Science Notes Part 3 in English

11] Chemistry in Daily Life

Cement and its uses

- ✓ Cement is an important chemical substance used in the construction of buildings.
- ✓ In 1824 Joseph Aspidin, a mason in England synthesised cement. As this cement resembled the limestone found in Portland, he named the cement as Portland cement.
- ✓ Cement is a mixture of limestone, clay and gypsum in definite proportion. This mixture is heated, cooled and powdered to get the chemical substance called cement. This greyish powdery cement is packed in airtight bags and sold.
- ✓ when water is added to cement, it sets to a hard substance within a few hours. This is known as setting of cement.

Uses of cement

Cement is used in different forms like mortar, concrete and reinforced cement concrete.

Mortar

Mortar is obtained in the form of thick paste by mixing cement, sand and water. This paste is used in flooring, constructing and plastering the walls of the houses.

Concrete

Concrete is a mixture of cement, sand, gravel and water. It is used in the construction of buildings, bridges, dams or reservoirs.

Reinforced cement concrete (RCC)

When concrete is filled in and around a steel wire netting or skeleton of iron rods and allowed to set we get reinforced cement concrete. This RCC is very strong and durable. This type of concrete is used in the construction of dams, bridges, pillars and roofs of the buildings. It is also used in making pipes, constructing water tanks, and laying sewage and drainage canals.

Plastics

Nowadays plastics are very much used in making pipes, toys, utensils, stationeries, medical instruments etc. Plastic water bottles are commonly used everywhere. Plastic is also a type of chemical substance.

Types and uses of plastics

Plastic pipe and plastic bottle melt and become soft on heating. On cooling, they become hard. These types of plastics are known as 'Thermo Plastics'. Polythene bags, PET bottles, PVC (Polyvinyl chloride) pipes, buckets, mugs, combs, toys etc. are made of **thermo plastics.**

Can we Cannot expand plastic handles of cookwares like PVC pipes by heating? No, we cannot. It is because they are **thermos setting plastics**.

An object made of thermo setting plastics cannot be softened or melted by heating. **Example: Bakelite and melamine.**

Bakelite is a non conductor of heat and electricity. It is used to make electrical insulators, switches and handles of cookwares. Melamine is a non-inflammable substance.

Moreover, it can withstand very high temperature. Therefore, it is used to make floor tiles, cookwares, fireproof clothes etc.

Plastics and environment

Plastics are also a great threat to our planet Earth. The disposed plastics bring about the following effects,

- Plastics do not get degraded.
- They do not allow rainwater to seep through the soil.
- They affect the growth of the plants.
- Water gets stagnant in these disposed plastic pieces. It becomes the breeding place for mosquitoes, which in turn spread contagious diseases.
- They arrest the flow of water.
- When food contaminated with plastic material is consumed, it leads to the death of living organisms.
- When Plastics/Polythene bags are burnt, they emit toxic gases. These gases mix in air and cause respiratory problems.

As plastics pollute land, air and water, we must avoid the usage of plastics. Instead of plastics we can use things made of cloth, jute, coir and areca-plate which are bio-degradable.

Glass and its uses

When we hear the word glass, it immediately reminds us of plane mirrors and spectacles. Glasses are also used in window panes, automobiles, decorative lamps etc.,

Some glasses allow the light to pass through them like spectacles. But the plane mirror does not allow light to pass through it. A chemical substance coated at the back of the mirror reflects the light thereby we could see the image.

Glass is made of chemical substances like silica (sand), calciumcarbonate limestone) and sodium carbonate. The above mixture is melted into a viscous liquid by heating it to a very high temperature.

This liquid is poured into a suitable mould and cooled to get glass objects of desired shape. When molten glass is cooled rapidly it becomes brittle. When the molten glass is cooled very slowly, it will not allow light to pass through. Therefore glass should not be cooled either very slowly or rapidly. It should be cooled gradually. This method of cooling is called annealing.

Glass finds a wide range of application in the manufacture of window panes, automobile windows, electric bulbs, medical instruments, laboratory apparatus like standard flasks, test tubes, beakers, measuring jars etc.

Different types of soaps like washing soap, toilet soap, baby soap, liquid soap, medicinal soap etc. are in use.

All the above mentioned soaps are not prepared from the same raw materials. The ratio of raw materials also differ. The raw materials used for the preparation of the soap are mentioned on the wrapper of the soap.

can prepare soap at home provided sodium hydroxide is available.

Fibres

We come to know from history, that ancient man wore the leaves of plants and skin of animals as clothing. But in our present civilized and modern scientific world we have developed fashionable and attractive dresses using different types of fibres.

During hot summer season we like to wear cotton clothes. During winter season we wear woollen clothes to protect ourselves from severe cold. During rainy season, we use umbrellas and rain coats made of polyester. The clothes which we wear are of different kinds.

In the above activity, the thin strands we get while separating thread are fibres. Fibres are drawn together and twisted to get thread. Clothes are woven using the thread.

Types of fibres and their uses

Fibres are classified into two types based on their source.

1. natural fibres
2. synthetic fibres

Natural fibres

Fibres which are obtained from plants and animals are known as natural fibres. Jute is obtained from the stem of the jute plant. It is used to make bags, curtains, carpets, etc. Cotton is obtained from cotton plant. Cotton fibres are twisted to get threads which are used to make cotton cloth.

Cotton fibre consists a chemical substance called “cellulose”. The fibres on the coconut shell are removed and processed to get coir. Coir is used to make ropes, carpets and other household articles. We get silk from the silkworms and wool from the fur of sheep.

Synthetic fibres

The fibres which are synthesized from chemical substances using scientific technology are called synthetic fibres. Polyester, nylon, rayon are some of the examples of synthetic fibres. These fibres are not only used in making clothes but also used in making fishing nets, ropes and parachutes. They are also used widely in various industries. Can you differentiate the clothes which are made out of natural fibres and made out of synthetic fibres?

Each group should share their observations with peer groups. Chemical substances are not only used to prepare the things that we have seen in this lesson but also used in the preparation, preservation, enriching taste and colouring of every substance that we use. Thus in our daily life chemical substances are used in food, clothing, shelter, transportation, medicine, entertainment and in industries. Since they have become part of our life, it is the duty of each and every one of us to use them carefully and wisely so as to preserve our environment. Science club debate topic “Invention of plastics by man is a crime”

12] Light

Galileo Galilei - He was a great Italian scientist. He was a physicist, mathematician, astronomer, and philosopher who played a major role in the Scientific Revolution. Earlier, it was believed that the earth was stationary and it was in the centre of the solar system. But the polish scientist Nicholaus Copernicus suggested that "The earth is not stationary. It spins on its own axis and revolves around the Sun". This theory appealed to Galileo and he proved this concept by his experiments.

In 1609, Galileo invented the telescope, through which he saw the stars, planets and the moon. According to Galileo, the Sun is a star. All stars are like the Sun.

