Chapter - 1 : Crop Production and Management

Quick Review

- To provide food for a large population, regular production, proper management and distribution of food is necessary.
- When nomadic people settled and cultivated lands, they produced rice, wheat and other crops, then agriculture was born.
- **Crop :** When plants of same kind are grown and cultivated at one place on a large scale, it is called crop. In India, two cropping patterns are found :

  Kharif crops : Grown from June to September (Rainy Season) e.g., paddy, maize, soyabean, etc.

  Rabi crops : Grown from October to March (Winter Season) *e.g.*, gram, pea, mustard, linseed etc.
- **Agricultural Implements :** Tools used for the purpose of various agricultural activities.
- **Main agricultural implements are :**

  (i) Plough **(ii)** Hoe **(iii)** Cultivator **(iv)** Tools used for sowing seeds.
- **Agricultural Practices :**

  General activities undertaken by the farmer over a period of time to cultivate crops are called agricultural practices. They are as follows :

(i) **Preparation of soil :** It is the first step before growing a crop. Soil has to be loosened (The process of loosening and turning of the soil is called tilling or ploughing). This also helps in growth of earthworms and microbes that add humus to it. The ploughed fields have big pieces of soil called crumbs.

(ii) **Sowing :** Before sowing, good quality seeds are selected. Farmers are advised to use good, healthy and high yielding seeds.
Methods of Sowing : Sowing is done either manually or by using machines. Some methods are –

(a) **Traditional Tools :** It was used by farmers. It has an upper funnel shaped part which is filled by seeds. The seeds pass down through two or three pipes having sharp ends that pierce into the soil and place seed in that space.

(b) **Manual Sowing :** In this method, the seeds are scattered in the entire field unevenly by sprinkling them into the soil by hand. This process is called broadcasting.

(c) **Seed Drill :** It is a mechanical method of sowing by using a tractor. Seed drill is a long iron tube having funnel at top. This is tied with the plough and seeds are put into the funnel of seed drill. This method protects the seeds from the damage caused by birds. It also saves time and labour.

(iii) **Adding manures and fertilizers :** The substances that are added to the soil in the form of nutrients for the healthy growth of plants are called manures and fertilizers.

Manure : It is an organic substance obtained from the decomposition of plant or animal wastes.

Fertilizers : These are chemical substances which are rich in a particular nutrient, *e.g.*, urea, ammonium sulphate, super phosphate, potash, NPK.

Advantages of Manure over Fertilizers :

The organic manure is considered better than fertilizers. This is because—

(a) it enhances the water holding capacity of the soil.

(b) it makes the soil porous due to which exchange of gases becomes easy.

(c) it improves the texture of the soil.

(iv) **Irrigation :** The supply of water to crops at different intervals is called irrigation. Sources of irrigation are—wells, tubewells, ponds, lakes, rivers, dams and canals.

Methods of Irrigation :

(a) **Traditional methods :** Water available in wells, lakes and canals is lifted up by different methods :

(i) Moat (Pulley system) **(ii)** Chain pump
(iii) Dhekli and **(iv)** Rahat (Lever system)

(b) **Modern methods :**

(i) **Sprinkler system :** Rotating nozzles sprinkle water as if it is raining. (Useful for sandy soil)

(ii) **Drip Irrigation :** Water falls drop by drop. (Best for fruits and vegetables).

(v) **Protection from weeds :**

- Undesirable plants that naturally grow with plants are called weeds.
- Removal of weeds is called weeding. It can be done by different methods as follows :

  (i) **Manual Weeding :** In this method, the weeds are removed from the crop field by pulling them up by hands and throwing away. Manual weeding is carried out by using trowel or Khurpi.

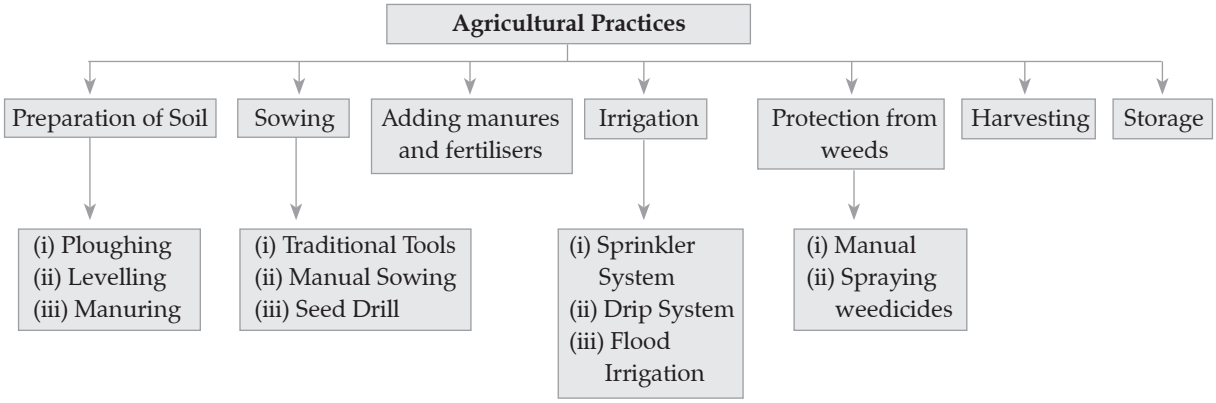
(ii) Spraying Weedicides : Certain chemicals called weedicides (herbicides) like 2,4-D are sprayed in the fields to kill the weeds but crops remain unaffected.

(vi) Protection from pests : Pests are organisms that damage the crops. Pest include rodents (rats) and insects like locusts, termites etc. These are controlled by using insecticides and pesticides.

Know the Terms

- **Agricultural Practices :** Cultivation of crops involves several activities undertaken by farmers over a period of time. These activities or tasks are referred to as agricultural practices.
- **Agriculture :** It is the applied branch of biology which involves the practice of cultivating crops as well as rearing animals.
- **Ploughing or Tilling :** The process of loosening and turning the soil is ploughing or tilling.
- **Sowing :** It is the process of scattering or putting seeds into the soil, so as to grow a new crop plant.
- **Crop rotation :** It is a practice in which different types of crops, especially leguminous or non-leguminous crops are grown alternately in the same field.
- **Mixed cropping :** It is also a method of increasing soil fertility by growing two or more crops together in the same field.

Flowchart



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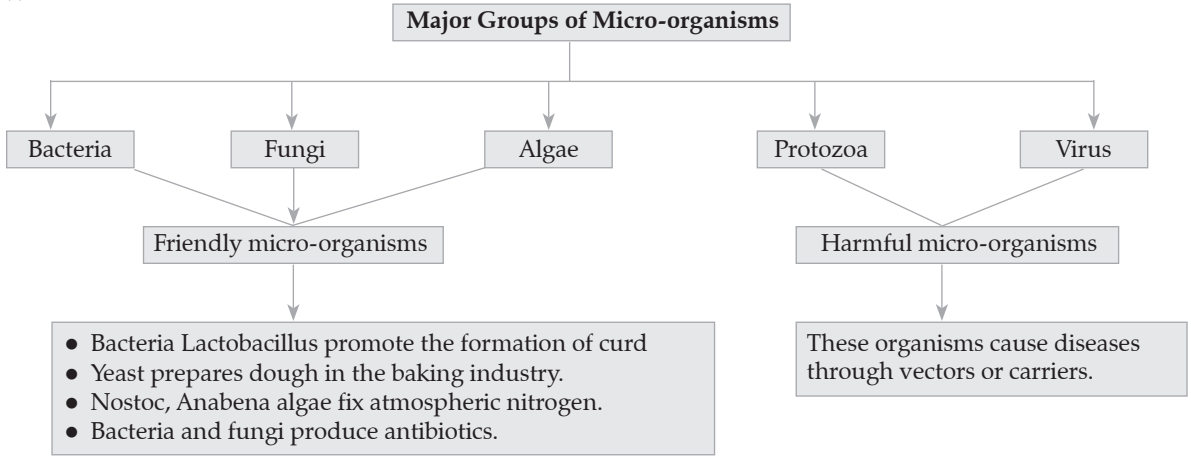
Chapter - 2 : Micro-Organisms : Friend and Foe

Quick Review

- Living organisms that cannot be seen with naked eyes are called **micro-organisms.** As they can be seen with the help of microscope, they are also called microscopic organisms.
- Micro-organisms are classified into four major groups. These are Bacteria, Fungi, Protozoa and some Algae.
- Viruses are also microscopic. They reproduce only inside the cells of host organism.
- Micro-organism may be single-celled (bacteria, some algae and protozoa) or multicellular (algae and fungi). They can survive under all types of environment.
- **Friendly micro-organisms :**
  - They are used in preparation of curd, bread and cake.
  - In cleaning up of the environment.
  - Production of alcohol.
  - Increase soil fertility (Nitrogen fixing bacteria).
  - Bacterium ''Lactobacillus'' forms curd from milk.
- The process of conversion of sugar into alcohol (by yeast) is known as **fermentation**.
- **Louis Pasteur** discovered fermentation in 1857.
- **Medicinal use of micro-organisms :** These days a number of antibiotics are being produced from bacteria and fungi. *e.g.*, streptomycin, and erythromycin.
- In 1929, **Alexander Fleming formed Penicillin**.
- **Edward Jenner** discovered the vaccine for small pox in 1798.
- Several diseases such as cholera, tuberculosis, small pox and hepatitis can be prevented by vaccination.

- **Harmful micro-organisms :**
  - Disease causing micro-organisms are called **pathogens**.
  - Microbial diseases that can spread from an infected person to a healthy person through air, water, food and physical contact are called communicable diseases. *e.g.*, cholera, common cold and chicken pox.
  - There are some insects and animals that act as carriers of disease causing microbes. For example, female **Anopheles** mosquito that carries the parasite of **malaria**. Female **Aedes** mosquito acts as a carrier of **dengue** virus.
- **Some common human diseases caused by microbes :**
  - **Virus :** Measles, Chicken pox, Polio, Hepatitis and Dengue.
  - **Bacteria :** Tuberculosis, Cholera and Typhoid.
  - **Protozoa :** Malaria and Dysentery.
- **Micro-organisms also cause diseases in plants :**
  - **Bacteria :** Citrus canker.
  - **Fungi :** Rust of Wheat.
  - **Virus :** Yellow vein mosaic of Bhindi (Okra).
- Micro-organisms that grow on our food, may produce toxic substances causing **food poisoning.**
- **Food Preservation :** Some chemicals such as sodium benzoate, sodium meta-bi-sulphite are used as preservatives in jams, squashes or in pickles.
  Common salt, oil, vinegar and sugar are also used as preservatives for meat, fish, jams, jellies, fruits, pickles etc.
- **Heat and cold treatment :** Milk is heated at 70°C for 15–30 sec and suddenly chilled and stored. This process was discovered by Louis Pasteur and is called **pasteurization**.
- **Nitrogen Cycle :** Our atmosphere has 78% Nitrogen gas. It is a part of proteins, chlorophyll, nucleic acids and vitamins.
  - The atmospheric nitrogen is taken only by certain bacteria and blue-green algae in the soil.
  - They convert it into nitrogen compounds (Proteins).
  - Animals feeding on plants get these proteins.
  - When plants and animals die, bacteria and fungi present in the soil convert the nitrogenous wastes into nitrogenous compounds to be used by plants again.
  - Certain bacteria convert some part of nitrogenous waste into N_2 gas, which goes back into the atmosphere.
- Microbes also cause diseases in animals, such as anthrax in cattle by bacterium **bacillus anthracis** and in plants such as citrus canker in citrus fruits by a bacteria. Foot and mouth disease is caused in cattles by a virus.
- Rust of wheat is a fungal disease in plants.
- Yellow vein mosaic of bhindi (okra) is a viral disease in plants.
- The carriers of disease causing microbes are called Vectors. For example, female Anopheles mosquito is carrier of malarial parasite (Plasmodium) and female Aedes mosquito acts as carrier of dengue virus.
- **Vaccine :** If dead or weakened microbes for a particular disease are introduced in a healthy body, the body produces suitable antibodies. These antibodies remain in the body for a long time and protect us from disease-causing microbes. The substance that is injected in the body to trigger it to produce its own defence mechanism is called **vaccine.**
- The medicines that kill or stop the growth of micro-organisms in our body are called **antibiotics.**
- The unnecessary administration of antibiotics should be avoided as they may be harmful for various body organs and become less effective in future.
- When disease causing microbes enter our body our defensive mechanism produces substances to fight disease causing microbes. These substances are called **antibodies.**

Flowchart



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Chapter - 3 : Synthetic Fibres and Plastics

