carnivores that live in the forest.
- We get several medicinal plants from the forests like turmeric and neem.
- The closed canopy and many layers of vegetation slow down the speed of raindrops.

- Transpiration and evaporation is maintained and help in bringing good rainfall in neighbouring areas.
- The root system helps water to seep down in the ground and increase water table unlike the cities where no surface area is left for percolation of rain water.
- They provide us with various products like timber, paper, fibres resins and gums.
- The forest also absorbs noise.

Deforestation

Deforestation is the clearing of virgin forests, or intentional destruction or removal of trees and other vegetation for agricultural, commercial, housing, or firewood use without replanting (reforesting) and without allowing time for the forest to regenerate itself. Deforestation can erode soils, contribute to desertification and the pollution of waterways, and decrease biodiversity through the destruction of habitat.

Deforestation

Causes of deforestation

- Development is essential for the country's growth. To meet the standard of urbanization the forest are cleared. These forests are the habitat for a wide range of biodiversity and gradually they also get affected due to deforestation.

- Forest fires are a natural cause of deforestation. A hot climate tips the balance towards a greater chance of a forest fire occurring.

- The forests are cleared in order to provide grazing land for the animals to meet the demand for milk and meat.

- Mining activities have left the land degraded. The trees are uprooted to make the land available for the mining process.

- The development of infrastructures like highways and railways require the clearing of the forest.

Consequences of deforestation

- If forests disappear, the amount of carbon dioxide in air will increase, resulting in the increase of earth's temperature leading to melting of glaciers and the snow cover and subsequently global warming.
- In the absence of trees and plants, the animals will not get food and shelter.
- In the absence of trees, the soil will not hold water, which will cause floods.
- Deforestation will endanger our life and environment.
- Clearing of the forests would make the land barren and would ultimately convert into a desert.

Deforestation

Exercises

17.1 What is the role of forest in maintaining the balance between oxygen and carbon dioxide in the atmosphere?
17.2 Why is the protection and conservation of biodiversity considered a serious issue?
17.3 Explain the role of decomposers in forests.
17.4 Mention few products obtained from forests.
!7.5 How does a forest cover prevents flood?
17.6 Enlist the consequences of deforestation.

Chapter-18 Wastewater Story

Components and Sources of Sewage

Water is an indispensable resource and is also present in abundance on the earth surface. The water which is utilized and going down the drains from sinks, showers, toilets, laundries is dirty and is called wastewater. This wastewater if left untreated may lead to water pollution.

Sewage is the wastewater containing solid and liquid wastes and pollutants. It is produced by humans from homes, industries, hospitals, offices and other places that use water for their various processes. A network of big and small pipes called sewer transports the waste water to the point of disposal. This is called sewerage.

Water Treatment

Larger pipes carry away the wastewater from your house to the line of sewer. Typically, these pipes are black-coloured iron pipes that are larger in size than the pipes that supply water. They are usually about 5 inches in diameter. These pipes are known as **sewer pipes.** The wastewater flows by gravity, rather than pressurized pipe flow, in the sanitary sewer pipes.

Sewer pipe

The wastewater is treated in the wastewater treatment plant and to make it clean from the **physical, chemical and biological contaminants.** The process of removing the contaminants from sewage water is done in various stages. This entire process is known as the sewage water treatment process.

Wastewater treatment process is carried out in various steps. These are described below:-

Bar screens

- The main purpose of the installation of the bar screens is to remove floating matter of comparatively large size like the rags, sticks, cans, plastic packets, napkins, papers etc.
- If such materials are not removed; they will choke up the small pipes or affect the working of sewage pumps.
- Screens should preferably be placed before the grit chambers. Depending upon the size of the openings, screens may be classified as coarse, medium and fine screens.

Bar screens

Grit sand removal chambers

- Grit in sewage is obtained from domestic sewage, floors of garages and service stations etc.
- The purpose of grit chamber is to remove grit, sand and other such inorganic matter from sewage.
- Velocity of flow in grit chamber is decreased to such an extent that heavier inorganic materials settle down at the bottom and lighter organic materials are carried forward for further treatment.

Clarification

Clarification tank

- The oldest and most widely used form of water and wastewater treatment uses gravity settling to remove particles from water.
- The shape of the tanks can be round, square or rectangular.
- Sedimentation takes place in the primary settling tanks and is relatively simple and inexpensive.
- The organic matter like faeces thus settled down is called sludge. The floatable solids like oil and grease are removed with the help of skimmer in this tank.

- Here air is blown by an aerating device through the bottom which solidifies grease and causes it to rise to the surface from where it is removed.
- The water thus obtained is called clarified water.

Aeration

- **Aeration Basins** supply large amounts of air to the mixture of primary wastewater and helpful bacteria and the other microorganisms that consume the harmful organic matter.
- The growth of the helpful microorganisms is increased by vigorous mixing of air (aeration) with the concentrated microorganisms (activated sludge) and the wastewater.
- Adequate oxygen is supplied to support the biological process at a very active level.