We were able to know more about the solar system only by using the telescope invented by Galileo. To commemorate the 400th anniversary of this invention, the year 2009 was declared the "International Year of Astronomy".

Sources of light

We need light to see objects. The objects that emit light are called as sources of light. Sources of light are of two types natural and artificial. The sun is the primary and the natural source of light. Some of the man-made objects also produce light. These are called artificial sources of light.

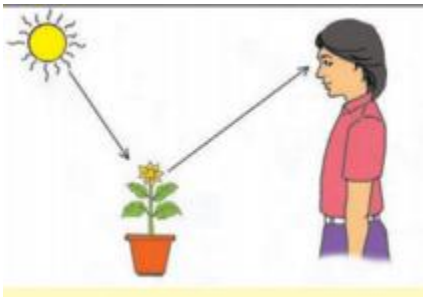
During the day, we are able to see with the help of sunlight and during the night, we can see with the help of light from the electric bulb, torch light, candle etc. Bodies that emit light on their own are called **luminous bodies.**

When the light from luminous bodies like the sun, torchlight etc reaches our eyes after bouncing back ie reflected from them. Objects like table, chair etc. do not emit light on their own. Objects like these that do not emit light on their own are called **non-luminous bodies.**

Therefore we understand that to see an object we need the following

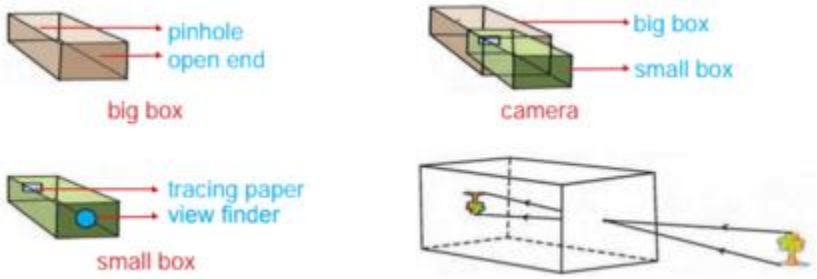
- a source of light

- object to be seen
- observer.



From the above activity, the candlelight/object was seen when the cylinder was straight. When the cylinder was bent the same candlelight/object could not be seen. This is because light travels in a straight line.This propertyis called **rectilinear propagation of light** .

Pinhole camera



The light that comes from the object passes through the pinhole and forms an inverted image on the tracing paper. When the distance between the pinhole and the tracing paper is increased, the size of the image also increases. When the distance is decreased, the size of the image decreases. If the size of the pinhole is increased, the clarity of the image decreases and the image becomes blurred.

Why the image formed in a pinhole camera is inverted?

The reason is light travels in a straight line. The light rays from the top of the object travel through the centre of the pinhole in a straight line and go downwards. Similarly the light rays from the bottom of the object travel through the centre of the pin hole in a straight line and go upwards. Therefore, we get an inverted image on the screen.

Transparent, Translucent and Opaque objects

The objects which allow light to pass through them are called **transparent objects**.

Spectacles, clear water, pure air are some more examples of transparent objects.

The objects which allow the light to pass through them partially are called translucent objects. Air with dust particles, mist, ground glass, a sheet of paper smeared with oil are some more examples of **translucent objects**.

The objects which do not allow light to pass through them are called opaque objects. Wooden door, plastic chair, brick are some more examples of opaque objects.

Shadows

When certain objects are placed in front of sunlight or torch light a shadow is formed behind the object. Since the object placed in the path of light do not allow light to pass through it, there is no possibility of light rays to go behind the object.

Hence that region is dark. This is because light travels in a straight line. Objects that cast shadow are opaque objects.

From this we know that all objects do not cast shadow, only opaque objects cast shadow. We also understand that we need a source of light, an opaque object and a screen (wall, floor, building etc. act as a screen) to cast shadow.

Properties of shadow :

- Shadow is always formed on the opposite side of the light source.
- It only shows the shape or outline of the object and not the details.
- A shadow cast by an intense beam of light is dark.
- A shadow is always black regardless of the colour of the object and the light source.
- The size of a shadow varies depending on the distance between the object and the source of light, and the distance between the object and the screen. (As the distance between the object and the source of light increases the size of the shadow decreases and as the distance between the object and the screen increases the size of the shadow increases)
- Source of light, an opaque object and the shadow will always lie in a straight line.

Reflection of light and plane mirror

When a tennis ball is thrown against a wall, it bounces back. Similarly when a beam of light falls on a smooth shining surface, it bounces back into the same medium (solid, liquid or gas). This phenomenon is called **reflection.**

Plane mirrors :

Have you seen your face in a mirror? What you see on the mirror is your own reflection. This is called image. Shall we learn, how we are able to see our own image on the mirror? Light rays from the light source which fall on our face are reflected.

These reflected rays are reflected back again when they fall on a mirror. When these reflected rays from the mirror reach our eyes we are able to see the image of our face (object) in the mirror. Isn't the surface of the mirror plane and smooth? This is called plane mirror.

13] Animals in Daily Life

Uses of animals

Animals and their products are of great use to man. Based on the utility of animals, they are classified into three groups

1. Food yielding animals

Animals are reared for milk, eggs and meat. Breeds of cows are mainly raised for milk eg. Jersey . Certain breeds of goat are reared for milk and meat. Honey bees give us honey. Fishes are a good source of protein.

2. Fibre yielding animals

Animals such as sheep, Llama and goat provide us fur. The fur is processed into wool. Silk moth gives us silk fibre.

3. Draught animals

Animals which are used for ploughing and transporting are called draught animals. B u l l o c k (k a n g e y a m) , O x , horse, elephant, donkey, etc are employed in farm activities and transport.

Animal Products

Animals provide us a variety of products like wool, silk, milk, honey, meat, leather, pearl, egg, lac and so on. Let us learn about some.

1. Wool: Wool is obtained from hairs on the bodies of animals such as sheep, llama and goat. It is used to make sweaters, shawls, blankets, socks, hand gloves etc.

2. Meat: Animals such as goat, sheep, pig, poultry birds, prawn, crab etc. yield flesh as food.

3. Silk: Silk is obtained from silkworm and it is used for making silk clothes.

4. Leather: The skin of animals such as goat, sheep, and cattle is used for manufacturing leather goods(bags, shoes, purses, suitcases, belts).

5. Pearl : Pearl is a valuable gem obtained from pearl oysters and is used in making ornaments.

6. Lac : Some insects secrete a resin like substance called lac. It is used for making paints, varnish, printing inks and cosmetics.

7. Milk: Animals like cows, buffaloes and goats give milk as food.

8. Honey: Honey is obtained from honey bees. It is consumed along with food and used in the preparation of certain medicines.

9. Egg: Poultry birds such as hen, duck, goose and turkey give us eggs as food.

Animal Fibres

Woollen clothes trap air and act as bad conductor of heat or cold. Hence they keep us warm during winter.