Quick Review

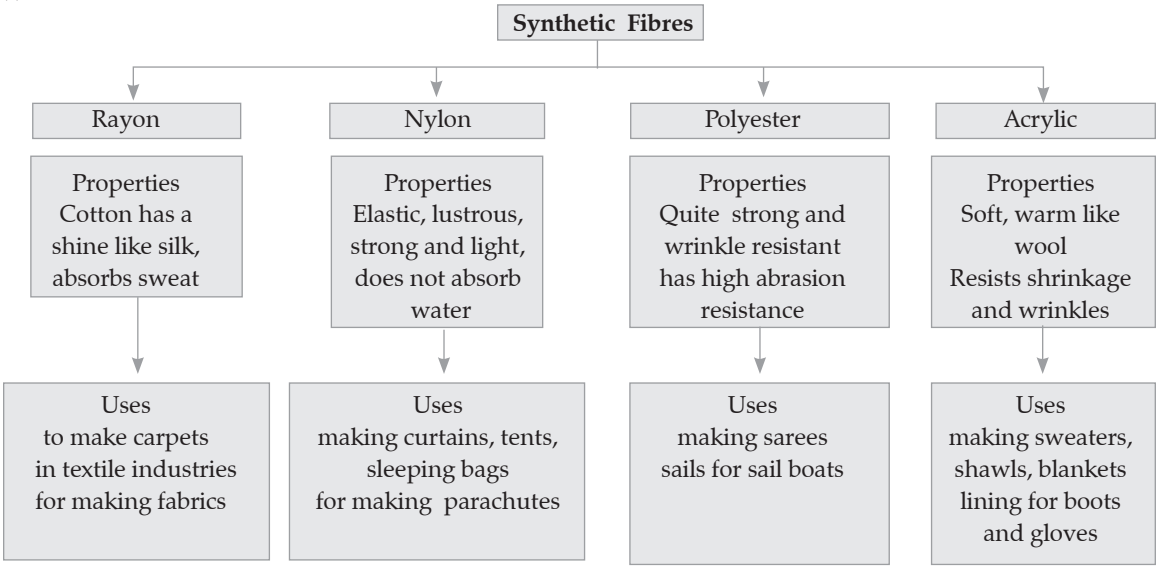
- Fibres are used for making a large variety of household articles. Fabrics are made from natural or synthetic fibres.
- **Natural fibres :** Cotton, wool, silk etc.
- **Synthetic fibres :** Nylon, polyester, artificial silk etc.
- Synthetic fibre is a chain of small units joined together. Each small unit is a chemical substance. Many such small units combine to form a large single unit called a polymer.
- Cellulose is polymer made up of large number of glucose units.
- Nylon is man-made fibre which was made without using any natural raw material and was prepared from coal, water and air. (First fully synthetic fibre).
- Nylon is used to make socks, ropes, tents, toothbrushes, car seat belts, sleeping bags, curtains, parachutes etc. It is stronger than a steel wire.
- Rayon or artificial silk is obtained by chemical treatment of wood pulp. It has properties similar to those of silk. Rayon is made from naturally occurring polymer (cellulose) present in wood pulp, therefore, it is a semi-synthetic fibre. It absorbs sweat.
- Rayon is used in textile industry for making fabrics, to make carpets, in medical field to make bandages and surgical dressings.
- Polyester is another synthetic fibre made of ester units. It is wrinkle free, remains crisp and is easy to wash. Terylene and Dacron are common examples.
- PET is a very familiar form of polyester. It is used to make bottles, utensils, films, wires and many other useful products.
- Polyester is actually made up of the repeating units of a chemical called an ester.
- Polycot is a mixture of polyester and cotton. Polywool is a mixture of polyester and wool.
- Acrylic is a synthetic fibre. It is light weight, soft and warm with a wool-like feel. Clothes made from acrylic are relatively cheaper but more durable than those made from natural wool. It resists shrinkage and wrinkles.
- Acrylic is used for making sweaters, shawls, blankets. It is also used for making lining for boots and gloves.
- **Characteristics of Synthetic fibres :**
  - Synthetic fibres are very strong and durable.
  - They absorb very little water, so dry up quickly.
  - These are wrinkle resistant and do not shrink.
- **Disadvantages of Synthetic Fibres :**
  - Synthetic fibre catches fire easily, it melts, on heating and sticks to the body of the person wearing it.
  - These clothes are not suitable for wearing during hot summer weather as these clothes do not have sufficient pores for the sweat to come out, evaporate and cool our body.
- Plastic is also a polymer.
- Thermoplastics are such plastics that get deformed easily on heating, *e.g.*, Polythenes and PVC.
- Thermosetting plastics are some plastics which, when molded once, cannot be softened by heating, *e.g.*, Bakelite and melamine.
- Plastics are not environment friendly. They take several years to decompose, do not burn easily and release lots of poisonous fumes in the environment.
- As responsible citizens, remember the 4R principle : Reduce, Reuse, Recycle and Recover.
- **Plastics as Materials of Choice :** Due to various qualities, plastics are used in our everyday life.
  - Plastics are **non-reactive :** They do not react with air, water and do not corrode easily. So, they are used to store various materials, including many chemicals.
  - Plastics are light, strong and **durable :** They are cheaper than metal. Moreover, higher strength and light weight makes plastics, a better choice for industries and household articles.
  - Plastics are poor conductors of heat and electricity **:** Handle of screw drivers and handles of frying pans are made of plastics. Special plastic cookware is used in microwave ovens for cooking food.
- Teflon is a special plastic on which water and oil do not stick. It is used for non-sticking coating on cook wares.
- Melamine plastic coatings on uniforms of firemen make them flame resistant.

Know the Terms

- **Polymers :** A polymer is an aggregated structure consisting of numerous small simple molecules of one or more kind, called monomers.
- **Cellulose :** It is natural polymer, occurring in the wall of plant cells.
- **Thermoplastics :** Plastics which get deformed easily on heating and can be bent easily are known as thermoplastics. Polythene and PVC are some examples of thermoplastics. These are used for manufacturing toys, combs and various types of containers.

- **Thermosetting plastics :** Plastics which when molded once, cannot be softened by heating are called thermosetting plastics. Bakelite and melamine are examples of thermosetting plastics.
- **Biodegradable :** The materials which get decomposed through natural processes such as action by bacteria and other microbes like fungi are known as biodegradable materials.
- **Non-Biodegradble :** The materials which are not easily decomposed by natural processes are known as non-biodegradable materials.

Flowchart



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Chapter - 4 : Materials : Metals and Non-Metals

Quick Review

- Element is the substance which cannot be broken down into two or more simpler substances by chemical reactions. *e.g.*, Hydrogen, helium, carbon, nitrogen, zinc, copper, silver, gold etc.
- All the elements are categorized into two groups : **(a)** metals and **(b)** non-metals.
- The elements which have tendency to lose electrons from their outermost shells are called metals.
- The elements which have a tendency to gain electrons in their outermost shells are called non-metals.
- Some elements which possess characters of both the metals and non-metals are called metalloids *e.g.*, Silicon, germanium etc.
- There are about 110 different elements. They can be broadly grouped into metals and non-metals.
- **Physical properties of metals :**
  - **Malleability :** The property of metals by which they can be beaten into thin sheets.
  - **Ductility :** The property of metal by which it can be drawn into wires is called ductility.
  - **Lustre :** Metal in the pure state generally shines; the shine on the metal is called the metallic lustre.
  - **Sonorous :** Metals produce ringing sounds. They are said to be sonorous.
  - **Conductivity :** Metals are good conductors of heat and electricity.
  - **Solid :** All metals are solid except mercury.
- **Physical properties of non-metals :**
  - Solid non-metals are soft and dull.
  - Non-metals are non-malleable, non-ductile, non-sonorous and bad conductor of heat and electricity.
- **Exceptional properties of metals :**
  - Metals such as Sodium (Na) and potassium (K) are soft and can be cut with a knife.
  - Mercury is liquid at room temperature.
  - Lithium is the lightest metal.
- **Exceptional properties of non-metals :**
  - Graphite is a good conductor of electricity.
  - Iodine and diamond have good shining surfaces.

- **Chemical properties of metals :**
  - **Reaction with oxygen:** Metals except gold and silver react with oxygen to form basic oxides,

e.g.,

$$\underset{\text{(Magnesium)}}{2Mg} + \underset{\text{(Oxygen)}}{O_2} \rightarrow \underset{\text{(Magnesium oxide)}}{2MgO}$$

- **Rusting of iron :**

$$\underset{\text{(Iron)}}{Fe} + \underset{\text{(Oxygen)}}{O_2} + \underset{\text{(Water)}}{H_2O} \rightarrow \underset{\text{(Iron oxide – rust)}}{Fe_2O_3xH_2O}$$

  - Dull green coating on copper vessel

$$2Cu + \underset{\text{Moist air}}{H_2O + CO_2} + O_2 \rightarrow \underset{\text{(Green coating)}}{Cu(OH)_2} + CuCO_3$$

  - Metal oxides are basic in nature.

    Oxide of sodium forms sodium hydroxide.

$$Na_2O + H_2O \rightarrow 2NaOH$$

This NaOH turns red litmus paper to blue.

(As bases turn red litmus paper to blue).

- **Reaction with water :** According to reactivity of metals, they react with water.
  - Sodium, potassium, calcium react with water at room temperature.
  - Iron reacts with water slowly.
- **Reaction with acids :** Acids reacts with metals to liberate hydrogen and salt of metal is formed.

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2$$

$$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$$

- **Reaction with bases :** Metal reacts with bases to produce hydrogen.
- **Displacement reaction :** Some metals are capable of displacing other metals from their solutions.

$$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$$

(Zinc replaces copper from copper sulphate)

- **Chemical properties of Non-metals :**
- **Reaction with oxygen :** Non-metals react with O_2 to form oxides.

$$S + O_2 \rightarrow SO_2$$

Non-metallic oxides are acidic in nature.

$$SO_2 + H_2O \rightarrow H_2SO_3$$

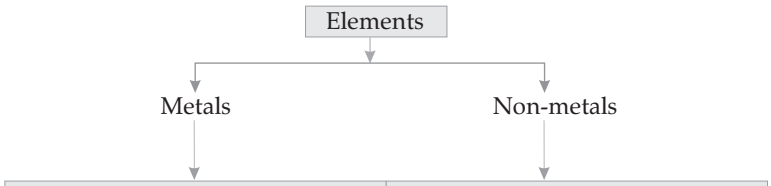
This H_2SO_3 (Sulphurous acid) turns blue litmus paper to red. *i.e.*, it is acidic.

- **Reaction with water :**
  - Non-metals generally do not react with water.
- **Uses of metals :**
  - Metals are used in making machinery, automobiles, aeroplanes, trains, satellites, industrial gadgets, cooking utensils, water boilers and alloys etc.
- **Uses of Non-metals :**
  - They are essential for life, (O_2 and CO_2).
  - Used in fertilizers, (N, P).
  - Used in water purification process, (Bleaching powder).
  - Used as an antiseptic, (Iodine solution).
  - Used in crackers.

Know the Terms

- **Displacement Reactions :** When in a chemical reaction, a more active metal displaces less active metals from their solutions, it is called displacement reaction.
- **Activity Series :** Metals are arranged in the order of their decreasing activity. This arrangement is called the activity series.
- **Alloys :** An alloy is a solid mixture of two or more metals or a metal and a non-metal.
- **Elements :** The substances which are made up of similar kind of particles are called elements.

Flowchart



Metals	Non-metals
i. Metals are lustrous and sonorous.	Non-metals are non-lustrous and non-sonorous.
ii. Metals are malleable and ductile.	Non-metals are not malleable and ductile.
iii. Metals are generally hard.	Non-metals are soft.
iv. Metals are good conductors of heat and elctricity.	Non-metals are bad conductors of heat and electricity.

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Chapter - 5 : Coal and Petroleum

Quick Review

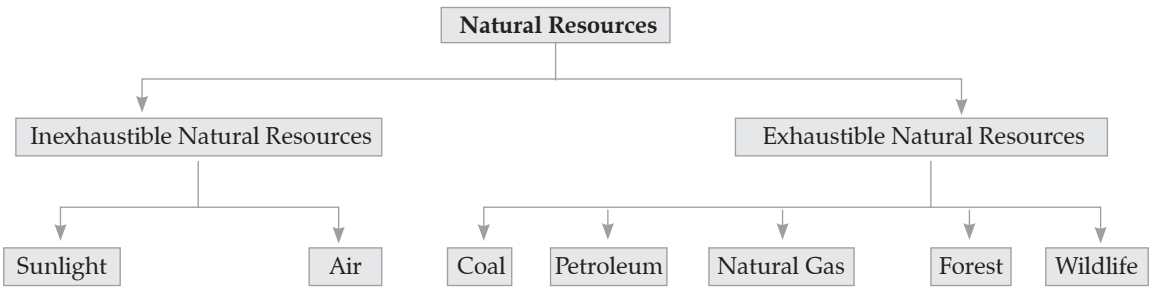
- **Resources :** We have various materials for our basic needs. Some of them are found in nature and some have been made by human efforts.
- **Natural resources :** The various resources which are obtained from the nature are called natural resources, *e.g.*, air, water, soil, etc.
- **Natural resources are of two types as given below :**
  - **Inexhaustible natural resources :** These resources are present in unlimited quantity in nature, *e.g.*, sunlight, air.
  - **Exhaustible natural resources :** The amount of these resources in nature is limited. They can be exhausted by human activities, *e.g.*, forest, wildlife, petroleum gas, etc.
- **Fuels :** Substances that burn in air to give heat and energy are called fuels.
- **Fossil Fuels :** Some exhaustible natural resources like fuel were formed from the dead plants and animals. These are also known as fossil fuels.
- **Coal :** It is fossil fuel. It is formed by the anaerobic thermal degradation of dead plants and animals, which got buried inside the earth over millions of years. Since, it was formed from the remains of plants and animals, so it is called fossil fuel.
- Coal is one of the fuels used to cook food. It is used in railway engines to produce steam to run the engines. It is also used in thermal power plants to produce electricity. Coal is also used as a source of many organic compounds such as benzene, toluene, phenol, etc.
- **Destructive Distillation of Coal :** The process of heating wood or coal in the absence of air is called destructive distillation. When coal is heated strongly in the absence of air in closed retorts, various useful products are obtained.
- **Products obtained from coal :**
  - **Coke :** It is a tough, porous and black substance obtained from coal. It is almost a pure form of carbon.
    Uses : Coke is used as a reducing agent in the extraction of metals such as iron, zinc etc. It is used in the manufacture of steel. It is used as a fuel.
  - **Coal gas :** It is a gas obtained during the processing of coal to get coke. It can be used as a source of light and heat.
    Uses : It is a gaseous fuel obtained during the processing of coal to get coke.
  - **Coal tar :** It is black, thick liquid obtained as the product, during processing of coal to get coke. It is a mixture of 200 substances. Many of its products are used as starting materials for manufacture of large number of substances such as dyes, drugs, perfumes, naphthalene balls.
    Uses : Coal tar was also used for metalling the roads. Now-a-days, a petroleum product bitumen is used for metalling the roads.
- **Natural gas :** It is a very important fossil fuel. Natural gas is stored under high pressure as compressed natural gas (CNG). CNG is very less polluting and cheaper fuel.
- **Petroleum :** It is a dark oily liquid from which many valuable substances, like petrol and diesel are obtained. It is found deep below the earth's crust trapped in rocks in certain areas. It is also called crude oil or mineral oil.

- **Formation of petroleum :** Petroleum was formed from the remains of plants and animals buried under the sea by the decomposition, millions of years ago. The plants and animals which lived in the sea, died and their bodies settled at the bottom of the sea and got covered with mud, sand and clay. Due to high temperature and pressure, and absence of air, these were slowly converted into petroleum and natural gas. Petroleum is extracted by drilling holes (oil wells) in the earth's crust. In drilling, Natural gas comes out first with great pressure and then crude petroleum comes out.
- **Refining of petroleum :** The process of separating the constituents or fractions of petroleum is called refining.
- **Various constituents of petroleum and their uses :**

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

- **Natural resources are limited :** Coal and petroleum are fossil fuels. It required the dead organism million of years to get converted into their fuels. The known reserves will last only a few hundred years. Burning of fuels is a major cause of air pollution. Their use is also linked to global warming. It is therefore necessary that we use these fuels only when absolutely necessary. In India, the PCRA (Petroleum Conservation Research Association) advises how to save petrol/diesel, their tips are as below :
  - Drive at a constant and moderate speed as far as possible.
  - Switch off the engine at traffic lights or at a place where you have to wait.

