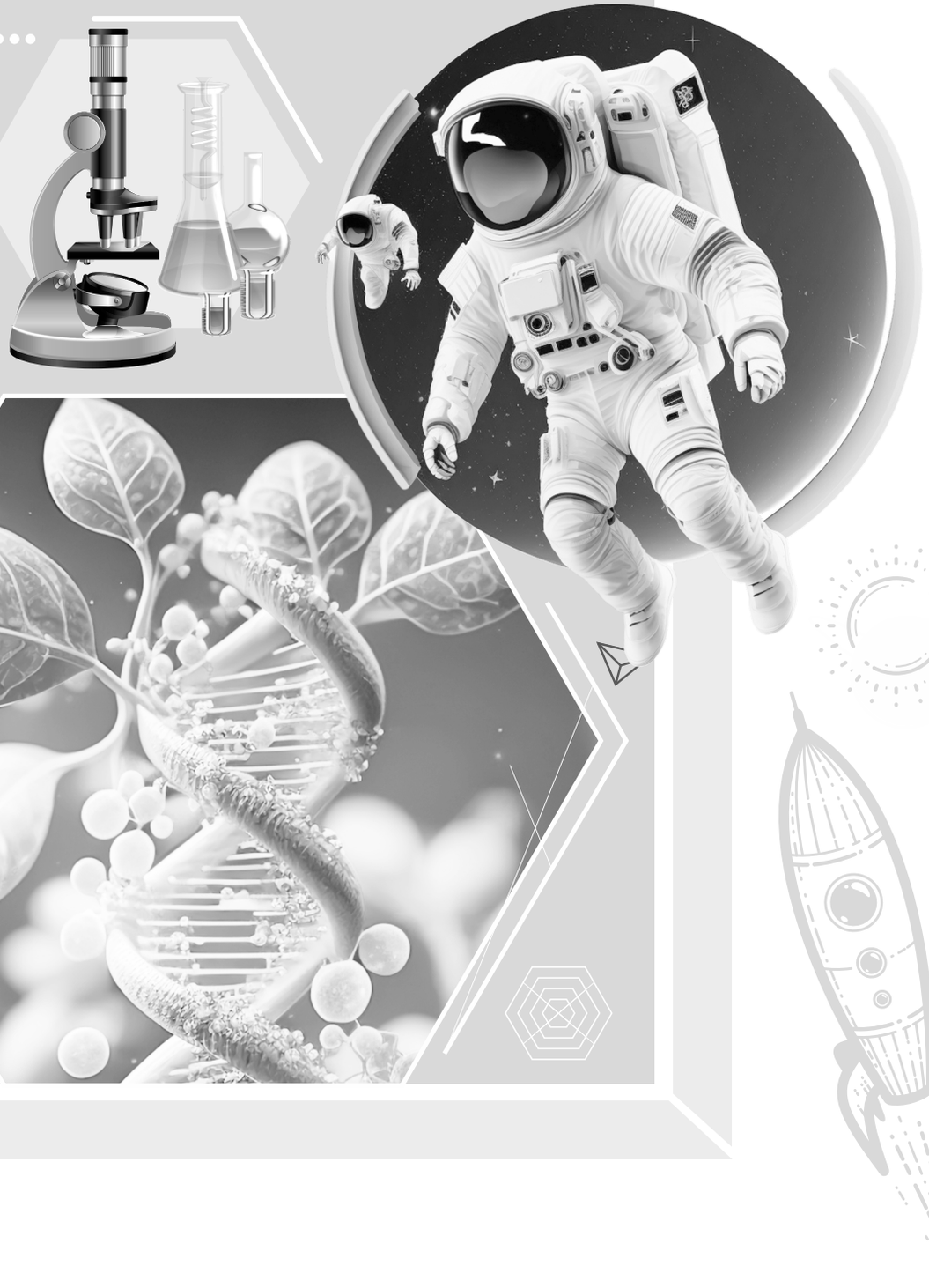
Sense & Science

7
GRADE



1. Plants and Their Nutrition

Exercise

A. 1. (c) 2. (a) 3. (a) 4. (c) 5. (d)

B. 1. Carbohydrates, proteins, fats, vitamins and minerals are the components of food that are necessary for our body. These are called nutrients. Nutrition is the process of taking in food by an organism and its utilization by the body. The energy from food is obtained by two processes, *i.e.* nutrition and respiration. The living world has organisms that show two types of nutrition—autotrophic nutrition and heterotrophic nutrition.

2. Stomata are tiny pores located on the under side of leaves. These are surrounded by guard cells which control opening or closing of stomata.

3. The plant kingdom also has plants that consume insects. The Venus flytrap and pitcher plant catch insects by unique methods. They are called insectivorous plants. In the pitcher plant, a leaf is modified to form a pitcher-like structure with a lid. Inside the pitcher are hairs pointing downwards. When an insect enters the pitcher, the lid closes and traps the insect, which gets entangled in the hair. The cells of the pitcher plant secrete digestive juices which digest the insect.

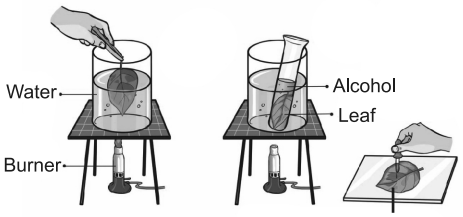
4. *Rhizobium* can take atmospheric nitrogen and convert it into a soluble form that the plants can absorb. *Rhizobium* cannot make its own food. It therefore lives in the roots of leguminous plants like gram, peas and moong where it gets food and shelter. In turn, it provides them with nitrogen. It thus has a symbiotic relationship with leguminous plants. We get most of the pulses from leguminous plants. Farmers do not add nitrogenous fertilizers in the soil in which leguminous plants are grown.

5. They secrete digestive juices on the dead and decaying matter to convert the solid matter into a liquid. They then absorb the nutrients from this liquid. This method of getting nutrients from dead and decaying matter in the form of a liquid is known as saprotrophic nutrition. Fungi and bacteria that use such mode of nutrition are known as saprotrophs or saprophytes.

C. 1. **Autotrophs :** Green plants prepare their own food from carbon dioxide from the air and water from the soil. The energy for preparing food is obtained from sunlight. This mode of nutrition is called autotrophic nutrition. Such plants are called autotrophs. Two examples of autotrophs are plants and algae.

Heterotrophs : All animals and non-green plants cannot prepare their own food. So, for their nutrition, they depend directly or indirectly on green plants. This mode of nutrition is called heterotrophic nutrition. Animals and non-green plants are called heterophs. Two examples of heterotrophs are fungi and bacteria.

2. Following experiment shows the testing a leaf for starch :



Testing a leaf for starch

Take a leaf from a plant that has been exposed to sunlight. Boil it for about five minutes in water so that it becomes soft. Put it in a test tube containing alcohol. Put the test tube in a beaker of water and warm the water gently until the alcohol begins to boil. (Caution: Do not allow the water in the beaker to boil.) The alcohol will dissolve the chlorophyll and the leaf will lose its green colour.