Aeration chamber

- The ratio of food (organic matter) to organisms to oxygen is continually monitored and adjusted to meet daily variations in the wastewater.
- Eventually, the microbes start to settle down at the bottom of the tank as activated sludge.
- The process of removal of water starts from the top of the tank. The activated sludge that settles down at the bottom of the tank is about 97% water.
- This water is removed by machines or sand-drying beds. Dry sludge can be used as manure.
- The water treated through this process contains low organic material. It is therefore discharged into the sea or river or into the ground for natural purification.

Chlorination

Before releasing the water treated in this manner, chlorination is necessary in order to make it germ-free. Chlorine tablets are thus added to it. This process is known as **chlorination**. Chlorine acts as a disinfectant. It is harmless to humans and other animals.

Measures taken at home to minimize waste

1. Cooking oil and fats should not be thrown down the drain as it can harden and block the pipes. In an open drain the fats clog the soil pores reducing its effectiveness in filtering water.

2. Microbes help in purifying water. We should not throw chemicals like paints, solvents, insecticides, motor oil, and medicines into the drain. It may kill these microbes.

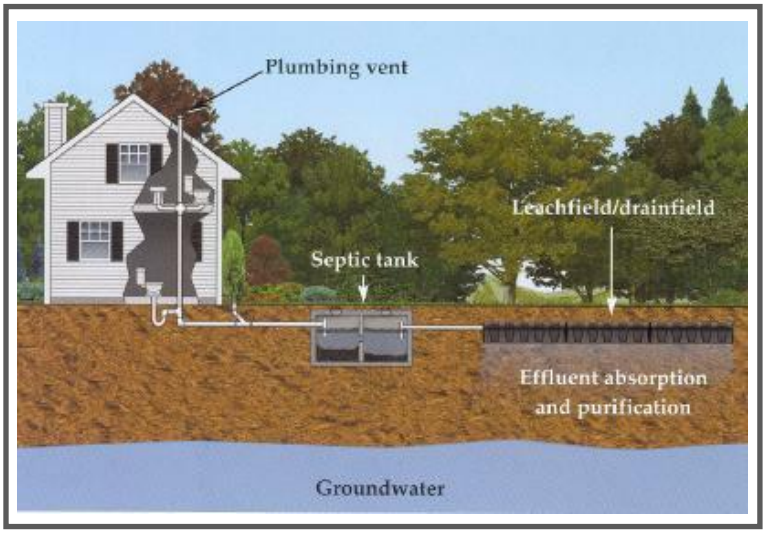
3. Large sized wastes like soft toys, cotton, sanitary towels, etc. choke the drains and do not allow free flow of oxygen thus they hamper the degradation process and hence should be avoided.

Alternative arrangement for sewage disposal

Low cost and on-site sewage disposal systems such as **septic tanks, chemical toilets, composition pit** etc are very suitable for isolated buildings or a small cluster of houses. The excreta collected in these toilets can be used for generating biogas.

Septic tanks

In the pretreatment portion of a septic system, many of the contaminants are removed from the wastewater in order to prepare it for final treatment and discharging into the environment. Contaminants in the wastewater include harmful bacteria that can cause illness, as well as nitrogen and phosphorus that can stimulate algae growth in water bodies.



Septic tank

The main unit of the pretreatment portion of the system is a tank – commonly called a septic tank. Septic tanks are used to settle out solids and partially treat wastewater before it reaches the distribution system.

Vermin processing toilet

Vermin processing toilet is a type of toilet in which human excreta is treated through earthworms. Earthworms convert human excreta into **vermin cake** that is a good variety of natural manure.

Chemical toilets

A chemical toilet is a toilet using chemicals to deodorize the waste instead of simply storing it in a hole, or piping it away to a sewage treatment plant. These toilets are usually found in airplanes, trains and caravans. Formaldehyde is mixed to the toilet water in order to disinfect the waste. Nowadays nitrate based chemicals are used that act biologically.

On-site human waste disposal technology

Excreta from the toilet seats flow through covered drains into a biogas plant. The biogas produced is used as a source of energy.

Sanitation and Disease

Proper sanitation facilities are therefore very important. Inadequate sanitation can cause serious problems of pollution and may pose several health hazards. The human excreta must be disposed of properly otherwise epidemics could break out. Awareness should be created about the necessity for personal social hygiene. Initiative should be taken by all to keep toilets at public places clean. We should not scatter litter anywhere.

Water and soil are polluted by human excreta. Water pollution gives rise to several water-borne diseases such as **hepatitis, dysentery, cholera, typhoid, polio, meningitis** etc.

Exercises

18.1 Untreated human excreta is a health hazard. Justify.

18.2 What is sewage? Explain why it is harmful to discharge untreated sewage into rivers or seas.

18.3 Why should oils and fats be not released in the drain? Explain.

18.4 How will you correlate sanitation with disease?

18.5. Give a brief description about the waste water treatment plant.