Flowchart



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Chapter - 6 : Combustion and Flame

Quick Review

- A chemical process in which a substance reacts with oxygen to give off heat is called combustion. The substance that undergoes combustion is said to be combustible. It is also known as fuel.
- **Example :** When a magnesium ribbon burns, it combines with oxygen of air forming magnesium oxide and produces heat and light.

$$\text{Magnesium} + \text{Oxygen} \rightarrow \text{Magnesium oxide} + \text{Heat} + \text{Light}$$

- **Combustible and Non-Combustible substances :**
  - The substances which burn in air or oxygen are called combustible substances. *e.g.*, Petrol, LPG, Kerosene etc.
  - The substances which do not burn in air or oxygen are called non-combustible substances *e.g.*, water, glass, sand etc.
- **Types of combustion :**
  - **Rapid combustion :** When combustion occurs rapidly, it is called rapid combustion.
  - **Spontaneous combustion :** The type of combustion in which material suddenly bursts into flames, without the application of any apparent cause is called spontaneous combustion eg., Burning of Phosphorus.
  - **Explosion :** When a sudden reaction takes place with the release of heat and light, and evolution of large amount of gas takes place, it is called explosion *e.g.*, fire crackers.
- **Necessary conditions for combustion :** There are three necessary conditions for combustion. These are :
  - Presence of a combustible substance.

- Presence of a supporter of combustion.
- Heating the combustible substance to its ignition temperature.

➢ **Ignition Temperature :** The lowest temperature at which a substance catches fire and starts burning is called its ignition temperature. A combustible substance cannot catch fire if its temperature is lower than its ignition temperature. *e.g.*, burning of matchstick.

➢ **Matchstick :** A mixture of antimony trisulphide, potassium chlorate and white phosphorus with some glue is applied on the head of a match made of suitable wood. When struck against a rough surface, white phosphorus gets ignited due to the heat of friction. These days the head of the safety match contains only antimony trisulphide and potassium chlorate.

➢ When the matchstick is struck against the rubbing surface, some red phosphorus gets converted into white phosphorus.

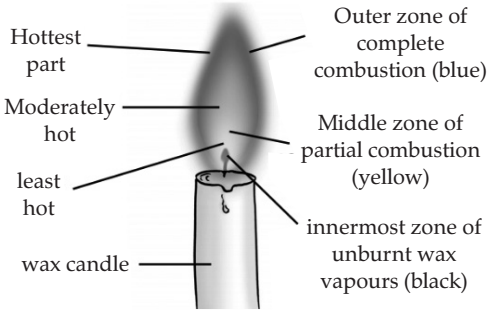
➢ **Fire extinguishers :** A substance that disrupts the contact between the air and the fire is called fire extinguisher.

- Fire brigade pours water on the fire. Water cools the combustible material so that its temperature is brought below its ignition temperature. This prevents the fire from spreading.
- For fire involving electrical equipments and inflammable materials like petrol, carbon dioxide is the best extinguisher. CO_2 being heavier than oxygen, covers the fire like a blanket, and the fire is controlled.

➢ **Flame :** A flame is a region where combustion of gaseous substance or vapour takes place.

➢ **Zones of Flames :**

- **Black Zone :** Innermost zone of unburnt vapours.



Different Zones of Candle Flame

- **Bright and Luminous Zone :** It is middle zone; brightness of this zone is due to the glow of unburnt carbon particles.
- **Blue Zone :** It is the outer zone of complete combustion. It is the hottest and non-luminous zone.

➢ **Ideal or Good Fuel :**

- Readily available
- Cheap
- It burns easily in air at a moderate rate.
- It produces large amount of heat.
- It does not leave behind any undesirable substances.

➢ **Calorific Value :** The amount of heat energy produced on complete combustion of 1 kg of fuel is called its calorific value. Its unit is kilojoule per kg (kj/kg).

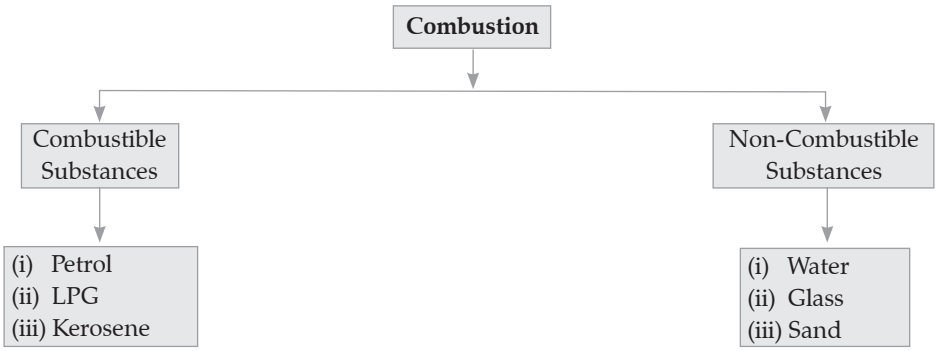
➢ **Burning of fuels leads to harmful products :**

- Carbon fuels such as wood, coal and petroleum release unburnt carbon particles. These fine particles are dangerous pollutants causing respiratory diseases such as asthma.
- Incomplete combustion of these fuels gives 'CO' *i.e.*, carbon monoxide gas. It is a very poisonous gas.
- Combustion of most fuels releases carbon dioxide in the environment, increased concentration of carbon dioxide in the air is believed to cause **global warming**.
- Burning of coal and diesel releases sulphur dioxide gas. These oxides dissolve in rain water and form acids. Such rain is called **acid rain.**

Know the Terms

- **Inflammable Substances :** The substances which have very low ignition temperature and can catch fire easily with a flame are called inflammable substances, *e.g.*, Petrol, alcohol, LPG etc.
- **Fuel :** A substance which produces heat on burning is called a fuel. These are the sources of heat energy. These fuels can be in solid, liquid or in gaseous state.

Flowchart



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Chapter - 7 : Conservation of Plants and Animals

Quick Review

- A great variety of plants and animals exist on the earth. They are essential for the well-being and survival of mankind.
- A major threat to survival of these organism is deforestation.
- Trees in the forest are cut for some of the purposes mentioned below :
  - Producing land for cultivation.
  - Building houses and factories.
  - Making furniture or using wood as fuel.
- Natural calamities causing forest fires and severe droughts.
- **Effects of deforestation :**
  - Deforestation causes increase of atmospheric temperature due to increase in concentration of carbon dioxide leading to global warming.
  - Severe drought and flood.
  - Deforestation changes the nature of soil, water holding capacity and soil erosion.
  - Deforestation causes the destruction of habitat of wildlife, its survival becomes difficult.
- **Biosphere** is that part of the earth in which living organism exist or which supports life.
- **Biological diversity** refers to the variety of organisms existing on the earth, their inter-relationships with the environment.
- To protect our flora and fauna and their habitats, protected areas called sanctuaries, national parks and biosphere reserves are formed.
- **Sanctuaries :** Areas where animals are protected from any disturbances to them and their habitats.
- **National Parks :** The areas reserves for wildlife where they can freely use the habitats and natural resources.
- **Biosphere Reserves :** Large areas of protected land for conservation of wild life animals, plants and traditional life of the tribals living in the area.
- The plants and animals found in a particular area are termed as flora and fauna of that area.
- **Endemic species** are those species of plants and animals which are found exclusively in a particular area.
- **Species** are a group of population that are capable of interbreeding.
- **Wildlife sanctuaries** provide protection and suitable living conditions to wild animals, where killing (Poaching) or capturing of animals is strictly prohibited.
- **National parks** are large areas to protect whole set of ecosystems. They protect flora, fauna, land space and historical objects of that area. Satpura National Park is the first reserve forest of India. The finest teak is found in this forest.
- Project tiger was launched by the government to protect tigers in the country.
- Animals whose numbers are diminishing to a level that they might face extinction are known as the endangered animals.
- An ecosystem is made up of all the plants, animals and micro-organisms in an area along with non-living components such as climate, soil, river deltas etc.
- **Red Data Book** is the source book that keeps a record of all the endangered species of animals and plants.
- Migratory birds fly to far away areas every year during a particular time because of climate changes. Birds who cover long distances to reach another land are known as migratory birds.
- **Recycling of Paper :** Paper is made from wood pulp that is produced from the wood of forest trees. Therefore, it is one of the important products we get from the forests and thus, a major cause of deforestation.

- 'Recycling of paper' is the process to make new paper from the waste paper that can be used again.

➢ We should save, reuse and recycle for the following reasons :

- To save forests trees from being cut.
- To save water used in paper making.
- To save energy (electricity) used in making paper.
- To reduce the amount of harmful chemical used in paper making.

➢ **Reforestation** is restocking of the destroyed forests by planting new trees. It can take place naturally also, if deforestated area is left undisturbed.

➢ **In India, there are following conservation acts to save forests :**

- The Government of India has enacted a Forest Conservation Act (1980).
- The Chipko Andolan.
- The Joint Forest Management Programme.

Know the Terms

➢ **Deforestation :** A forest is a large area covered with trees and plants. It provides habitats for animal and plants. The process of clearing away forests by cutting them down or burning them is called deforestation.

➢ **Biodiversity :** It refers to the variety of organisms existing on the earth, their inter-relationships and relationships with the environment.

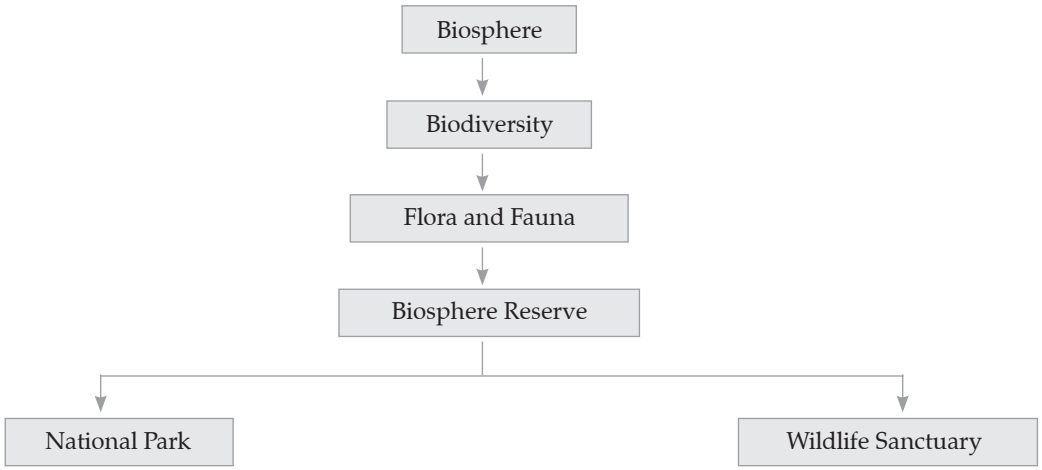
➢ **Species :** It is a group of population which is capable of interbreeding. This means that the members of a species can reproduce fertile offsprings only with the members of their own species.

➢ **Endangered Animals :** Animals whose numbers are diminishing to a level that they might face extinction are called endangered animals.

➢ **Extinct Animals :** The species which no longer exist anywhere on the earth are called extinct animals.

➢ **Migration :** The process of an animal (or bird) to move from one place to another on the basis of season is called migration.

Flowchart



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Chapter - 8 : Cell-Structure and Functions

Quick Review

➢ **Cell :** Cell is the basic structural and functional unit of living organisms.

➢ Robert Hooke in 1665 observed slices of cork under a simple magnifying device. He observed cells in the cork.

➢ The egg of a hen represents a single cell, and can be seen by naked eye.

➢ Cell can be seen by microscope.

➢ Organisms made of more than one cell are called multicellular organisms.

➢ A single celled organism is called unicellular. *e.g.*, Amoeba, Protozoa.

➢ A single celled organism performs all the functions such as digests food, respires, excretes, grows and reproduces within the cell.

➢ Group of cells performing same function is called tissue.

➢ Shape and size of the cell depends on the function performed by it.

- Generally, cells are round, spherical, or elongated. Some cells are long and pointed at both the ends. They are spindle shaped. Some are long and branched like nerve cells.
- Components of the cell are enclosed in a membrane. It provides shape to the cells of plants and animals.
- Plant cells have additional covering called cell wall.

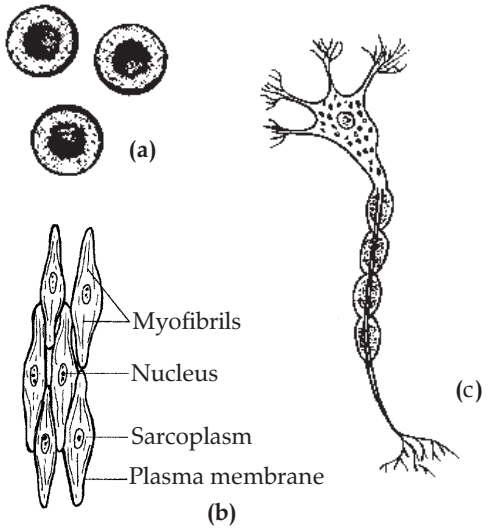


Fig. (a) Spherical Red Blood Cells of Humans, (b) Spindle Shaped Muscle Cells, (c) Long Branched Nerve Cells.

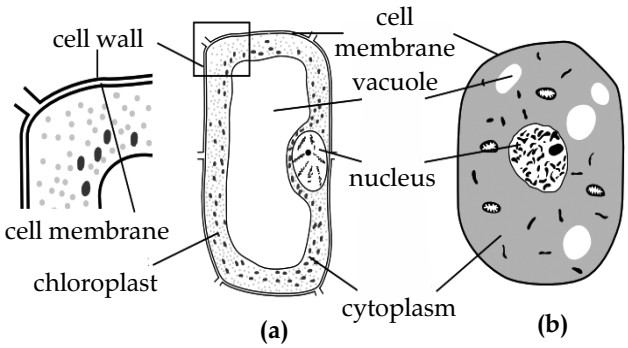


Fig. Plant and Animal Cell (Eukaryotic Cells)

- The smallest cell is 0.1 to 0.5 micrometer in bacteria. The largest cell measuring 170 mm × 130 mm is the egg of an ostrich.
- A tissue is a group of similar cells performing a specific function.
- Tissues make organs and organs make organ system which performs different functions such as digestion, assimilation and absorption.
- **Parts of the cell:**

- **Cell membrane :** The cytoplasm and nucleus are enclosed within the membrane. It is also called the plasma membrane. It is porous and allows the movement of substance or material both inward and outward.
- **Cytoplasm :** The jelly like substance between the nucleus and the membrane is called cytoplasm.
- **Cell wall :** An outer thick layer in cells of plants is called cell wall.
- **Organelles :** Various other components of cells are present in the cytoplasm. These are mitochondria, golgi bodies, ribosomes etc. called cell organelles.
- **Nucleus :** The central dense round body is called the nucleus. Nucleus is separated from the cytoplasm by a membrane called the nuclear membrane. It is also porous. It has a smaller spherical body called nucleolus. Nucleus contains thread like structures called chromosomes. These carry genes and help in inheritance or transfer of characters from the parents to the offsprings.