Wash the leaf in warm water to remove the alcohol. Now spread the leaf flat out on a white tile and pour iodine solution on it. Remove the leaf from iodine and wash it with water. Hold it up against the light. You will observe that parts of the leaf become blue-black. These parts of the leaf have starch in them.

3. Carbohydrates synthesized by plants during photosynthesis are made up of carbon, hydrogen and oxygen. These are used to synthesize other food components such as proteins and fats. Proteins contain nitrogen. Though air contains large amounts of nitrogen, plants cannot directly absorb this nitrogen. They get nitrogen in two ways.

   Soil has certain bacteria called *Rhizobium* that convert atmospheric nitrogen into water-soluble compounds. Plants absorb these compounds along with water and get nitrogen.

   Farmers add fertilizers rich in nitrogen to the soil. These are absorbed by plants.

4. Plants absorb nutrients from the soil so their amount goes on decreasing. In a forest, these nutrients are naturally replenished by decaying of dead plants and animals. But on a farm, these nutrients have to be added to the soil as manure and fertilizers. Such manure and fertilizers contain plant nutrients like nitrogen, potassium and phosphorus.

5. Some non-green plants live in or on other living organisms and obtain their food from them. For example, dodder plant sucks food from another plant using root-like structures. Such plants are called parasites. The plant from which a parasite gets its food is called a host.

Some parasitic plants such as mistletoe plant, which grow on trees like mahua or mango, have green leaves and can synthesize their food. They take water and minerals from the host plants. They are known as partial parasites.

D. Do it yourself.

E. Do it yourself.

F. Do it yourself.

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2. Animals and Their Nutrition

Exercise

A. 1. (b) 2. (b) 3. (b) 4. (a) 5. (b)

B. 1. A spider weaves a sticky web in which small insects get stuck. It then injects digestive juices into the body of the insect, which digest the body parts of the insect. Thus, the digestion of a spider's food actually takes place outside the spider's body. The spider then sucks up the digested food.

2. The frog uses its long sticky tongue to catch insects. It has a well-developed digestive system where food is digested with the help of digestive juices.

3. The human body performs the different steps of nutrition inside a long tube, which is coiled in some places, called the gut or alimentary canal. Its main parts are the mouth; oesophagus or food pipe; stomach; small intestine; large intestine, the rectum; and the anus.

4. Small taste buds are spread across the tongue's surface. Each taste bud can detect all tastes— sweet, salty, sour and bitter. Earlier scientists thought that the taste buds that detect different kinds of tastes are located in specific areas of the tongue but it is not considered true now.

5. The inner lining of the stomach secretes mucous, hydrochloric acid and digestive juices. The mucous protects the inner lining of the stomach while the acid kills bacteria in the food and also helps in digestion of proteins.

C. 1. The various processes involved in nutrition are as follows :

- The taking in of food is ingestion. It involves taking in the food through the mouth and eating it.
- The breakdown of food into a simple, soluble form with the help of digestive juices made in the body is digestion.
- The process by which the food in the soluble form passes into the body fluids such as blood is absorption.

- The process by which absorbed nutrients are utilized by the body is assimilation.
- The process of elimination of undigested solid parts of the food is egestion.

2. There are four types of teeth : incisor, canines, premolars and molars.
   - Incisors : They are needed for bitting and cutting food.
   - Canines : They are needed for tearing food.
   - Premolars : They are needed to tear and crush food.
   - Molars : They are needed to chew, crush and grind food.
3. After the food is swallowed, it slides down the pharynx into the oesophagus (food pipe), which extends from the mouth to the stomach. It is made up of muscles which gently push food down to the stomach in a wave-like action known as peristalsis.
4. (a) **Saliva :** It helps in breaking down the starch, present in food, into sugar. It also makes the food wet and slippery, thereby making it easier to swallow.

   (b) **Bile juice :** It is secreted by the liver and helps in breaking down the fats, present in the food, into fatty acid and glycerol.

   (c) **Pancreatic juice :** The pancreas secretes pancreatic juice to change starch into simple sugars and proteins into simpler compounds called amino acids.
5. The digested food is then absorbed by the small intestine through thousands of small finger-like projections, known as villi (singular: villus), in its inner wall. These increase the surface area of absorption of digested food. Each villus has a network of fine blood capillaries lying close to the surface. The food absorbed on the surface of the villus is passed into the blood in the capillaries.

E. Do it yourself.

F. Do it yourself.

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3. Respiration in Livings

Exercise

A. 1. (a) 2. (d) 3. (a) 4. (c) 5. (a)

B. 1. We already know that energy is released from digested food by the process of respiration. Here, the nutrients of the digested food react with oxygen in the body cells to release energy. The reaction with oxygen is known as oxidation.

2. We should not over water potted plants because water replace the air present in the soil and roots won't be able to breathe.

3. Stomatal apparatus is a pair of guard cells with or without surrounding subsidiary cells which functions as a valve to open or close stomatal pore for gaseous exchange and transpiration.
4. The main organs of the respiratory system in man are the nostrils (the passages in the nose), trachea (windpipe), bronchi and lungs.
5. Cellular respiration occurs in the cells. During cellular respiration, the sugar molecules in food are oxidized to form carbon dioxide and water, and energy is given out.
6. When a person starts doing exercise, his muscle works harder and required more energy. For more energy, the person needs more supply of oxygen because energy is released by the process of cellular respiration. For this more oxygen supply to the lungs, the person starts breathing faster.
7. The chemical reaction occurs during the anaerobic respiration in yeast :

   Glucose (without using oxygen) $\rightarrow$ Alcohol + Carbon dioxide + Energy
8. An athlete suffers muscular cramps due to accumulation of lactic acid in the muscles. To provide relief, the lactic acid needs to be displaced. The impacted area can be massaged, rest can be given, a hot shower may also help. Slow breathing will help in early oxidation of the acid.

C. 1. The two main processes of respiration are :
   - external respiration or breathing, i.e. taking in air rich in oxygen (inhalation) and giving out air rich in carbon dioxide (exhalation).
   - internal respiration or cellular respiration, i.e. using oxygen to break down food and release energy. This respiration takes place in the body cells.

2. (a) Fishes have respiratory organs called gills for exchange of gases. These gills are made up of a large number of filaments which are richly supplied with thin blood veins or capillaries. As water enters through the mouth, it flows over the gills. The blood in the capillaries absorbs oxygen and gives out carbon dioxide through its walls.

   (b) In cockroaches, there are openings called spiracles on their bodies. Air enters through these openings and reaches all parts of the body through respiratory tubes called trachea and their branches called tracheoles.
3. The air around us is impure and polluted but our lungs require air which is moist, warm and clean. As the air we breathe in passes through the nostrils, it is moistened by the slimy mucous secreted by the inner lining of the nose. The air becomes warm by the blood circulating in the nose. Dirt, dust particles and disease-causing germs

are trapped by the mucous and the hair in the nose and prevented from entering the respiratory system. We will not get clean air if we breathe through our mouth instead of our nose. So, we should always breathe through the nose as it will protect us from catching an infection.