Wool

Wool is a thick coat of hairy fibres (fleece) obtained from sheep, goat, yak and other animals. It is composed of a protein called keratin. Several breeds of sheep are reared in our country that yield different kinds of wool. The skin of sheep has two types of hair. a) Coarse beard hair and b) Fine soft under hair.

Normally fine hairs provide the fibres for making wool. Yak wool is common in Tibet and Ladakh. Angora wool is obtained from Angora goats which are found in Jammu and Kashmir. The wool from Angora goat is called as “Mohair”. The underhair of Kashmiri goat (Pashmina) is woven into fine shawl. It is very soft and expensive.

Processing of wool

There are many steps involved in processing the fur into wool. The process of cutting off the woollen fleece of sheep with a thin layer of skin is called shearing. The wool is used to manufacture sweaters, shawls, blankets, hand gloves etc.

Silk

Silk is also a natural animal fibre. Silk worm secretes the silk fibre. The best known type of silk is obtained from the cocoon of larvae of mulberry silkworm. Silk fabric was first developed in ancient China.

Uses of Silk

Silk is used for making silk clothes, parachutes, insulation coils for telephone and wireless receivers.

Sericulture

The rearing of silk worms for obtaining silk is called **Sericulture.** It is a very old occupation in India. The silk fibre is obtained from the cocoon of the silk moth. There are varieties of silk moths and the silk they yield is different in texture.

The types of silk are

1. Mulberry silk

2. Tassar silk

3. Eri silk

4. Muga silk

The most common silk is mulberry silk. Mulberry silk is superior in quality because it is soft, lustrous and creamy white in colour. It is secreted by the silk producing glands of silkworm.

Steps of preparing silk fibre.

1. A female silk moth lays hundreds of eggs at a time.

2. The eggs are kept under hygienic conditions and under suitable temperature.

3. When the eggs hatch into larvae, they are fed on mulberry leaves.

4. After 25 to 30 days of feeding, they spin a protective case around them called cocoons.

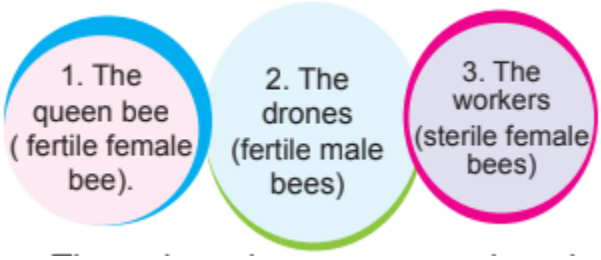
5. The cocoons are dipped in hot water and the silk fibres are separated.

6. The process of taking out threads from the cocoon is called Reeling.

7. The thread is woven into silk cloth.

Apiculture

Honey bees live in beehives. A beehive consists of numerous small compartments called honey combs. Bees live in colonies. There are three kinds of bees in a beehive. They are



There is only one queen bee in a beehive. The work of the queen bee is to lay eggs. There are a few hundreds of male bees which help in reproduction. The worker bees are thousands in number. They perform various functions.

Honey is used as food. It is used in the preparation of certain medicines in Siddha, Ayurveda and Unani. Bees also produce wax, which is used for making candles. Some Indian varieties of bees are

1. Rock bee (Apis dorsata)

2. Little bee (Apis florea) and

3. Indian bee (Apis indica)

Nowadays, bee-keeping is practised to produce more honey. The rearing of honey bees to produce honey in large scale is known as apiculture. A well known Italian breed called Apis mellifera is the best for bee-keeping because it has high honey collecting capacity and it does not sting much.

Poultry

The rearing of hens and other fowls to produce eggs and flesh is called Poultry farming. Several kinds of birds like hen, duck, turkey, goose etc.. are reared for the production of eggs and flesh. The place where the fowls are reared is called Poultry farm.

Namakkal district in Tamil nadu is famous for poultry industry. In our country, hen is the most favourite domestic bird. Poultry keeping has developed into a very big industry. Some varieties of hens are reared for the production of eggs only.Such hens are called layers. There are some varieties of hens grown for flesh. They are called broilers.

The poultry house should be well lighted and well ventilated. The common poultry feed is grains and lots of fresh water. Hens that hatch eggs are called Broody hens. They sit on eggs and keep them warm. This is known as incubation. The eggs hatch after 21 days.

Animal protection and maintenance

Ever since human beings appeared on the earth, they have been living with animals. Plants and animals are dependent on each other. We have to protect them to maintain the balance in nature because our own survival depends on this.

Domestic animals can be cared by

1. Providing animals with good feed and clean drinking water to keep them fit and healthy.

2. Providing shelters that are clean, airy and well lighted .

3. Protecting them from diseases

Care of Wildlife

As people use more and more land to cultivate crops, graze cattle, build houses and factories, animals and plants are being forced out of existence. Poaching, pollution and use of excess pesticides have killed so many plants and animals. Some have been completely wiped out from the earth. If an animal no longer exists, it is said to be extinct. If they are in danger of becoming extinct, they are said to be endangered. Wildlife protection and maintenance is called **wildlife conservation**.

Some of the conservation measures are :

1. setting up of National Parks and Wildlife Sanctuaries.

2. stringent action against poaching.

3. discouraging deforestation.

Wildlife and forest are the wealth and pride of a country. So it is our moral duty to protect the plants and animals. We can protect our animals by

1. Not harming any animal or plant.

2. Growing trees that provide home to birds and insects.

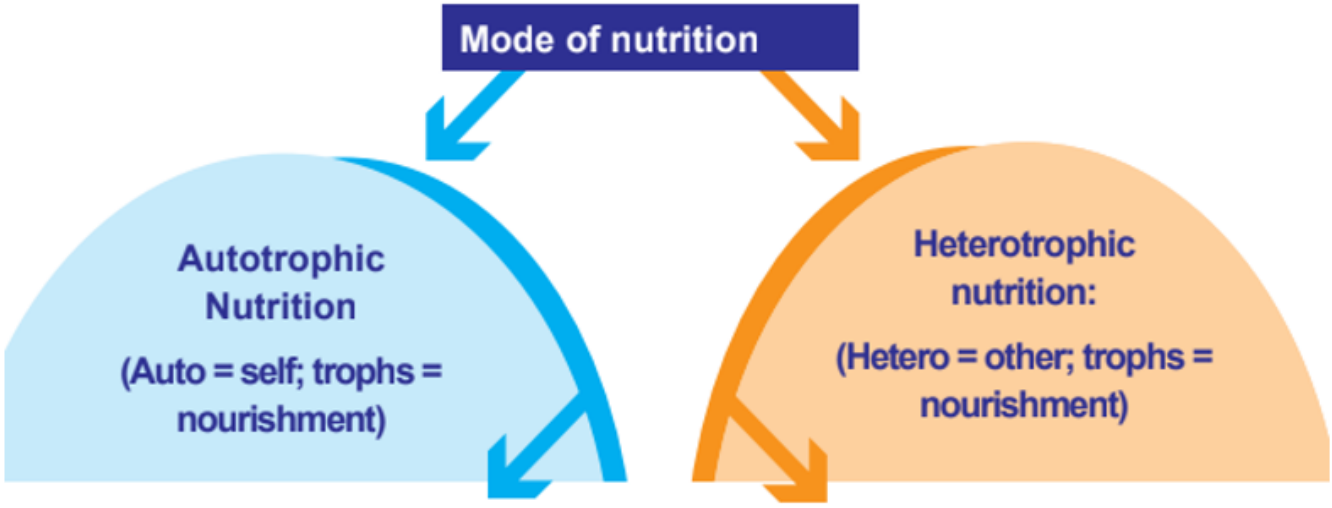
3. Not buying animal products that are banned. eg. Tusk.

