

Crop and Food Production

I. Answer the following questions :

Ans. 1. Various agricultural practices or tasks performed by a farmer to cultivate a crop are as follows :

(a) **Preparation of soil (by ploughing, levelling) :** Plants are grown in the soil. They absorb water, nutrients and mineral salts from the soil. It is, therefore, important and necessary to prepare the soil well to ensure a healthy produce.

Ploughing: Ploughing or tilling is the first step in the preparation of soil. It loosens and turns the soil well.

Soil is tilled with the help of ploughs. Ploughs and other tools needed for large scale production of crops are called agricultural implements. Ploughs are either drawn by bullocks or driven by tractors.

Levelling : The soil is still in large clumps after ploughing, levelling of soil is done with the help of a leveller. Levelling of soil is required for sowing as well as for irrigation purposes.

(b) **Selection and Sowing of Seeds (Planting of Crops) :** Sowing is the process of putting seeds in the soil. Good and healthy seeds are selected for sowing. Seeds to be sown must be free from diseases and also resistant to diseases. So applying manures and fertilizers is the third step in this process.

Sowing of seeds is done by two methods. They are as follows :

(i) **Broadcasting :** Broadcasting is the method of sowing seeds by hand at random.

(ii) **By Using Seeds Drills :** The second method of sowing is by using seed drills.

(c) **Applying Manures and Fertilizers :** Plants depend on the soil for their nutrients. So applying manures and fertilizers is the third step in this process.

Manures : Manures are organic materials which supply all the element a plant needs in small amounts. The important type of manures are as follows :

Farmyard Manure, Green Manure, Compost.

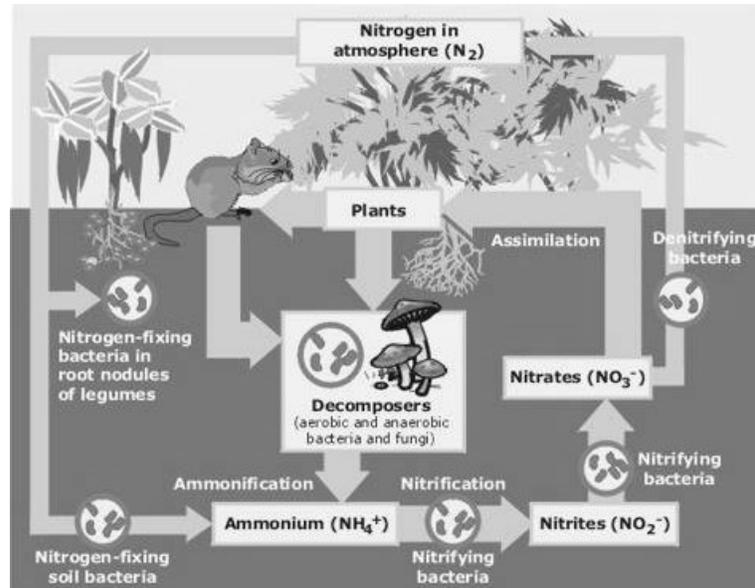
Fertilizers : Fertilizers are inorganic materials that are used mainly to increase the essential elements in the soil.

(d) **Irrigation :** Watering the field, is known irrigation. It is the next step.

Methods of irrigation : Depending on the nature of the type of crop and the soil, different methods of irrigation are used. They are as follows :

- (i) Sprinkler Irrigation, (ii) Flood irrigation, (iii) Furrow irrigation, (iv) Drip irrigation, (v) Basin irrigation, (vi) Lift irrigation
 - (e) **Weeding :** The process of removing weeds is called weeding. This may be done manually or by spraying weedicides.
 - (f) **Harvesting, Threshing and Winnowing**
 - Harvesting :** The process of harvesting is the removal of crop from the field after maturity.
 - Threshing :** Removal of grains from the chaff, is called threshing.
 - Winnowing :** After threshing, seeds or grains are separated from the chaff (hay) by wind.
 - (g) **Preservation and Storage of Grains :** The objective of crop preservation is to retain the crop quality during post harvest storage. During storage, respiration causes degradation of stored food materials. The crop quality is thus changed. Crop conservation procedures often reduce the rate of respiration, thereby enhancing the period of storage of useful products. Drying, canning and freezing are some of the methods of preservation.
 - (h) **Crop Improvement :** Crop improvement consisted mostly of selecting good quality seeds which were healthy and disease free. Crop improvement through breeding, now forms the backbone of modern agriculture.
2. After the crop is harvested, we need to protect it from harmful substances such as insects and microbes. For this purpose we use the facility of storage and preservation. We preserve the crops by the methods of drying, canning and freezing. Drying reduces the moisture content of stored food materials. Canning does not permit microbial growth, whereas freezing reduces the rate of respiration of micro-organisms. Storage means keeping the harvested grains till they are taken finally to the consumer. Seeds are stored to protect them from birds, insects, rodents and micro-organisms and also for use during periods of food scarcity.
- Seeds, can be thus, stored in clay pots, woven baskets or even holes in the barn or granaries in cemented halls called godowns. These godowns should be protected from pests. They can be fumigated by pesticides. The commonly used insecticides are malathrion, BHC and DDT.
3. The nitrogen cycle is the process by which nitrogen is converted between its various chemical forms. This transformation can be carried out via both biological and non-biological processes. Important processes in the nitrogen cycle include fixation, mineralization, nitrification, and denitrification.

Schematic representation of the flow of nitrogen through the environment can be shown as ahead :



The importance of bacteria in the cycle is immediately recognized as being a key element in the cycle, providing different forms of nitrogen compounds assimilable by higher organisms.

4. **Nitrogen fixation** : Nitrogen fixation is the process by which free atmospheric nitrogen is converted into nitrogen compounds mainly soluble nitrates.

It is important for the following reasons :

In nature, Biological Nitrogen Fixation (BNF) takes place through micro-organism containing the enzyme nitrogenases which catalyses the conversion of atmospheric nitrogen into ammonia. Ammonia is subsequently used by plants for the synthesis of biological molecules such as proteins, amino acids and nucleic acids. The free living nitrogen-fixing bacteria combine and fix atmospheric nitrogen in the form of nitrates. These substances are used by plants to make their own type of proteins.

Atmospheric nitrogen and oxygen combine to form nitrogen oxides during high energy electrical discharge in the atmosphere. These dissolve in rain to form nitric acid. When natural minerals like limestone present in the soil react with nitric acid, soluble nitrates (such as calcium nitrate) are formed, which can be absorbed by the plants.

5. You can prepare a herbarium file by taking following steps:
 - (a) **Looking for plants** : Almost all natural environments are suitable for searching plants for the herbarium.

- (b) **Picking up plants** : With the help of a small knife or small handy space pick only those crop plants. Which are fresh and not wet. Carefully remove all the insects or foreign bodies attached to the specimen.
 Arrange the picked specimen inside the folder between few layers of newspapers so that every plant has some paper on both sides.
- (c) **Collecting information** : Collect some important information about the specimen of crop plants, you are picking up. This will help you in the identification of the specimen. You can collect information about the habitat, shape and size, height, colour, type of leaves, locally used name and uses of the plants.
- (d) **Drying** : Now take out the specimen from the bag or the folders and dry them into a press made of heavy cardboard or thick plywood. The minimum time required for complete drying ranges from two to four days.
- (e) **Mounting the specimen or herbarium sheets** : Once the specimen is dried and stiff, it can be mounted on the herbarium sheets. The size for mounting paper can range from 42 cm × 26 cm to 45 cm × 30 cm.
- (f) **Putting labels** : Put a label on each sheet which should include the name of the specimen and the date and place of collection.
- (g) **Organizing herbarium sheets** : Place all the herbarium sheets together, 4 i.e., one above another in a folder.
6. We get different types of food items and many other products such as wool and silk, from animals. Example of some animal sources of food are given below :
- Poultry animals such as chicken, ducks, turkey and geese yield egg. In addition, the flesh of animals such as goat; chicken and fish is also eaten as food.
 - We obtain milk from animals such as cows, buffaloes, and goats. Milk is used to prepare a variety of dairy products such as butter, ghee; curd and cheese.
 - Fish is a nutritious food, rich in proteins and vitamin A and D. Cod liver oil and shark liver oil also obtained from fish are a rich source of proteins.
 - Honey is produced by honey bees from the nectar of flowers. It consists of water, sugar, minerals and enzymes. It is an antiseptic and easily digestible.

II. Fill in the blanks with the appropriate word/words given in the brackets:

Ans. 1. Ploughing, 2. Cereals, 3. Manure, 4. Winnowing, 5. Sickle

III. Match the statements in column A with those in column B.

Ans. 1. (d) Legume, 2. (e) Fibre, 3. (c) Incubator, 4. (b) Honey-bee, 5. (a) Cereal

IV. Tick (✓) the correct options of the following :

Ans. 1. (a), 2. (d), 3. (b), 4. (c)

I. Answer the following questions.

Ans. 1. Micro-organisms or microbes are very tiny living organisms which are invisible to the naked eye and can only be seen with the help of a powerful microscope. Micro-organisms are found all around us; floating in the air and in water, moving about in the soil and on plants, inside our body parts and those of all animals. Micro-organisms enter our body by food products and various utensils. They also enter through dead leaves, clothes, books, jams, pickles, dung, shoes etc.

2. **Occurrence** : Bacteria are found in all the places wherever life is possible. They are in the air we breathe, the food we eat, and the soil upon which we walk. They are on almost anything that we touch. A large number of bacteria occur in animal or human bodies. They can live both in the presence and absence of oxygen and can survive in extremely cold and hot conditions.

Nutrition : On the basis of nutrition, bacteria are classified into two groups :

(i) **Autotrophic Bacteria** : Only very few bacteria can synthesize their own food in the presence of sunlight and chlorophyll.

(ii) **Heterotrophic Bacteria** : Almost all bacteria have no chlorophyll. Therefore, they depend on readymade foodstuff from other sources.

Reproduction : Bacteria generally reproduce by binary fission. First a bacterium divides into two and so on. Rate of reproduction is very high under favourable conditions of nutrition, temperature, moisture and pH; divisions may take place every 10 to 40 minutes.

3. Algae are unicellular or multicellular micro-organisms with chlorophyll. They are simple plants that have no roots, stems or leaves.

Major Groups of Algae : Based on the nature of the pigment present, algae may be classified into following four groups :

(i) **Red algae** : It is a large group of algae that includes many seaweeds that are mainly red in colour. Some kinds yield useful products (agar, alginates) or are used as food.

(ii) **Green Algae** : Green algae commonly cause scums on ponds. A common green algae found in ponds and streams is spirogyra. It is a multicellular algae. It consists of long strands of cells arranged end-to-end that form filaments.

(iii) **Blue-green Algae** : These algae are more closely related to bacteria than to other algae. These are single-celled and microscopic but can be seen as blooms on lakes.

(iv) **Brown Algae** : These include the largest algae—some are over 60 m long. Most brown algae live in seas.

Most brown algae are multicellular and live in the oceans near the coasts.

4. Viruses are so tiny that they cannot be seen without the help of powerful microscope. Viruses have some living and some non-living properties. They carry out life activities, but only when living inside a living cell. They do not grow or reproduce outside an organism. They can be crystallized and store in bottles for many years.

Structure : Viruses are peculiar in their structure. These are not considered to be organisms at all since they do not possess a cellular organisation.

Types : Viruses are generally named on the basis of : (i) The host or (ii) the disease they cause. For example, tobacco mosaic virus (TMV) is so named as the host is a tobacco plant and the virus produces mosaic pattern on the leaves. Similarly, the measles virus causes measles in man.

Classification : Viruses can be classified under following groups according to the type of host.

(i) **Bacterial Virus** : It uses bacteria as the host cell.

(ii) **Plant Virus** : It uses a plant body as a host.

(iii) **Animal Virus** : It uses a animal body as a host. For example, food-and-mouth disease is caused by virus.

Viruses cause various diseases in an organism by changing the normal activities of cells. Some diseases caused by viruses in human beings are Polio, AIDS (Acquired Immune Deficiency Syndrome), cold, and mumps. In other animals, viruses cause rabies, distemper and foot-and-mouth disease. Viruses also cause many diseases in plants. They spread from one diseased organism to another organisms. Among human beings, viruses are spread by insects, air, water, food and by contact with other humans.

5. The process of treating and handling food with an aim to stop or slow down its spoilage while maintaining its nutritious value, texture and flavour is called food preservation.

Different food preservation techniques are employed for different types of food. They are as follows :

(i) **Boiling** : Boiling food items can kill all existing microbes. Milk and water are common example of food items that are boiled to kill microbes.

(ii) **Refrigeration and Freezing** : Refrigeration at low temperatures and freezing help to preserve food for a longer time because bacteria and fungi cannot thrive in cold temperatures.

Food items that can be stored by freezing include meat, milk and

vegetables. Frozen food items are popular as they provide access to off season fruits and vegetables and food items from far-off places.

(iii) Dehydration : Since moisture is one of the main needs for microbial growth, removal of water is an efficient method of food preservation. The process of removal of water from a substance is known as dehydration.

Food items such as cereals and pulses are generally dried under the sun to remove the moisture present in them. Spices and dry fruits are also preserved by this method.

(iv) Canning : Storing cooked and sterilized food in airtight cans is also an effective way for preserving food. Many food items such as jams, vegetables, fish and even cooked food are canned and sold in the markets. Foods like fruits and fishes are boiled, sterilized and put into tins and closed airtight.

(v) By Adding Preservatives : Food can also be preserved by adding preservatives. Salt, sugar, oil, spices, sodium benzoate and potassium metabisulphite are some of the most commonly used preservatives.

(vi) Pasteurization : Pasteurization is a method of food preservation in which the food items are heated to a high temperature and then rapidly cooled. This helps to destroy harmful micro-organisms without changing the composition, flavour or nutritive value of the food item.

II. Fill in the blanks with the appropriate word/words given in the brackets:

Ans. 1. Microbiology, 2. green, 3. fungi, 4. proteins, 5. red

III. Match the statement in column A with those in column B :

Ans. 1. (b) Curd formation, 2. (d) Decomposition of organic matter resulting in foul smell, 3. (a) Baking, 4. (c) Method of food preservation, 5. (f) An algae, 6. (e) Multicellular fungi

IV. Tick (✓) the correct options of the followings :

Ans. 1. (b), 2. (d), 3. (d), 4. (c)

3

Materials in Daily Life

I. Answer the following questions.

Ans. 1. Polymer is a large molecule comprised of repeating structural units (monomers) joined together. Polymers are of two types :

(i) Natural Polymers, e.g. jute, cotton, silk and wool.