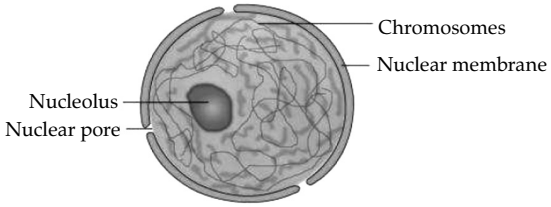


Fig. Ultra Structure of Nucleus

- **Cells are divided into :**
  - **Prokaryotic cells :** The cells having nuclear material without the nuclear membrane.
  - **Eukaryotic cells :** The cells having well organized nucleus with nuclear membrane.

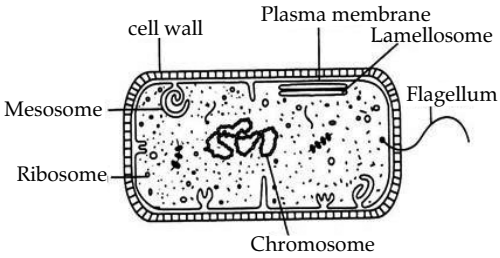


Fig. A generalised prokaryotic cell of a bacterium

- **Vacuole :** Plant cells have large vacuole whereas animal cells have small vacuoles.
- **Plastids :** Plastids are found in plant cells. They are of different colours. Some of them contain green pigment called chlorophyll. Green coloured plastids are called chloroplasts.

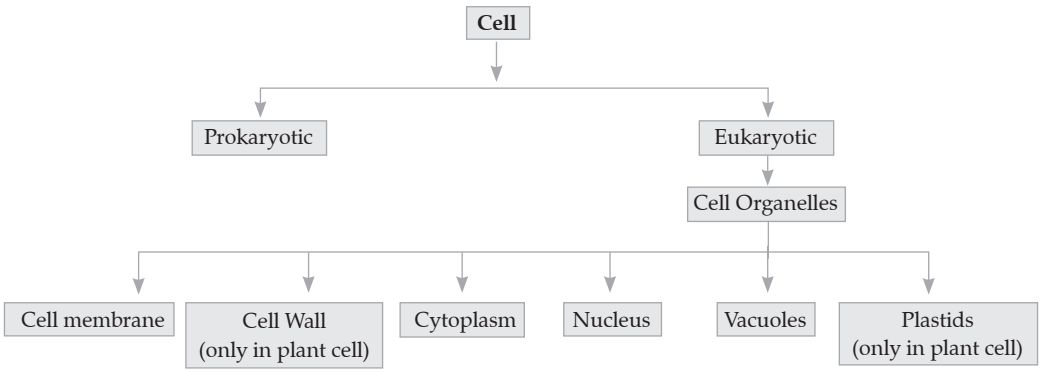
- **Comparison between Plant cell and Animal cell :**

S.No.	Part	Plant Cell	Animal Cell
(1)	Cell membrane	Present	Present
(2)	Cell wall	Present	Absent
(3)	Nucleus	Present	Present
(4)	Nuclear membrane	Present	Present
(5)	Cytoplasm	Present	Present
(6)	Plastids	Present	Absent
(7)	Vacuole	Present (large)	Present (small)

Know the Terms

- **Unicellular and Multicellular :** Organisms that are made up of more than one cells are called multicellular organisms. Organisms made up of single cell are called unicellular organisms. They are able to carry out all metabolic functions essential for life in a single cell *e.g.*, Amoeba, Paramecium etc.
- **Pseudopodia :** Amoeba is capable of changing its shape with the help of cytoplasmic projections of varying length that protrude out of its body called pseudopodia. It helps in digestion and locomotion in Amoeba.
- **Organ :** An organ is made up of tissues which in turn, are made up of cells. The cell in a living organism is the basic structural unit.
- **Chromosomes :** The thread like structures, present inside the nucleus are called chromosomes and are visible only during cell division. They contain genes.
- **Gene :** It is a unit of inheritance in living organisms. It controls the transfer of hereditary characteristics from parents to offsprings in different combinations, that result in different new characteristics.
- **Protoplasm :** It is the living substance including the entire contents of cell, *i.e.*, cytoplasm and nucleus.

Flowchart



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Chapter - 9 : Reproduction In Animals

Quick Review

➢ **Reproduction :** The process through which living beings produce new young ones of their own kind is called reproduction. It is essential for :

- the continuation of species
- addition of new species
- replacement of dead organisms
- transfer of variations from one generation to another.

➢ **Modes of Reproduction :** Like plants, animals also reproduce by (i) Sexual reproduction and (ii) Asexual reproduction.

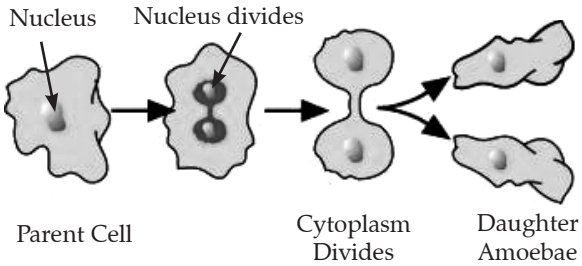
- **Sexual Reproduction :** The type of reproduction beginning from the fusion of male and female gametes is known as sexual reproduction. In this process of sexual reproduction, a male and a female gamete (reproductive cells) fuse to form a single cell called Zygote. This zygote gradually develops into an adult, similar to the parents. The individual that grows from a zygote, receives characters of both the parents – mother and father.
- **Asexual Reproduction :** The type of reproduction in which only a single parent is involved is called asexual reproduction. In asexual reproduction, sex cells (gametes) are not produced. No fusion of gametes takes place for the production of zygote or offsprings.

There are many forms of asexual reproduction. Some of them are :

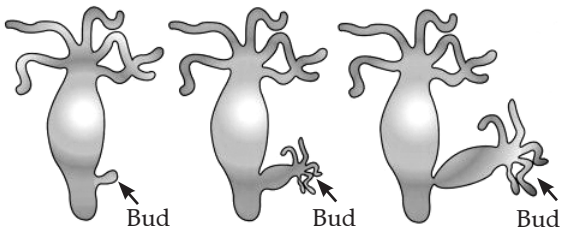
(i) Binary Fission : In this, a parent cell divides into two daughter cells (both nucleus and cytoplasm divide), which grow and mature into two separate new individuals. *e.g.*, Amoeba, Paramecium.

Amoeba reproduces by this method under favourable conditions.

Firstly, the nucleus divides into two, it is followed by the division of the cytoplasm. A constriction develops in the body which gradually deepens to form two daughter Amoebae which grow into full size.



(ii) Budding : In this type of asexual reproduction a bulge or bud develops from the parent body. This bud enlarges, gets detached from parent and develops into a similar/identical organism and can live independently when separated from the parent *e.g.*, Hydra, Yeast etc.



➢ **Significance of Asexual Reproduction :**

- It is an easy and quicker method of reproduction. As only single parent is involved, the genetic constitution of the species is preserved.
- The reproductive parts in humans and the process of reproduction in them : In humans, male and female reproductive parts are present in separate individuals.

➢ **Male Reproductive Organs :** Male human reproductive organs contain :

- A pair of testes (singular – testis), two sperm ducts and a penis.
- The testes produce the male gametes called sperms.
- The sperm ducts carry sperms to the penis.
- The penis is used for ejecting sperms and also passing urine. The tail in sperm helps in movement of the sperm to reach the egg in the female sex organs.
- A human sperm is unicellular (single celled), has a head, a middle piece and a tail.

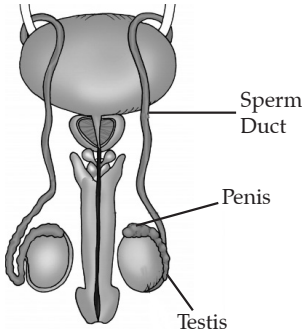


Fig. Male Reproductive Organs

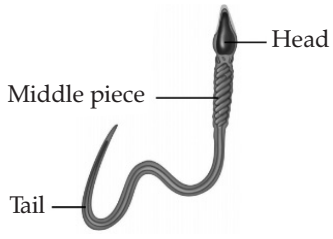


Fig. Human Sperm

➢ **Female Reproductive Organs :** Female human reproductive organs contain :

- A pair of ovaries which produce female gametes called ova (eggs).
- **Oviduct (fallopian tubes) :** A single matured egg is released into the oviduct by one of the ovaries every month.
- **Uterus :** Uterus is the part where development of the baby takes place.

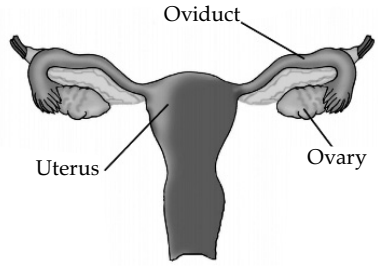


Fig. Female Reproductive Organs

- **Egg (ovum) :** Like a sperm, an egg is also a single cell. It contains a nucleus and the cytoplasm. The egg may be very small as in humans, much larger as in ducks and hens. Ostrich egg is the largest.

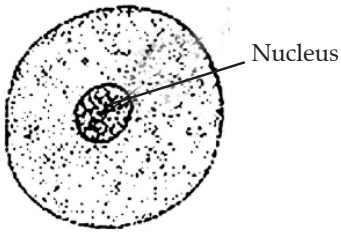


Fig. Human Ovum

- **Fertilization :** The fusion of a sperm with an egg is called fertilisation. During fertilisation, the nuclei of the sperm and the egg fuse to form a single nucleus. This results in the formation of a fertilized egg called Zygote.

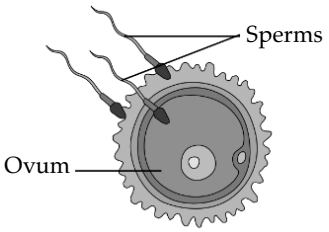


Fig. Fertilization

➢ **Development of Embryo :**

- Fertilization results in zygote. Zygote begins to develop into embryo.
- These cells begin to form groups that develop into different tissues and organs.
- This developed structure is called embryo.
- Embryo continues to develop in the uterus.
- The stage of the embryo in which all the body parts can be identified is called foetus
- When development of foetus is complete, the mother gives birth to a baby.

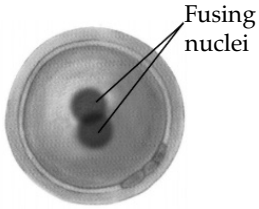


Fig. Zygote

- **Life-cycle of Animals :** Sexually reproducing animals start their life from a zygote which develops into an embryo that grows into mature adult. The adult produces sex cells (egg and sperm). The fusion of sperm and egg leads to zygote. This whole cyclic order is known as **life-cycle.**
- In some animals, the young ones may look very different from the adult. For example, in case of frog, fertilized egg (zygote) develops into tadpole (larva) which later develops into adult frog.

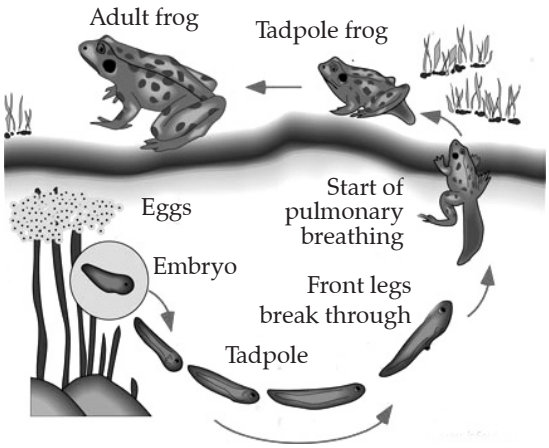
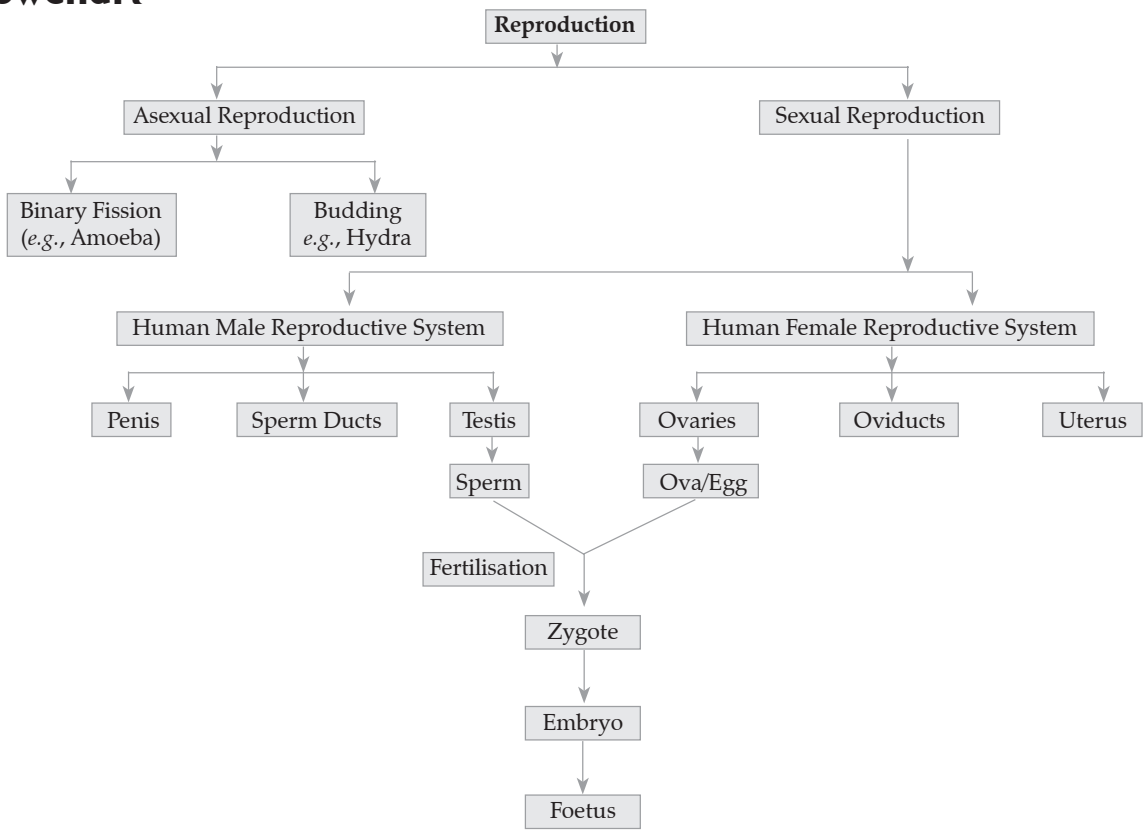