14] Nutrition in Plants and Animals

Food is a basic necessity for all living organisms to survive. It is because food provides energy to all living organisms to do their life activities. Food also helps them to grow and build their bodies. How do living organisms obtain their food? Green plants can make their own food by using sunlight, water and carbon dioxide. Animals cannot make their own food. They depend on plants directly or indirectly for their food. The mode of taking food by an organism and utilizing it by the body is called nutrition.

Modes of Nutrition in Plants

There are two modes of nutrition in organisms. They are autotrophic and heterotrophic nutrition.



Green plants are the only organisms which can synthesize food for themselves and also provide food for other organisms including us. The mode of nutrition in which organisms make their own food is called **Autotrophic Nutrition** and such organisms are called **autotrophs**.

eg. Green plants.

Non-green plants and most animals (like us) take in readymade food from plants and other animals. The mode of nutrition in which organisms depend on others for their food is called Heterotrophic Nutrition and those organisms are called heterotrophs. eg. All animals, including human beings.

Photosynthesis

Inside, the leaves also have a wonderful green substance called chlorophyll.

At the same time air comes into the leaf through tiny openings named stomata and water moves up from roots below.

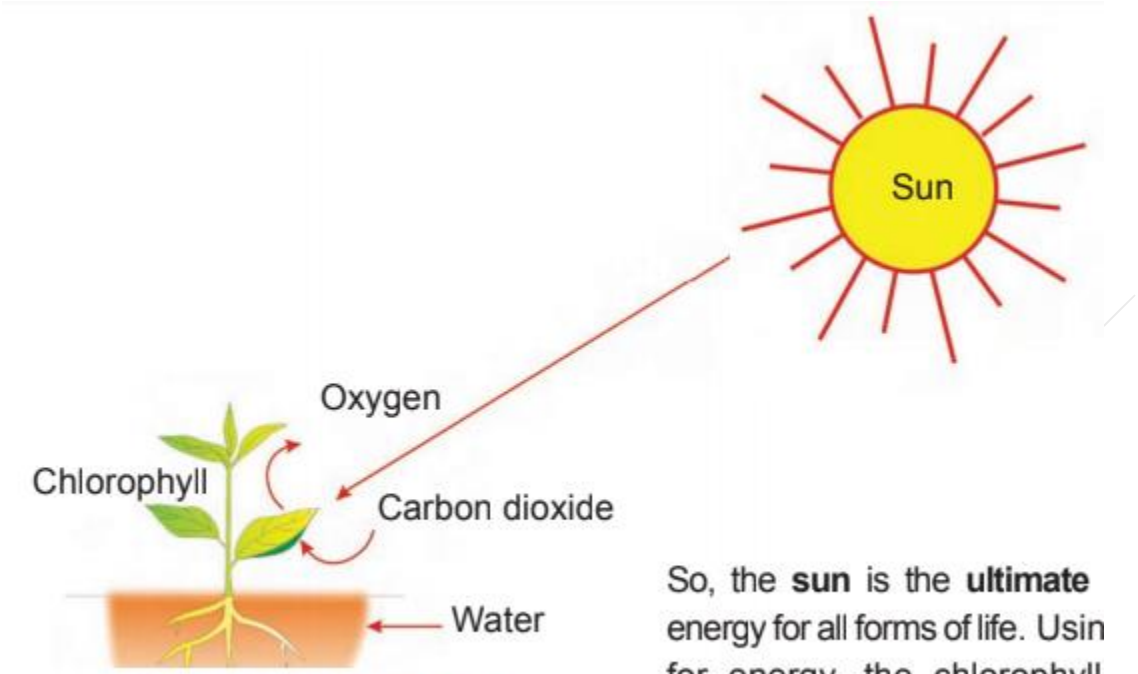


Fig 2.3. Photosynthesis chart

In the absence of the sun, there would be no photosynthesis. Hence, there would not be any food. In the absence of food, life would be impossible on earth.

So, the sun is the ultimate source of energy for all forms of life. Using sunlight for energy, the chlorophyll changes water and carbon dioxide into food for the plant.

The process of preparing food with the help of water, carbon dioxide, sunlight and chlorophyll in plants is called photosynthesis.

Photosynthesis can be represented by the equation given below

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

There are some leaves of plants which show different colours other than green. Can they do photosynthesis? Yes, they can. The huge amount of red, brown and other pigments eclipse the green colour.

Other Modes of Nutrition in Plants

There are some non-green plants which cannot prepare their own food. They take readymade food prepared by other plants. They follow heterotrophic nutrition. They may be saprophytes, parasites, insectivorous plants etc.

Saprophytes

Sometimes we see umbrella-like structures growing on decaying matter on the road side during the rainy season. These organisms are called fungi. They grow on dead organic matter. They produce digestive enzymes on the dead matter and change it into simple nutrients.

They absorb the nutrients in dissolved form (solution) and utilize it. Such a mode of nutrition is called saprotrophytic nutrition and those plants are called saprotrophytes. eg: mushroom, bread mould.

Parasites

we can see yellow coloured tubular structures coiling around the stem of a tree. This is a plant called cuscuta. It cannot synthesize food. As it lacks chlorophyll, it depends on the tree on which it is climbing for food. The plant which provides food is called host and the plant which consumes it is called parasite.

Symbiotic Plants

There is yet another mode of nutrition in which two different types of organisms live together and mutually help each other for nutrition. Lichens are organisms that consist of a fungus and alga. The algae gives food to the fungus and the fungus absorbs water and minerals and gives to algae. Here, both the organisms help mutually. The phenomenon by which two different organisms live together for mutual help is called symbiosis. The organisms are called symbionts.

Fig 2.9. Lichens

Nutrition in Animals:

Our body is also a machine. We get energy from the food that we eat. Food contains not only energy but also the raw materials needed for body's growth, maintenance and repair. Mostly animals take in solid food. This mode of nutrition is called holozoic nutrition.

Nutrition includes five steps

1. Ingestion

The process of taking food into the body is called ingestion. The mode of intake of food differs in different organisms. eg: Butterflies and bees suck the nectar of the flowers. Snakes (Python) and frogs swallow their food. Aquatic animals (Blue Whale) filter feed.

2. Digestion

The process of breaking down of complex food into simple food with the help of enzymes is called digestion.

3. Absorption

The process by which the digested food passes into the villi of the wall of the intestine is called absorption.