- (ii) Synthetic Polymers, e.g. rayon, nylon, terylene, dacron, teflon. Polythene or polyethylene is made of long chains of ethylene (C_2H_4) molecules joined together.

Advantages of Synthetic Fibres :

- (i) Synthetic fibres can be produced on a large scale and thus, they cost less.
- (ii) They have a high lusture and do not turn yellow with age.
- (iii) They do not need ironing and do not shrink on washing.
- (iv) They last longer as compared to natural fibres.
- (v) They are easy to clean and dry quickly.
- (vi) They are strong and durable and require less care.
- (vii) They are elastic. Elasticity refers to a quality of a material to regain its original shape, after it has been stretched or compressed.
- (viii) They are drawn from the spinneret which makes them fine their end. Thus, the texture of these fibres produced is very soft.

Disadvantages of Synthetic Fibres :

- (i) Unlike natural fibres, they do not absorb sweat. Therefore, clothes made from the synthetic fibres are very uncomfortable in summer or rainy season.
 - (ii) They easily melt and burn to form small sticky beads at a very high temperature. Therefore, there is always a risk of getting burns, especially in the kitchen, while wearing clothes of synthetic fibres.
 - (iii) They get electrically charged in dry weather. You might have seen sparks flying from blankets made from synthetic fibres during night. These sparks are due to the electric charge. This electric charge causes skin problems in some persons.
 - (iv) They are non-biodegradable and hence cause a lot of pollution.
 - (v) Most synthetic fibres need very careful rorning as they melt very easily.
2. Plastic is used in every sphere of life starting from automobiles to small capsules of medicines. They are used in the following ways :
- (i) Plastic parts are replacing metals in aeroplanes, cars and many mechanical devices.
 - (ii) Plastics have replaced wood and stone in many applications.
 - (iii) Plastics are used to pack a variety of items. For example, plastic, wraps preserve foods longer than paper wrapper.
 - (iv) Textile industry uses plastics to replace natural fibres such as cotton, silk and wool.
 - (v) Plastics are used for making handles of cooking vessels, containers and films used in microwave ovens.
 - (vi) Since they are poor conductors of electricity, they are used as covering materials in electrical appliances, cords, electrical outlets and wiring.

- (vii) Being insoluble in water they are used to make bottles, buckets and containers for storing water and plastic cups and tumblers for drinking water.

Some of the hazards associated with plastic disposal are as follows :

- (i) Most plastic wastes end up littering roadside floating in lakes and streams and collecting in ugly dumps. These provide homes for many disease-causing germs and animals.
- (ii) When wastes are dumped in water, they result in water-pollution. They also pose a threat to aquatic life as toxic substances present in plastics can cause death or reproductive failure in fish and other aquatic animals.
- (iii) Plastics that get buried in the soil cannot be decomposed by micro-organisms. This prevents rain water from seeping into earth. This affects the plants growing in that area as they do not get enough water from the soil.
- (iv) When plastics are burned, they produce toxic gases and smoke that cause air-pollution.

3. **Thermoplastics** : Thermoplastics are the plastics that can be melted by heating and thereafter moulded into desired shapes and sizes any number of times. Polythene, polystyrene, are examples of thermoplastics.

Thermosetting Plastics : Thermosets are also plastics in which material are obtained by gently heating and then moulding. However, the moulded materials cannot be remoulded again and again. Thus, they are plastics for one time use and the moulding is permanent. They are harder and stiffer than thermoplastics. Bakelite, formica are the examples of thermosetting plastics.

4. Synthetic fibres are superior as compared to natural fibres in following three ways :

- (i) Synthetic fibres has a high lustre in comparison with natural fibres. Also do not turn yellow with age as in the case of natural fibres.
- (ii) They last longer as compared to natural fibres.
- (iii) Compared to natural fibres they are very much strong and also require less care.

In comparison to natural fibres, synthetic fibres are inferior in following three ways :

- (i) Unlike natural fibres, synthetic fibres do not absorb sweat. Therefore, clothes made from these are very uncomfortable in summer or rainy season.
- (ii) Natural fibres can withstand fire for a time being but synthetic fibres can caught fire in a very quick time.
- (iii) Natural fibres are biodegradable and thus do not cause pollution but synthetic fibres are non-biodegradable and hence cause a lot of pollution.

II. Fill in the blanks with the appropriate word/words given in the bracket.

Ans. 1. high, 2. easily, 3. natural, 4. nylon, 5. elasticity

III. State whether the following statements are 'true' or 'false' :

Ans. 1. False, 2. False, 3. True, 4. False, 5. True

IV. Tick (✓) the correct option of the following :

Ans. 1. (c), 2. (c), 3. (a), 4. (d), 5. (b)

4

Metals and Non-Metals

I. Answer the following questions.

Ans. 1. Characteristics of elements : Elements with full outer shells tend to be inert. They do not react easily with other element, they do not easily make compounds with other elements. Helium, argon, krypton, neon and xenon (noble gases) are some elements with full outer shell. They do not react with other elements.

Elements with only a few electrons in their outer shells are more reactive. They form compound more easily with other elements. They may lend electrons to other elements or they may share electrons from other elements to fill their outer shells.

Occurrence : Elements may occur naturally or may be prepared artificially. Out of 115 elements known till today, 92 are naturally occurring and the remaining have been prepared artificially. Under ordinary conditions, most of the elements are solids. Copper, gold, iron and lead are solids. Some elements like bromine, mercury are liquids, still others are gases like nitrogen, oxygen. Eight elements make up almost 99% of the earth's crust.

2. Some of the physical properties of metals are as given below :

(i) **State :** Metals are generally solids at room temperature.

(ii) **Lustre :** Metals usually have lustre. When freshly cut, metals have a brilliant shine over the cut surface. This metallic shine is called lustre.

(iii) **Hardness :** Metals are generally hard. However, metals like sodium, potassium are soft and can be cut with a knife.

(iv) **Density :** Metals generally have a high density. The mass of a substance per unit volume is called density.

(v) **Malleability :** The properties of metals due to which they can be beaten into sheets is called malleability. Metals are generally malleable; for example, gold, silver, copper, etc.

- (vi) **Ductility** : The property by which a substance can be drawn into thin wires is called ductility. Metals are usually ductile.
- (vii) **Melting and boiling point** : Metals in general have a high melting and boiling point.
- (viii) **Tensile strength** : The property due to which a substance can bear a lot of strain without breaking is called its tensile strength. Metals have high tensile strength. However, zinc, arsenic and antimony are exceptions.
- (ix) **Conductivity** : Metals are generally good conductors of heat and electricity.
- (x) **Colour** : All the metals have a silvery grey colour, except gold which has yellow colour and copper which has reddish orange colour.
- (xi) **Sonority** : Metals are generally sonorous. They make a ringing sound when struck.
- (xii) **Solubility** : Metals usually don't dissolve in liquid solvents.
- (xiii) **Opacity** : Metals are opaque substances. We cannot see through them.

3. Chemical properties of non-metals are as follows :

Non-metals have a tendency to accept electrons from metals. After accepting electrons, they are converted into negative ions. Non-metals can combine with other non-metals by sharing electrons.

- (i) **Reaction with oxygen** : Non-metals react with oxygen to form oxides. Some of these oxides form acids when dissolved in water.

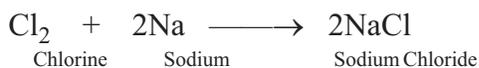


- (ii) **Reaction with acids** : Non-metals do not remove hydrogen from acids. They accept electrons instead of supplying them.
- (iii) **Reaction with chlorine** : Non-metals form chlorides when they react with chlorine.



- (iv) **Reaction with hydrogen** : Non-metals react with hydrogen to form hydrides. These hydrides are formed by sharing of electrons. For example ammonia (NH₃), hydrogen sulphide (H₂S) are well-known hydrides.

- (v) **Reaction with metals** : Non-metals form ionic compounds when react with metals.



4. Uses of Metals : There are three forms of metals useful to mankind. They include pure metals, mixed metals and metal compounds. Some uses of metals are as follows :

- (i) Aluminium foil is used as a packaging material for some food products.
- (ii) Copper and aluminium being good conductors of electricity are used in preparing electrical wires.
- (iii) Mercury is used in thermometres.
- (iv) When iron is mixed with a small amount of chromium and nickel it forms stainless steel, which is hard and does not rust. Stainless steel is used for making utensils, cutlery and surgical instruments.
- (v) On combining the elements sodium and chlorine, a metallic compound called sodium chloride is formed. It is also known as common salt. This salt is used widely food materials.
- (vi) Washing soda, baking soda, bleaching powder, quicklime and plaster of paris are some useful and important metallic compounds.
- (vii) Baking soda or sodium bicarbonate is used in cooking as baking powder, as a medicine against acidity in stomach and in cold drinks.
- (viii) Bleaching powder is used as bleaching agent in laundry. It is also used in paper and textile industries.

Uses of non-metals

- (i) Phosphorus is useful in killing rats and for preserving food grains. Red phosphorus is used in preparing matchsticks and fireworks.
 - (ii) Silicon is widely used as a semi-conductor. It is also used in making glass and cement.
 - (iii) Sulphur is used in manufacturing sulphuric acid. It is useful in preparing skin ointments for skin diseases and for the preparation of disinfectants.
 - (iv) Sulphur is also used in making fireworks and preparing insecticides for agricultural products.
 - (v) Graphite a form of carbon, marks on paper and can easily write on it. It is therefore used for making pencil leads.
- 5.** The activity series of metals is an list of metals ranked in order of decreasing reactivity to displace hydrogen gas from water and acid solutions. It can also be used to predict which metals will displace other metals in aqueous solutions. This series can be given as under :

Table : Reactivity series of metals

Potassium	Most reactive
↓	
Sodium	
↓	
Magnesium	
↓	
Aluminium	
↓	
Zinc	
↓	
Iron	
↓	
Lead	
↓	
Tin	
↓	
(Hydrogen)	
↓	
Copper	
↓	
Silver	
↓	
Gold	Least reactive

6. Metals that are fairly unreactive are called noble metals. Silver, gold and platinum are some noble metals. Uses of these are as follows :

Uses of Silver :

- (i) Silver is a good conductor of electricity. It is used to make contacts in some kinds of electric equipments.
- (ii) Silver is used in electroplating. A layer of silver is deposited on another metal by electrolysis.
- (iii) Silver compounds are commonly used in photography. Silver chloride, silver iodide and silver bromide are all sensitive to light. All are photographic chemicals.
- (iv) It is used to make coins and medals.

Uses of Gold :

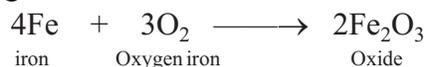
- (i) Gold can be beaten into different shapes. This makes it useful in dentistry. Fillings and crowns can be moulded from it.
- (ii) Gold can be beaten into sheets. It is used for gold lettering.
- (iii) Special coins and medals are made from gold. It is also used in jewellery and ornaments.

Uses of Platinum :

- (i) Platinum is used in number of different alloys. Alloys of platinum and silver are used for making electrical parts and bearings.
- (ii) It is used to make surgical instruments and chemical equipments.

(iii) It is used to make fine jewellery.

7. Corrosion is a chemical process by which metal get damaged and become of no use. When iron combines with oxygen, its surface is changed into iron-oxide as given below :



This is called corrosion.

The best way to prevent a metal from corrosion is to coat the metal with paint and varnish. Painting is cheap and a simple way of protecting iron. In some cases, a layer of oil is better than paint. An oil film on the surface of an iron or steel object provide a barrier against air and moisture. Zinc or tin can be used to coal on iron to stop it from rusting. Steel or iron can also be coated by zinc. This process is called galvanization.

II. Fill in the blanks with the appropriate word/words from the brackets :

Ans. 1. Magnesium, 2. hydrogen, 3. good, 4. higher, 5. Gold, 6. graphite

III. State whether the following statements are 'true' or 'false' :

Ans. 1. True, 2. True, 3. False 4. False, 5. False, 6. True

IV. Tick (✓) the correct options of the followings :

Ans. 1. (c), 2. (a), 3. (d), 4. (a) 5. (a), 6. (c)

5

Combustion, Flame and Fuels

I. Answer the following questions:

Ans. 1. The process of burning of substance in the presence of air or oxygen with the liberation of heat and light is called combustion. Combustion is broadly divided into following categories depending upon the rate at which it takes place.

- (i) **Rapid combustion :** It is a form of combustion in which a large amount of heat and light is released in a very short span of time.
- (ii) **Slow combustion :** This type of combustion takes place very slowly and at low temperature. A steady production of heat is evolved in this type of reaction.
- (iii) **Spontaneous combustion :** It is the rapid ignition of organic matter without apparent cause, typically through heat generated internally by rapid oxidation. For example, Sodium and white phosphorus catch fire without any external heat.

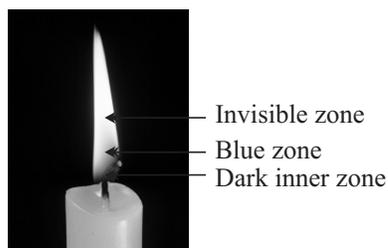
- (iv) **Incomplete combustion** : Incomplete combustion of hydrocarbon fuels takes place in inadequate amount of air or oxygen. This results in the formation of carbon-dioxide, soot, water, heat and light.

Differences between combustion substances and non-combustible substances are as follows :

Combustible substance : A substance which on heating in air or oxygen catches fire easily, with the liberation of heat and light energy, is called a combustible substance. Wood, paper, coal, coke, hydrogen, liquified petroleum gas (LPG), compressed natural gas (CNG), petrol, kerosene, diesel, alcohol, ether etc., are examples of combustible substances.

Non-combustible substance : A substance that does not burn in air or oxygen, is called a non-combustible substance. Substances such as water, glass, cement and sand are examples of non-combustible substances.

2. A flame is a region where combustion of fuel takes place.



Zones of a Flame

3. The candle flame can be divided into three following zones :
- (i) **The innermost zone** : The innermost zone of the candle appears back as it lacks oxygen and hence no combustion takes place. It contains unburnt wax vapours and is the coolest zone of the candle flame.
 - (ii) **The middle zone** : The middle zone is where the wax vapours start burning. The flame is luminous but not very hot. This is the largest and the bright zone of the flame. This zone gives soot and smoke.
 - (iii) **The outermost zone** : This is the hottest part of the flame. The flame appears blue and the temperature is very high. The temperature of this zone is around 1800°C .