Fig. Life Cycle of Frog

Know the Terms

- **Gametes :** The special reproductive cell formed by male and female individuals that takes part in sexual reproduction is called gamete. It is haploid in nature. Male gametes are called sperms, while female gamete is called ovum or egg.
- **Internal Fertilization :** Fertilization which takes place inside the body of the female is called internal fertilisation. For Example : as in humans, dogs, cows, birds etc.
- **External Fertilization :** Fertilization which takes place outside the body of the female is called external fertilisation. It is very common in aquatic animals, such as fish, starfish and amphibians (animals who live in water as well as on land such as frogs).
- **IVF or invitro Fertilisation :** The fertilisation of an egg that takes place outside the body in a test tube or in any other apparatus is known IVF or invitro fertilisation.
- **Test-Tube Babies :** In this technique freshly released egg and sperms are put together for a few hours for IVF. In case fertilisation occurs the zygote is allowed to develop for about a week and then placed in the uterus of the mother. Complete development takes place in the uterus and the baby is born like any other normal baby. The term test-tube babies is misleading, because babies cannot grow in test-tubes.
- **Embryo :** The stage, when cells produced by the division of the zygote begin to form groups that develop into different tissues and organs of the body, is termed as an embryo.
- **Viviparous :** The animals such as dog, lion, elephant, cat etc., which give birth to young ones are called viviparous.
- **Oviparous :** The animals, such as lizards, butterfly, crow and hen, which lay eggs that hatch and give rise to young ones are called oviparous.
- **Metamorphosis :** The process of transformation of larva to an adult through a series of drastic changes is referred to as metamorphosis such as in frog, silkworm, butterfly etc.
- **Cloning :** It is an artificial method invented by man to produce organ cell or part of living organisms without sexual or asexual reproduction. Sheep named Dolly was cloned by Ian Wilmeut (Scotland).

Flowchart



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Chapter - 10 : Reaching The Age of Adolescence

Quick Review

- **Teenagers :** Generally adolescence begins at the age of 11 and lasts upto 18 or 19 years of age. Adolescents are also called teenagers because they cover the period of the 'teens' *i.e.*, 13 to 18 or 19 years of age.
- **Puberty :** The period of adolescence during which an adolescent reaches sexual maturity and becomes able to have children.
- **Changes at Puberty :**
  - During puberty sudden increase in height takes place. This happens due to elongation of long bones of legs and arms that make a person tall.
  - Girls grow faster than boys by about 18 years of age; both reach their maximum height. The rate of growth in height varies in different individuals.
  - Height of an individual (male or female) depends on the genes inherited from parents. However, right kind of food during growing years is also essential.
- **Calculation for full height (cm) :** The average rate of growth in the height of boys and girls with age given in the chart helps in calculating full height of the individuals.

Age in Years	% of full height	
	Boys	Girls
8	72%	77%
9	75%	81%
10	78%	84%
11	81%	88%
12	84%	91%
13	88%	95%
14	92%	98%
15	95%	99%

16	98%	99.5%
17	99%	100%
18	100%	100%

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

(as given in the chart)

For example : A girl is 9 years old and 120 cm tall. At the end of the growth period she is likely to be

$$\frac{120}{81} \times 100 \text{ cm} = 140 \text{ cm tall (Approx.).}$$

- **Development of Sex Organs :** At the age of puberty male sex organs such as penis, testes are completely developed. Testes begin to produce sperms.
- In girls ovaries enlarge and start releasing mature eggs.
- **Reaching Mental, Intellectual and Emotional Maturity :** Intellectual development takes place and they spend considerable time in thinking.
- **Secondary Sexual Characters :** In boys, testes produce sperms, boys begin to grow facial hair, hair grow under the arms, on their chest and in the region above the thighs and in the pubic region. These are called secondary sexual characters. Male sex hormone testosterone is secreted at the onset of puberty.
- In girls ova are formed. Breasts begins to develop, hair grows under arms and in the region above the thighs or the pubic region. The female sex hormone estrogen is released. Release of sex hormones is controlled by the pituitary gland.
- Endocrine glands release hormones into the blood stream to reach a particular body part called target site. It responds to the hormones.
- In female, the reproductive phase of life begins at puberty and generally lasts till the age of 45 to 50 years. Ovum matures and if fertilization does not occur, the released egg and the thickened lining of the uterus, along with blood is shed off and is called menstruation. It occurs once in 28 to 30 days. The first flow is termed as menarche and stoppage phase is called menopause.
- **Sex Determination (Boy/Girl) :** Sex chromosome present in the nucleus of sperm and ova determines the sex in human beings. Pair of sex chromosomes in female is XX and in male is XY. When sperm carrying X chromosome fuses with ova the child will be a female, whereas when sperm carrying Y chromosome fuses with ova the child will be a male.
- **Hormones :** Hormones are chemical substances secreted by endocrine glands. They are also known as ductless glands. These glands release hormones directly into the blood stream to reach a particular body part known as target site.
- Hormones control the changes that occur at adolescence. The male hormone called testosterone is secreted by the testes at the onset of puberty and in girls, ovaries secrete female hormone or estrogen which makes the breasts develop. Their secretion is under the control of pituitary endocrine gland.
- Reproductive phase lasts for a much longer time in males than in females. The uterine wall in females prepares itself to receive the developing fertilized egg.
- **Hormones other than Sex Hormones :**

S. No.	Name of Endocrine gland	Hormone secreted	Functions
(1)	Pituitary gland	**(i)** Growth hormone **(ii)** Other Hormones	Regulates normal growth of a person to regulate functioning of **(a)** Thyroid gland **(b)** Adrenal gland **(c)** Production of testosterone by testes and estrogen by ovaries.
(2)	Thyroid gland	Thyroxine	Controls body metabolism. Lack of thyroxine causes **Goitre.** Sufficient iodine in diet prevents goitre.
(3)	Pancreas	Insulin	Controls carbohydrate metabolism. Lack of insulin secretion causes **Diabetes.**
(4)	Adrenal Gland	**(i)** Adrenaline **(ii)** Hormone	Maintains correct balance of salt-water in the blood. It helps the body to adjust to stress due to anger, worry or embarrassment.

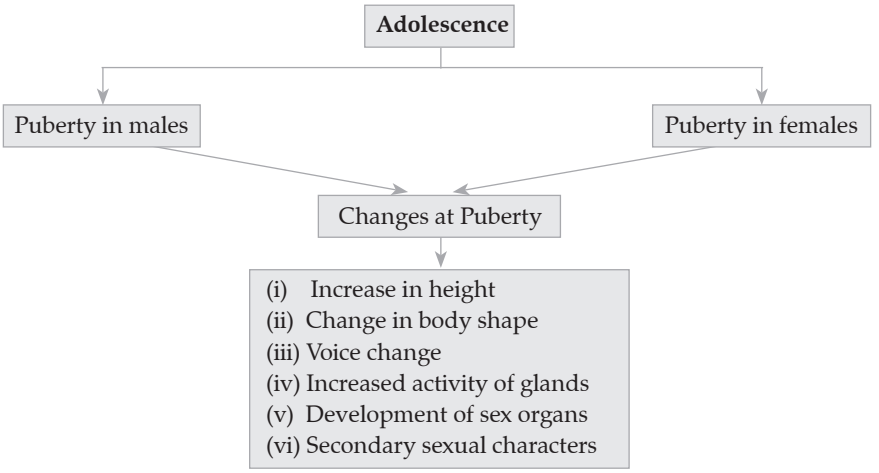
- **Reproductive Health :** The diet for an adolescent has to be carefully planned. He/she should take a balanced diet.
- **Personal Hygiene :** For teenagers the increased activity of sweat glands sometime makes body smelly. All parts of the body should be washed and cleaned properly everyday.
- **Physical Exercise :** Walking and playing in fresh air keeps the body fit and healthy.
- **Say 'No' to Drugs :** If you take some drugs, just say 'No' unless it is prescribed by the doctor. Drugs are addictive. They ruin health and happiness both.

Know the Terms

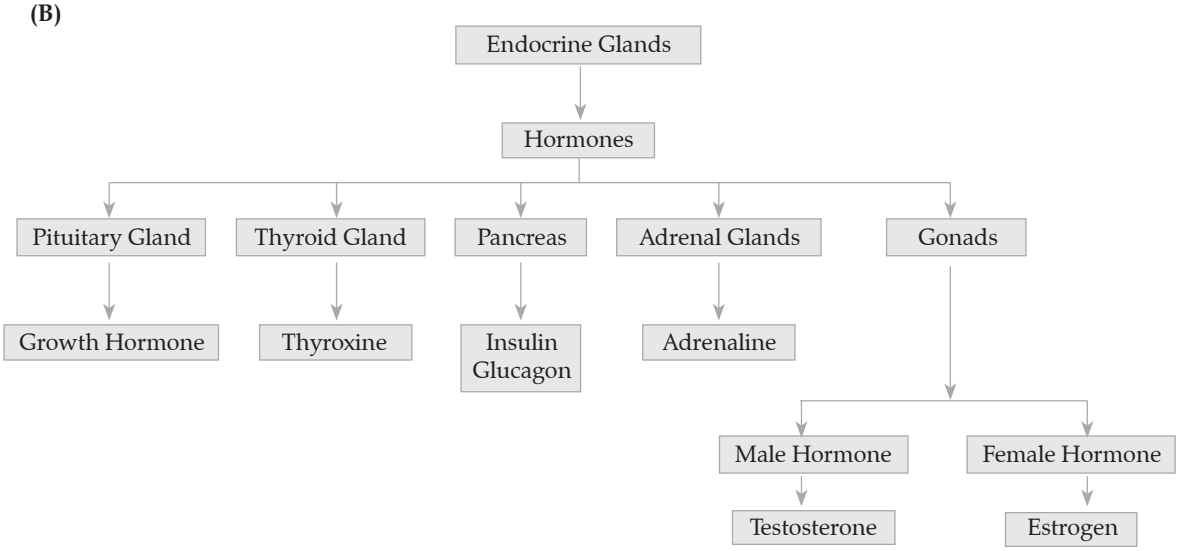
- **Adolescence :** The period of life, when the body undergoes changes, leading to reproductive maturity is known as adolescence.
- **Target Site :** The hormones reach through blood into particular body part. These body parts are called target site.

Flowchart

(A)



(B)



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Chapter - 11 : Force and Pressure

Quick Review

- A push or pull on an object is known as force. The motion imparted to objects is due to the action of a force.
- A moving object like a ball is either made to move faster or slower or its direction of motion is changed. Actions like picking, opening, shutting, kicking, hitting, lifting, flicking, pushing, pulling, are often used to describe certain tasks. Each of these actions usually results in some kind of change in the motion of an object.
- **Forces due to an interaction :** An interaction of one object with another object results in force between the two objects.
- If the magnitude of the applied force or direction of the force changes, its effect also changes.
- The state of motion of an object is described by its speed and the direction of motion. The state of rest is considered to be the state of zero speed, *e.g.*, before hitting football, the ball was at rest and so its speed was zero.
- The application of force on an object may change its shape *e.g.*, the shape of a ball of dough when it is rolled to make a chapati.
- **Exploring Forces :** Forces applied on an object in the same direction add to one another.
- If the two forces act in the opposite directions on an object, the net force acting on it is the difference between the two forces.

- The strength of a force is usually expressed by its magnitude.
- **A Force :**
  - may make an object move from rest.
  - may change the speed of an object if it is moving.
  - may change the direction of motion of an object.
  - may bring about a change in the shape of an object.
  - may cause some or all of these effects.
- **Force can be of two types :**

(i) Contact Force	(ii) Non-Contact Force
Muscular force	Magnetic force
Frictional force	Gravitational force
Mechanical force	Electrostatic force

- The force responsible for changing the state of motion of objects is the force of friction. It always acts on all the moving bodies and its direction is always opposite to the direction of motion.
- **Pressure :** The force acting on a unit area of a surface is called pressure. It is especially true for those forces which act perpendicular to the surface on which the pressure is to be computed.

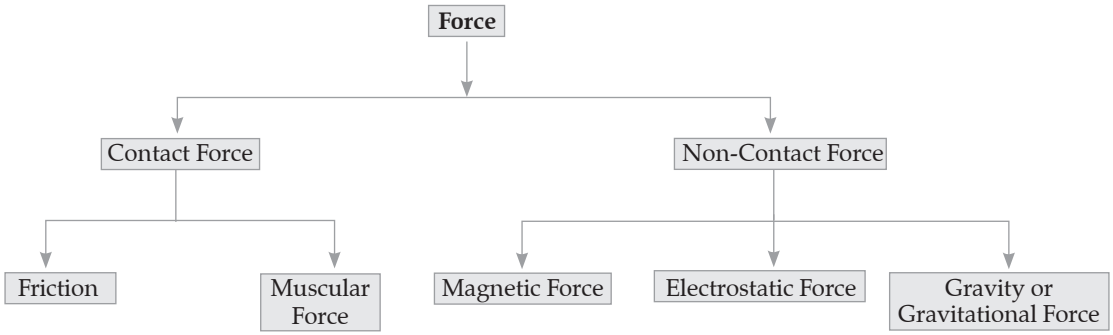
$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

  Lesser the area, greater is the effect of force.
- A porter places a round folded long piece of cloth on his head while carrying heavy load. By doing this he increases the area of contact of the load with his head. So, the pressure on his head at a particular place of head is distributed to adjoining areas. As a result, he finds it easier to carry the load.
- The base of the dam is made quit wide. This reduces pressure exerted by the enormous amount of stored water.
- **Atmospheric Pressure :** The pressure exerted by atmospheric air is termed as atmospheric pressure. This is the weight of air column over a unit area (1 cm^2). For example, the area of head of boy is $10\,cm \times 10\,cm$ is as large as 1000 kg. This heavy weight does not crush us because the pressure inside our body is also equal to the atmospheric pressure as it cancels the pressure outside.
- **Effects of Force :** There are three effects of force :
  - It changes or tries to change direction.
  - It changes or tries to change speed.
  - It changes or tries to change shape.
- At least two objects must interact for a force to come into play.
- Forces applied on an object in the same direction are added to one another.
- If the two equal forces act in the opposite direction, the net force will be zero.
- **Force of friction :** The force of friction always acts opposite to the direction of motion.
- **Electrostatic Force :** The force exerted by a charged body on another charged or uncharged body is called electrostatic force.