4. Do it yourself.
5. When air enters the lungs, it passes through the alveoli. Gas exchange takes place in the alveoli, which are lined with blood capillaries. The capillaries absorb oxygen from the alveoli and transport carbon dioxide from the blood to the alveoli.
6. In the lungs, each bronchus branches out into smaller tubes called bronchioles. At the end of these tubes are tiny air sacs called alveoli (singular: alveolus). The air we breathe in eventually reaches these air sacs. The sacs are surrounded by blood vessels. The oxygen present in the air we breathe in, goes into the blood contained in blood vessels. The carbon dioxide present in the blood (as a waste product of respiration) passes out of the blood into the air sacs. Thus, exchange of gases takes place in the lungs.
7. Both combustion and cellular respiration involve the oxidation of substances. While in respiration, food is oxidised and energy is released in a stepwise manner, in combustion the combustible substance is oxidised with the release of large amount of energy. Also, in both the processes energy is liberated.

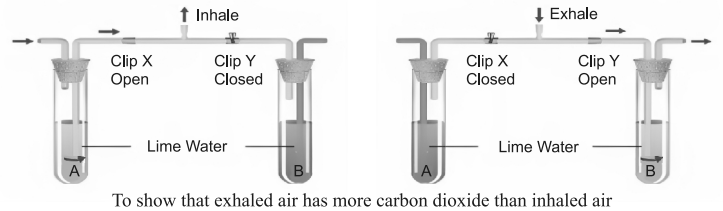
Differences between Combustion and Cellular Respiration

	Parameter	Combustion	Cellular Respiration
1.	Rate	Combustion is a fast process.	Cellular respiration is a slow process.
2.	Temperature	It occurs at high temperature.	It occurs at body temperature.
3.	Place	It can occur anywhere.	It occurs only in living cells.
4.	Energy	Energy is released in a single step in the form of heat and light.	Energy is released in steps, and stored in chemical molecules called ATP.

8. Exhaled air has more carbon dioxide can be shown by the following experiment—

   Take two test tubes, each of them half-filled with lime water. Using two-holed stoppers, glass tubes and clips, set up the apparatus as shown in figure. Use the rubber tube at the middle to breathe in and out

through the mouth. As you suck in air through the rubber tube, open clip X and close clip Y. The inhaled air passes through lime water in test tube A. As you exhale through the rubber tube, open clip Y and close clip X. The exhaled air passes through the lime water in test tube B.



To show that exhaled air has more carbon dioxide than inhaled air

It is observed that lime water in test tube A is only slightly milky while that in the test tube B, it is very milky. This shows that the exhaled air has more carbon dioxide, which turned lime water more milky than the inhaled air.

9. **Differences between Breathing and Cellular Respiration**

	Parameter	Breathing	Cellular Respiration
1.	Nature of process	It is a physical process of exchange of gases. No chemical reaction takes place.	Chemical reaction of oxidation of food takes place.
2.	Place	It takes place outside the cells.	It takes place within the cells.
3.	Energy	There is no release of energy.	There is release of energy.

10. An aerobic respiration is a type of respiration in which breakdown of glucose takes place in the absence of oxygen. Yes, it occurs in the human body also.
11. Many a times, during strenuous activity such as long distance running, our body does not get enough oxygen to produce the required energy. To get the additional energy, anaerobic respiration occurs within our muscle cells. In this process, there is partial breakdown of glucose to produce lactic acid. The accumulation of lactic acid in the body causes muscular cramps. That is why we sometimes have cramps after heavy exercise.

D. Do it yourself.

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4. Transportation of Materials

Exercise

A. 1. (b) 2. (a) 3. (a) 4. (a) 5. (c)

B. 1. Xylem and phloem are important for transportation of materials in plants because xylem transports water and minerals upwards from the roots, whereas phloem transports food from the leaves to other parts of the plant.

2. Large quantities of water are absorbed by a plant for photosynthesis but all this water is not used by the plant. The excess water escapes in the form of water vapour mainly through the stomata present in leaves in a process known as transpiration.

3. Translocation is the process by which the food prepared by the leaves is transported to all parts of the plant in the form of a solution.

4. The pulse rate is exactly equal to the heartbeat, as the contractions of the heart cause increase in blood pressure in the arteries that lead to a noticeable pulse.

5. If a person's kidneys are damaged, doctors remove body wastes by a medical process known as dialysis.

C. 1. Roots have numerous root hairs that increase the surface area for the absorption of water and minerals. These root hairs are in contact with the water present in the soil. Water enters the cells of the root hair by the process of osmosis. Osmosis is the movement of water from a region of higher concentration to a region of lower concentration through a semi-permeable membrane. Hence, they perform the function of absorption.

2. The circulatory system consist of the blood, the blood vessels and the heart.

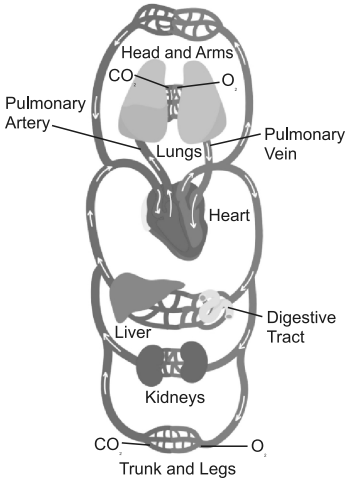
Functions of blood : Blood will help in transporting materials to different parts of the body. Like

- digested food from the small intestine to all parts of the body.
- oxygen from the lungs to the body cells and carbon dioxide from the cells to the lungs.
- liquid waste from the body cells to the kidneys for removal from the body.

Functions of blood vessels : Blood vessels carry blood through them to different parts of the body.

Function of heart : It pumps blood to all parts of the body.

3. **Blood Circulation**



The circulatory system in humans

- The right auricle receives deoxygenated blood from various parts of the body through the veins and relaxes to receive it. It then contracts to send the blood into the right ventricle, which relaxes to receive it.
- The right ventricle contracts to pump the blood to the lungs through the pulmonary artery.
- Exchange of gases takes place in the lungs and oxygenated blood is sent to the left side of the heart through the pulmonary vein.
- The left auricle relaxes to receive the oxygenated blood. It then contracts to send the blood to the left ventricle, which relaxes to receive it.
- The left ventricle contracts to pump the oxygenated blood to the rest of the body. The right side of the heart is completely separated from the left side with a partition called septum so that the two types of blood do not mix. The heart has a number of valves that allow the blood to flow in one direction only. Adjoining figure shows the complete circulatory system in the body.

4. Do it yourself.
5. When the blood enters the kidneys, nephrons filter out excess water, salts and urea from the blood. The clean blood leaves the kidneys and continues its circulation in the body. Wastes are excreted from the body in the form of urine.