A candle burns in the following ways :

- (i) It is the wax vapours that burn. Neither liquid nor solid wax burn.
- (ii) When a candle wick is lit, the heat produced from the flame melts the wax.
- (iii) The wick absorbs the molten wax.

(iv) The gaseous wax burns in the flame, which keeps the flame alive. This process goes on till the entire wax gets burnt.

4. **Formation :** Coal is believed to be formed from fossils which got buried under the earth's crust during earthquakes, volcanic eruptions etc., which occurred about 300 million years ago. Due to high temperature and pressure and absence of air, the fossils got converted into coal.

Occurrence : Russia, China, USA, UK, Germany, Africa and Australia have rich deposits of coal. In India, big coal mines are found in Jharia and Bokaro in Jharkhand and Raniganj in West Bengal.

Types : Different varieties of coal differ from one another in respect of their carbon content and other impurities. The oldest and brilliant solid coal is called anthracite. It contains 94-98% of carbon. The second and the most common variety is bituminous or stone coal. It is soft and less brighter than anthracite. It contains about 82% of carbon. Lignite is the brown coal. It contains 70% of carbon. It is supposed to be the youngest regarding the time of formation. The next type of coal called peat contains about 60% of carbon.

5. **Occurrence :** Petroleum is fossil fuel which occurs deep down under the earth's crust between two non-porous rocks (impervious rocks). Natural gas is found above the petroleum oil, trapped under rocks.

Mining : The crude oil is obtained by drilling a hole into the earth's crust and sinking pipes into it. When the pipe reaches the oil deposits, natural gas comes out with a large pressure. When the pressure is subsided, the crude oil is pumped out of the oil well. The process of obtaining crude oil from its source is called mining.

6. Gaseous fuels are combustible gases that can be burned in a furnace or an engine. Some important gaseous fuels are as follows :

(i) **Gobar gas or biogas :** It is obtained by the bacterial action on cattle dung and water in circular pits in the absence of air. Methane and ethane the main constituents of gobar gas. Biogas is a clean fuel and does not produce smoke. It is convenient to use. It does not have any storage problem. It is directly supplied through pipes from the gas plant. Above all, gobar gas is cheaper than most common fuels.

(ii) **Producer gas :** This gas is a mixture of nitrogen and carbon-monoxide and is prepared by passing air over red hot coke. It is used as a fuel in the industries.

(iii) **Natural gas :** It is obtained from petroleum wells. It is also produced abundantly in marshy areas. It is a mixture of methane and ethane.

(iv) **Compressed natural gas (CNG) :** It is the liquid form of natural gas. Today it is used as a fuel for transport vehicles. It is an environment friendly fuel compared to other fossil fuels.

- (v) **Water gas** : It is a mixture of carbon-monoxide and hydrogen. It is a much better fuel because carbon-monoxide and hydrogen both are combustible.
- (vi) **Coal gas** : It is a mixture of methane, hydrogen and carbon-monoxide. It is obtained by the destructive distillation of coal.
- (vii) **Liquified Petroleum Gas (LPG)** : It is a mixture of butane (85%) and propane (15%). This gas should be used with extreme care because it is highly combustible, highly volatile and catches fire easily.

II. Fill in the blanks with the appropriate word/words from the brackets :

Ans. 1. highest, 2. Gaseous, 3. solid, 4. methane, 5. mining

III. State whether the following statements are 'true' or 'false'.

Ans. 1. True, 2. False, 3. False, 4. True, 5. True, 6. False

IV. Tick (✓) the correct options of the following :

Ans. 1. (c), 2. (d), 3. (b), 4. (b), 5. (a), 6. (a)

6

Conservation of Biodiversity

I. Answer the following questions :

Ans. 1. The existence of a diverse variety of plants, animals and other living organisms, is known as biodiversity. It includes all the forms of life i.e., plants animals and micro-organisms present on the earth. It is the genetic, species and ecological diversity of the organisms in a given area. Biodiversity, i.e. variety of living things makes the world a more beautiful and exciting place to live.

The major threat to biodiversity is the ever-increasing human population and a consequent need for more and more food and shelter. In this century, however human impacts have accelerated that rate possibly causing thousands of species and subspecies to become extinct every year. If present trends continue, millions of kinds of plants, animals and microbes can be destroyed in the next few decades.

The most serious threat to biodiversity comes from habitat destruction. Habitat destruction takes place due to deforestation and due to cities, industries crop lands, mines and many other activities.

2. When we think about negative impacts on animal life caused by humans, our first instinct is to list the harmful practices that impact wildlife. Over hunting and illegal trade causes many species to become endangered or

even to become extinct. This problem also includes negative aspects of the exotic pet trade.

Humans enter sensitive ecosystems and extract precious specimens to sell for pets, or worse, to sell as ingredients for folk medicine or delicacies. This removal of species from the wild degrades the biodiversity and genetic variety in a system and this could eventually lead to the collapse of the entire ecosystem.

Poaching is another harmful impact that humans have on wild life.

Habitat loss is also a major problem for wildlife. This is caused by human developments encroaching on wild areas, and because of deforestation for agriculture or lumber. And finally, humans cause habitat destruction by introducing non-native animals to ecosystems.

The following steps should be taken to conserve wildlife :

- (i) Illegal hunting and trapping of animals should be prohibited.
 - (ii) Animals and plants have a strong relationship with their habitat. Forests constitute the best natural habitat for wildlife. So, the natural habitats should be conserved.
 - (iii) The sale and export of animal products, e.g. tiger and panther skins, rhino, horn, feather, fur, bones, shells of tortoise and turtle, skin of Indian gharials, crocodiles and python snakes and elephant tusks should be prohibited and made punishable by law.
 - (iv) Efforts should be made to protect and propagate the threatened and endangered species in their natural/artificial habitat.
3. Biosphere reserves are protected areas wherein people are important component of the system. These are multipurpose protected areas being developed to :
- (i) conserve representative samples of ecosystems.
 - (ii) long term in-site conservation of genetic diversity and
 - (iii) promote appropriate and sustainable management of the resources.

Effects of Pollution on Biodiversity can be given as under :

Pollution has made the atmosphere impure. By the pollution of fresh water, plants and animals are severely affected. Many sources of food have been affected by the excessive use of pesticides such as DDT. The food contaminated by the pesticides is very harmful for health. It causes the population of the birds to decline. In birds it prevents the formation of eggshells, causing them to break before they can be hatched.

Pollution, thus, disturbs the biological systems which renew natural resources.

4. Species which are restricted to a particular geographic region are called endemic species. In India certain areas are very rich in endemic species like the north-east India, the western Ghats and the north-western and eastern Himalayas. Some endemic species are also specific to the eastern

Ghats. Through the Gangetic plains are generally poor in endemics, the Andaman and Nicobar Islands contribute at least 220 species to the endemic plants of India.

India contains globally important populations of some of Asia's rarest animals. Some of them are the one-horned rhino (Assam), the Bengal tiger and the great Indian Bustard.

5. Movement of animals in large numbers from one place to another to overcome unfavourable conditions is called migration. The Siberian crane is endemic to Siberia. It travels large distances and comes to India in groups during winter to avoid cold unfavourable conditions of Siberia. Some endemic species migrates because of the following reasons :
- Migration provides a suitable place for reproduction. For example, the fresh water eels go to salt water from fresh water to lay-eggs, while the salmon migrates from salt water to fresh water to lay eggs and comes back.
 - Migration often provides the migrating species with more favourable conditions of temperature, food or water. For instance, bats of cold and temperate regions are known to migrate to warmer areas during winter.

II. Fill in the blanks with the appropriate word/words from the brackets :

Ans. 1. deforestation, 2. flora, 3. Deforestation, 4. rhino, 5. 1973, 6. Kerala

III. State whether the following statements are 'true' or 'false' :

Ans. 1. False, 2. True, 3. True, 4. False, 5. False, 6. False

IV. Tick (3) the correct answer the following :

Ans. 1. (d), 2. (a), 3. (b), 4. (c), 5. (a), 6. (c)

7

The Cell

I. Answer the following questions :

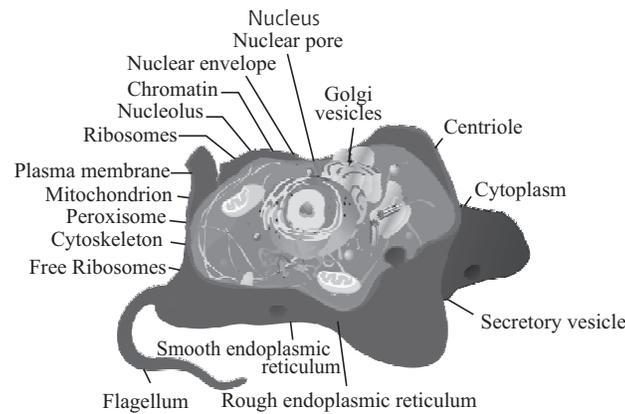
- Ans.** 1. The cell is the basic structural unit of our body. Characteristics of Cells are as follows :
- Cells vary from organism to organism. Some cells are very small (microscopic), while others are large (macroscopic). The cell size of very small bacteria varies from 0.1 to 0.5 micron in diameter. The cells may be oval, rounded, triangular, tubular, cuboidal, spindle-shaped or elongated.
 - Cells must secure food for energy, remove waste, obtain oxygen and synthesise new living material. They must produce necessary chemicals, regulate water balance, react to change in the environment and reproduce other cells.

- Cells were discovered by an English scientist, Robert Hooke in 1665, while examining a slice of cork under a microscope. Hooke observed that a slice of cork is made up of tiny honeycomb, like compartments, one on top to the other. He called these compartments as cells. It was much later that other scientists discovered that all living things are made up of cells.

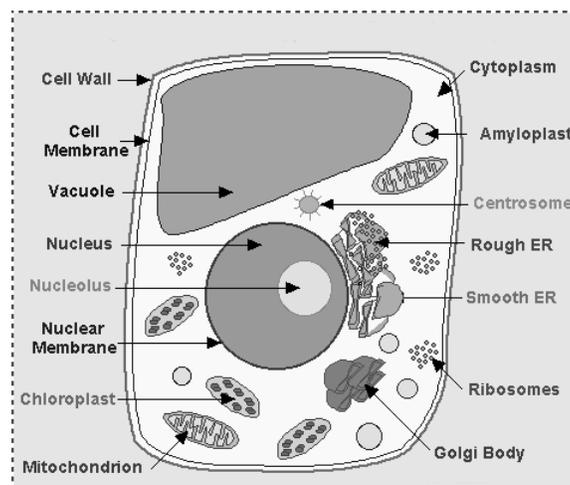
Different Kinds of Cells : There are a lot of different kinds of cells. Different cells can have different purposes, different jobs, different shapes, and different characteristics. For example, plant cells have a cell wall and animal cells don't.

Cells come in different shapes. They can be shaped like balls, cubes, saucers, rectangles, etc. Animal cells are usually spherical or flat-sided. The amoeba, a one-celled organism that lives in water, has no regular shape. Some muscle cells are long, thin, and pointed on both sides. Some nerve cells, with their long branches, look like trees.

3. Structure of an animal cell



Structure (cross-section) of a plant cell



4. The differences between an animal cell and plant cell are as follows :
- (i) One of the biggest differences between a plant and an animal cell is the presence of a cell wall made up of cellulose in plants. This allows plants to build up high pressure inside the cell without bursting. This cell wall is necessary in the case of plants as plant cells need heavy exchange of fluids through osmosis. Animal cells do not have this cell wall.
 - (ii) Another difference arises because of the use of photosynthesis, a process through which plant convert sunlight into food. For this purpose, plants have chloroplasts having its own DNA. This is absent in animal cells.
 - (iii) Plant cells have a large vacuole which is present in cells' cytoplasm. This vacuole takes up all the space in a plant cell with cell membrane encircling them. This vacuole contains waste materials, water and nutrients that plant can use or secrete whenever necessary. On the other hand animal cells have small vacuoles in comparison to plant cells.
 - (iv) Another difference is that plant cells are mostly regular in size whereas animal cells vary greatly in size and shape.

5. The process by which cells reproduce, is called cell division.

Cell division in multicellular organism : After attaining a certain size, the cell divides into two and keeps multiplying by cell divisions. During cell division the nucleus divides first and the division of cytoplasm takes place later. During nuclear division the nucleus enlarges and the nuclear membrane disappears.

The nucleus then splits into two halves. These halves are called daughter nuclei. Then the cytoplasm moves towards the daughter nuclei. At the same time the cell membrane begins to contract from the middle and finally the cell divides into two daughter cells.

6. In multicellular plants, there are two types of tissues mainly, meristematic tissues and permanent tissues.

- (i) Meristematic tissues are located mainly at the tip of the root and stem, in case there is active growth. The thickness of the stem also increases with due to the active cell division of the meristematic tissue.

The root cap consists of dead cells that protect the cells of the meristematic tissue.

- (ii) Permanent tissues develop from the meristematic tissues. The cells of these tissues are larger than that of the meristematic tissues.

Simple tissues : Simple tissues are composed of only one type of cells. These simple tissue are further divided into :

- (a) Parenchyma (b) Collenchyma (c) Sclerenchyma

(iii) **Conducting tissues or complex tissues** : Tissues that help in performing their function, are called conducting tissues or complex tissues. There are two types of conducting tissues in plants.

(a) Xylem (b) Phloem.

(iv) **Cork Tissue** : Cork tissue is a collection of tightly packed dead cells found on the inner bark of the woody plants.

(v) **A vascular tissue** : Xylem and phloem tissues together make up the vascular bundle. The arrangement of vascular bundles differs in the root, stem and leaf.

7. **Animal Tissues** : Main kinds of animal tissues are as given below :

(i) **Epithelial tissues or surface tissues** : An epithelial tissue is a thin, protective layer of cells. It covers the outer and inner lining of all the body parts such as outer surface of the skins, inner surface of the mouth, oesophagus (food pipe), stomach, intestine, and lungs.

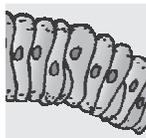
Types of epithelial tissues :

(a) Columnar epithelium

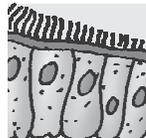
(b) Ciliated epithelium

(c) Squamous epithelium

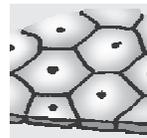
(d) Glandular epithelium.



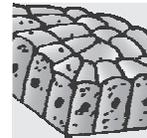
Columnar



Ciliated



Squamous



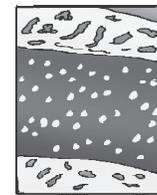
Glandular

(ii) **Connective tissues** : A connective tissue connects of various tissues and organs. Different types of connective tissues are as follows :

(a) **Tendons** : Tendons connect or attach muscles to bones. They look like strong, white cords and are made of a protein in the form of densely packed bundles of collagen.