Know the Terms

- **Magnitude :** The strength of a force is usually expressed by its magnitude.
- **State of Motion :** The state of motion of an object is described by its speed and the direction of motion. At rest the state of the object is considered the state of zero speed.
- **Muscular Force :** The force resulting due to the action of muscles is known as the muscular force.
- **Contact Force :** Force that can be applied only when it is in contact with an object is called a contact force. For example, muscular force can be applied only when it is in contact with an object. Friction is also an example of contact force. The force of friction always acts on all the moving objects and its direction is always opposite to the direction of the motion.
- **Non-Contact Force :** The force exerted on an object without touching it is known as non-contact force. For example, the force exerted by a magnet on a piece of iron and Electrostatic Force which is force exerted by a charged body on another charged or uncharged body.
- **Gravitational Force (Gravity) :** The attractive force of the earth which acts upon all the objects is known as the force of gravity. Every object in the universe, whether small or large, exerts a force on every other object. This force is called the gravitational force.

Flowchart



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Chapter - 12 : Friction

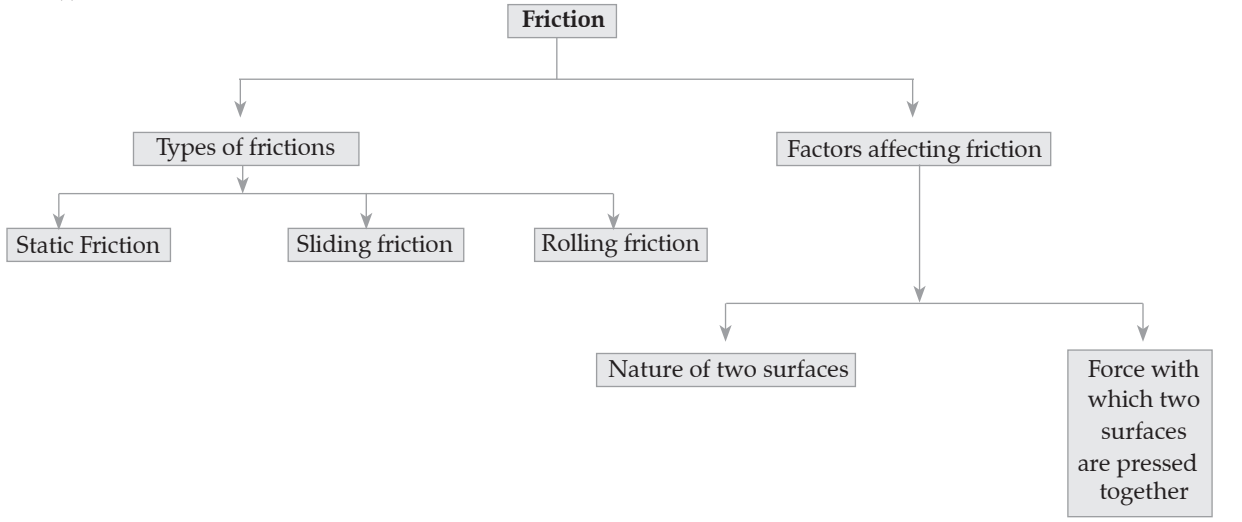
Quick Review

- Any object, moving over the surface of another object slows down when no external force is applied on it. This is due to the force of friction.
- Friction depends on the nature of surfaces in contact.
  - Force of friction is less on smooth surfaces.
  - Force of friction is greater on rough surfaces.
- The force required to overcome friction at the instant when an object starts moving from the rest is a measure of static friction.
- The force required to keep the object moving at a given speed is a measure of sliding friction.
- Friction is a necessary evil that makes us walk, write, hold things etc.
- **Factors affecting friction :**
  - Friction depends on the nature of surfaces in contact.
  - Friction is more between rough surfaces and less in smooth surfaces.
  - Friction depends on how hard the two surfaces press together.
  - Friction is independent of the area of contact.
- **Friction is essential in following ways :**
  - We could not hold articles such as glass tumbler and other things without friction. It becomes very difficult to hold a greasy glass.
  - We could not write with a pen or pencil if there was no friction.
  - When we write with chalk on the blackboard, its rough surface rubs off some chalk particles which stick to the blackboard. It helps us to read what is written on the blackboard with a chalk.
  - Friction helps objects to move, stop or to change the direction of motion. We cannot walk without friction.
  - Without friction no building could be constructed.
- **Friction is an evil :**
  - It wears out materials. For example, soles of shoes, ball bearings, steps of a stair, parts of machines etc.
  - Friction produces heat. When a machine is operated, heat generated causes much wastage of energy.
- We deliberately increase friction in some cases to get the desired results. For example :
  - Soles of shoes are grooved. It is done to provide the shoes better grip on the floor, so that we can safely walk on it.
  - The treated tyres of cars, trucks, buses, bulldozers provide better grip with the ground.
  - Bicycles, scooters, and other automobiles are provided with the brake system. When we press the brake lever, break pads arrest the motion of the rim due to friction. The wheel stops moving.
- Increasing and reducing friction :
  - Friction can be increased by making the contact surface rough. *e.g.*, the treated tyres of cars, trucks, provide better grip with the ground.
  - When it is needed to reduce the friction, the contact surface is smoothened or the substances which reduce friction called lubricants, are used.
- **Rolling friction :** When one body rolls over the surface of another body, the resistance to its motion is called rolling friction.
- **Fluid friction :** Fluids exert force of friction on objects in motion through them. The frictional force exerted by fluids is also called drag.
- Sliding friction is slightly less than static friction.

Know the Terms

- **Friction :** The force which opposes the relative motion between two surfaces in contact is called friction. The force of friction always opposes the applied force that may be push or pull.
- **Spring Balance :** It is a device used for measuring the force acting on an object. It consists of a coiled spring, a pointer moving on a graduated scale. When a force is applied, stretching of spring takes place. The reading on the scale indicated by the pointer gives the magnitude of the force.
- **Static Friction :** The force required to overcome friction at the instant an object starts moving from rest is a measure of static friction.
- **Sliding Friction :** The force required to keep an object moving with the same speed is a measure of sliding friction. The sliding friction is slightly smaller than the static friction.
- **Lubricants :** The substances which reduce friction are called lubricants.

Flowchart



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Chapter - 13 : Sound

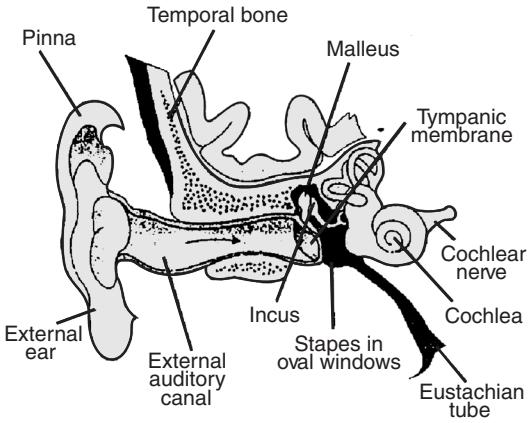
Quick Review

- Sound is a form of energy.
- Sound is produced by a vibrating body.
- To and fro or back and forth motion of an object is called vibration.
- Sound is produced by humans through the voice box or the larynx. It is situated at the upper end of the wind pipe. Two vocal cords, are stretched across the voice box and have a narrow slit between them. When the lungs force air through the slit, the vocal cords vibrate and produce sound.
- Sound needs a medium for propagation.
- We hear sound through our ears.

Know the Terms

- Amplitude is the maximum distance from mean position. Loudness of sound depends upon its amplitude.
- **Time period :** The time taken by a vibrating body to complete one oscillation.
- Frequency is the number of oscillations per second. The SI unit of frequency is Hertz. The frequency determines the shrillness or pitch of a sound. Usually male has low pitched (bass) sound and female has high pitched sound (Shrill).
- 20 Hz to 20,000 Hz is audible sound for human beings. Sound less than 20 Hz frequency is **called infrasonic** sound and sound more than 20 kHz is called **ultrasonic sound.**
- Unpleasant sound called noise may cause health problems to humans beings.
- **Noise pollution :** Televisions, transistors, radios at high volumes, desert coolers, air conditioners, horns of vehicles etc. cause noise pollution.
- **Measures to limit noise pollution :** Silence devices must be installed in aircraft engines, transport vehicles etc. Trees must be planted along the roads and around buildings to cut down on the sound.

- **We hear sounds through our ears. The human ear has three main parts :**

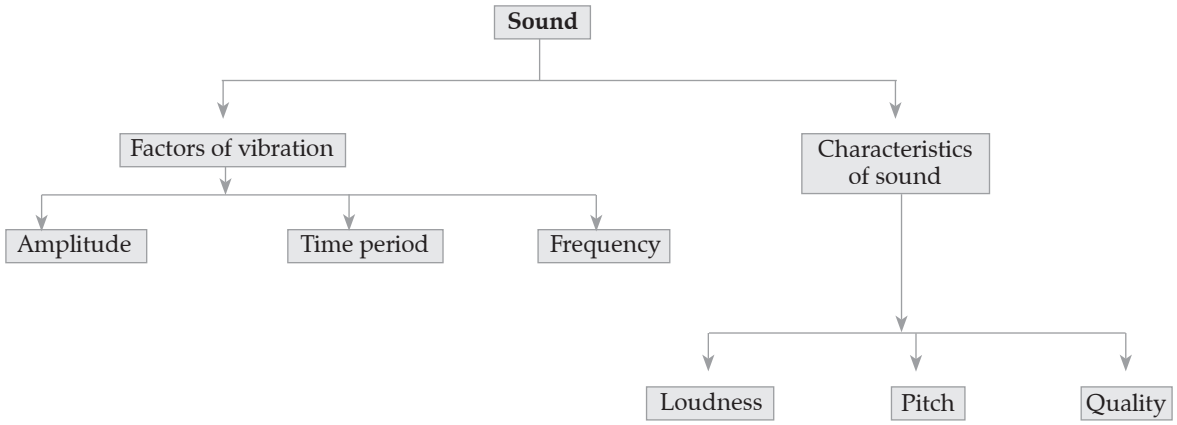


Human Ear

- **Outer ear :** It has a canal at the end of which is a stretched membrane called eardrum. The sound waves pass through ear canal and eardrum to vibrate.
- **Middle ear :** It has a set of three bones that are linked together and attached to the eardrum. These bones receive vibrations from eardrum and pass on to the inner ear.
- **Inner ear :** The inner ear receives vibrations from the middle ear and changes them into nerve impulses that are interpreted by the brain and we hear the sound.

- If υ = velocity of sound wave, n = frequency of sound wave, λ = wavelength of sound wave.
  Then $\upsilon = n\lambda$
- Maximum speed of sound is in solids, followed by liquids and then in gases.
- **Musical Sounds :** The sounds which produce pleasant sensation to the ear are termed as musical sounds.
- **Musical instruments :** Musical instruments are generally of the following types :
- **String instruments :** The vibration of string produces musical sound as in sitar.
- **Wind instruments or reed instruments :** The column of air is vibrated by blowing air directly through tubes is known as reeds as in Shehnai or Flute.
- **Membrane instruments :** The musical sound is produced due to the vibration of skin or membrane mounted on the instruments such as Tabla.
- **Ghana vadya :** The instruments which are simply beaten or struck as in the Manjira (cymbals) and Jal Tarang.
- **Noise :** The sounds which produce unpleasant sensation to the ears are termed as noise.
- **Vacuum :** When air is removed from a vessel, then it is called vacuum.
- Sound plays an important role in our lives.
- We hear a variety of sounds in our surroundings.
- Sound is produced by musical instruments like flute and tabla by vibration.
- The **vibratory motion** is also known as **oscillatory motion**.
- The unit of frequency is **hertz**.
- **Eardrum :** When sound enters in outer ear, it travels down a canal at the end of which a thin membrane is stretched tightly. It is called eardrum.
- **Wind pipe :** The tube like vessel through which air enters in the lungs is called wind pipe.
- **Noise pollution :** The presence of excessive or unwanted sounds in the environment is called noise pollution.

Flowchart



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Chapter - 14 : Chemical Effects of Electric Current

Quick Review

- The materials which allow electric current to pass through them easily are called good conductors of electricity. The materials which do not allow electric current to pass through them are called poor conductors of electricity.
- Some liquids are good conductors of electricity and some are poor conductors of electricity.
- Due to the heating effect of current, the filament of bulb gets heated and starts glowing. If current is weak, the filament does not get heated and it does not glow.
- LED (Light Emitting Diodes) can be used in place of electric bulb in the tester. LED glows even if a weak electric current flows through it.
- Distilled water is a poor conductor of electricity. Impure water or salt dissolved water can conduct electricity.
- The passage of an electric current through a conducting solution causes chemical reaction. As a result bubbles of gas may be formed on the electrodes. Deposits can also be seen on electrodes.
- Electroplating is widely used in industries for coating one metal object with another metal.
- The electrode connected to the positive terminal of battery is called anode and the one connected to the negative terminal of the battery is called cathode.
- **Uses of Electroplating :** Electroplating is widely used in industry for coating metal objects with a thin layer of a different metal. This may be done to :
  - make objects appear shiny,
  - make objects resistant to scratches
  - coat less reactive metal on more reactive metals to protect from getting spoilt.
  - electroplate less expensive metals with silver and gold to make ornaments.

  For example :
  - Chromium has a shiny appearance, doesn't corrode and is resistant to scratches. But, chromium is expensive and it is not economical to make the whole object out of chromium. So, the objects, such as taps, car parts, wheel rims, etc. are made from a cheaper metal and electroplated with chromium.
  - Jewellery made of cheap metals is electroplated with silver or gold to make it appear as if made of silver or gold.
  - Tin is less reactive than iron. So, iron cans used for food items are electroplated with tin to prevent spoilage from contact with iron.
  - Iron used in bridges and automobiles is electroplated with a coating of zinc to protect it from corrosion and formation of rust.
- The disposal of the used conducting solution of electroplating factories is a major problem. It is a polluting waste and there are specific disposal guidelines to protect the environment.
- There are three effects of electricity :

  (i) Chemical effect **(ii)** Heating effect **(iii)** Magnetic effect

(i) **Chemical Effect :** When electric current is passed through conducting liquids, then chemical changes take place. This is called chemical effect of electric current.

