5 CHAPTER

Life Processes

Level - 1

MULTIPLE CHOICE QUESTIONS (MCQs) (1 Mark)

1. Option (D) is correct.
Explanation: During the aerobic respiration of glucose in human cells, glucose is completely oxidised into carbon dioxide and water, and this process occurs in the mitochondria after glycolysis. This yields the maximum ATP per molecule of glucose, typically around 36–38 ATP molecules. In contrast, ethanol and carbon dioxide in yeast cells and lactic acid in muscle cells are products of anaerobic form of respiration, which produces only 2 ATP per glucose molecule.

2. Option (B) is correct.
Explanation: The left ventricle is responsible for pumping oxygenated blood into the aorta, which distributes it to all parts of the body through the systemic circulation. When the left ventricle contracts, it generates the pressure needed to force oxygen-rich blood into the aorta and then to the rest of the body. In contrast, the left atrium only receives oxygenated blood from the lungs via the pulmonary veins and pushes it into the left ventricle during its contraction. The right atrium and right ventricle handle deoxygenated blood. The right atrium receives deoxygenated blood from the body, and the right ventricle pumps it to the lungs via the pulmonary artery for oxygenation.

3. Option (C) is correct.
Explanation: Stomata closes when the plant does not need carbon dioxide for photosynthesis (such as during the night or in conditions where photosynthesis is not active). This helps the plant conserve water.
Stomatal closure occurs when water flows out of the guard cells, causing them to become flaccid. This happens because of a decrease in turgor pressure in the guard cells.

4. Option (D) is correct.
Explanation: Translocation is the process by which the soluble products of photosynthesis, such as sugars, are transported through the plant. This transport occurs primarily in the phloem tissue, from the leaves (where photosynthesis occurs) to other parts of the plant that need energy or storage.

5. Option (C) is correct.
Explanation: (i) The right atrium receives deoxygenated blood from different parts of the body through the vena cava, not oxygenated blood from the lungs.
(ii) The left atrium transfers oxygenated blood to the left ventricle, which then sends it to various parts of the body.
(iii) The right atrium receives deoxygenated blood from different parts of the body through the vena cava.
(iv) The left atrium transfers oxygenated blood to the left ventricle, which then sends it to the aorta, and the aorta distributes it to different parts of the body.
Based on this information, statements (ii) and (iii) are true.

6. Option (B) is correct.
Explanation: When a person breathes in (inhales), the ribs lift up and out due to the contraction of the intercostal muscles. This increases the volume of the chest cavity. The diaphragm also contracts and flattens, moving downward, which further increases the volume of the thoracic cavity and allows the lungs to expand and fill with air.

7. Option (B) is correct.
Explanation: • Proteins are broken down into amino acids during digestion. The process begins in the stomach and continues in the small intestine with the help of enzymes like pepsin and trypsin.
- Carbohydrates are broken down into glucose (a type of sugar) through the action of enzymes like amylase, which starts in the mouth and continues in the small intestine.
- Fats are broken down into fatty acids and glycerol by enzymes called lipases, primarily in the small intestine.

8. Option (C) is correct.
Explanation: The correct path of air takes during inhalation in the human respiratory system is as follows:

1. **Nostrils:** Air enters through the nostrils (or mouth), where it is filtered, warmed, and moistened.
2. **Pharynx:** The air then passes into the pharynx, which is the throat area that connects the nasal cavity to the larynx and oesophagus.
3. **Larynx:** From the pharynx, the air passes into the larynx, also known as the voice box, which contains the vocal cords. The larynx also directs air toward the trachea.
4. **Trachea:** The air moves down the trachea (windpipe), which is a tube that leads to the lungs.
5. **Alveoli:** Finally, the air travels into the bronchi, then to smaller bronchioles, and eventually reaches the alveoli, where gas exchange occurs (oxygen enters the blood, and carbon dioxide is removed).

9. Option (B) is correct.
Explanation: In plants, waste products like resins and gums are metabolic by-products that are often stored in parts of the plant where they do not interfere with vital processes. Old xylem serves as a storage site for these waste products because old xylem is no longer functional for water conduction, and storing waste products there prevents them from affecting the active tissues of the plant.