(b) **Ligaments** : Ligaments are bands of tough fibrous tissues that hold body organs such as the heart, in place and fasten bones together.

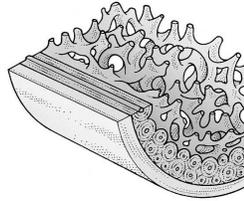
(c) **Cartilage** : Cartilage is a non-porous, transparent and elastic tissue without blood vessels and nervous tissues. It has an intercellular substance called matrix. Cartilage are found in nose, ears, rings of trachea and bronchial tubes, between vertebrae and at the ends of long bones.



Cartilage Tissue

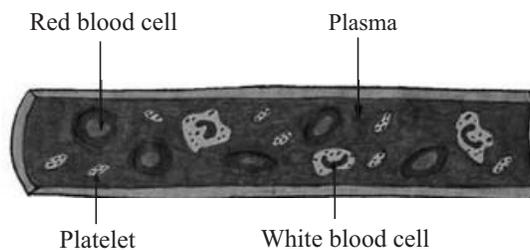
(d) **Bones** : A bone is a hard and porous tissue. It has a good supply of blood vessels and nerves. It consists of both living cells and a rigid mass of inorganic salts such as compounds of calcium and

phosphorus. The collagen it has, gives the bone resistance, while calcium and phosphorus make it hard.



Bone tissue

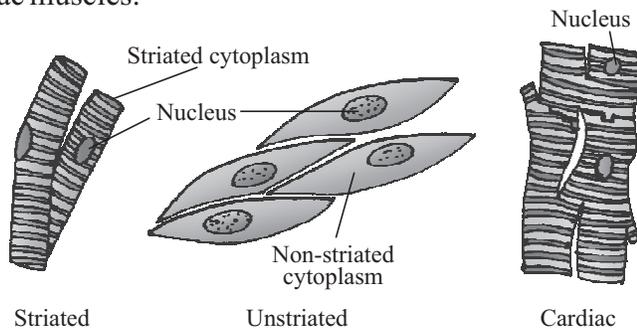
- (e) **Blood :** Blood is a fluid vascular tissue and contains the blood cells. It consists of plasma, the extracellular fluid (ECF) and solid corpuscles or cells. Blood is made of three kinds of cells, namely the white blood cells, the red blood cells and the platelets. The red blood cells carry oxygen to all parts of the body, the white blood cells help to fight infection and the platelets help in the formation of blood clot.



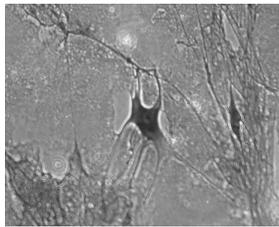
The Structure of RBCs and WBCs

- (iii) **Muscular tissues :** The muscular tissues form the body muscles which contract and relax. This way, they help the body for all types of movements. A muscular tissue is a bundle of long and cylindrical cells. Organs like the heart, stomach, intestine, urinary bladder and the muscles of arms and legs etc., are formed of muscular tissues. There are three kinds of muscular tissues :

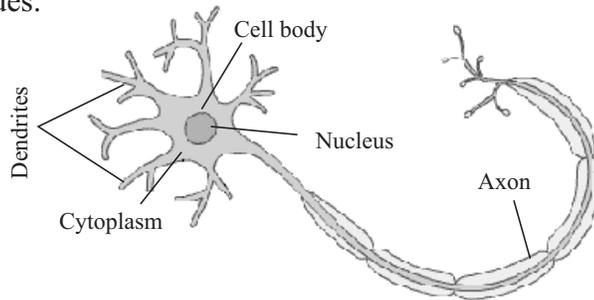
- (a) Striated or voluntary muscles (b) Unstriated or involuntary muscles (c) Cardiac muscles.



- (iv) **Nervous tissues :** The nervous tissues constitute the nervous system. A nervous tissue is made of elongated cells called neurons or nerve cells. Each nerve cell consists of a cell body called cyton. The cyton contains the nucleus and one or more elongated hair like extensions called the dendrites or dendrous. One of these is long and is called axon. Several axons bound together to form a nerve. The brain and the spinal cord are formed of nervous tissues.



A nervous tissue



The Structure of a Nerve Cell

II. Fill in the blanks with the appropriate word/words given in the brackets:

Ans. 1. organ, 2. Mitochondria, 3. Plastids, 4. microscope, 5. simple, 6. Multicellular

III. State whether the following statements are 'true' or 'false':

Ans. 1. True, 2. False, 3. False, 4. False, 5. True

IV. Tick (✓) the correct options of the following :

Ans. 1. (b), 2. (a), 3. (d), 4. (d), 5. (a), 6. (a)

8

Reproduction and The Endocrine System

I. Answer the following questions.

Ans. 1. The process by which living beings produce offsprings of their own kind, is called reproduction. In animals reproduction is of following two types :

(i) Asexual Reproduction :

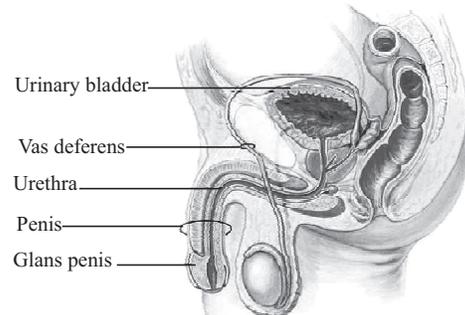
(a) Binary fission : Unicellular organisms such as amoeba, paramecium and euglena reproduce by the method of binary fission. When amoeba is ready to reproduce, it splits into two. The two little amoeba then feed and grow. When fully grown, each amoeba splits again.

- (b) **Budding** : Hydra reproduces by the process of budding. A new hydra grows out of the side. It gets food from its parent. Ultimately, the new hydra breaks away and becomes independent.
- (ii) **Sexual Reproduction** : Most multicellular organisms reproduce sexually. These are of various types :
The organisms which produce only one type of gametes are called unisexual. Frogs, fish, birds, reptiles and humans are all unisexual. Some of organisms produce both the gametes in the same individual. These organisms are called bisexual or hermaphrodite. Earthworms, leeches and flower of most of the plants are examples of bisexual organisms.
Reproduction in some animals are as follows:
- (a) **Reproduction in fish** : Bony fish reproduce by the male and the female. They release sperms and eggs into water. The sperms then swims to the eggs to fertilize them. This is called external fertilization or spawning.
- (b) **Reproduction in Frogs and Toads** : Frogs and toads are amphibians. Although they live on land, they breed in water. The male mates the female to complete fertilization in water. The fertilized egg develops into larva (the tadpole) which finally changes into adult.
- (c) **Reproduction in Reptiles and Birds** : Reptiles and birds lay eggs. The males and females mate on the land. The sperm are put inside the female body, where they fertilize the eggs. This is called internal fertilization.
- (d) **Reproduction in mammals** : Mammals also have internal fertilization. The embryo develops inside the mother's body and is born at a right stage. Mammals take peculiar care of their young ones.
2. Development of some secondary sexual characteristics in boys and girls are called puberty. Puberty is the time when a boy is biologically ready to become a father and girls is biologically ready to become a mother.
- Puberty in boys** : In boys, puberty starts around the age of 12-14 and continues till about the age of 18. In boys, one particular hormone released from the pituitary gland stimulates the testes to produce the male sex hormone testosterone. This hormone is responsible for the development of secondary sex characteristics and the development of sperm cells in males.
- Puberty in girls** : In most girls, the puberty stage starts at the age of 11-12 and is completed by the age of 17. In girl, one particular hormone released from the pituitary gland stimulates the ovaries to produce female

sex hormone such as oestrogen and progesterone. Oestrogen is responsible for the production of eggs and development of secondary sex characteristics in females.

3. Male Reproduction Organs :

Testes or testis is an endocrine gland. A pair of testes are small, oval and extra abdominal structures. These are located in a sac called scrotum. Each testis contains many seminiferous tubules. A duct called urethra originates from each testis.

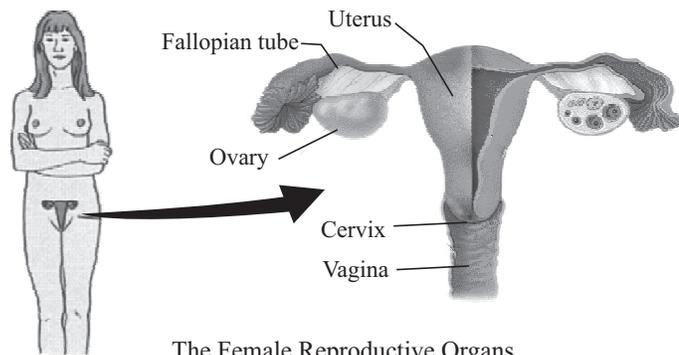


A narrow duct which helps to transport sperms from the testes. In the abdomen vas deferens passes over the urinary bladder and joins the urethra from behind.

The urethra runs through a muscular organ called penis. The tip of penis is slightly broader and is called glans. The special structures called seminal vesicles, in the testes, secrete a fluid for the nourishment of sperms. The sperm cells are released into the female genital tract by the penis.

4. Female Reproductive Organs :

(a) **Ovaries** : The ovaries are a pair of small, almond-shaped structures situated near the front of the abdomen. They are cream-coloured. They produce female sex hormones oestrogen and progesterone.



The Female Reproductive Organs

(b) **Oviducts** : The oviducts or fallopian tubes, are a pair of tubules that extend from near the ovaries to the uterus. Each oviduct has a funnel-shaped opening lying close to the ovary called the oviducal funnel or infundibulum which has finger-like projections called the fimbriae. It collects ovum from the peritoneal cavity due to vibration of fimbriae.

(c) **Uterus :** Uterus is the organ where the zygote matures and grows till it is ready to be born. The embryo (the developing baby) grows and develops inside the uterus which is also called the womb.

The uterus is a hollow pear-shaped muscular structure which lies between the urinary bladder and the rectum in the pelvis region. Its upper broader part is called fundus, the middle part the body and the lower narrow part is called cervix. Cervix leads into vagina.

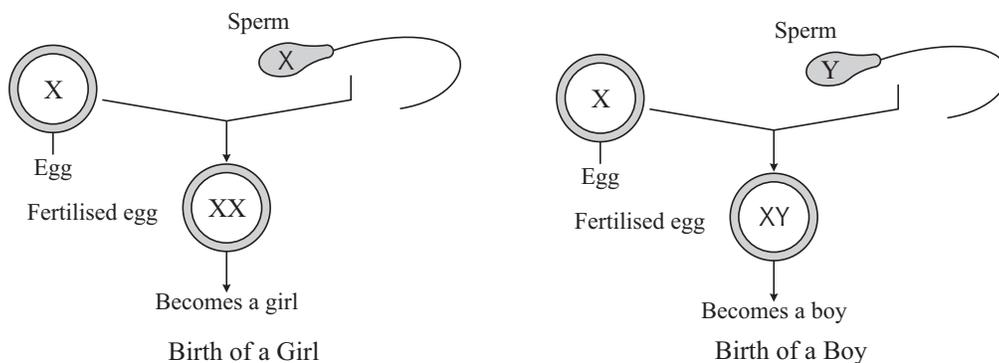
(d) **Vagina :** Vagina is a narrow, muscular canal that opens outside through vaginal opening situated in the vestibule between the folds of labiaminorla of the vulva, the female genitalia. The vagina, receives the seminal fluid, serves as the lower part of the birth canal and acts as an excretory duct for uterine secretions and menstrual flow.

5. Spawning is the other name of external fertilization. In it the sperms and eggs are released into water. The sperms then swims to the eggs to fertilize them. Bony fish is an animal which reproduce by this method.

6. The sex of the baby developing inside the mother's womb is determined by a special part of our body cells called chromosomes. Each cell contains 23 pairs of chromosomes. Of these, one pair contains the genes for sex chromosomes. There are two types of sex chromosomes, X and Y. Female cells contain the XX pair, while male cells carry the XY pair.

The gametes contain only one set of chromosomes consisting of one member of each pair. The female egg cells contains one X chromosomes to represent the sex chromosome, while a male sperm cells carry either of the two sex chromosomes-X or Y.

When the egg gets fertilized the sex of the baby will depend on which sperm fertilises it. If the sperm carrying the X chromosomes fertilises the egg, it would be a girl, since the chromosomes pair will be XX. If the sperm carrying the Y chromosome fertilises the egg, the baby will be a boy, since the pattern will be XY. So, the sex of a baby depends on the fathers sperm and not on the mother's ovum.



7. The chemical substances which regulate and co-ordinate various body functions are called hormones.

Hormones play a vital role in human body. They trigger off the start of many processes in the body. Each gland produces a specific hormone and secretes it directly into bodies and out like chemical messengers. It is because of these hormones that we experience various moods such as anger, happiness, sadness, excitement and irritation.

8. Fertilization is the action or process of fertilizing an egg, female animal or plant, involving the fusion of male and female gametes to form a zygote.

Two types of fertilization are as follows :

- (i) **Internal fertilization** : In it the fusion of male and female gametes occurs inside the female body.
- (ii) **External fertilization** : In it the fusion of male and female gametes occurs outside the female body.

II. Fill in the blanks with the appropriate word/words given in brackets :

Ans. 1. sperm, 2. fertilization, 3. gestation, 4. Placenta, 5. sexual, 6. Vas deferens, 7. adrenal

III. State whether the following statements are 'true' or 'false':

Ans. 1. True, 2. False, 3. True, 4. True, 5. True

IV. Tick (✓) the correct options of the followings :

Ans. 1. (d), 2. (c), 3. (b), 4. (a), 5. (c)

9

Force and Friction

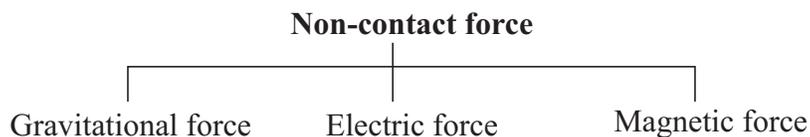
I. Answer the following questions :

Ans. 1. A force is a physical cause that changes or tends to change the state of rest or of motion of an object. The word push, pull stretch and squeeze denote a force.