(ii) **Heating Effect :** The current flowing in the circuit is usually detected by using a small electric bulb like torch bulb. When an electric current flows through a bulb, then due to heating effect of current the filament of the bulb gets heated to a high temperature and it starts glowing, this phenomenon is known as heating effect of electric current.

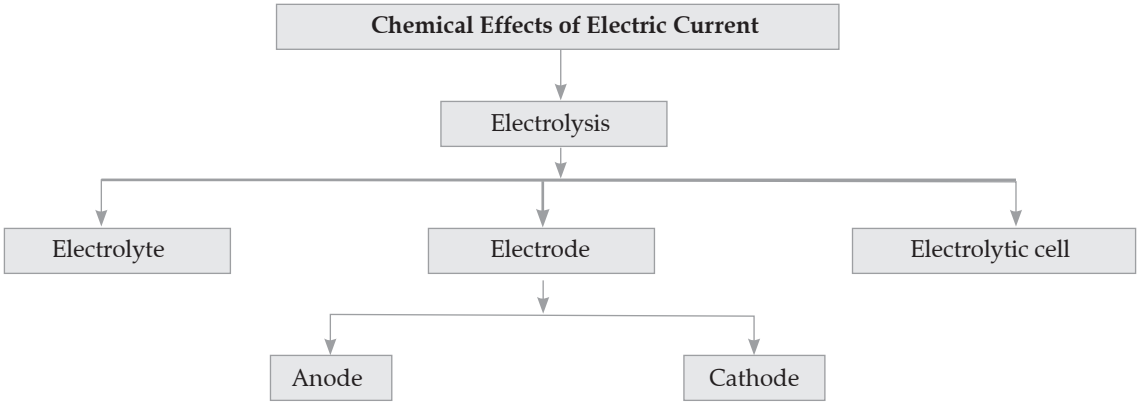
(iii) **Magnetic Effect :** The current flowing in a wire can be detected by the deflection of magnetic needle kept nearby a current flowing wire. This is called magnetic effect of current.

Know the Terms

- **LED (Light Emitting Diode) :** The device which is used in the tester in place of bulb is called LED. It is used when a weak electric current flows through it and it starts to glow in weak current.
- **Electroplating :** The process of depositing a layer of any desired metal on another material by means of electricity is called electroplating. It is the most common application of chemical effects of electric current.
- **Electrolyte :** An electrolyte is a liquid which conducts electricity *e.g.,* a solution of copper sulphate salt in water is an electrolyte.
- **Electrode :** It is a solid electrical conductor through which an electric current enters or leaves something like a dry cell or an electrolytic cell. Electrodes are of two types *i.e.,* anode and cathode.
- **Electrolytic Cell :** An electrolytic cell is an arrangement having two electrodes
- **Electrolysis :** The chemical decomposition produced by passing an electric current through an electrolyte is called electrolysis, *e.g.,* acidified water decomposes into hydrogen and oxygen on passing an electric current through it.

- **Tester :** The instrument used to test whether any material is good conductor or not is called tester.
- **Circuit :** The closed path through which electric current passes from one part to another part is called electric circuit.

Flowchart



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Chapter - 15 : Some Natural Phenomena

Quick Review

- Cyclones, tsunami, earthquakes, droughts, lightning etc., are some destructive natural phenomena.
- **Lightning** is an electric spark, on a huge scale.
- In 1752, **Benjamin Franklin, an American scientist,** showed that lightning and the spark from clouds are exactly same phenomena.
  - Rub a plastic with soft cotton cloth, it can attract very small pieces of paper.
  - When a plastic refill is rubbed with polythene it attracts paper pieces.
  - In all the above activities the rubbed object acquires a small electric charge. These objects are called charged objects.
  - There are two types of charges—positive charge and negative charge. Like charges repel and unlike charges attract each other.
  - It is a convention to call the charge acquired by a glass rod when it is rubbed with silk as positive. The other kind of charge is said to be **negative.**
  - A device can be used to test whether an object is carrying charge or not. This device is known as electroscope.
  - The process of transferring of charge from a charged object to the earth is called earthing.
  - Earthing is provided in a building to protect us from electrical shocks due to any leakage of electric current.
  - Lightning strike can destroy life and property.
- **The story of Lightning :**
  - Lightning occurs due to rubbing.
  - During a thunderstorm, the air currents move upwards while the water droplets move downward. This vigorous movements cause separation of charges. This leads to the positive charges collect near the upper edges of the clouds and the negative charge to accumulate near lower edges of the clouds.
  - There is an accumulation of positive charges near the ground also.
  - Negative and positive charges meet, producing streaks of bright light and sound. We see streaks as lightning. The process is known as **electric discharge.** The process of **electric discharge** between different clouds or between clouds and the earth causes lightning.

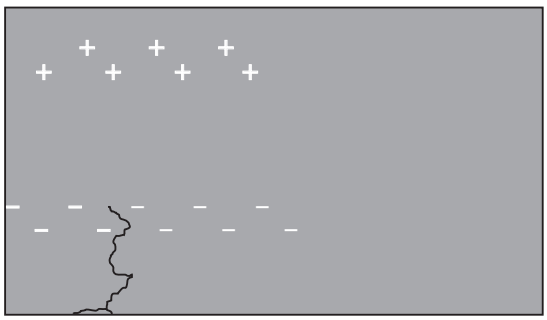


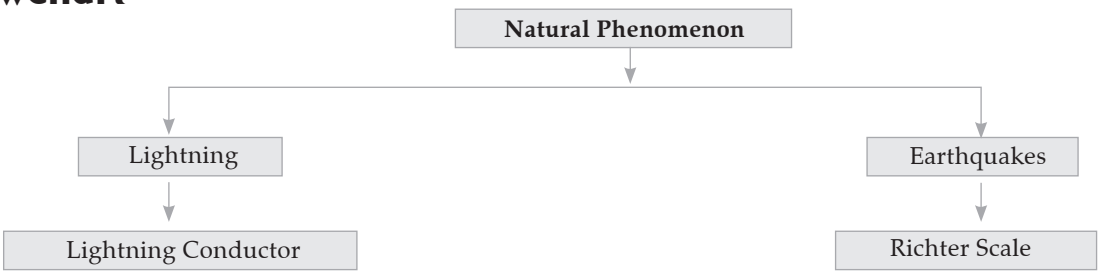
Fig. Accumulation of charges leading to lightning

- **Earthquakes :** An earthquake is sudden shaking or trembling of the earth, which lasts for a very short time.
  - Earthquakes can cause floods, tsunami, landslides etc.
  - The tremors are caused by the disturbance deep down inside the earth crust. The outermost layer of the earth is not in one piece. It is fragmented and each fragment is called plate. These plates are in continuous motion. When they brush against one another, they cause disturbance resulting in an earthquake on the earth surface. The weak zones of the earth plates are also known as **Seismic** or **Fault Zones.**
  - The power of an earthquake is expressed in terms of a magnitude on a scale called the **Richter scale.**
- **Seismograph :** It is an instrument to record seismic waves.
- Richter scale is not linear. This means that an earthquake of magnitude 6 does not have one and half times the destructive energy of an earthquake of magnitude 4. Actually, an increase of 2 in magnitude means 1000 times more destructive energy.
- **Protection Against Earthquakes :** Earthquakes cannot be predicted. So, the buildings in fault zones/seismic zones should be designed so that they can withstand major tremors.
- Take the following steps to protect yourselves in the event of the earthquake :
  - If you are at home
  - Hide under a table till the shaking stops.
  - Do not stand or sit near tall and heavy objects.
  - If you are in bed, do not get up. Protect your head with a pillow.
  - If you are outdoors.
  - Drop down away from buildings, trees and overhead power lines.
  - If you are in a bus, a car or any other covered vehicle, do not come out till the tremors stop. Ask the driver to drive slowly to a safe place.
- **Electricity :** The directional and continuous flow of charges is called electricity.
- **Type of Electricity :** There are two types of electricity on the basis of nature :
  (i) Static electricity **(ii)** Current electricity
- When charges are in rest and do not move then such electricity is called static electricity.
- When charges are in motion, current electricity is formed.

Know the Terms

- **Electroscope :** It is a device that can be used to test whether an object is carrying charge or not. Electroscope consists of closely placed two metallic (aluminium) foils or strips.
- **Seismic Zones :** Earthquakes are caused by the movement of plates; the boundaries of the plates are the weak zones where earthquakes are more likely to occur. These weak zones are also known as seismic or fault zones.
- **Seismic Waves :** The tremors produce waves on the surface of the earth. These waves are called seismic waves.
- **Lightning conductor :** Lightning conductor is a device which is used to protect the buildings from the effect of lightning.

Flowchart



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Chapter - 16 : Light

Quick Review

- When light from an object enters our eyes then only we can see the object. The light may have been emitted by the object, or may have been reflected by it.
- A polished or a shiny surface acts as a mirror. A mirror can change the direction of light that falls on it.
- After striking the mirror the ray of light is reflected in another direction The light ray that strikes on any surface is called incident ray. The ray that comes back from the surface after reflection is known as the reflected ray.
- **Normal :** The ray perpendicular to the surface, at the point of incidence is called normal.
- **Angle of incidence :** The angle between the normal and the incident ray is called the angle of incidence.

- **Angle of reflection :** The angle between the normal and the reflected ray is called the angle of reflection.
- **The laws of reflection are :**
  - The angle of incidence is equal to the angle of reflection.
  - The incident ray, the normal and the reflected ray, all lie in the same plane.

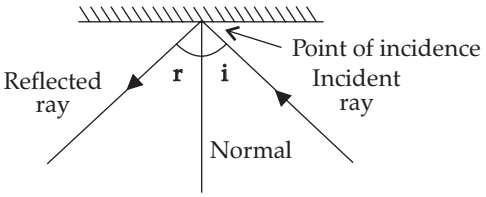


Fig. : Angle of incidence and angle of reflection

- **Lateral Inversion :** In an image formed by a mirror, the leftside of the object appears on the right and the right appears on the left. This is known as lateral inversion.
- When all the rays reflected from a plane surface are not parallel the reflection is known as diffused or irregular reflection. Reflection from a smooth surface like that of a mirror is called regular reflection.

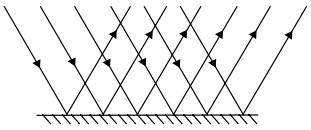


Fig. Regular reflection

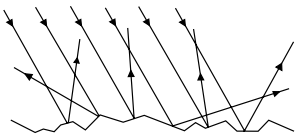


Fig. Rays reflected from irregular surface

- **Multiple Image :** Large number of images are formed by mirrors placed at an angle to one another. e.g., kaleidoscope.
- Splitting of light into its colours is known as dispersion of light. Rainbow is a natural phenomena showing dispersion.
- **Human eye :** It is roughly spherical in shape.
  Cornea : Transparent front part of eye.
  Pupil : A small opening in the cornea.
  Iris : Coloured part of eyes, it controls the size of pupil.
  Lens : Focuses light on retina.
  Retina : Site of image formation.
  Cones and Rods : There are two kinds of cells present in retina.
  - Cones, that are sensitive to bright light
  - Rods, which are sensitive to dim light.

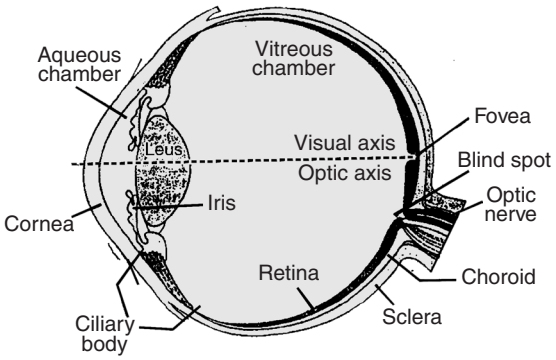


Fig. : Human Eye

Blind spot : At the junction of the optic nerve and the retina there are no sensory cells so no vision is possible at this spot. This is called the blind spot.
Yellow spot : It is located in the centre of the retina. It has maximum concentration of light sensitive cells.

- The most comfortable distance at which one can read with a normal eye is about 25 cm. It is also called least distance of distinct vision.
- Some persons can see objects close to them clearly but cannot see distant object. On the other hand some can see the distant objects clearly but are unable to see nearby objects. These are eyesight defects and can be corrected by using correct power lens.
- **Care of Eyes:** Use suitable spectacles. Too little or too much light is bad. Do not look at the sun directly, wash your eyes frequently.
- Visually challenged persons can read and write using Braille system. It has 63 dot patterns or characters. Each character represents a letter, a combination of letters, a common word or a grammatical sign.
- **Kaleidoscope :** It is based on the principle of multiple reflections. It consists of three plane mirrors (whereas a periscope, a similar device consists of two plane mirrors.) These three mirrors are inclined at an angle of 60^0 to each other in a tube (hard card board tube). One end of the tube is closed with the two circular glass discs, the inner being transparent glass and the outer ground glass.
- Glass pieces or bangle pieces of various colours are kept between the two discs.
- Due to reflection, hexagonal patterns of coloured bangles can be seen.
- An interesting feature of kaleidoscope is that you will never see the same pattern again.
- **Persistence of vision :** The impression of an image persists for about 1/16 of a second on the retina even after we have stopped seeing the object. If still images of a moving object are flashed on the eye at a rate faster than 1/16 second, then the eye perceives this object as moving.
- Owl can see very well in the night. It has a large cornea and a large pupil to allow more light in its eyes. Its retina has a large number of rods but only a few cones. These features allow the owl to see at night.

- **Periscope :** The periscope makes use of two plane mirror placed in 'z' shaped box at 45^{o} angle as shown in figure below.

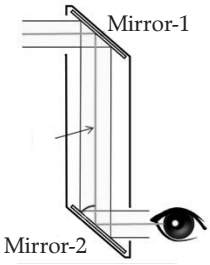


Fig. Mirror 1 and Mirror 2 placed at 45^{0}

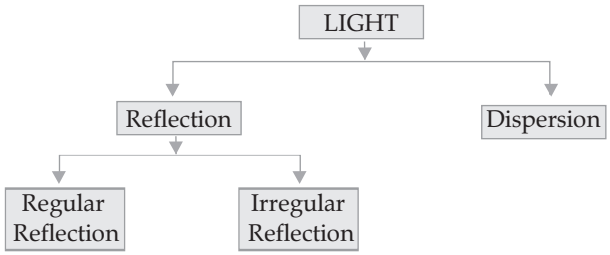
- Due to reflection from mirror 1 and reflection from mirror 2 one is able to see objects which are not visible directly. Periscopes are used in submarines, lakes and also by soldiers in bunker to see things outside.