10. Option (D) is correct.
Explanation: *Rhizopus* is a type of fungus that breaks down organic material outside its body through external digestion. The fungus releases digestive enzymes into the surrounding environment to break down food (e.g., decaying plant material). Once the food is broken down into simpler molecules, the fungus absorbs the nutrients. This process is characteristic of saprophytic organisms like *Rhizopus*.

11. Option (D) is correct.
Explanation: The villi of the small intestine primarily absorb nutrients such as amino acids, sugars, and fatty acids from the digested food. Water absorption largely occurs in the large intestine, not in the small intestine. The small intestine absorbs some water, but the majority of water absorption happens in the large intestine before waste is excreted from the body.

12. Option (B) is correct.
Explanation: Sphincter muscles are present at the exit of stomach and anus. The role of sphincter muscles present at the exit of stomach is that it is responsible for regulating the opening of stomach into small intestine so that small quantities of food move to small intestine at a time. The anal sphincter controls the release of faces from the body.

13. Option (B) is correct.
Explanation: Label IV corresponds to the guard cells surrounding the stomatal pore. These are the actual structures controlling gaseous exchange, as the stomata open and close based on the turgidity of the guard cells. Massive gaseous exchange for photosynthesis occurs primarily through the stomatal openings controlled by these guard cells.

14. Option (C) is correct.
Explanation: During vigorous exercise, when the supply of oxygen to the muscles is insufficient to meet the energy demands, the cells switch to anaerobic respiration. In this process:
- Pyruvate (produced from glucose during glycolysis) is converted into lactic acid in the absence of sufficient oxygen.
- The accumulation of lactic acid in the muscles causes a drop in pH, leading to muscle fatigue and cramps.

15. Option (B) is correct.
Explanation: The diagram shows water being absorbed from the roots and then transported upward through the plant, with water vapour being released from the leaves. This process is transpiration, which is the loss of water in the form of water vapour through stomata in the leaves. This process is crucial for maintaining water flow, delivering minerals to different parts of the plant and cooling the plant.

16. Option (B) is correct.
Explanation: The opening and closing of stomata are controlled by the guard cells, which surround each stomatal pore. The process depends on the movement of water:
- When guard cells take in water (due to osmotic changes), they become turgid. This causes the stomatal pore to open.
- When guard cells lose water, they become flaccid, and the stomatal pore closes.

17. Option (B) is correct.
Explanation: Transpiration is the process by which plants lose water in the form of water vapor from their aerial parts, mainly through small pores called stomata present on the leaves. This loss of water is important for temperature regulation as it helps in cooling down the plant's surface, similar to sweating in humans.

18. Option (B) is correct.
Explanation: (1) Nucleus: The big dot visible inside the guard cell is the nucleus, which regulates cellular activities.
(2) Chloroplast: The green oval-shaped structures in the guard cells are chloroplasts, which allow guard cells to perform photosynthesis.
(3) Vacuole: The large central structure in the guard cell is the vacuole, responsible for storing water and helping in stomatal movement.
(4) Guard Cell: The entire bean-shaped cell is the guard cell, which surrounds the stomatal pore.

19 . Option (D) is correct.
Explanation: The breakdown of glucose begin with glycolysis, which occurs in the cytoplasm of the cell. During glycolysis, one molecule of glucose ($C_6H_{12}O_6$) is broken down into two molecules of pyruvate (pyruvic acid, $C_3H_4O_3$). In both aerobic and anaerobic respiration, glycolysis is the common initial step. The end product of glycolysis is always pyruvate regardless of whether oxygen is present (aerobic) or absent (anaerobic).