Effects of Force :

- (i) **Force can make a stationary object move or make a moving body move faster** : Force is physical quantity that changes or trends to change the state of rest or uniform motion of an object in a straight line.
- (ii) **Force can slow down or completely stop a moving object** : Force is a quantity whose direction is very important. For example, if we want to stop a moving body, we have to apply a force opposite to the direction of motion of the moving body.

- (iii) Force can change the direction of a moving object : A body moving in a circular path is continuously changing its direction. Such a body is under the influence of a force continuously. For example, the earth is continuously under the influence of Sun's gravitational force.
 - (iv) Force can change the shape and size of objects : If you pull a rubber band, it becomes longer and finally breaks. You can also break things by applying a force.
2. (i) **Contact forces** : A force applied on an object by another object which is in direct contact with it, is called a contact force. Frictional force is an example of contact force. It is exerted between the surfaces to two bodies in contact.
- (ii) **Non-contact forces** : When a force is applied on an object without coming in contact with each other, it is called a non-contact force. These forces act at a distance. Examples of non-contact forces are as follows :



3. Friction is the resistance to motion experienced when two surfaces, in contact, move with respect to one another.
The force of friction depends upon the following factors :
- (a) Frictional force depends on the nature of the surfaces in (i.e., smoothness or roughness) contact with each other.
Friction is reduced when there is less contact between the two surfaces. That is why less force is used to move a load when rollers are placed under it.
 - (b) The force of friction is directly proportional to normal reaction. If F is the force of friction and R is the normal reaction then :

$$F \propto R$$
 or
$$F = \mu R$$
 where μ is the coefficient of force of friction.
 - (c) The force of friction is independent of area of contact.
Within limits, friction between two solid surfaces moving with respect to each other does not depend on the relative speed between the two surfaces and the area of contact.
4. Small metal balls made of stainless steel, brass, ceramic, etc., that are placed between moving surfaces (the surfaces can be flat or cylindrical) to reduce friction are called ball bearings.
Ball bearings are very useful as they change the sliding friction into rolling friction. This is a very useful thing to do since rolling friction is

much smaller than the sliding friction. Ball bearings are used in most mechanical structures which have moving parts.

5. Advantages of friction are as follows :

- (i) Friction is used to hold objects with our hands, gripping, climbing a ladder, sitting on a chair etc.
- (ii) While walking, we push obliquely on the ground and the force of friction acts in the opposite direction. The reaction of the force of friction on the foot in the forward direction helps us to walk, while the reaction force in vertical direction balances the weight of the body.
- (iii) Friction helps screws and nails to hold in the wood. Nuts and bolts are held together only due to friction.
- (iv) Brakes of a vehicle depend on friction. When brakes are applied, the vehicle is stopped by the force of friction between the brake-lining and the drum (or the wheel).
- (v) A billiard player depends on the frictional force between the ball and the end of his cue for a good shot.

In some cases greater friction is required, which can be achieved by the following methods :

- (a) **By making the surface rough :** The rough surfaces provide a better grip on each other. That is why the tyres of vehicles are made rough.
- (b) **By increasing weight :** By increasing the weight of a moving body, the friction increases, which makes a better grip of the two surfaces.
- (c) **By using a dry surface :** Dry surfaces provide more friction than the wet ones. That is why sand is sprinkled on a smooth road after rains to make it rough.

6. Disadvantages of friction are as follows :

- (i) Due to friction, unwanted heat and noise are produced. The heat can damage machine parts and reduce the efficiency of the machine. This noise can also be a serious pollutant and affects the people living close to the source of noise.
- (ii) Due to friction, wear and tear of the machinery increases. It reduces the life of the machine.
- (iii) When a body moves over another body, a part of energy is used in overcoming the force of friction. This energy dissipates in the form of heat energy.
- (iv) If the engine of a vehicle is not given a continuous supply of oil, the position of cylinder gets so hot that they get jammed.

Reducing Friction : Undesirable friction can be reduced in following ways. This is done to improve the efficiency and to minimize the loss of energy.

- (a) **By using lubricants** : Common lubricants like oil, grease, graphite powder, compressed air etc., are applied between two surfaces in contact for reducing friction between them.
 - (b) **By polishing** : Surface irregularities which cause friction can be reduced to minimum by using sand paper.
 - (c) **By using ball bearings or roller bearings** : Ball bearings and roller bearings are used in the systems to minimize friction.
 - (d) **By streamlining** : By designing the shapes of many moving objects through a fluid (air or water) friction between the object and the fluid can be reduced to a large extent. Aeroplanes, rockets etc. are given streamlined shapes to reduce friction.
7. Lubricants are the substances, such as oil or grease, used for minimizing friction, esp. in an engine or component. It is a substance introduced to reduce friction between moving surfaces. Lubricants fill minute unevenness of the two surfaces and separate them by forming a very thin layer in between, i.e. converting solid frictions into fluid friction, which is surely less than the solid friction.

II. Fill in the blanks with the appropriate word/words given in the brackets:

Ans. 1. force, 2. newton, 3. non-contact, 4. streamlined, 5. hot, 6. Gravitational

III. State whether the following statements are 'true' or 'false':

Ans. 1. False, 2. True, 3. False, 4. True, 5. False, 6. True

VI. Tick (✓) the correct options of the following statements :

Ans. 1. (a), 2. (d), 3. (a), 4. (d), 5. (a)

10

Pressure

I. Answer the following questions:

Ans. 1. The physical quantity that combines force and the area over which it acts is called pressure. The SI unit of pressure is pascal (Pa), which is newton per square metre.

$$\text{Pressure (in Pa)} = \text{Force (in newton)} / \text{Area (in m}^2\text{)}$$

$$\text{or } P = F/A$$

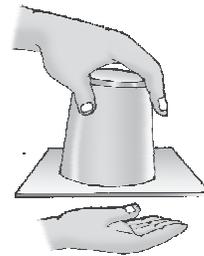
Pressure depends on many factors. Such as low pressure areas have less atmospheric mass above their location, whereas high pressure areas have more atmospheric mass above their location. Likewise, as elevation increases, there is less overlying atmospheric mass, so that pressure decreases with increasing elevation.

2. Examples involving pressure :
- Sharp cutting edges of tools :** All cutting instrument like knives, scissors, blades etc., have sharp cutting edges so that the area of cross-section is minimum. The area under the edge of a knives blade is extremely small beneath it, to push easily through the material that needs to be cut.
 - Movement of a camel on sand :** A camel can easily walk on sandy ground in desert, while we cannot walk on sand like a camel. It is because a camel has flat broad feet that increases the area of contact with the sand. Because of which the pressure exerted by the camel on the sand is reduced and its feet sink very little in the sand. This makes a camel move fast on the sand.
 - High building on wide foundations :** Base area of a high tower or a tall building is quite large so that the ground is able to tolerate the pressure of the building or the tower.
 - Use of long skis :** Skiers use long and flat skis to slide on the snow. Large area of cross-section of skis reduces the pressure on the snow and sinking down into the soft ground. So, the skiers easily slide over snow without sinking their feet into ground.
 - Buses and trucks with wheels and wide tyres :** Usually, heavy trucks are provided with broad wheels at the rear end on either side so that the surface area of tyre increase and with the result, pressure exerted due to heavy load is decreased. Hence, trucks do not sink deep in the soft muddy mud.

3. To show the presence of atmospheric pressure, do the following :

Take a glass tumbler (with a smooth edge of the mouth and without a rim), a piece of stiff cardboard (little bigger than the mouth of the tumbler) and water.

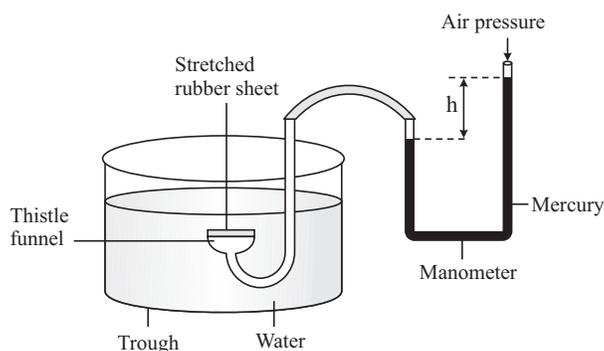
Fill the tumbler with water to the brim and cover it with the cardboard piece. Place your palm over the piece of cardboard and quickly invert the tumbler. Slowly remove your hand supporting the piece of cardboard.



You will see that the cardboard piece will not fall, but will be able to support a full glass of water. This happens because the atmospheric pressure provides enough force to push the cardboard piece upward.

4. To show that the pressure at a point in a liquid acts equally in all directions, do the following :

Keep the thistle funnel at some particular position within the liquid (water) in a pressure detector. Note down the level of the liquid in U-tube of manometer. Now turn the mouth of the thistle funnel in different directions keeping the depth constant. By looking at manometer, you will



find that the level of the liquid U-tube does not change. It shows that equal pressure is exerted in the liquid in all directions.

5. Important facts about pressure in liquids are as follows :
 - (a) **Pressure in a liquid increase with depth :** Pressure exerted by a liquid increases with increasing depth. This is because the deeper you go, the greater the weight becomes above.
 - (b) **Pressure at one depth acts equally in all directions :** From a vessel of water having similar holes all round it at the same level, water comes out as fast and far from each hole. Hence, the pressure exerted by the water at this depth is the same in all the directions.
 - (c) **A liquid finds its own level :** When a liquid is poured into communicating tubes, it stands at the same level in each tube. This proves that a liquid finds its own level.

6. Atmospheric pressure is measured with a device called barometer.

Structure : A barometer has a following type of structure.

A tube of 1 m (100 cm) long is filled with pure and dry mercury, so that all air bubbles are trapped out while filling, and then this tube is inverted in a bowl of mercury. The mercury falls by a few centimeter creating an empty space above the mercury level.

Measuring atmospheric pressure : The method of measuring pressure in it is to record the level of mercury. A mercurial barometer has a section of mercury exposed to the atmosphere. The atmosphere pushes downward on the mercury. If there is an increase in pressure, it forces the mercury to rise inside the glass tube and a higher measurement is shown. If atmospheric pressure lessens, downward force on the mercury lessens and the height of the mercury inside the tube lowers. A lower measurement would be shown.

7. Force = 50 m
 Area = $0.005 \times 10^{-4} \text{ m}^2$
 = $5 \times 10^{-7} \text{ m}^2$

$$\begin{aligned}
 &= \frac{\text{Force}}{\text{Area}} = \frac{50 \text{ N}}{5 \times 10^{-7} \text{ m}^2} \\
 &= 10 \times 10^7 \text{ Pa} \\
 &= 1 \times 10^8 \text{ Pa (or 10,00,00,000 Pa)}
 \end{aligned}$$

II. Fill in the blanks with the appropriate word/words from the brackets :

Ans. 1. pascal, 2. fluids, 3. pressure, 4. atmospheric, 5. height, 6. pressure

III. Write whether the following statements are 'true' or 'false' :

Ans. 1. True, 2. False, 3. False, 4. True, 5. False, 6. False

IV. Tick (✓) correct option of the following statements :

Ans. 1. (b), 2. (b), 3. (d), 4. (b), 5. (a)

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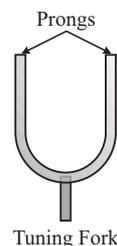
Sound

I. Answer the following questions.

Ans. 1. Sound is a mechanical wave that is an oscillation of pressure transmitted through a solid, liquid, or gas, composed of frequencies within the range of hearing and of a level sufficiently strong to be heard. Sounds are generally produced by vibrations. This can be proved by the following activity.

A sound is produced because of a vibration. Thus, sound is a vibration, that is capable of being heard. Every sound producing body can be called a vibrating body.

Tuning Fork : It is a U-shaped metallic bar with a stem in the middle. The two arms of the tuning fork are called prongs. Prongs are set into vibrations when any one of them is struck with a rubber pad gently. Tuning forks are made of frequencies which normally correspond to musical notes. The value of frequency is marked on the tuning fork.

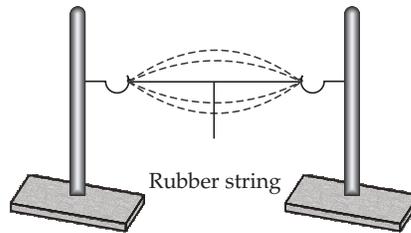


2. Objects that produce sound are called sources of sound. Some common sources of sound are automobile horns, television, radio, music systems, machinery in factories, human being and animals. Even the rustling of leaves in the breeze, sound of rain falling on the roof, sound of thunder and zooming of aeroplanes also produce sound. It is important to understand that sound can be produced from almost all objects around us. Do the following activity to understand it.

A stretched vibrating rubber string produces sound.

Tie both the ends of a rubber string with two poles as shown in the figure. Pull the string gently to stretch it and release it.

A pleasing sound is heard. The sound lasts as long as the rubber string vibrates. When the string stops vibrating, you do not hear any sound. Vibrations in a stretched rubber string produce sound.



3. Sound travels in the form of waves. Waves are characterized by their frequency, speed and amplitude. Two main characteristics of sound are pitch and loudness, which in turn are determined by the frequency and amplitude of the waves, respectively. Main characteristics of sound are as follows :

(a) **Loudness** : If we strike a drum hard, its skin vibrates with a greater amplitude producing a louder sound. On the other hand if it is struck softly, its skin vibrates to produce soft sound.

The amplitude of a vibrating body is the maximum displacement from its mean position to which the body moves. As, the amplitude of a wave is directly related to its energy, so we can say that the greater the energy carried by the wave, the louder is the sound produced.

Loudness is the property by virtue of which a loud and faint sound is distinguished from one another, both having the same pitch.

(b) **Pitch** : It is the characteristics of sound by which an acute or shrill note can be distinguished from a grave or flat note. Different sounds of the same loudness can be distinguished by the difference in their frequencies. The sound produced by an object with a high frequency is called shrill or high pitched sound. If the pitch is low, the sound is flat or grave and its frequency is also very low.

(c) **Quality or Timbre** : Quality or timbre is the characteristics of sound by means of which you can distinguish two notes of the same loudness and pitch but sounded by two different instruments.

4. Audible sounds are those sounds which are in the range of 20 Hz to 20,000 Hz frequency. These sounds can be heard by us. For example, sounds made by other human beings, musical instruments, most of the animals, etc.

Inaudible sounds are those sounds which have a frequency of below 20 Hz and above 20,000 Hz. We cannot hear these types of sounds. For example sound made by Galton Whistle, bats, etc.

5. Differences between noise and music can be shown below :

Noise :

- (i) Noise produces a disagreeable or jarring effect on ears.
- (ii) In a noise, there is no regularity about the waves.
- (iii) There may be quite sudden changes of loudness or intensity in a noise.
- (iv) Various notes can be heard separately during a noise.
- (v) Generally, frequency is low in noise.