D. Do it yourself.

E. Do it yourself.

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5. Reproduction in Plants

Exercise

A. 1. (a) 2. (a) 3. (d) 4. (d) 5. (b)

B. 1. Reproduction is important because it is the process of producing new individuals of the same kind.

2. There are various forms of asexual reproduction in plants. Some of these are as follows :
   (i) Fragmentation; for example—Spirogyra
   (ii) Budding; for example—Yeast
   (iii) Spore formation; for example—Ferns
   (iv) Vegetative reproduction; for example—Onion
3. When new plants are produced from the vegetative parts of the mother plant, such as root, stem or leaves, without the help of any reproductive organs, it is known as vegetative reproduction.
4. Artificial propagation is the process of growing new plants by artificial methods. Some of these are as follows :
   Grafting, cutting, layering and tissue culture.
5. A seed contains a plant embryo in a resting stage. It begins to grow only under favourable conditions. So, it must get moisture and oxygen. Most seeds need warmth also. When all the conditions are favourable, germination begins.

C. 1. The three different ways of vegetative reproduction are as follows :

Grafting : This method is commonly used in horticulture to grow new varieties of fruit plants. It comprises of keeping a twig or bud of one plant (the scion) over the cut stem of another plant (the stock) and tying them up together. The stock must have an extensive root system under the soil. The tissues of the stock and scion join together to form one plant. The stock supplies the essential nutrients to the scion.

This method helps to grow new varieties by combining the features of two plants. For example, a high-yielding variety can be grafted to a disease-resistant variety to grow a new variety with both characteristics. Many different varieties of mangoes have been developed by this method.

Cutting : In this method, a healthy young branch of a plant with leaf buds is cut off and planted in moist soil. The cutting develops roots and grows into a new plant. This method is used to propagate plants like rose, sugarcane and Bougainvellia. It helps to grow many new plants to be produced from a single plant without waiting for flowers and seeds.

Layering : In this method, a young branch is bent towards the ground and covered with moist soil. After some time, roots develop from the covered part. This is called a layer. The branch may now be cut and grown into a new plant. This method is called layering and is commonly used to develop plants, such as rose, jasmine *(chameli)* and *Bougainvellia*.

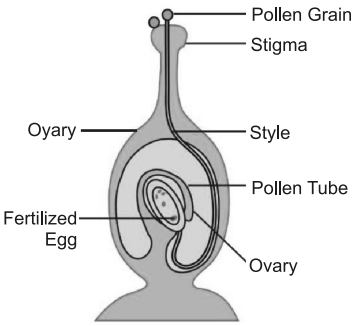
2. The advantages of vegetative reproduction are as follows :
   - It allows to produce new plants quickly. Using plants parts takes less time than waiting for the seeds to grow. For example, fruits

plants grown by this method start bearing fruits much quicker than plants grown from seeds.

- The plants produced by this method are exact copies of the parent plant without any variations. This way, plant growers can produce exact copies of a plant with the required characteristics, such as resistance to disease. All plants so produced will have the same characteristics.
- Plants reproduced vegetatively usually need less attention than plants grown from seeds, in the early stages of growth.
- New varieties of plants with required characteristics can be developed by this method.

3. Pollination is the process of transference of pollen grains from the anthers to the stigma. The pollen grains are carried to the stigma of either the same flower (self-pollination) or of a different flower of the same kind (cross-pollination).

   The stigma of each flower secretes a liquid with sugar. The pollen grains respond to this liquid and start growing. But, the pollen grain start growing only if the liquid is produced by a flower of its own species. They do not grow if they land on the stigma of a flower of a different species.

   Fertilization in a flower

   After pollination, a thin tube (the pollen tube) grows down from the pollen grain through the pistil. It carries the male cell. It grows until it reaches the ovule and enters it. The male cell moves into the ovule and fuses with the egg to form the zygote.

4. A plant produces a large number of seeds. If all these fall below the plant and begin to grow, they will not get enough space, water, minerals and sunlight, and so they will not develop into healthy plants. Many of them may even die. Therefore, dispersal of seeds is necessary.
5. **Tissue Culture :** In this method, a piece of tissue is cut off from the growing tip of a plant. The cells are separated and kept in a nutrient medium with hormones that make the cells divide and form groups of cells. All this is done under controlled conditions. Roots also develop. These are then kept in a different nutrient medium containing hormones that make the shoots develop. The different plantlets can now be grown in pots of soil. *Chrysanthemums,* orchids, Asparagus and many other plants are grown by this method.

D. Do it yourself. **E.** Do it yourself. ❑

6. Matter and Its Structure

Exercise

A. 1. (b) 2. (b) 3. (b) 4. (b) 5. (d)

B. 1. When two elements are mixed together, a compound is only formed when they react with each other. If they do not react, no compound is formed.

2. Properties of one compound differ from that of the other compound because of the following reasons :
   - Each compound is formed by a different set of elements.
   - Even with the same set of elements, different compounds are formed by varying numbers of constituent atoms.

3. Most of the elements have a great tendency to combine with each other to form compound. Thus, they are not found in free state in nature.

4. Iron sulphide can be formed by heating a mixture of iron and sulphur. It becomes a hard black solid and does not represent the individual properties of iron and sulphur individually.

   Fe + S $\longrightarrow$ FeS

   (Iron) (Sulphur) (Iron sulphide)

   Above equation represent the chemical change in which iron reacts with sulphur to form iron sulphide.

5. A formula represent the number of atoms of each element in a molecule.

C. 1. **Difference between Elements and Compounds**

Elements	Compounds
◆ A substance which is made up of only one kind of atoms that cannot be broken down into simpler substances by chemical methods is called an element.	It is a substance formed by the chemical combination of two or more elements in fixed proportions.
◆ The smallest particle of an element is an atom.	The smallest particle of a compound is a molecule.
◆ **Examples :** Iron, gold, hydrogen and oxygen.	**Examples :** Water, iron sulphide, sodium oxide and carbon dioxide.

2. **Difference between Atom and Molecule**

Atom	Molecule
◆ An atom is the smallest particle of an element that takes part in a chemical reaction. Which cannot be further divided chemically.	A molecule is the smallest particle of an element or a compound, which can be further divided into atoms chemically.
◆ It may or may not exist independently.	A molecule bears the same property as its atom.
◆ **Example :** Hydrogen (H)	**Example :** Hydrogen gas (H_2)

A molecule of an element can be same as its atom. Example : A molecule of oxygen will have two atoms of oxygen.

3. (a) **Sodium Oxide**
   - ◆ The elements in sodium oxide are sodium and oxygen. The valency of sodium is 1 and that of oxygen is 2. So, we write them as Na^1O^2.
   - ◆ There is no common factor in the valencies 2 and 1. So, we move on the third step.
   - ◆ Interchanging the valencies and writing them as subscript we get the formula of sodium oxide as Na_2O.

   (b) **Magnesium nitrate**
   - ◆ The elements in magnesium nitrate are magnesium and nitrate. The valency of magnesium is 2 and that of nitrate is 1. So, we write them as $Mg^2(NO_3)^1$.
   - ◆ There is no common factor in the valencies 2 and 1. So, we move on the third step.
   - ◆ Interchanging the valencies and writing them as subscript, we get the formula of magnesium nitrate as $Mg(NO_3)_2$.