Know the Terms

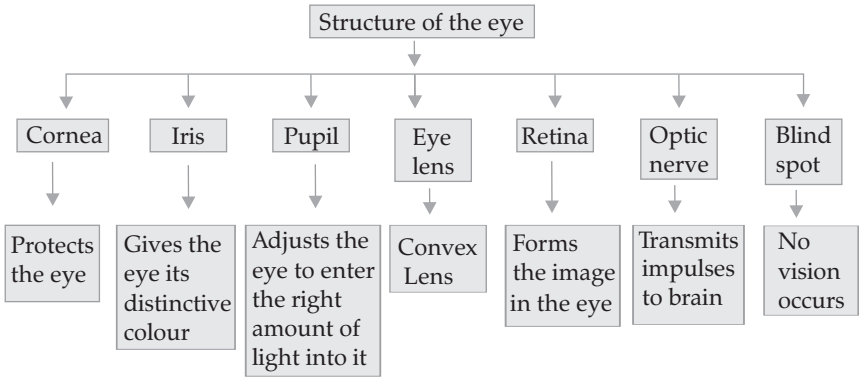
- **Reflection :** The mirror surface or a shiny surface scatters back a beam of light falling on it. This scattering back of light by mirror or shiny surface is known as refection.
- **Luminous Objects :** The objects which shine in the light of other object are called illuminated objects. The objects which emit their own light are known as luminous objects.
- **Dispersion :** Splitting of light into its constituent colours is called dispersion. The sunlight is referred to as white light that consists of seven colours.

Flowcharts

A.



B.



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Chapter - 17 : Stars and The Solar System

Quick Review

- The stars, the planets, the moon and many other objects in the sky are called celestial objects.
- Moon does not produce its own light, whereas the sun and other stars do.
- The day on which the whole disc of moon is visible is known as full-moon day.
- On the fifteenth day, when the moon is not visible, the day is known as new-moon day.
- The various shapes of the bright part of the moon as seen during a month are called phases of the moon.
- The distance of stars is expressed in light year. One light year is the distance travelled by light in one year.

- The moon's surface is dusty and barren. There are many craters of different sizes. It also has steep and high mountains. It has no atmosphere and no water.
- The stars forming a group that has a recognizable shape are called a constellation.
  e.g., – Ursa major (Big Dipper, the great bear or the Saptarishi).
  - Orion (Hunter), seen during winter in the late evenings.
  - Sirius (Brightest star in the sky).
  - Cassiopeia (Visible during winter in the early part of the night).
- **Ursa Major :** It can be seen during summer time in the early part of the night. It is also known as saptarishi.
  Ursa Major consists of a group of seven stars. Three stars appear to form the handle of the dipper and four stars form its bowl. (as shown in figure (a) below). It appears to move from east to west in the sky.

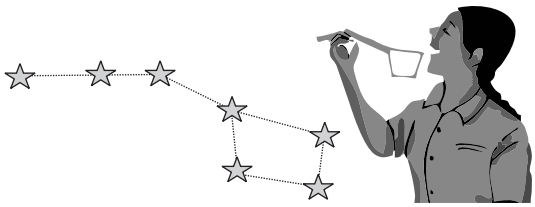


Fig. (a) Ursa Major **Fig. (b) Dipper used to drink water**

- **'Great Bear' or 'Big Dipper' :** The name 'Big Dipper' has been derived from the word 'Dipper'. Dipper was used in olden days for drinking water as shown in figure (b) above.
- **Orion :** Orion can be seen during winter in the late evening. It has seven or eight bright stars. Orion is also called the Hunter or Kalpurush. The three middle stars represent the belt of the hunter. The four bright stars appear to be arranged in the form of a quadrilateral.

Fig. Orion appears like a hunter

The brightest star located close to Orion constellation is called **Sirius.**

- **Cassiopeia :** This constellation is visible during winter in the northern sky. It looks like a distorted letter W or M.
- **Pole Star :** To locate Pole star, look at the stars at the end of Ursa Major as shown in Fig. Imagine a straight line passing through these two stars. Extend this imaginary line towards the north direction (Fig.). On this line you can locate a star which is not too bright and around which there are no stars. It is the **Pole Star.**
- The Pole star always appears to remain at the same position in the sky.

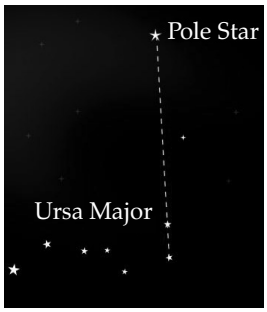


Fig. Locating the Pole star in the sky

- The stars of Ursa Major appear to revolve around the Pole star. The Pole star is not visible from the southern hemisphere.
- **Solar system :** The Sun and the celestial bodies that revolve around it form the solar system. It consists of planets, comets, asteroids and meteors.
  - The eight planets are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.
  - A planet has a definite path (in which it revolves around the Sun), called an orbit.
  - Some planets are known to have moons/satellites revolving round them.

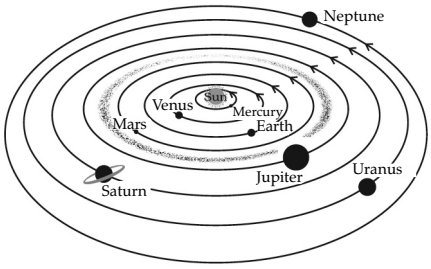


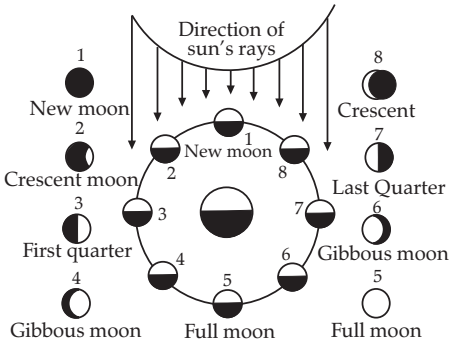
Fig. The solar system (not to scale)

- There are many man-made satellites revolving round the earth. These are called artificial satellites.
- **Asteroids :** There is a large gap in between the orbits of Mars and Jupiter. This gap is occupied by a large number of small objects that revolve around the Sun. These are called asteroids.
- **Comets :** They revolve around the Sun in highly elliptical orbits.
- **Meteors and Meteorites :** Shooting stars are called meteors. A meteor is usually a small object that occasionally enters the Earth's atmosphere. Some meteors are large and so they can reach the earth before they evaporate completely. The body that reaches the Earth is called meteorite.

➢ **Light year :** It is the distance covered by light at its speed in a year. The speed of light is 3×10^8 m/sec.
1 light year = $3 \times 10^8 \times 3600 \times 24 \times 30 \times 12 = 9.46 \times 10^{12}$ kms (Approx.)

➢ **Astronomical unit :** Distance between the Earth and the Sun is 150,000,000 (15 Crore) kms. Light takes about 8.3 minutes to reach the Earth from the Sun. This distance between Earth and the Sun is also called 1 Astronomical Unit.

➢ **Phases of the moon :** When the bright portion of the moon visible from Earth is increasing these phases are called waxing phase. When the bright portion is decreasing this is called **vanning phase.** When more than half of the moon is dark, it is called Crescent Moon. When more than half is bright, it is called **Gibbous Moon.**

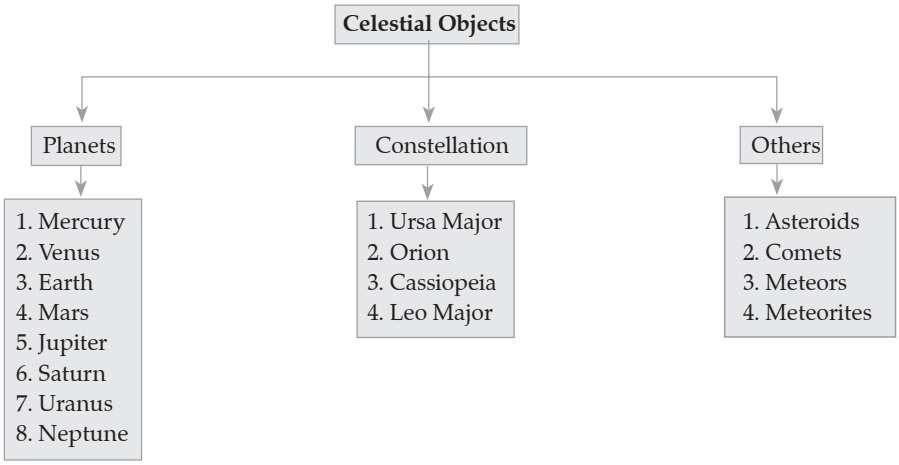


Know the Terms

➢ **Moon :** It is a natural satellite of the Earth and it revolves around the Earth in a definite regular path, called its orbit.

➢ **Period of Revolution :** The time taken by a planet to complete one revolution around the sun is called its period of revolution.

Flowchart



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Chapter - 18 : Pollution of Air and Water

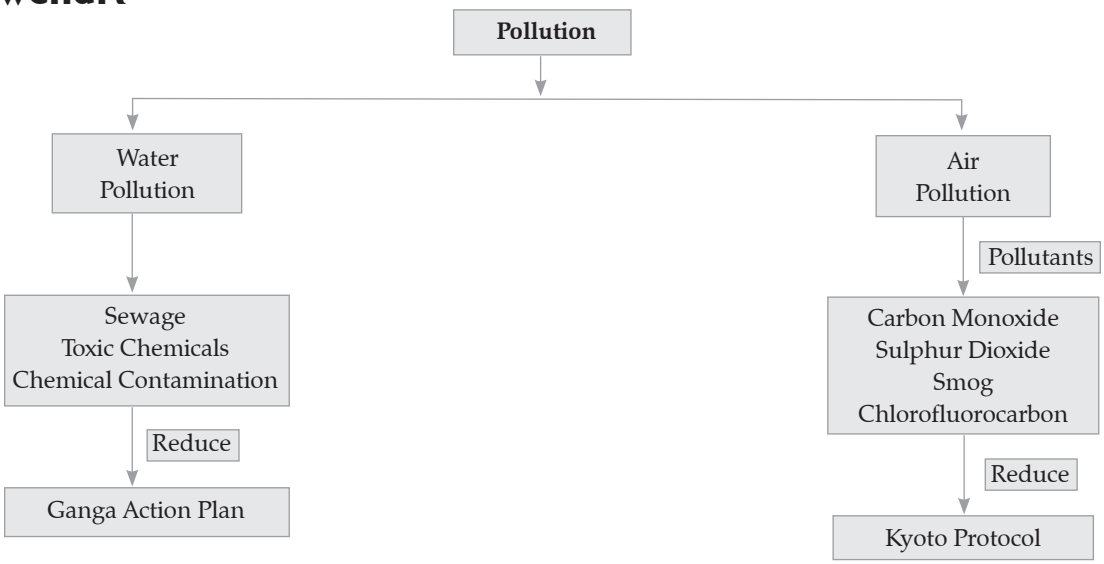
Quick Review

- We all are aware that our environment is not what is used to be. We ourselves feel the impact of the degrading quality of air and water in our lives.
- **Air pollution :** When the air is contaminated by unwanted substances that have a harmful effect on both the living and the non-livings, it is known as air pollution.
  The substances that contaminate the air are called **air pollutants.** Such as smoke, dust, forest fires or volcanic eruptions. The other sources are factories, power plants, automobile exhausts and burning of fire wood and dung cakes.
- **Smog :** A thick fog-like layer in the atmosphere especially during winters, which is made up of smoke and fog.
- Major sources of gaseous or air pollutant are carbon monoxide, sulphur dioxide and nitrogen dioxide. Other pollutants are Chloro Fluoro Carbons(CFCs) that are used in refrigerator, air conditioners and aerosol sprays.
- **Greenhouse effect :** The trapping of radiations by the Earth's atmosphere is called the greenhouse effect. Without this process, life would not have been possible on the Earth. But now it threatens life. CO_2 is one of the gases responsible for this effect.
  Due to green house effect, the average temperature is gradually increasing, called global warming.
  Gases like methane (CH_4), nitrous oxide (N_2O), CO_2 and vapour are called green-house gases.
- **Acid rain :** The gases such as sulphur dioxide (SO_2) and nitrogen dioxide (NO_2) react with water vapour in the atmosphere to form sulphuric acid and nitric acid and constitute the acid rain.
- **Marble cancer :**
  - Acid rain has resulted in corrosion of the marble of the Taj. This phenomenon is called Marble Cancer.
  - Suspended Particulate Matter (SPM) emitted from Mathura oil refinery, has been responsible for yellowing of the marble of Taj.
- **CNG and LPG :**
  The Supreme Court has ordered industries to switch to cleaner and safer fuels such as CNG (Compressed Natural Gas) and LPG (Liquefied Petroleum Gas).
- **Water pollution :** Whenever harmful substances such as sewage, toxic chemicals, silt etc. get mixed with water, the water becomes polluted.
- Ganga is one of the ten most endangered rivers of the world. An ambitious plan to save the river Ganga called Ganga Action plan was launched in 1985.
- **Global warming :** Due to human activities there is accumulation of CO_2 in the atmosphere. Carbon dioxide traps heat and does not allow it to escape into space. As a result, the average temperature of atmosphere of the earth gradually increases. This gradual increase in temperature is known as global warming.
- **Potable water :** Water which is purified and suitable for drinking is known as potable water. 25% of the world's population is living without safe drinking water.
- **Chlorination :** Adding chlorine tablets to water for purification is called chlorination. It is a common chemical process. We should not use more chlorine tablets than specified.
- Water is a precious natural resource. We should conserve it and should follow the mantra – reduces, reuse, and recycle.
- The substances which contaminate the air are called air pollutants.
- Many respiratory problems are caused by air pollution.

Know the Terms

- **Pollution :** The presence of unusually high concentration of harmful or poisonous substances in the environment (air, water) is called pollution. The substances that pollute something, especially atmosphere and water are called pollutants.
- **Green House Effect :** The warming up of the earth's atmosphere due to trapping of the sun's heat rays by gases like carbon dioxide, methane, etc in the atmosphere is called green house effect.

Flowchart


Pollution
Water Pollution
Air Pollution
Sewage
Toxic Chemicals
Chemical Contamination
Reduce
Ganga Action Plan
Pollutants
Carbon Monoxide
Sulphur Dioxide
Smog
Chlorofluorocarbon
Reduce
Kyoto Protocol

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