Musical sound :

- (i) Musical sound produces an agreeable or a pleasing effect on ears.
- (ii) In musical sounds, waves succeed each other at regular intervals.
- (iii) There are no sudden changes of loudness or intensity in a musical sound.
- (iv) The different notes constituting the sound succeed each other so rapidly that ears are not able to perceive them separately.
- (v) Generally, frequency is high in musical sounds.
- (vi) Noise pollution is caused by unwanted sound from any source that causes discomfort of any kind.

6. Noise can lead to the following health hazards :

- (i) Loud noise during night disturbs sleep and comfort.
- (ii) It may cause partial or permanent hearing loss.
- (iii) It may also cause lack of concentration in work and studies.
- (iv) It increases nervous tension, irritation and blood pressure.

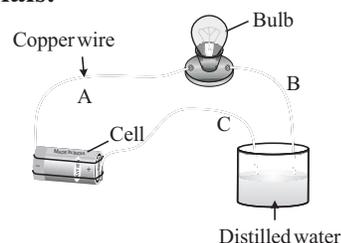
Measures of reducing noise pollution :

Following are some of the measures one should adopt to keep noise pollution under control. It requires a certain degree of discipline.

- (i) Traffic noise could be reduced to a great extent by instilling traffic discipline among bus and automobile devices.
- (ii) The use of loudspeaker should be stopped.
- (iii) Cars and other vehicles should not play loud music while driving. This can disturb the concentration of other drivers and also the residents of the neighbourhood.
- (iv) People working in factories etc. where they are subjected to constant loud noise of machinery should take special precaution to protect their ears.
- (v) People living in flats should not talk too loudly or play the music system too loudly so as not to disturb their neighbours.
- (vi) Airports and noise-making factories should be shifted away from the residential area of the city.

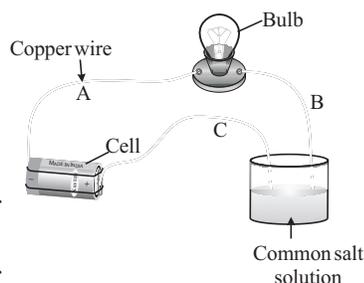
II. Fill in the blanks with the appropriate word/words from the brackets :**Ans.** 1. vibrations, 2. stringed, 3. different, 4. longitudinal, 5. Unwanted**III. Write whether the following statements are 'true' or 'false' :****Ans.** 1. True, 2. False, 3. False, 4. False, 5. False, 6. False**IV. Tick (✓) the correct options of the following statements :****Ans.** 1. (d), 2. (c), 3. (b), 4. (d), 5. (a)**I. Answer the following questions :****Ans.** 1. An electric current is a stream of moving electrons. The path along which the movement of electrons takes place, is called an electric circuit.**Testing the electrical conductivity of materials.**

Take a dry cell and connect conducting wires and an electric bulb with it. Keep a gap of 5 cm between two ends of conducting wires in the circuit. Place the materials to be tested in the gap making sure it touches ends of the wires and thus, the circuit is completed. Observe whether the bulb lights up. The bulb lights up when the material is a conductor of electricity.



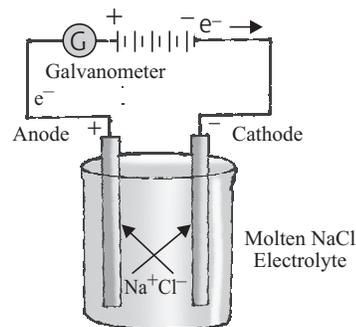
2. To show that pure water is a bad conductor of electricity.

Take a dry cell, connecting wires and electric bulb. Connect the bulb and dry cell with connecting wires. Fill a beaker about half with distilled water (pure water). Dip the open ends of the connecting wires as shown in the figure. The bulb does not light up because pure water is a bad conductor of electricity. If you test it with simple tap water, bulb will light up. It because of dissolved salts in water.



3. The production of a chemical reaction by passing an electricity through an electrolyte is called electrolysis. A liquid that conducts electricity because of ions is called an electrolyte.

Process of electrolysis : In an electrolytic cell two plates or rods made of a conducting material like (graphite, copper) are dipped in a liquid called electrolyte. These plates are called electrodes. One of them connected to the negative pole of the cell, is called the cathode and the other one connected to the positive pole of the cell, is called the anode. The ends of the two electrodes are connected to a cell/battery.

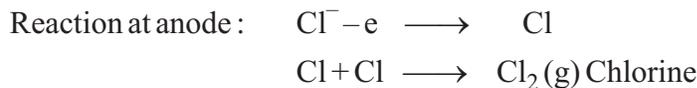
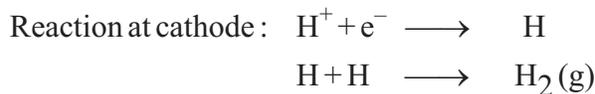
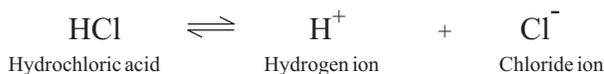


When we switch on electric current, the electrolyte breaks into positive and negative ions. The positively charged ions called the cations move towards the cathode and the negative ions called the anions, move towards the anode.

At the cathode, the cations take up electrons and become neutral. The anions move to the anode and give up electrons. This explains how ions move in an electrolytic cell and thus 'conduct' electricity.

- Hydrochloric acid (HCl) is an electrolyte. When dissolved in water, it forms hydrogen ions (cations) with a positive charge and chloride ions with a negative charge (anions). On electrolysis of hydrochloric acid, the hydrogen ions travel towards the cathode, the negative electrode and the chloride ions travel towards the anode, the positive electrode. When the ions reach the electrodes, their electric charges are neutralized. That is, cations accept electrons from the cathode to become neutral atoms and anions donate electrons to anode to become neutral atoms. The hydrogen atoms become molecules of hydrogen gas and the chloride atoms become the molecules of chlorine gas. Bubbles of two different gases rise up from the electrodes. The overall reactions taking place during the electrolysis of hydrochloric acid are as given below :

Dissociation :



- Pure water is a bad conductor of electricity. To make the water an electrolyte, a small amount of sulphuric acid (H_2SO_4) is added to it. The resulting solution is called acidulated water.

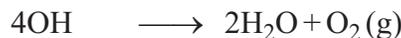
The acidulated solution is taken in

a voltmeter consisting of platinum electrodes. The test-tubes filled with acidulated water is inverted over each electrode as shown in the figure. Electrolysis is carried out by passing an electric current through the electrodes.

Hydroxyl ions (OH) move towards the anode and lose one electron each to become OH atoms. The hydroxide atoms combine to form water and oxygen gas is liberated.

During the passages of electricity, for every one volume of oxygen liberated at anode, two volumes

overall reactions taking place during the electrolysis of acidulated water are as given below :



6. When we pass an electric current through a copper sulphate solution, it dissociates into copper ions and sulphate ions. The electrodes here are also made of copper.

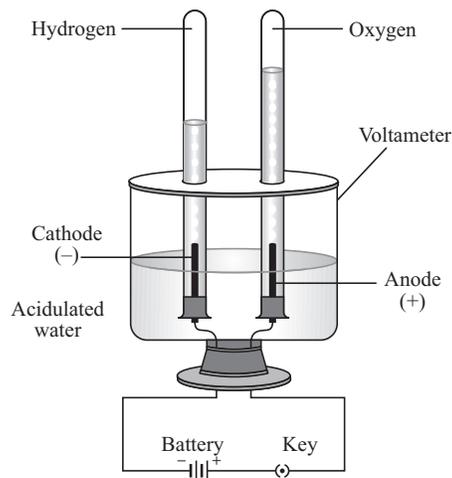
At cathode : The copper ions, which are positively charged move to the cathode. They gain electrons here and get deposited as copper metal on the cathode.

At anode : At anode, the copper metal loss electrons and becomes copper ions that go into the solution. They then move to the cathode and get deposited there.

The sulphate ions do not take part in the reaction. The anode slowly dissolves into the solution. The reaction takes place as long as the anode lasts. An important application of this process is the purification of copper metal.

7. Different chemical effects of chemical current having useful applications are as follows :

(a) **Extraction :** Many metals like aluminium and sodium are extracted from their ores by using electricity. The extraction of metals from their molten ores by electrolysis is called electro-metallurgy.



Electrolysis of Acidulated Water

- (b) **Electroplating** : Electroplating is a method of coating a metal that easily corrodes with a metal that does not corrode easily. The plating is done by using electric current.
8. Applications of electroplating are as follows :
- (a) **Decoration** : Metals used for jewellery, like gold and silver are very expensive. In order to reduce the cost, cheaper metals are used to make jewellery and thus coated with silver or gold.
- (b) **Protection against corrosion** : Articles made of more reactive metals such as iron get rusted often; so to protect them, they are electroplated with less reactive metals. For example, iron is plated with chromium in some parts of cycles and automobiles to protect them from being rusted.
- (c) **Electroplating** : It is used in the manufacture of printed circuit boards (small electrical circuits) with electronic components generally printed on a plastic board, which are used in many appliances like radios, T.V., computers etc.

II. Fill in the blanks with the appropriate word/words given in the brackets:

Ans. 1. electrons, 2. molten, 3. chemical, 4. positive, 5. cathode, 6. citric, 7. LED, 8. cation, 9. increase, 10. copper

III. Write whether the following statements are 'true' or 'false':

Ans. 1. True, 2. False, 3. False, 4. True, 5. False, 6. False, 7. True, 8. False, 9. False, 10. True

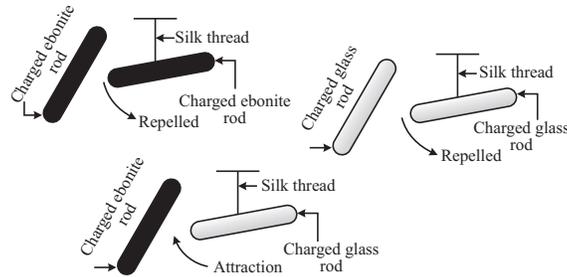
IV. Match the statements in column 'A' with those in column 'B':

Ans. 1. (b), 2. (a), 3. (e), 4. (f), 5. (c), 6. (d)

V. Differentiate between :

- Ans.** 1. **Electrolyte** : The molten materials that conduct electricity are called electrolytes.
Non-Electrolytes : The substances which in their water solution or in molten state cannot pass electric current, are called non-electrolytes.
2. **Cations** : These are the positively charged ions in an electrolyte.
Anions : These are the negatively charged ions in an electrolyte.
3. **Conductor** : Material that allow electric current to flow through them are called conductors.
Insulator : Materials is that do not allow electric current to pass through them are called insulators.
4. **Cathode** : Cathodes are the negative terminal in a battery.
Anode : Anodes are the positively terminal in a battery.
5. **Electro refining** : The refining or purification of metals such as copper, gold, silver and lead is done by using electricity. It is called electro refining.
Electroplate : Electroplating is a method of coating a metal that easily corrodes with a metal that does not corrode easily. The plating is done by using electric current.

force on each other. If the two objects are oppositely charged (positive-negative) or negative-positive) they attract each other.



4. When the two oppositely charged bodies are brought close to each other, an electric field is developed between them. If the air gap is quite small, the strong field can pull the electrons out of the atoms of air molecule forming ions. Discharging takes place which is seen as a flash with cracking sound. This phenomenon of discharge is called 'sparking'.
5. **Lightning** : Lightning is a static charge that that moves from a cloud to the ground, from the ground to a cloud or from one cloud to another. Lightning usually strikes with thunderstorms.

Occurrence : When the weather is humid and there is wind blowing, clouds develop static electricity within them. Some clouds get negatively charged and others get positively charged. The oppositely charged clouds get attracted towards each other and come close to each other. When oppositely charged clouds come close, the electrons from the negatively charged clouds move towards the positively charged clouds through the moist air. As a result lightning occurs.

6. Many natural phenomena occur during lightning. Some of them are beneficial to us. For example, intense heat and high temperature during lightning enable nitrogen of the atmosphere to combine with oxygen to form its oxides. These oxides of nitrogen get dissolved in water to form a very dilute solution of nitric acid that comes to the ground with rain, which is essential for plant growth and animal kingdom.

Formation of ozone also takes place during lightning which prevents harmful radiation of light reaching the earth's surface.

Precautions During Lightning : When lightning strikes the earth it can be extremely dangerous, lightning usually strike tall buildings and trees.

If you are caught in a thunderstorm :

- (a) Do not take shelter under a tall tree. Not only are you in danger of being struck by lightning, but if the tree gets struck by lightning, it could catch fire and cause great harm to you.
- (b) Do not run across a large open field or high ground.

- (c) Try to go indoors to take shelter.
- (d) You can even take shelter inside a car or a bigger vehicle like a truck.
- (e) If you can't find a safe place, squat down in a low-lying place.
- (f) Do not use an umbrella and avoid holding or touching metallic objects like T.V. antenna.
- (g) Inside your house, disconnect your computer, television, telephones etc.
- (h) If you are travelling in a car, or bus, stay inside only. The bodies of these vehicles are metallic and so produce a shielding effect due to the fact that electrostatic field inside a conductor is zero.

II. Fill in the blanks with the appropriate word/words from the brackets :

Ans. 1. Same, 2. more, 3. attract, 4. Electrons, 5. bad, 6. negative, 7. lightning, 8. huge

III. State whether the following statements are true or false :

Ans. 1. True, 2. False, 3. True, 4. True, 5. False, 6. False, 7. True, 8. False, 9. True, 10. True

IV. Match the statements in column 'A' with those in column 'B' :

Ans. 1. (d), 2. (c), 3. (h), 4. (e), 5. (f), 6. (g), 7. (b), 8. (a)

V. Name each of the following :

Ans. 1. Lightning and Thunderstorm.
2. Positive and Negative.
3. Static electricity.
4. Rubbing of glass rod with fur.
5. Copper.

VI. Tick (✓) the correct option of the following statements :

Ans. 1. (a), 2. (a), 3. (b), 4. (d), 5. (b), 6. (c), 7. (c), 8. (a), 9. (d)

14

Light

I. Answer the following questions :

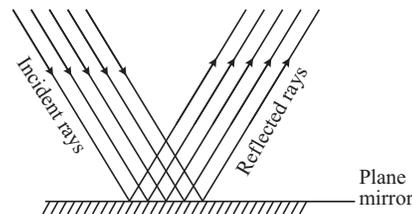
Ans. 1. Light is that form of energy which affects the eyes in such a way as to produce the sensation of sight. It spreads out from any source in which it is produced. When a ray of light hits a mirror or any polished surface, it bounces off the surface. This is called the reflection of light.
Do the following activity to understand the reflection of light :

Direct the light of a torch on a wall to produce a patch of light on the wall. Now, place a mirror such that the light of the torch falls on it. The position of the patch of light is changed. It shows that the direction of the beam of light changes after striking the mirror. Tilt the mirror slightly to either side without changing the direction of the beam of light. You see that in every position to direction of beam of light changes in a definite direction.