   (c) **Magnesium sulphate**
   - ◆ The elements in magnesium sulphate are magnesium and sulphate. The valency of magnesium is 2 and that of sulphate is 2. So, we write them as $Mg^2(SO_4)^2$.
   - ◆ 2 is a common factor in the valencies 2 and 2. So, divide valencies by 2. Now, $Mg^1(SO_4)^1$.
   - ◆ Interchanging the valencies and writing them as subscript, we get the formula of magnesium sulphate $MgSO_4$.

   (d) **Aluminium Chloride**
   - ◆ The elements in aluminium chloride are aluminium and chlorine. The valency of aluminium is 3 and that of chlorine is 1. So, we write them as Al^3Cl^1.

- There is no common factor in the valencies 3 and 1. So, we move on the third step.
- Interchanging the valencies and writing them as subscript, we get the formula of aluminium chloride as $AlCl_3$.

4. A chemical equation is the symbolic representation of a chemical reaction. A chemical equation shows the result of a chemical reaction in which the reactions and the products are represented by symbols or formula.

   The chemical equation needs to be balanced so that it follows the law of conservation of mass. A balanced chemical equation occurs when the number of the different atoms of elements in the reactants side is equal to that of the products side.

5. Writing the formula for calcium chloride :
   - The elements in calcium chloride are calcium and chlorine. The valency of calcium is 2 and that of chlorine is 1. So, we write them as Ca^2Cl^1.
   - There is no common factor in the valencies 2 and 1. So, we move on the third step.
   - Interchanging the valencies and writing them as subscript, we get the formula of calcium chloride as $CaCl_2$.

D. Do it yourself.

E. Do it yourself.

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7. Acids, Bases and Salts

Exercise

A. 1. (b) 2. (c) 3. (c) 4. (a) 5. (b)

B. 1. One must not taste every substance to find out if it is acidic or basic since it is not safe. There are some special substances that have different colours in acidic and basic mediums. They are called acid-base indicators. They are used to test if a substance is acidic or basic. Litmus is a natural indicator which is obtained from lichens.

2. Acidic substance : Lemon juice
   Basic substance : Baking soda

3. The zinc will react with sulphuric acid forming zinc sulphate dissolved in solution and releasing hydrogen gas.
   $Zn(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2(g)$

4. Dilute acids react with carbonates like calcium carbonate ($CaCO_3$) or sodium carbonate (Na_2CO_3) to form salts and carbon dioxide gas.

$CaCO_3$ + 2HCl $\longrightarrow$ $CaCl_2$ + H_2O + CO_2

Calcium carbonate | Hydrochloric acid | Calcium chloride | Water | Carbon dioxide

5. When an ant bites, it injects formic acid intio the skin. So by applying base it neutralises and gives relief.

C. 1. (a) **Sulphuric Acid :** Sulphuric acid is one of the most widely used chemicals in industry. Its main uses are as follows :
- In automobile batteries.
- To manufacture fertilizers such as ammonium sulphate and superphosphate.

(b) **Hydrochloric acid :** Its main uses are as follows :
- To manufacture chemicals such as glue.
- In the oil industry to dissolve oil-bearing rocks.

(c) **Nitric Acid :** Its main uses are as follows :
- To manufacture explosives such as TNT (trinitrotoluene) and nitroglycerine.
- To manufacture fertilizers such as ammonium nitrate.

2. The reaction of an acid with a base to form a salt and water is called neutralization reaction. Salt and water are produced in this process with the evolution of heat.
3. Substances that are bitter in taste and feel soapy to touch are called bases.

Physical properties of bases are as follows :
- Bases are hydroxides of metals.
- Bases have a bitter tatse.
- Bases have a soapy feel.

4. Salts can be prepared by following methods :

(i) **Neutralisation reaction :** When an acid reacts with a base, they neutralize each other's chemical properties and form a salt and water. For example, when hydrochloric acid reacts with sodium hydroxide (caustic soda), sodium chloride (common salt) and water are produced.

(ii) **Reaction Between an Acid and a Metal :** We already know that a metal displaces hydrogen from an acid to form a salt.

For example, zinc reacts with dilute sulphuric acid to form zinc sulphate salt liberating hydrogen gas.

5. The name of a salt is derived from the name of the metal (given first) and the non-metallic part.
- Carbonates are obtained from carbonic acid (H_2CO_3).
- Sulphates are obtained from sulphuric acid (H_2SO_4)

D. Do it yourself.

E. Do it yourself.

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8. Physical and Chemical Changes

Exercise

A. 1. (c) 2. (a) 3. (c) 4. (d) 5. (a)

B. 1. The water pipes are galvanised to prevent the iron pipes from rusting and corrosion.

2. When water is frozen, it forms ice. It has the same chemical properties as that of water only there is a change in the state of water from liquid to solid. That is why freezing water is a physical change.

3. **Exothermic Reactions :** Reactions which are accompanied with release of heat are called exothermic reactions. Release of heat is shown by writing '+ heat' on right-hand side of the equation.

   Endothermic Reactions : Reactions which are accompanied with absorption of heat are called endothermic reactions. Absorption of heat is shown by writing '– heat' or right-hand side or '+ heat' on the left-hand side of the equation.

4. Crystallization is a process by which a pure soluble substance separates out in the form of crystals from its hot and saturated solution on cooling.

5. Any solution containing more solute than required to prepare a saturated solution at any fixed temperature is called supersaturated solution.

C. 1. Rusting is prevented by not letting the iron to come in contact with moisture and air. In this method, the iron is coated with oil, grease or paint. However, if there is a crack in the coating, rusting starts. A more efficient method is to coat the iron with another metal such as chromium or zinc. This process of depositing a layer of zinc on iron is called galvanization.

2. The two conditions under which decomposition reaction normally takes place are as follows :

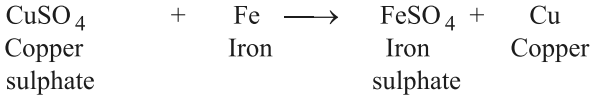
   (i) Heating; for example, When copper carbonate is heated, it decomposes into copper oxide and carbon dioxide.

   $$\underset{\text{Copper carbonate}}{CuCO_3} \longrightarrow \underset{\text{Copper oxide}}{CuO} + \underset{\text{Carbon dioxide}}{CO_2\uparrow}$$

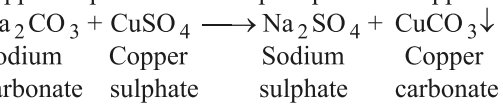
   (ii) Electrolysis; for example, When an electric current is passed through water in which a little sulphuric acid has been added, the water decomposes to give hydrogen and oxygen gases.

   $$\underset{\text{Water}}{2H_2O(l)} \longrightarrow \underset{\text{Hydrogen}}{2H_2(g)\uparrow} + \underset{\text{Oxygen}}{O_2(g)\uparrow}$$

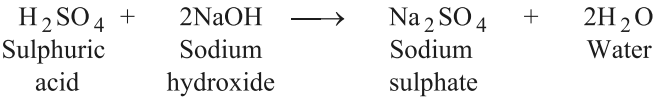
3. In a displacement reaction, one element replaces another element from a compound. Generally, a more reactive element replaces a less reactive element from its compound. For example,
   - Iron is a more reactive element than copper. So, if a piece of iron is added to a solution of copper sulphate, iron sulphate is formed and copper metal gets deposited on the iron piece.