4. Assimilation

The ways in which the absorbed food is utilized in cells is called assimilation.

5. Egestion

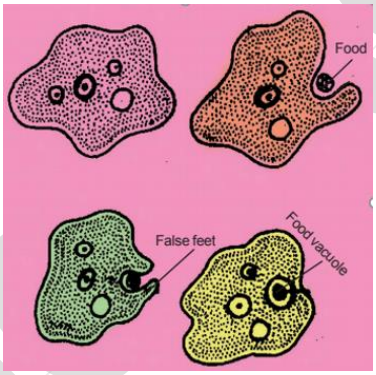
The removal of undigested food through anus is called egestion.

Nutrition in Amoeba

Amoeba is a unicellular organism. It lives in the stagnant water bodies. It feeds on microscopic organisms. Though amoeba is a one-cell animal, it takes in solid food through its body surface. So the mode of nutrition is holozoic. Whenever the food touches the body surface of amoeba, it engulfs the food with the help of pseudopodia (false feet) and forms the food vacuole. The food is digested with the help of enzymes inside the food vacuole. The digested food reaches the entire cell by diffusion. Amoeba uses the food for getting energy, making proteins for growth, etc. The undigested food is thrown out of the body through its body surfaces.

Human Digestive System

Think of any food that you like, a sweet, a fruit etc. Let us find out what happens to it when eaten. It passes through the digestive system. This system is made up of mouth, oesophagus, stomach, small intestine, large intestine and anus.



Mouth

We ingest the food into mouth cavity through mouth. Mouth cavity contains teeth, tongue and salivary glands.

Teeth

Teeth help us to cut the food into small pieces, chew and grind it.

Salivary Glands

There are three pairs of salivary glands in our mouth. These glands secrete a watery fluid called saliva. It makes the food wet so that we can easily swallow it. It contains an enzyme called amylase which helps in the digestion of starch

Tongue

The tongue is an organ of taste. It helps to mix the food with saliva and make it wet. It also helps in rolling and pushing the food while swallowing.

Oesophagus

It is a tube which connects the mouth and stomach. It is also known as food pipe. It helps to pass the food from the mouth to the stomach.

Stomach

Stomach is a bag-like structure where the food is further digested. The food is churned. Stomach secretes digestive juice called gastric juice which helps to digest food.

Small Intestine

It is a very long tube and is about 7 metre in length. Here the food is mixed with bile juice, pancreatic juice and intestinal juice. These juices help in completing the digestion. At the end of digestion, carbohydrates are broken down into glucose and fructose, proteins into amino acids and fats into fatty acids and glycerol. This digested food is absorbed by the villi in the small intestine.

Large Intestine

It is about 1.5 metre in length and helps in absorbing water. It is the place for temporary storage of undigested food. Digestion does not take place here.

Anus

The undigested food (faecal matter) is eliminated through anus and the process is called egestion. Let us find out how the food moves in our digestive system.

Food in the digestive system moves from the oesophagus to the anus by rhythmic contraction and expansion of the wall of the digestive system. This movement is called peristalsis.

Types of Teeth

We all have two sets of teeth in our life time. The first set of teeth grows when a baby is about one year old. This set of teeth is called milk teeth. They are twenty in number. Milk teeth stay in a child up to the age of seven to eight years. When the milk teeth fall off, a new set of teeth grow. They are called permanent teeth. They are thirty-two in number. Of these, sixteen are in the upper jaw and sixteen are in the lower jaw. All the teeth in our mouth are not the same. There are four types of teeth. They are incisors, canines, premolars and molars.

Incisors: These are chisel shaped teeth at the front of the mouth. They are eight in number. Four are present in each jaw. These are used for biting the food.

Canines: These are sharp and pointed teeth. They are four in number and two are present in each jaw. Canines are used for cutting and tearing of food.

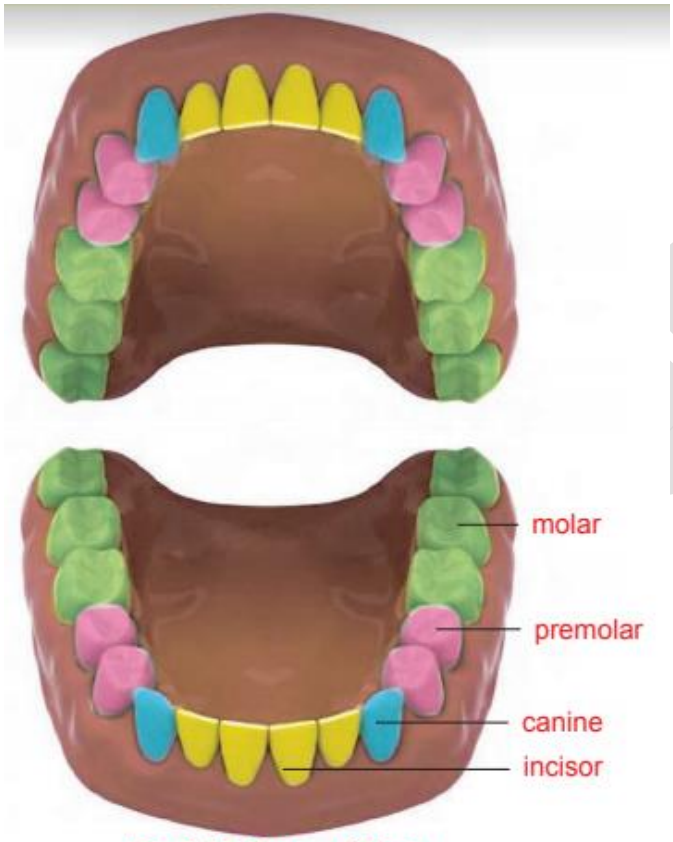


Fig 2.13. Types of Teeth

Premolars: These are large teeth behind canines on each side. They have large surface. They are eight in number and four are present in each jaw. They help in chewing and grinding the food.

Molars: These are very large teeth present just behind the premolars. They have more surface area than premolars. They are used for chewing and grinding of food like premolars. They are twelve in number and six are present in each jaw.