Now ask someone to stand at a place where the patch of light, falls directly on the eyes. Now ask him to try to locate the source from where the light appears to come. Now rechange your position. You will find that it appears as if the torch is placed behind the mirror and the beam of light is coming from it. The torch that appears behind the mirror, is called the image of the torch. This phenomenon of change in the direction of light from a polished surface is called the reflection of light. Reflection of light give rise to image formation.

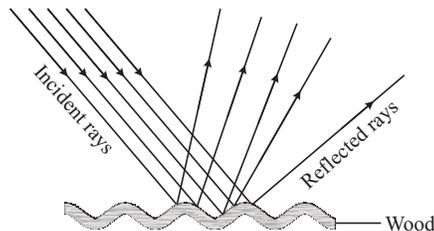
2. Depending on the nature of the surface, there are usually two types of reflection : regular reflection and diffused or irregular reflection.

(a) **Regular reflection :** Though light bounces of all kinds of substances, but we can see images of objects only from a highly polished surface. This is because a polished surface reflects a parallel beam of light in one direction, as shown in the figure. Such a reflection is called a regular reflection.



A Ray Diagram of Regular Reflection

(b) **Diffused or irregular reflection :** Reflection from a rough surface is called diffused or irregular reflection. When a parallel beam of light is incident on a rough or irregular surface such as a wall or a piece of wood, the rays of light get reflected in all the directions and the reflected light spreads over a wide area. Such a reflection is called diffused or irregular reflection.



A Ray Diagram of Irregular Reflection

3. Characteristics of the image formed by a plane mirror are as follows :

(i) **Size :** The image size and the object size are the same.

(ii) **Upright or inverted** : A plane mirror forms an upright (erect) image.

(iii) The distance of the image (from the mirror) equals the distance of the object from the mirror.

Apart from these a plane mirror also has a characteristic of lateral inversion as explained below:

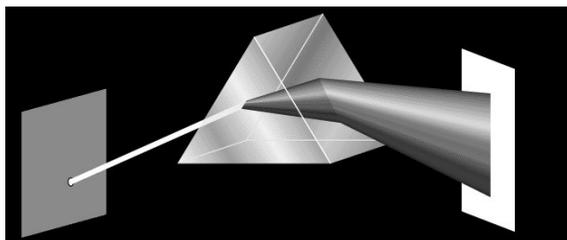
Thus, the image formed by a plane mirror has the following characteristics :

Erect, virtual, of the same size as the object, at the same distance behind the mirror as the object is in front of the mirror and laterally inverted.

Lateral inversion : In a plane mirror, the right side of an object appears to be the left side of the image and the left side of an object appears to be the right side of the image.

For example, if you write the letter B on a paper and hold it in front of a plane mirror you will observe that the letter B appears as Ɔ . Thus, images formed by a plane mirror show left-right inversion known as lateral inversion. This is called lateral inversion.

4. When a light ray passes from one medium to another at angle, it refracts (or bends). White light is a combination of different colours in the visible spectrum, and different colours have different indexes of refraction. Thus, when the ray of white light passes through a prism, the colours refract at different angles. The order of the colours from the base of the prism is violet, indigo, blue, green, yellow, orange and red. This order of colours can be easily remembered by remembering the word VIBGYOR.

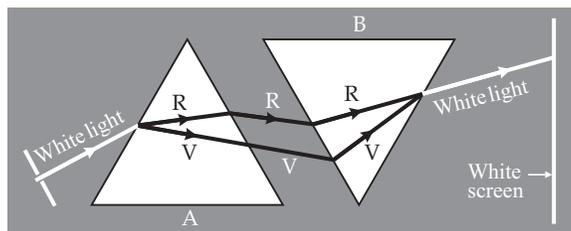


A Visible Spectrum Produced by a Prism

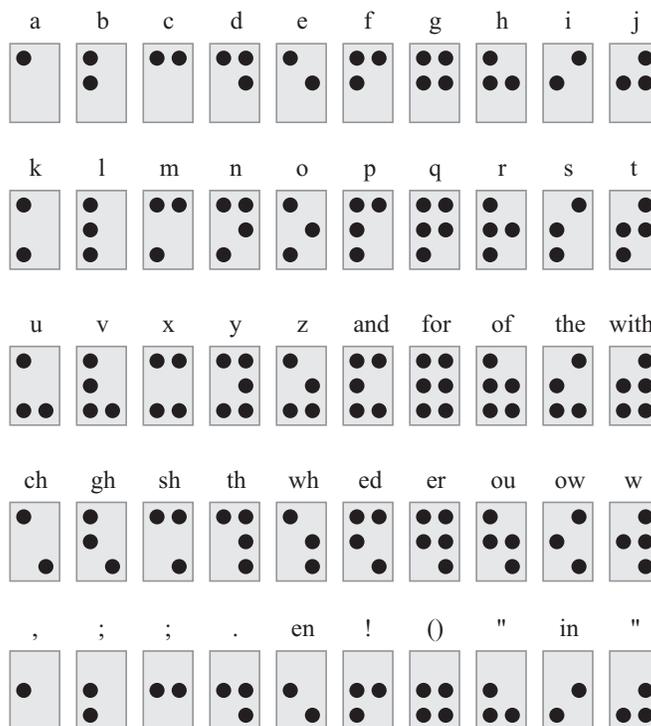
Recombination of the seven colours of the dispersed white light to get white light is known as recombination of white light. For this do the following :

Place a prism (A) on a table and a screen behind it. Allow a narrow beam of light to be incident on the prism (A). The white light gets dispersed and we obtain a band of seven colours on the screen.

Now remove the screen and place another prism (B) of the same material in the opposite direction. Place a white screen behind second prism. A spot of white light appears on the screen. Thus the second prism has recombined the dispersed light.



5. Braille script is a script developed by Louis Braille for the blind persons. In 1829, Braille published a dot system basing it on a cell of six dots. From 63 possible arrangements of the dots, Braille devised an alphabet, punctuation marks, numerals and a notation for music. After a long struggle, Braille's code won universal acceptance for all written languages and mathematics, science and computer notation.



Some Symbols of Braille cells

II. Fill in the blanks with the appropriate word/words from the brackets :

Ans. 1. incident, 2. retina, 3. regular, 4. infinite, 5. French

III. Tick (✓) the correct option of the following statements :

Ans. 1. (b), 2. (d), 3. (c), 4. (a), 5. (c), 6. (b)

I. Answer the following questions.

- Ans.** 1. A celestial body is any natural body outside of the Earth's atmosphere. The universe consists of different celestial bodies such as stars, planets, satellites, meteors, meteorites, comets, asteroids, etc.
2. The Moon is the only natural satellite of the earth and is our nearest neighbour in space. It is the brightest object in the sky, next to the sun. The surface of the moon is rugged. It is made up of very large craters (deep depression or holes) and very high mountains. It has no atmosphere, and hence, no life exists on it. The moon rotates on its axis as it revolves round the earth. It takes 27.3 days to make one complete turn on its axis. The moon revolves around the earth in an oval-shaped path. The moon moves from west to east around the earth.

Phases of the Moon : Because of the moon's periods of rotation and revolution are the same, we always see one side of the moon. The other side always remains hidden from the earth.

The moon has no light of its own. It reflects the light of the sun. When this reflected light reaches the earth, we see the moon. Only that part of the moon is visible, which reflects the sunlight towards the earth. This light is visible from the earth in varying amounts during periods called phases.

On the New Moon day, the moon is between the sun and the earth. Thus, the reflected light from the moon does not reach the earth, and hence, it is not visible. In a way, the dark side of the moon is facing us on New Moon Day.

The night just after the New Moon Day, we see the Crescent Moon. It is because only the reflected light from the crescent part reaches the earth. The rest of the moon is only faintly visible, because the sunlight reflected from the earth also falls on the moon's disc.

The crescent goes on increasing day-by-day till on the fifteenth day (from the New Moon Day) the full bright face of the moon is visible. On this day the earth is between the sun and the moon and such that the night side of the earth is facing the day side of the moon. This is called the Full Moon Day. This gradual increase in the bright disc of the moon is called the waxing of the moon.

After the full moon, the bright face of the moon goes on decreasing every night. The decrease in the bright-disc of the moon is called the waning of the moon. By another fifteen days, New Moon is formed. The waxing and

waning of the disc of the moon, as the moon revolves around the earth is called phases of the moon.

3. **Comets** : The bright 'star-like', objects with a long tail, approaching the sun in a highly elliptical orbit are called comets. The bright star-like object is commonly called the 'head of the comet'. It consists of frozen water, along with dust and rocks. When the comet reaches the sun, the gases and ice with the dust change the sun, the gases and ice with the dust change the gaseous motion, which appears in the form of a long tail. The tail of a comet always points away from the sun.

Meteors : Meteors are metallic or strong bodies which move around the sun. Most meteors burn completely at altitudes of 70-100 km above the Earth.

Meteorites : Meteorites are meteors which are too big and fail to burn in the atmosphere. If a meteorite reaches the Earth's surface, it is called meteorite. Only the larger meteors reach the earth's surface.

Asteroids : In addition to the major planets orbiting the sun, there are many irregularly shaped lumps of rocks materials also. These are called asteroids. They are also known as minor planets. Most asteroids, orbit the sun between Mars and Jupiter.

4. Many a times certain groups of stars seem to form a recognizable pattern in the night sky. These groups are called constellations. Some easily noticeable constellations are Ursa Major, Ursa minor and Orion.

(i) **Ursa Major or Big Dipper or Vrihat Saptarishi** : This constellation consists of the 7 bright stars, arranged in a pattern somewhat resembling the shape of a big bear. If we join these seven stars with imaginary lines, the figure obtained looks like a big ladle. If an imaginary line joins the two stars at the edge of the lader, it will points to the pole star.

(ii) **Ursa Minor or Little Dipper or Laghu Saptarishi** : It is also called the lesser bear. One part of this constellation is faint and difficult to spot.

(iii) **Iron** : This is one of the most prominent and easily identifiable constellations in the night sky.

Prominent stars of this constellation are Betelgeuse and Rigid. Betelguese is also called Alpha Ori and is one of the twenty brightest star in the sky.

5.

Planet	Radius (At the equator)	Distance from the sun (In million miles)	Mass (Relative to the earth)	Time of rotation (In earth years)	Time of revolution (In earth days)
Mercury	2,440 km	36	0.06	58.64	0.24

Venus	6,502 km	67	0.82	-243.02	0.62
Mars	3,396 km	128 to 155	0.11	1.03	1.88
Jupiter	71,492 km	483.78	317.8	0.41	11.86
Saturn	60,268 km	887	95.2	0.43	29.46
Uranus	25,559 km	1784	14.6	-0.72	84.01
Neptune	24,764 km	2794	17.2	0.67	164.8
Earth	6,378 km	93	1.00	1.00	1.00

II. Fill in the blanks with the appropriate word/words from the brackets :

Ans. 1. Neptune, 2. 1975, 3. Venus, 4. Earth, 5. Hydrogen

III. Write whether the following statements are 'true' or 'false' :

Ans. 1. False, 2. False, 3. True, 4. True, 5. True

IV. Write the correct options of the following statements :

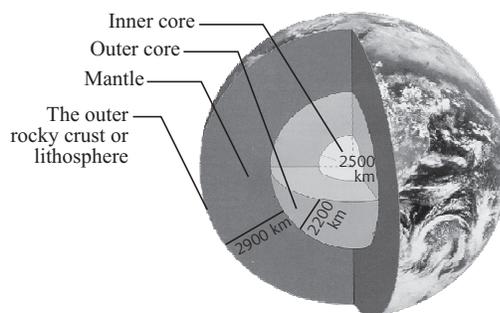
Ans. 1. (b), 2. (c), 3. (a), 4. (a), 5. (a)

16

Earthquakes

I. Answer the following questions :

Ans. 1. The inside of the earth is made up of a number of layers. At the centre of the earth is a solid solid inner core made up of iron under a very, very high pressure and temperature. Surrounding the inner core is outer core which is liquid in nature and is mostly made up of iron. Surrounding the outer core is mantle. It is 2900 km thick and is made up of molten solid rocks commonly called magma. The magma contains dissolved hot gases at high pressure.



Inside the Earth

2. Plate Tectonics : The surface of the earth is not one continuous piece but is broken into a large number of pieces called plates. The world is divided into seven large plates and several small plates. Due to the convectional

currents (slow movement) inside the earth, these plates move with respect to each other by about a few inches a year. Though, this movement seems to be very small, the magnitude of energy developed by this small movement is enormous. The boundaries of these plates are prone to vigorous geological activity and this movement of these plates with respect to one another results in earthquakes, volcanoes, mountain formation etc.

The theory that the surface of the earth's is made of lithospheric plates which move is called plate tectonics. The theory explains the location of earthquakes, volcanic eruptions and newly forming mountains.

3. Distribution of plates on the world map.



4. Earthquakes are produced due to sudden movement of rocks along an existing fault. A fault is a fracture in the earth's outer shell when plates slide past each other. Faults occur in the weak areas of the earth's rock. The movement occurs when the rock can no longer bear the tensions and forces that have built up in them. When rocks cannot bend any further, they suddenly fracture and rebound or snap back into positions that relieve the pressure. This is how earthquake occurs.
-
- Folding and Faulting
5. Most earthquakes are casually related to compressional or tensional stress built up at margins of the huge moving lithospheric plates that make up the earth's surface. The immediate cause of most shallow earthquake is the sudden release of stress along a fault, or fracture in the

earth's crust, resulting in movement of the opposing blocks of rock past one another.

These movements cause vibrations to pass through and around the earth in wave form. Volcanic eruptions, rockfalls, landslides and explosions can also cause a quake, but most of them are of only local extent.

Occurrence of Earthquakes : The earth's outer shell consists of about seven large and about 10 small plates. The plates move slowly and continuously on a layer of hot, soft rock. During their movement, the plates collide, move apart or slide past one another. The movement of plates causes zones of fault around plate boundaries.