4. In a double decomposition reaction, two compounds react by exchanging their elements or groups. These reactions are of two types :
   (a) **Precipitation reaction :** In such a reaction, two compounds react in their aqueous (solution) state to form an insoluble product, which appears in the form of a precipitate.
   For example : Aqueous sodium carbonate reacts with aqueous copper sulphate to form a precipitate of copper carbonate.



   (b) **Neutralisation reaction :** In such a reaction, an acid reacts with a base to form salt and water. For example,
   Sulphuric acid reacts with sodium hydroxide solution to form sodium sulphate (salt) and water.



5. Oxidation is a chemical reaction which involves addition of oxygen or removal of hydrogen from a substance.
   An oxidizing agent is one that oxidizes other substances by providing oxygen to them or by removing hydrogen from them.

D. Do it yourself.

E. Do it yourself.

❑

9. Heat Energy

Exercise

A. 1. (b) 2. (d) 3. (c)

B. 1. Heat causes change in temperature, expansion, change of state and chemical changes.

2. The temperature at which pure water boils at sea level is the upper fixed point.
3. A bimetallic strip consist of two metal strips, one of iron and the other of brass, firmly bolted together.

C. 1. When we heat a substance its molecules gain energy and start vibrating rapidly and start expanding the length, area and volume of the substance. As a result, a substance expands.

2. Examples of nuisance of thermal expansion :
   (i) The railway tracks over which trains run are made of iron. During summer, the iron expands. To allow this expansion, space is left between two sections of the rail tracks. If this is not done, expansion of the tracks may cause them to bend. This may cause accidents.
   (ii) In summer, electric cables between two poles expand and sag. In winter, they contract and become taut. If cables are laid in summer, they should be left a little loose to allow for contraction during winter. If this is not done, they may break in winter.

3. $$F = \left(\frac{9}{5} \times C\right) + 32$$

$\Rightarrow$ $$F = \left(\frac{9}{5} \times 30\right) + 32 = 54 + 32 = 86°F$$

$$C = \left(\frac{5}{9}\right)(F - 32)$$

$\Rightarrow$ $$C = \left(\frac{5}{9}\right)(90 - 32) = \frac{5}{9} \times 58 = 32.22°F$$

D. Do it yourself.

❑

10. Methods of Heat Flow

Exercise

A. 1. (d) 2. (b) 3. (c)

B. 1. Materials which allow heat to be conducted through them easily are called good conductors of heat. Metals such as copper, iron, silver and aluminium are good conductors of heat. Most metals are good conductors of heat.

Glass allows very little heat to flow through it. Materials which do not allow heat to be conducted through them easily are called bad conductors of heat or insulators of heat. Wood, glass and plastic are insulators of heat.

2. Ventilators are installed on the top most part of the walls because the air we breathe out is warmer and lighter, and rises up. It escapes from the ventilators and is replaced by cool and heavier fresh air coming in from doors and windows below. Thus, stale air goes out at the top and fresh air comes in from below due to the convection currents set up in the air in the room.
3. The polished curved surface at the back of the heating rod in a room heater reflects the radiant heat from the heating rod. Thus, the radiant heat spreads across the room, thereby making the room warmer.

C. 1. When one end of the rod is heated, the molecules at that end start vibrating faster. They hit the nearby molecules and make them vibrate. These molecules again hit the neighbouring molecules. This way, the vibrations and heat gets transferred from the hot end to the cold end.
2. The process of transfer of heat through a medium like liquid or gas is called convection. It can be observed that when water is heated, water near the flame gets hot and starts rising up. On the other hand, cold water moves down from the sides of the flask, towards the source of heat. Then, this water becomes hot and rises up. This process continues till all the water present in the flask gets heated. This process of heat transfer is called convection.
3. Do it yourself.

D. Do it yourself.

E. Do it yourself.

❑

11. Measurement

Exercise

A. 1. (c) 2. (a) 3. (a) 4. (c) 5. (c)

B. 1. Standard units are used in measurements because these are standardize, reliable and can be uniformly used by everyone. Other units like footstep and hand span are unreliable because they vary from person to person.
2. The discovery of the simple pendulum made the accurate measurement of time possible. According to the principle of simple pendulum, if a weight hung from a string is made to swing, it always complete one to-and-fro motion in exactly the same time.
3. The time taken by a pendulum to complete one oscillation is known as its time period.
4. Modern electronic watches are based on the vibrations of the crystals of substance 'quartz' present in it. These crystals vibrate very fast at a very precise rate. Such vibrations are used to measure time accurately.

5. An object said to be in uniform motion if it travels in a straight line and covers equal distances in equal intervals of time.

C. 1. In 1960, the General Conference of Weights and Measures recommended that a common system of measurement should be used all over the world. This system was called the SI (Systeme International d'Unites' in French) system. In this system, the standard units are :

- Metre is the standard unit of length (written as 'm').
- Kilogram is the standard unit of mass (written as 'kg').
- Second is the standard unit of time (written as 's').
- Kelvin is the standard unit of temperature (written as 'K').

Following are two other systems of units :

(i) CGS system

(ii) MKS system

2. $\text{Distance } (d) = 270\,\text{km}$

$$\text{Time } (t) = 4\frac{1}{2}\,\text{hours} = \frac{9}{2}\,\text{hours}$$

$$\text{Speed} = \frac{d}{t} = \frac{270}{\frac{9}{2}} = \frac{270 \times 2}{9} = 60\,\text{km/h}$$

3. Given, $\text{distance } (d) = 200\,\text{m}$

$\text{time } (t) = 10\,\text{second}$

(a) $\text{Speed (in m/s)} = \frac{200}{10} = 20\,\text{m/s}$

(b) $\text{Speed (in km/h)} = 20 \times \frac{18}{5} = 72\,\text{km/h}$

4. Given, $\text{Time } (t) = 7\,\text{hour}$

$\text{Speed } (s) = 950\,\text{km/h}$

Distance between New Delhi and London $= 7 \times 950 = 6650\,\text{km}$

5. Draw it yourself.

D. Do it yourself.

E. Do it yourself.

❑

12. Light and Images

Exercise

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

B. 1. The angle which an incident ray makes with a normal perpendicular to the surface at the point of incidence is called angle of incidence.