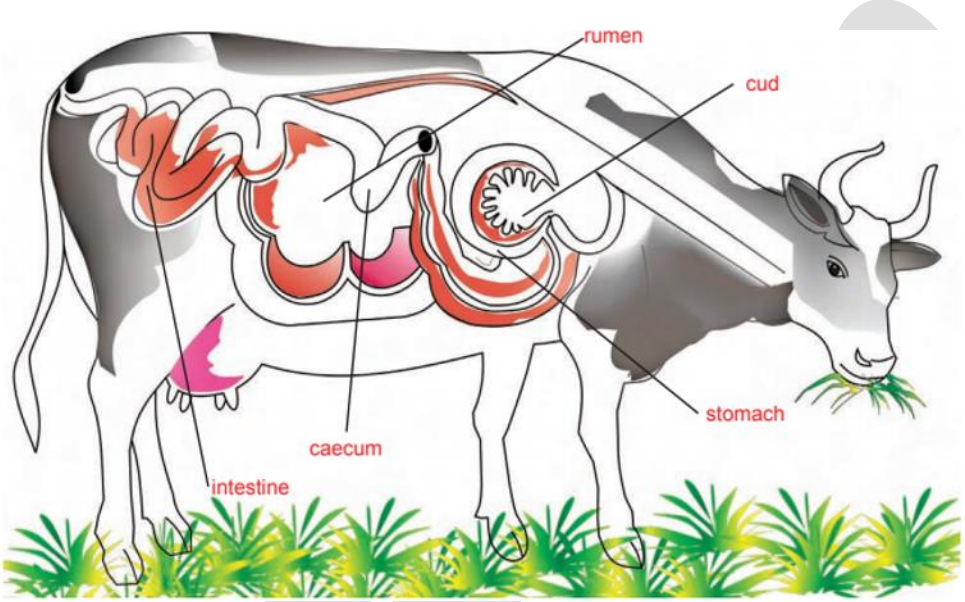
Tooth Care

Permanent teeth serve for life time. They are not replaced like the milk teeth. Hence, great care should be taken for keeping the teeth clean. The enamel in the teeth of children is much thinner than on the teeth of adults. So, teeth of children are more liable to decay than those of adults. Children should avoid very cold or very hot food. They should brush twice a day. Teeth should not be rubbed with hard things like brick powder.

Ruminants

Shall we observe some grass eating animals such as goat, cow and buffalo. They keep on chewing even when they are not eating or at rest. They have an interesting digestive system. In fact they eat grass hurriedly and swallow quickly and store it in the first chamber of the stomach called rumen.

In the rumen, the grass is fermented with the help of certain bacteria and the partially digested grass is called cud. Later, the cud is brought back to the mouth in small quantities and the animal chews it. The process of chewing the cud is called rumination. Animals which chew the cud are called **ruminants.**



Grass is rich in cellulose which is a kind of carbohydrate. Herbivorous animals can digest it. The other animals and humans cannot digest cellulose. There is a sac-like structure called caecum between the small and large intestine in ruminants. This sac contains some bacteria which produce an enzyme called cellulase which digest the cellulose.

15] Plant Morphology

Characteristics of Living things

Things that have life are called living things.

eg. Plants and animals.

Things that do not have life are called non-living things.

eg. Rock, book.

Among living things, some are plants and some are animals. Now the question is, how do living things differ from non-living things? Living things show the following characteristics, whereas non-living things do not.

All living things

- need food,
- respire to convert food into energy.
- grow at certain stages of life.
- respond to their surroundings.
- live for a definite span of time.
- reproduce their own kind.
- are made up of cells.

Habitat - Various Habitats Of Plants

We see different varieties of plants around us. All plants are well adjusted to the place where they live. The living place of a plant provides food, shelter and suitable climate to survive and reproduce successfully. Such a place of living is called a habitat. Plants live in different habitats such as water, land, desert, hills and so on. WARMING (1909) classified the plants into three types on the basis of their water requirement. They are

1. Hydrophytes

2. Mesophytes

3. Xerophytes

1. Hydrophytes

Hydrophytes means water plants (Hydro = Water, and Phytes = Plants). These plants live in the water of ponds, lakes and rivers. Plants which live in water are called hydrophytes.

They are divided into three types:

a) Free-floating hydrophytes These plants float freely on the water surface. eg. Water hyacinth (Agayatamarai)

b) Attached floating hydrophytes

These plants are fixed at the bottom of the pond and the leaves float on the surface of the water.

eg. Water-lily (alli), Lotus.

c) Submerged hydrophytes

These plants are rooted in the mud and remain under- water.

eg. Vallisneria

Adaptations of Hydrophytes

1. Root system is poorly developed. In some cases roots are even absent.

2. Stem is thick, short and spongy with air spaces to float in water.

3. Leaves have a waxy-coat that prevents their decay in excess water.

2. Mesophytes

These plants grow in places with moderate water supply. They cannot grow in places with too much of water or too little water. Most of the crop plants are mesophytes. eg. Wheat, maize, sunflower, mango, neem.

Adaptations of mesophytes

1. They have well developed root system.

2. Leaves are usually large and broad.

3. Xerophytes

Xerophytes means desert plants:

(Xero = Desert and Phytes = Plants)

Plants which grow in dry areas (deserts) are called Xerophytes. The plant body is adapted to cope with the water scarcity, high temperature, strong winds, etc.

eg. Opuntia (chappathikalli).

Fig 3.6. Opuntia (chappathikalli)

Adaptations Of Xerophytes:

1. They have long roots which go deep into the ground so as to absorb water.

2. In Opuntia, the stem is thick, flat and green and does the function of photosynthesis.

3. Leaves are reduced or modified into spines to prevent the loss of water from their surface.

Herbs, Shrubsand Trees

Flowering plants can be grouped based on their size of stem. They are herbs, shrubs and trees.

1. **Herbs**
   - Small plants with soft and green stems are called herbs.
   - They are non-woody plants and do not grow more than one metre in height.

eg. Radish, wheat, paddy, sunflower.

2. **Shrubs**
   - The medium sized plants with a thin but hard and woody stem are called shrubs.
   - They do not have a clear main stem.
   - They tend to branch and become bushy.

eg. Rose, jasmine, croton, Tulsi, lemon.

3. **Trees**
   - Tall and big plants with a distinct hard and woody stem are called trees.

- The main stem is called trunk which gives out branches and leaves.

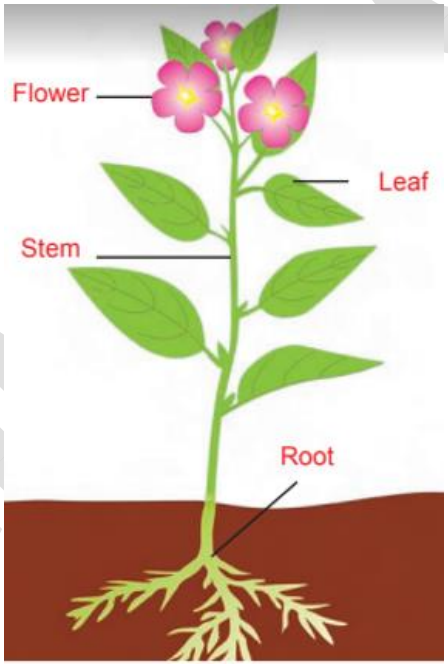
eg. Neem, mango, teak, coconut, banyan.

Parts Of A Plant

- The main stem is called trunk which gives out branches and leaves.

eg. Neem, mango, teak, coconut, banyan.

Shall we recollect the salad that Mani and Mythili made. It was made with different parts of the plant. A typical flowering plant consists of two main systems, viz. Root System (underground part), and Shoot System (aerial part). The root System consists of main root and its lateral branches. The Shoot System has a stem, branches and leaves. The flowering plant produces flowers, fruits and seeds at maturity. Root, stem and leaves are called vegetative parts of a plant as they do not take part in reproduction. Flowers, fruits and seeds are reproductive parts of a plant as they take part in reproduction.