6. To determine the strength and location of earthquakes, scientists use an instrument called a seismograph. The magnitude of an earthquake can be determined from data recorded by a seismograph. The most common scale used to measure the magnitude of an earthquake is Richter Scale. An earthquake of 2.0-4.0 on the Richter scale is not too severe and damaging. More than 4-8 is a moderate to severe earthquake. An earthquake greater than 8-9 would be extremely severe.
7. There have been many earthquakes in India. The damage caused by the major ones are as follows :
 - (a) A powerful earthquake struck the India-Pakistan border on the morning of 8 October, 2005. It had a magnitude of 7.6 and was severely felt in Pakistan, northern India and eastern Afghanistan. It is estimated that more than 50,000 people lost their lives due to this earthquakes.
 - (b) On January 2001, there was a major earthquake in Gujarat. More than 20,000 people lost their lives in this earthquake. Properties valued over thirty billion rupees were destroyed. The worst affected towns were Bhuj and Ahmedabad.

In most cases, during an earthquake, people lose their lives because they live in unsafe buildings. Educating people about the importance of being prepared for earthquakes will go a long way in saving lives in future earthquakes.

Earthquake Harards :

- (i) An earthquake of moderate intensity can create fissures and cracks in the ground. As a result roads, property, lines and fences are often destroyed.
- (ii) The courses of rivers are sometimes affected by earthquakes.
- (iii) Buildings, roads, bridges and other structures often suffer severe damage during earthquakes.
- (iv) In cities, fire often accompanies earthquakes and are generally responsible for more damage than the earthquakes itself.
- (v) Large earthquakes in the coasts can also cause movement in the ocean floor that creates tsunami.
- (vi) Ground failure due to liquefaction.

II. Fill in the blanks with the appropriate word/words from the brackets :

Ans. 1. severe, 2. Richter, 3. earthquake, mantle 4. natural, 5. tectonic, 6. seismic, 7. fault, 8. earth's crust

III. Write whether the following statement are 'true' or 'false':

Ans. 1. True, 2. False, 3. True, 4. True, 5. True, 6. True, 7. False, 8. True

IV. Match the statement in column 'A' with them in column 'B':

Ans. 1. (e), 2. (c), 3. (d), 4. (b), 5. (a)

V. Give one word for each of the following :

Ans. 1. Fault, 2. Inner Core, 3. Seismic Focus, 4. Liquefaction, 5. Epicentre, 6. Crust, 7. Seismograph, 8. Seismology, 9. Mantle, 10. seismogram

VI. Tick (✓) the correct options of the following statements :

Ans. 1. (b), 2. (b), 3. (a), 4. (c), 5. (d), 6. (a), 7. (b)

17

Natural Resources

I. Answer the following questions.

Ans. 1. A natural resource is a reservoir of materials taken from nature, need to sustain life. Natural resources are derived from nature which man uses for his needs. Forests are very useful for us. Forests are a valuable natural resource. Forests are also an important component of the environment as they help to main the biological balance.

Important uses of forests are as follows :

- Forests provide habitat to a large number of plants, animals, birds and insects.
- Trees like in carbon-dioxide from the atmosphere during photosynthesis and release oxygen in the process. Also, transpiration in trees increases the humidity of a place and results in rainfall.
- Trees provide us with useful products such as gum, paper, timber, medicines, etc.
- Trees and plants are the primary producers and hence form an important part of food chains and food webs.
- Dead plants decompose to form humus, a material that provide nutrients to the soil.
- Roots of trees help to hold the soil in place and prevent soil erosion and landslides.

- (g) Fossil fuels such as coal and petroleum are obtained from the dead remains of plants and animal that got buried under the earth's crust millions of years ago.
2. Deforestation mean cutting down forests on a large scale. The population explosion, urbanization and industrialization are the main causes of deforestation.

Causes of Deforestation : Wood is one of the main reasons that trees are felled for and it finds extensive applications in our daily life. One of the primary uses of wood in rural area as a fuel. Construction-wood known as timber is extensively used for making furniture and in building construction. Wood is also used for making paper, artworks, ships, boats, weapons and even clothing (rayon). Wood is also engineered to make plywood (for roofing and flooring applications), chipboard (used for making furniture, cabinets and automobiles). The other causes of deforestations are as follows :

- (i) **Commercial logging :** Commercial logging which supplies the world market with woods such as meranti, teak, mahogany and ebony for furniture and building material is a major cause of deforestation.
- (ii) **Urbanization :** Increasing human population and rapid urbanization have led to the conversion of forests and woodlands to agricultural land to feed the growing human population on the earth.
- (iii) **Overgrazing :** Many-a-time animals such as goats and sheep are left to graze in the forests and farmland, unattended. It is definitely a key factor in contributing to deforestation.
3. Deforestation has long-term harmful impacts on the environment, and eventually human beings.

Effect on wildlife : Forests are natural habitat of many species of plants, birds and animals. Cutting down trees will destroy the homes of the these species, which in turn may endanger the very existence of these species.



4. Two movements that have gained recognition to conserve forests are as follows :

The Chipko Movement : Forests are main sources of livelihood in hilly and mountainous areas of India. In the 1970s and 1980s there was a resistance by the people against the destruction of forests, which spread throughout India and came to be known as the Chipko Movement.

The Chipko Movement of April, 1973 took place in village Mandal in the upper Alaknanda valley of then Uttar Pradesh. It spread over the next five years to many other districts of the Himalayas in Uttar Pradesh. The resistance amongst the villagers was triggered by the government's decision to allot a part of forest area in Alaknanda valley to a sports goods company. This angered the villagers because the government had earlier rejected their demand to use wood for making agricultural tools. The success of the Chipko Movement in the hills saved thousands of trees.

Narmada Bachao Andolan : It was a people's movement that was formed with the aim to protect the trees that would get destroyed by the proposed construction and rise in the height of a series of dams on the river Narmada. This Andolan was set up in 1986 under the leadership of Medha Patkar. Slowly, many prominent social workers joined the movement. Today, the movement is also fighting to get proper rehabilitation facilities from the government for the people who have been affected by the project.

5. The major consequences of over-extraction of fossil fuels are discussed here :
 - (i) **Exhaustion of existing resources :** The over-extraction of fossil fuels is slowly depleting the earth of these resources.
 - (ii) **Air pollution :** When coal and petroleum products are burnt as fuel, they give off carbon-dioxide, a greenhouse gas that leads to global warming. They also give off pollutants such as carbon-monoxide, nitrogen oxides, sulphur oxides, particulate matter like mineral ash or fly ash and unburnt hydrocarbon that pollutes the air.
 - (iii) **Threat to marine life :** Coal contains many trace elements, including arsenic and mercury, which are dangerous if released into the environment. Mercury that is released into the air settles in water in due course. The mercury in water can build up in fish and shellfish and can be harmful to animals and people who eat them.
 - (iv) **Disturbs land and ocean habitats :** Exploring and drilling for oil also disturbs land and ocean habitats. If oil is spilled into rivers or oceans it can harm wild life. Oils sometimes get into water when fuels leak from motorboats and jet skis. Leaks also happen when we use petroleum products on land.
6. The main causes of depletion of resources are as follows :
 - (i) With the tremendous increase of human population the demand for natural resources is increasing.

- (ii) To provide shelter and other basic necessities for the ever-increasing population, man has depleted some resources.
 - (iii) Unscientific mining and quarrying for extraction of metallic ores and minerals have also depleted resources.
 - (iv) Forest fires destroy standing trees and also kill seeds, seedlings and wildlife.
 - (v) Indiscriminate hunting resulted in the extinction of many plants and animal species.
 - (vi) Natural forces such as landslides, floods, earthquakes, ice and snow also can damage the resources like plants, animal, soil, water etc.
 - (vii) Construction of dams, canals and other water reservoirs also cause depletion of natural resources.
7. Natural resources are of following two types :
- (i) **Renewable resources** : The sources which are replenished through natural cycles are called renewable resources. For example, oxygen in the air is replenished through photosynthesis and fresh water is renewed through the water-cycle.
 - (ii) **Non-renewable resources** : Non-renewable resources are those which are not replaced in the environment after utilization, because their natural formation takes millions of years. Coal, oil, natural gas, minerals etc., are non-renewable resources.

II. Fill in the blanks with the appropriate word/words from the brackets :

Ans. 1. erosion, 2. two, 3. coal, 4. Deforestation, 5. petrol

III. Write whether the following statements are true or false :

Ans. 1. True, 2. False, 3. False, 4. True, 5. True

IV. Tick (✓) the right options of the following statements :

Ans. 1. (b), 2. (c), 3. (b), 4. (d), 5. (d)

18

Air and Water Pollution

I. Answer the following questions :

Ans. 1. The contamination of the environment with substances which are harmful to living beings is called pollution. The principal causes of air-pollution can be summarized as below :

- (i) **Industries** : Industries often pollute air seriously. Paper and pulp industries, steel plant, petrol refineries and chemical plants are some of the chief causes of pollution.

- (ii) **Automobiles** : Burning of fossil fuels into automobile also releases carbon-dioxides, oxides of sulphur and nitrogen into the atmosphere. Automobile alone contribute to about 60% of the air pollution.
 - (iii) **Smog** : Some gases like sulphur dioxide, nitrogen oxide and unburnt hydrocarbons are released into the atmosphere from aircraft. When these gases combine with ultraviolet radiations on sunlight they form a very harmful photochemical called smog. Smog formation is a very common problem of big cities.
 - (iv) **Particulate matter** : Particulate matter consists of tiny particles of solid or liquid suspended in a gas. Volcanic eruptions, dust storms, burning of fossil fuels in thermal plants and forest fires are some of the natural resources.
 - (v) **Chlorofluoro Carbons (CFCs) Freons** : These are extensively used as coolants in refrigerators and air-conditioners and as propellants in aerosol spray cans. CFCs are also used in home insulation, plastic foam and throw away metallic cans.
2. Effect of air pollution on global climate and animals are as follows :
 - (i) Excess of carbon-dioxide in the atmosphere causes suffocation.
 - (ii) Sulphur oxides and nitrogen oxides when present in higher concentration in the atmosphere, react with rain water they produce acid rain. This acid rain causes damage to the marble buildings and statues. It is also toxic to plant and animal life.
 - (iii) Sulphur dioxide released from coal and oil combustion causes headache, chest constriction, irritation in the respiratory system, vomiting etc. Together with such problems, sulphur dioxide gas also causes allergies, coughing, dizziness, lung diseases and sore throat and eye irritation.
 3. We can take following precautions to reduce air pollution due to human activities.
 - (i) Use of unleaded petrol should be encouraged.
 - (ii) The exhaust gases in vehicles should be passed through a catalytic converter which converts harmful carbon-monoxide and nitrogen oxides to harmless carbon-dioxide, nitrogen and water before releasing the exhaust into the atmosphere.
 - (iii) Shift to less polluting fuels such as CNG (Compressed Natural Gas).
 - (iv) Regular pollution-check on vehicles should be made mandatory.
 - (v) Fumes released from industries should be freed from sulphur and its oxides before being emitted by the chimneys.
 - (vi) Make use of public transport and car pools to the extent possible.

- (vii) Plants saplings in the neighbouring area after getting the required permission.
 - (viii) Design posters and organize awareness campaign on the need to reduce air pollution.
 - (ix) Factories should change the methods of manufacture and use fuels that cause lesser pollution. Factory area should be separate and at quite some distance away from residential areas.
4. The addition of harmful and unwanted materials into water is called water-pollution.

Causes of Water Pollution :

- (i) **Industrial wastes :** Discharge of untreated industrial wastes into water bodies is one of the major causes of water pollution. The industrial wastes include toxic substances such as chloride, ammonia, hydrogen sulphide, different acids and salts of metal like, zinc, copper, lead, nickel, mercury, arsenic etc.
 - (ii) **Agricultural wastes :** Various minerals and organic wastes are carried to the lakes, rivers and other water reservoirs from agricultural fields, where a variety of inorganic pesticides and chemical fertilizers, insecticides and herbicides are applied almost throughout the year. As a result, certain pesticides such as DDT can enter the bodies of aquatic animals and eventually reach human beings by way of food chains.
 - (iii) **Oil pollution :** Oil leaks from ferry boats and ships leave a trail of oil on the water surface and in the process pollute rivers and oceans. Oil spills from huge tankers is also a major cause of worry as they have adverse effects on marine animals. Oil refineries situated near sea-shore also pollute water.
 - (iv) **Domestic sewage :** Discharge of sewage water containing human urine and faeces, animal dung, cloth washing etc., into lakes, rivers and other water bodies is one of the most common primary sources of water pollution especially near big cities. Gutter water and faulty drainage system may also pollute water.
5. We can do the following to control water-pollution.
- (i) Septic tank treatment should be used for individual houses of communities.
 - (ii) The sewage and factory wastes have to be cleared before they flow into the water reservoirs.
 - (iii) Biological treatment for the sewage should be carried out.
 - (iv) The use of fertilizers and herbicides should be judicious and minimal.
 - (v) The use of synthetic detergents should be minimised.
 - (vi) The excreta and other garbage should be treated in a biogas plant to get fuel as well as manure.

- (vii) The water of rivers, streams, lakes and ponds should be purified. This is done by the government. One such example is the Ganga Purification Project. The Indian Government has undertaken the project to prevent the pollution of the Ganga River. Under this project, water treatment plants have been set to treat the industrial and domestic waste water entering the river.
- (viii) Bathing and washing clothes near the water bodies such as lakes, ponds and rivers should be restricted.
6. Boiling and chlorination of impure water is the most common methods of purifying water at home. They are physical and chemical treatment respectively. Besides this another method of water purification at home in by using the electric water filters.

Use of Electric Water Filters : Electric water filters have a micro porous filter, carbon, and a source of ultraviolet radiation. Micro porous filter strains out physical impurities present in water, such as dust, rust, dirt and mud. Carbon also absorbs organic impurities and removes unwanted taste and odour. It is normally present as either Granulated Activated Carbon (GAC) or powdered block carbon. Finally, ultraviolet radiation kills microorganisms. This method of water treatment comes under chemical methods.

II. Fill in the blanks with the appropriate word/words from the brackets :

Ans. 1. Pollution, 2. Chlorofluorocarbons, 3. leaching, 4. Typhoid, 5. bacteria
6. potable

III. Write whether the following statements are 'True' or 'False' :

Ans. 1. False, 2. True, 3. False, 4. True, 5. False, 6. True

IV. Tick (✓) the correct options from the following statements :

Ans. 1. (c), 2. (c), 3. (c), 4. (b), 5. (d), 6. (d)