20. Option (C) is correct.
Explanation: During night time, photosynthesis stops because light is not available. However, plants continue to respire, and the CO_2 produced during respiration is released into the environment. As a result, the net release of CO_2 is higher during the night compared to the daytime.
21. Option (C) is correct.
Explanation: The urine formed in nephron is collected through collecting ducts. These collecting ducts fuse to form minor calyces which are followed by major calyces. These major calyces join the kidney pelvis. Urine flows into ureters from kidney pelvis. Then the ureter transports urine into the urinary bladder. The urethra is a long tube which connects urinary bladder to the urinary meatus for removal of urine from the body. In males, urethra travels through the penis and meet the urethral meatus located at the tip of the penis. In females, urethra connects to the urethral meatus above the vagina. The urethra is also known as the urinary opening. So, the correct pathway or passage of urine is Collecting duct → Ureter → Bladder → Urethra.
22. Option (C) is correct.
Explanation: The kidneys act as natural dialysis chambers in the human body. They play a crucial role in filtering waste products, excess ions, and water from the bloodstream to form urine. This process helps maintain the body's internal balance of fluids and electrolytes while removing metabolic waste and toxins from the body.
23. Option (B) is correct.
Explanation: Capillaries are the smallest blood vessels in the body and are responsible for facilitating the exchange of gases, nutrients, and waste products between the blood and tissues. Their thin walls are indeed permeable to gases such as oxygen and carbon dioxide, allowing for the diffusion of these gases between the bloodstream and surrounding tissues. Therefore, option (B) is supported by the diagram, which likely depicts the intricate network of capillaries within the circulatory system.
24. Option (B) is correct.
Explanation: When gaseous exchange in the lung capillaries decreases, the immediate effect will be that pulmonary veins will receive blood with less oxygen. This is because less oxygen will be able to diffuse from the alveoli into the bloodstream. As a result, the blood returning to the heart via the pulmonary veins will have lower oxygen levels.
25. Option (C) is correct.
Explanation: The pancreas secretes various digestive enzymes, including lipase, which is responsible for the digestion of fats. When the pancreas is malfunctioning, such as in the case of Mr. Ayub, the production and secretion of lipase may be impaired. As a result, the breakdown of dietary fats into smaller molecules for absorption in the small intestine will be compromised.
26. Option (A) is correct.
Explanation: The respiratory tract is lined with tiny hair-like structures called cilia, which play a crucial role in trapping dust particles, bacteria, and other harmful substances, preventing them from entering the lungs. Smoking damages and destroys these cilia, impairing their ability to clear mucus and debris from the airways effectively.

ASSERTION-REASON QUESTIONS (1 Mark)

1. Option (A) is correct.
Explanation: In the human heart, the ventricles have thicker muscular walls than the atria. This is true because the ventricles are responsible for pumping blood with significant force. The left ventricle pumps oxygenated blood to the entire body (systemic circulation), and the right ventricle pumps deoxygenated blood to the lungs (pulmonary circulation). So, they have thicker muscular walls to generate the force needed. Thus, both assertion and reason are true and reason is the correct explanation of assertion.
2. Option (C) is correct.
Explanation: Blood clotting prevents excessive loss of blood because it is a physiological process that helps prevent excessive loss of blood when blood vessels are injured. It involves the formation of a blood clot or thrombus to seal the wound and stop bleeding. Blood clotting is primarily due to the interaction of various components in the blood, particularly platelets and clotting factors, rather than blood plasma and white blood cells. Thus, assertion is true but reason is false.
3. Option (C) is correct.
Explanation: The inner walls of the small intestine have finger-like projections called villi, which increase the surface area for efficient absorption of nutrients. These villi are richly supplied with blood vessels that transport absorbed nutrients to every cell of the body, where they are utilised for energy, tissue building, and repair. The large surface area provided by the villi is essential for the effective absorption of nutrients, which is the function of the villi in the small intestine. Hence, the function of villi is to increase the surface area for absorption of nutrients, not to complete the digestion of food.
4. Option (D) is correct.
Explanation: The walls of the ventricles are thicker than those of the atria because the ventricles need to pump blood with higher force to various body organs. The atria, on the other hand, only need to pump blood to the adjacent ventricles, which requires much less force. Thus, assertion is false but reason is true.