2. A real image is one that can be formed on a screen. For example, the image formed by a projector in the cinema hall is a real image.
3. In the image formed by a plane mirror there is an interchange of left and right. This is called lateral inversion. It is an important property of image formed by a plane mirror.
4. We say that convex lenses have a real focus while concave lenses have virtual focus because in convex lens rays after refraction actually passes through focus while in concave lens they do not actually pass through focus rather they appear to pass through focus.
5. White light consists of seven colours. The pattern consisting of bands of colours formed when white light passes through a prism is known as a spectrum.

C. 1. Draw it yourself.

2. Characteristics of image formed by a plane mirror are :
   - the image formed is virtual
   - the image is erect
   - it is of the same size as the object
   - the image is laterally inverted.

3. The main uses of concave mirror are as follows :
   - Concave mirrors are used in torches and car headlights to reflect the light of the bulb to form a powerful beam of light.
   - Shaving mirrors are concave with focal length greater than the normal distance at which the mirror is kept from the face. The face is thus within the focal length of the mirror. A virtual magnified image of the face can then be seen in the mirror.
   - A dentist uses a concave mirror to see a magnified image of the teeth.

4. The following are the difference between a real image and virtual image :
   (i) A real image can be caught on a screen whereas a virtual image cannot be caught on a screen.
   (ii) A real image is always inverted whereas a virtual image is always erect.
   (iii) A real image is formed when the rays of light after reflection or refraction actually meet at some point whereas as virtual image is formed when the rays of light after reflection or refraction appear to meet at a point.
   (iv) A real image is formed by the actual intersection of light rays whereas a virtual image is formed by the imaginary intersection of light rays.
   (v) A real image can be formed in a screen but a virtual image can be only seen in the mirror.

(vi) A real image is formed by only concave mirror however a virtual image can be formed by concave, convex and plane mirror also.

D. Do it yourself.

E. Do it yourself.

❑

13. Electric Current

Exercise

A. 1. (d) 2. (b) 3. (a) 4. (a) 5. (a)

B. 1. An electric circuit is the arrangement where an electric current flows in a conductor when it is connected to a source of electric current.

2. A device called a miniature circuit breaker or MCB is commonly used instead of or in addition to fuses. It is a switch that automatically stops the current in a circuit if the current in it exceeds the specified maximum limit.

3. Yes, every conductor heats up when an electric current is passed through it. The amount of heat depends on the length, thickness and the resistance on the material of the conductor. Nichrome is usually used in heating appliances.

4. Potential difference is the difference in the potential between two terminals of a battery or any other current source connected to an electric circuit. In the circuit, current flow from high to low potential because electrons flow from low potential to high potential.

5. A fuse wire is made up of an alloy, with a low melting point. The heat produced due to short circuit melts the fuse wire and breaks the circuit.

C. 1. Do it yourself.

2. The strength of the solenoid can be increased by :
   - Increasing the number of turns in the solenoid.
   - Increasing the current in the solenoid.
   - Winding the solenoid around a magnetic material.

3. A coil of insulated wire wound around a piece of a magnetic substance is called an electro-magnet. Electromagnets are used in electric bells and buzzers and in making electric motors.

4. An electric bell comprises of an electromagnet, an armature, a contact adjusting screw, a gong and a hammer. The armature comprises of a soft iron rod mounted on a spring. One end of the iron rod presses against the top of the contact adjusting screw.

   When the switch is pressed on, current flows in the electromagnet and attracts the iron rod towards itself, causing the hammer to strike the gong. At the same time, the armature loses contact with the screw, the

current is switched off and this causes the electromagnet to lose its magnetism. As a result, the armature springs back to its original position and closes the circuit once again. Current flows again and the cycle repeats itself till the current is switched off.

D. Do it yourself.

E. Do it yourself.

❑

14. Forests and Their Conservation

Exercise

A. 1. (c) 2. (d) 3. (a) 4. (c) 5. (d)

B. 1. The branches of a tree above the trunk form the crown of the tree. Different trees have crowns of different types and sizes. These crowns of tall trees together form a thick and dense roof over the other plants, called a canopy. The thick canopy does not let sunlight to come in. So, it is quite dark inside a thick forest.

2. Vultures and crows are two scavengers. They eat dead bodies of plants and animals. This helps in keeping the environment clean.

3. A grasshopper eats a green plant—a frog eats the grasshopper— the frog is eaten by a snake—the snake is eaten by an eagle. The chain of events mentioned above is an example of many food chains existing in nature.

4. Forest fires are controlled by spraying fire extinguishing solutions from aircrafts or by changing the direction of wind by using strong blowers.

5. Afforestation is the practice of renewing a forest by planting saplings or small trees.

C. 1. The sequence of living organisms in a community in which one organism to transfer food energy is called a food chain. An example of a food chain is that operating in a grassland :

Grass $\longrightarrow$ Deer $\longrightarrow$ Lion
(Producer) (Herbivore) (Carnivore)

2. An interconnected network of food chains that form a multiltude of feeding connections among different organisms of a biotic community is called a food web.

3. Nature maintains the population of each species of animals in sufficient numbers, to maintain a balance. That is why we say that to kill and to be killed, to grow and to die and get decomposed, is the law

of nature. It is due to these activities that the balance in nature is maintained.

4. Planned harvesting is cutting only some trees in an area. It helps in the conservation of forests as, the uncut trees prevent erosion and fruits of these trees produce seeds so that new trees can grow.
5. Forests are useful to us in following ways :
   (i) Forests prevent soil erosion.
   (ii) They maintain the balance between carbon dioxide and oxygen levels in the atmosphere.
   (iii) They maintain the climate of a place and cool the environment.
   (iv) They increases rainfall.
   (v) They provide all basic needs of the mankind including food, clothing and shelter.

D. Do it yourself.

E. Do it yourself.

❑

15. Wastewater and Sewage

Exercise

A. 1. (a) 2. (d) 3. (d) 4. (b)

B. 1. Sewage is the wastewater containing both liquid and solid wastes produced by human activities from homes, industries, hospitals, etc.

2. Untreated sewage contains a wide variety of dissolved and suspended impurities. Hence, it is necessary to treat sewage before disposing it in a water body to remove its impurities and to prevent its devastating effect on humans, animals, fishes and birds.
3. When it rains very heavily, large amount of water comes down in a very short time. If the city does not have a proper storm water drainage system, this water starts overflowing on the streets and even enters houses. This is dangerous for public health and property. Sanitation system may overflow during floods. There is also the risk of flood water contaminating drinking water supplies, bursting pipelines and cause sewers to backflow or even break. Such situations present a major health risk, as excreta flows onto the surface. That is why cholera epidemics are common after floods.
4. Sewage treatment involves physical, chemical and biological processes that remove the physical, chemical and biological contaminants present in waste water.
5. Contamination of drinking water can occur in covered drainage system. This is because in many cases, one very common case is

damaged leaky joints in water pipes in areas where the water pipe and sewage line pass close together.

C. 1. There are the following problems arise due to improper drainage system :

- Formation of stagnant pools which act as breeding places for mosquitoes that can cause diseases.
- Different types of germs such as those of cholera can also grow and multiply in stagnant weastewater.
- Decay of organic waste present in wastewater leads to unpleasant smell.