Roots, Stem, Leavesand Flowers

Root system

The part of the plant which grows under the soil is called Root System. It usually develops from the radicle of embryo. It is the descending part of the plant. It grows away from sunlight. It does not have chlorophyll. Nodes and Inter-nodes are absent. It does not bear leaves or buds. Root system is broadly classified in two types. They are

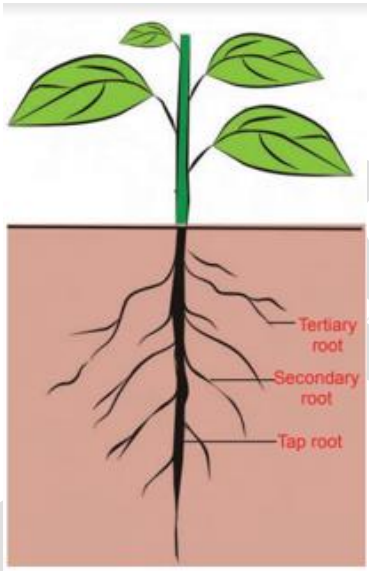
1. Tap root system

2. Adventitious root system

1. Tap Root System

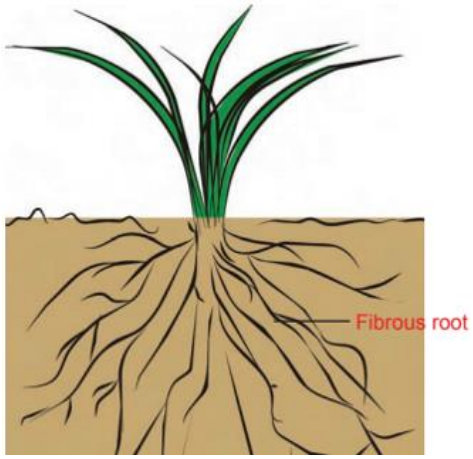
The radicle of the embryo grows deep into the soil and becomes the primary root (tap root). This root gives rise to lateral roots such as secondary roots and tertiary roots. Generally dicot plants have tap root system.

eg. Mango, neem, carrot, radish, etc.



2. Adventitious Root System

Roots that grow from any part of the plant other than the radicle are called adventitious roots. These roots arise in cluster which are thin and uniform in size. As these roots arise in cluster, they are also called as fibrous roots. Most monocot plants show adventitious roots. eg. Rice, grass, maize, bamboo.



Normal functions of roots

1. Roots absorb water and minerals from the soil and transport to the stem.

2. Roots fix the plant firmly to the soil.

Shoot system

The part of the plant which grows above the ground is called shoot system. It develops from the plumule of the embryo. Stem is the ascending part of the plant axis. It grows towards the sunlight. The shoot consists of main stem with branches,nodes, inter- nodes, leaves, buds, flowers and fruits. Young stems are green and old stems are brown in colour. The place from where the leaf arises is known as node. The distance between the two successive nodes is called inter- node . It bears buds either in the axils of leaves or at the tip of the stem.

Normal functions of stem

1. Support: The stem holds the branches, leaves, flowers and fruits.

2. Conduction: The stem transports water and minerals from roots to the upper parts. It also transports the prepared food from leaves to other parts.

Leaf

Leaf is a thin, broad, flat and green part of the plant. The leaf consists of three main parts. They are leaf blade (leaf lamina), leaf stalk (Petiole) and leaf base.

Leaf blade (leaf lamina):

It is the expanded part of the leaf which is green in colour. It has a midrib (a main vein) in the centre of the leaf blade. The midrib has branches on either side which are called veins.

Petiole

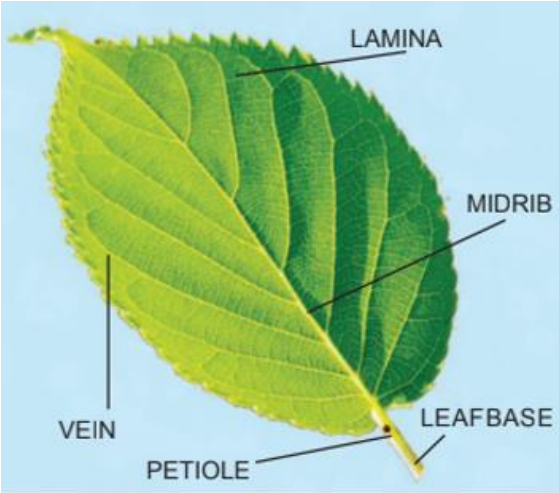
The stalk of the leaf is called petiole. It connects the lamina to the stem.

Leaf base

The basal part of the leaf with which it is attached to the stem is called leaf base. The leaf base may bear two small lateral leaf-like structures called stipules.

Normal functions of leaf

1. Synthesis of Food: Leaves produce food by photosynthesis.



2. Exchange of Gases: Leaves exchange gases through stomata. Plants take in carbon dioxide and give out oxygen during photosynthesis. They take in oxygen and give out carbon dioixide during respiration. This is called exchange of gases in plants.

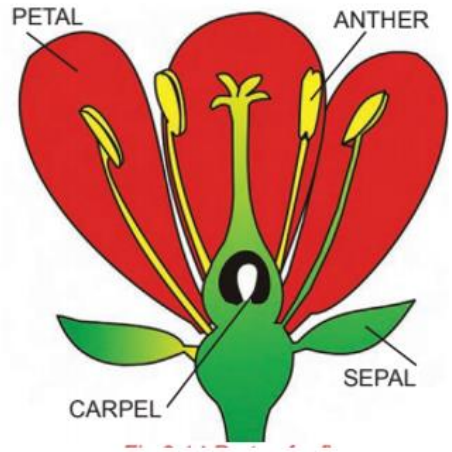
3. Transpiration: The loss of excess water from the leaf in the form of water vapour through stomata is called transpiration.

Flower

Flower is called the reproductive part of a plant because it helps in sexual reproduction. The flower changes into fruit after pollination and fertilization. Like leaves, flowers also have stalk. The stalk of a flower is called pedicel. There are stalk less flowers also.

eg. Banana.

Parts of a typical flower



A flower has four parts, viz. Calyx, Corolla, Androecium and Gynoecium.

Calyx: The green, leaf like parts in the outermost circle of a flower are called sepals. They protect the flower when it is a bud.

Corolla: The brightly coloured parts of a flower are called Petals. They are the second part of the flower.

They can be of different colours, shapes and sizes.

Androecium: The stamen is the third part of a flower. It is the male part of the flower. Each stamen consists of a stalk called filament and a bag like structure on the top of filament called anther. Anther forms pollen grains which are the male gametes.

Gynoecium: It is the inner most part of the flower. It is the female part of a flower. A carpel has three parts. The upper part of the carpel is the stigma. The middle part is called style. The lower swollen part is called ovary. Ovary contains ovule which has the egg (female gamete).