2. Improper storm drainage system in a city can lead to contamination of drinking water, bursting of pipelines and back flow of sewers. It is dangerous for public health and property. Contamination of drinking water can spread water-borne diseases like cholera, typhoid, etc.

3. Main steps used in sewage treatment are as follows :

Screening

- The wastewater is first passed through screens of vertical bars, which remove large solid materials such as plastic bags, cans and sticks.
- The water is then passed through grit chambers or settling tanks, where solids such as sand, silt and gravel settle down and are removed.

Primary Treatment

- After this, the wastewater is passed into a sedimentation tank called a clarifier, where organic materials settle down and are removed with a scraper. This is called sludge. Floating materials like oil and grease are removed with a machine called a skimmer. The water that emerges from the settling tank is called clarified water. This sludge is passed through a process called digestion to obtain methane, carbon dioxide and a humus-like material. It consists of decomposing the sludge with the help of anaerobic bacteria (bacteria that do not need oxygen to grow). Dried sludge is used as a fertilizer. The methane formed can be used as a fuel.

Secondary Treatment

- Then air is pumped through the clarified water in an aeration tank. This allows aerobic bacteria (bacteria that need oxygen to grow) to grow and consume organic contaminants such as faeces, food waste and soap still left in the water. The bacteria ultimately settle down at the bottom of a settling tank as activated sludge. They are then pumped back into the aeration tank to be reused. The water is removed from the top. The dried sludge is to be used as manure.
- The treated water now contains low levels of organic matter and suspended impurities.

Disinfection

- The water is then disinfected by adding chlorine to it, or by exposing it to ultraviolet rays. This kills disease-causing germs. The water can now be released into a water body such as a river or lake and used for agricultural or industrial purposes.

4. The sludge obtained from a wastewater treatment plant (WWTP) is used as manure and biogas.
5. Following are the three ways that can be used for sewage disposal if a proper sewage treatment plant is not available :
   (i) **Making septic tanks :** It is suitable for places that have no sewerage system.
   (ii) **Making vermi-processing toilet :** Here, the sewage is treated by earthworms in a pit. The earthworms gradually eat all the organic matters and decompose it.
   (iii) **Use of human excreta in biogas plant :** Here, the human excreta from the toilet seats in the homes travels directly to biogas plant through covered drains.

D. Do it yourself.

E. Do it yourself.

❑

Half-Yearly Model Test Paper

A. 1. (d) 2. (b) 3. (c) 4. (c) 5. (b)

B. 1. A spider weaves a sticky web in which small insects get stuck. It then injects digestive juices into the body of the insect, which digest the body parts of the insect. Thus, the digestion of a spider's food actually takes place outside the spider's body. The spider then sucks up the digested food.
2. We should not over water potted plants because water replace the air present in the soil and roots won't be able to breathe.
3. The pulse rate is exactly equal to the heartbeat, as the contractions of the heart cause increase in blood pressure in the arteries that lead to a noticeable pulse.
4. A formula represent the number of atoms of each element in a molecule.
5. One must not taste every substance to find out if it is acidic or basic since it is not safe. There are some special substances that have different colours in acidic and basic mediums. They are called acid-base indicators. They are used to test if a substance is acidic or basic. Litmus is a natural indicator which is obtained from lichens.

C. 1. Carbohydrates synthesized by plants during photosynthesis are made up of carbon, hydrogen and oxygen. These are used to synthesize other food components such as proteins and fats. Proteins contain nitrogen. Though air contains large amounts of nitrogen, plants cannot directly absorb this nitrogen. They get nitrogen in two ways.

- Soil has certain bacteria called *Rhizobium* that convert atmospheric nitrogen into water-soluble compounds. Plants absorb these compounds along with water and get nitrogen.
- Farmers add fertilizers rich in nitrogen to the soil. These are absorbed by plants.

2. When air enters the lungs, it passes through the alveoli. Gas exchange takes place in the alveoli, which are lined with blood capillaries. The capillaries absorb oxygen from the alveoli and transport carbon dioxide from the blood to the alveoli.
3. Roots have numerous root hairs that increase the surface area for the absorption of water and minerals. These root hairs are in contact with the water present in the soil. Water enters the cells of the root hair by the process of osmosis. Osmosis is the movement of water from a region of higher concentration to a region of lower concentration through a semi-permeable membrane. Hence, they perform the function of absorption.
4. A chemical equation is the symbolic representation of a chemical reaction. A chemical equation shows the result of a chemical reaction in which the reactants and the products are represented by symbols or formula.

   The chemical equation needs to be balanced so that it follows the law of conservation of mass. A balanced chemical equation occurs when the number of the different atoms of elements in the reactions side is equal to that of the products side.
5. The name of a salt is derived from the name of the metal (given first) and the non-metallic part.

- Carbonates are obtained from carbonic acid (H_2CO_3).
- Sulphates are obtained from sulphuric acid (H_2SO_4). ❑

Annual Model Test Paper

Exercise

A. 1. (d) 2. (d) 3. (c) 4. (a) 5. (c)

B. 1. Any solution containing more solute than required to prepare a saturated solution at any fixed temperature is called supersaturated solution.

2. Heat causes change in temperature, expansion, change of state and chemical changes.
3. Ventilators are installed on the top most part of the walls because the air we breathe out is warmer and lighter, and rises up. It escapes from the ventilators and is replaced by cool and heavier fresh air coming in from doors and windows below. Thus, stale air goes out at the top and fresh air comes in from below due to the convection currents set up in the air in the room.
4. The time taken by a pendulum to complete one oscillation is known as its time period.
5. A device called a miniature circuit breaker or MCB is commonly used instead of or in addition to fuses. It is a switch that automatically stops the current in a circuit if the current in it exceeds the specified maximum limit.

C. 1. Rusting is prevented by not letting the iron to come in contact with moisture and air. In this method, the iron is coated with oil, grease or paint. However, if there is a crack in the coating, rusting starts. A more efficient method is to coat the iron with another metal such as chromium or zinc. This process of depositing a layer of zinc on iron is called galvanization.
2. When we heat a substance its molecules gain energy and start vibrating rapidly and start expanding the length, area and volume of the substance. As a result, a substance expands.
3. The process of transfer of heat through a medium like liquid or gas is called convection. It can be observed that when water is heated, water near the flame gets hot and starts rising up. On the other hand, cold water moves down from the sides of the flask, towards the source of heat. Then, this water becomes hot and rises up. This process continues till all the water present in the flask gets heated. This process of heat transfer is called convection.
4. Distance $(d) = 270\,\text{km}$

$$\text{Time } (t) = 4\frac{1}{2}\,\text{hours} = \frac{9}{2}\,\text{hours}$$

$$\text{Speed} = \frac{d}{t} = \frac{270}{\frac{9}{2}} = \frac{270 \times 2}{9} = 60\,\text{km/h}$$

5. An interconnected network of food chains that form a multiltude of feeding connections among different organisms of a biotic community is called a food web.

❑