Uses of a Flower

Flowers are used to make perfumes, medicines and for ornamental purposes.

Modifications Ofroot, Stem And Leaves

Root, stem and leaf have their normal functions as mentioned earlier. In addition to the normal functions, some of the roots, stems and leaves change their shape and structure to do extra functions. Modifications of Tap Root:

1. Storage Roots:

The tap root becomes thick and fleshy due to storage of food materials. Based on the shape of the root, they are

a) Conical: The root is broad at the apex and gradually tapers towards the base like acone.

eg: Carrot

b) Fusiform: When the root is swollen in the middle and tapers gradually towards both the ends like a spindle, it is called fusiform.

eg: Radish.

c) Napiform: When the root is swollen at the apex coming almost spherical and tapers suddenly towards the base give a top-like appearance, it is called napiform.

eg: Turnip, beetroot.

2. Respiratory Roots

Plants which grow in saline swamps near the sea shore develop numerous upright aerial roots called respiratory roots. They help in breathing.

eg. Avicennia (vellai alayatri) It is found at Pitchavaram in Tamilnadu.

Modifications of Adventitious Roots

1. Storage Roots

a) Tuberous Roots: Some of the adventitious roots store food and become swollen without any definite shape.

eg. Sweet Potato (chakravalli kizhangu).

b) Fasciculated Roots: The swollen tuberous roots occurring in clusters are called fasciculated roots.

eg. Dahlia.

2. Supporting Roots

a) Prop Roots: A number of roots are produced from aerial branches. These roots grow vertically downward and fix into the ground. These roots act as pillars and give additional support to the main plant. Such roots are called prop roots.

eg. Banyan.

b) Stilt Roots: Plants with delicate stems develop short and thick supporting roots from the basal part of the stem. They fix to the ground and give support.Such roots are called stilt root.

eg. Maize, sugarcane

Fig 3.21 Sugarcane (Karumbu)

ig 3.22 Banyan (Aala maram)

3. Parasitic Roots

Roots of parasitic plants penetrate into the host tissue to absorb nourishment. Such roots are called parasitic roots.

eg. Cuscuta

4. Epiphytic Roots

There are some plants which grow on the branches of other trees for only shelter and not for food. These plants grow some roots which hang freely in the air and velamen tissue in these roots absorb moisture. Such roots are called epiphytic roots.

eg. Vanda (orchid)

Modifications of stem

In addition to the normal functions of stem, the stem also performs certain special functions in some plants. In such cases, either the complete plant or a part of the stem is modified to do those special functions. Such stems are called modified stems.

1. Underground Stem Modifications

Stem of some plants remain underground and do the function of storage. They are of different types.

a) Tuber: It is modified underground stem which develops by swelling of tip of stem. It stores a large amount of food.

eg. Potato.

b) Rhizome: These are thickened stem that grow horizontally under the soil.

eg. Ginger.

2. Sub-Aerial Modifications of Stem

This modification is meant for vegetative propagation. In some plants, branches are weak and they lie horizontal on the ground or may become buried in top soil. Aerial branches and adventitious roots develop at nodes. These are called as Creepers.

The Creepers are of two types.

(a) Runners: eg. Grass, Pumpkin

(b) Stolons: eg. Strawberry.

3. Aerial Stem Modifications

Normally buds develop into branches or flowers. In some plants, the buds undergo modification for definite purpose. Some of the aerial stem modifications are:

a) Stem Tendril: In some plants , the axillary bud is modified into tendril, which helps the plant to coil around a support.

eg. Passion flower, snake gourd.

b) Thorn: In some plants, the axillary bud is modified into thorn for protection.

eg. Bougainvillea.

c) Phylloclade: In some xerophytes, the leaves are reduced to spines. The function of the leaves is taken over by the stem which is green and flat. Such a stem is called Phylloclade.

eg. Opuntia

Modifications Of Leaf:

In some plants, the leaf is modified as under:

a) Leaf Tendril: In some plants, the leaf is modified into slender, wiry coiled structure, known as tendril. They help in climbing.

eg. Pea

b) Leaf-Spine: In opuntia, the leaves are reduced to spines. They are protective in function and prevent transpiration.

eg. Opuntia.

c) Pitcher: In some plants, the leaves are modified into pitcher to trap insects to fulfill their nitrogen deficiency.

eg. Nepenthes.

d) Bladder: In some plants, the leaf is modified into a bladder, to trap insects.

eg. Utricularia. (Bladder-wort)

Kinds Of Stem

Stems of flowering plants attain diverse forms in order to perform their various functions. Based on the texture, stems of plants are grouped under three broad categories.

1) Reduced Stems: In some plants, the stem is reduced to small disc. Nodes and inter-nodes are absent in the disc.

eg. Radish, carrot, turnip, onion.

2) Erect Stems: Most of the flowering plants possess upright erect woody stems.

eg. Bamboo, banyan, eucalyptus, coconut

3) Weak Stems: There are thin, soft and delicate stems which cannot stand erect without support. They are two types.

1. Upright Weak Stems: They may be twiners or climbers

a) Twiners: The stems are long, slender, flexible and very sensitive. They coil around an upright support without any special structure.

eg. bean.

b) Climbers: They climb up the support with some clinging structures

eg. Betelvine (vetrilai), pepper (Milagu).

2. Prostrate Weak Stems: These stems spread over the ground. They may be trailers or creepers.

eg. Tridax (vettukaya poondu).

Movements in Plants

Plants generally do not move from place to place like animals. But the parts of the plant show growth movements in response to some stimuli like sunlight, water, soil, etc. Therefore, the tendency of the plant parts to grow towards or away from the direction of stimuli is called tropism.

1. Tropism

There are three types of tropism.

a) Phototropism: The tendency of the plant parts to grow either towards or away from the direction of sunlight, is called phototropism. Stem grows towards the sunlight. So, stem is positively phototropic. Root grows away from the sunlight. So, root is negatively phototropic.

b) Geotropism: Roots tend to grow towards the soil or gravity. This is called geotropism. Root is positively geotropic and stem is negatively geotropic.

c) Hydrotropism: The roots tends to grow towards the direction of water, whereas stem does not. So, root is positively hydrotropic and stem is negatively hydrotropic.

2. Nastic movement

The plant Mimosa - Touch Me Not (Thotta surungi) is sensitive to touch. When the plant is touched, the leaves fold. The folding of leaves in Mimosa is not due to growth. It is an irregular movement and it is called nastic movement.

Fig 3.37 Geotropism

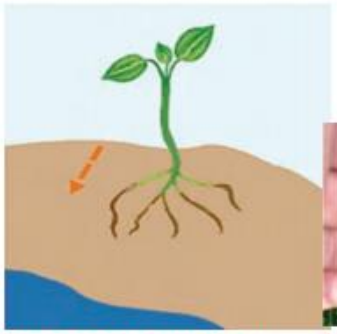


Fig 3.38 Hydrotropism

Nastic movement