5. Option (C) is correct.

Explanation: *Amoeba,* a unicellular organism, uses finger-like projections called pseudopodia to capture food particles. The pseudopodia extend from the cell surface, surround the food particle, and form a food vacuole inside the cell for digestion, making the assertion true. However, the reason is false because not all unicellular organisms take in food through the entire cell surface. For example, in *Paramecium*, food is taken in at a specific spot called the oral groove, and cilia help move food particles to this location. Therefore, the reason does not apply universally to all unicellular organisms. Thus, assertion is true but reason is false.

Level - 2

CASE BASED QUESTIONS (4 Marks)

1. (i) (1) The artery that brings oxygenated blood to the kidney is the renal artery.

(2) The cluster of thin-walled blood capillaries present in the Bowman's capsule is known as the glomerulus.

(ii) The organ which stores urine in the human excretory system is the urinary bladder. The urinary bladder is under nervous control. The process of urination is regulated by signals from the nervous system.

(iii) (a) Two major steps involved in the formation of urine include:

- **Filtration:** Occurs in the glomeruli of the kidneys, where blood plasma is filtered into the Bowman's capsule, removing waste but retaining essential substances.
- **Reabsorption and Secretion:** Takes place in the renal tubules, where necessary nutrients and water are reabsorbed back into the bloodstream, and additional wastes are secreted into the tubular fluid to form urine.

OR

(b) Selective reabsorption in the nephron occurs primarily in the tubular part of nephron, renal tubules, where substances like glucose, amino acids, salts, and a significant amount of water are reabsorbed from the initial filtrate. The amount of water reabsorbed depends on the body's excess water and the amount of dissolved waste to be excreted. Factors influencing the amount of water reabsorbed include the body's hydration levels and the concentration of waste substances in the blood, which need to be filtered out and excreted.

2. (i) The salivary glands are present in the buccal cavity. The secretion of these glands, saliva, contains the enzyme salivary amylase, which acts on starch and breaks it down into maltose (a simpler sugar).

(ii) The two organs with sphincter muscles at their exit are the stomach and anus.

(iii) (a) (1) If mucus is not secreted by the gastric glands, the stomach lining would be exposed to the acidic gastric juice containing hydrochloric acid and digestive enzymes like pepsin. This would lead to the erosion of the stomach lining, potentially causing ulcers and damage to the stomach wall.

(2) If villi are absent in the small intestine, the surface area for nutrient absorption would be drastically reduced. This would result in poor absorption of nutrients into the bloodstream, leading to malnutrition and other health issues.

OR

(b) Bile juice, produced by the liver, does not contain any digestive enzymes. However, it plays a crucial role in digestion by:

1. **Emulsifying fats:** Bile breaks down large fat globules into smaller droplets, increasing the surface area for the enzyme lipase to act upon.
2. **Neutralising acidity:** Bile is alkaline and helps neutralise the acidic chyme (partially digested food) coming from the stomach, creating an optimal pH for enzymes in the small intestine to function efficiently.

Level - 3

VERY SHORT ANSWER TYPE QUESTIONS (2 Marks)

1. The steps for the synthesis of glucose by the plants are:

Step 1: Absorption of light energy by chlorophyll.

Step 2: Conversion of light energy to chemical energy and splitting of water.

Step 3: Reduction of carbon dioxide into carbohydrates.

Special feature of Desert Plants: In desert plants, the stomata open during the night to reduce water loss, allowing carbon dioxide to be absorbed and stored as organic acids. During the day, when the stomata are closed to conserve water, the stored carbon dioxide is released and used in photosynthesis.

2. (i) Salivary amylase: Breaks down starch which is a complex molecule into simpler sugar like maltose.

(ii) Pepsin: Helps to digest proteins in stomach.

(iii) Trypsin: It helps in digesting proteins to amino acids.

(iv) Lipase: Breaking down of emulsified fats to fatty acids and glycerol, enabling fat digestion and absorption.

3.

S. No.	Feature	Alveoli	Nephron
1.	Structure and Location	Tiny sac or balloon like structure located in the lungs at the end of bronchioles.	Nephron tubular structures located in kidneys.
2.	Function	Responsible for gas exchange (oxygen and carbon dioxide) between the air and blood.	Responsible for filtering blood to form urine and remove waste product.

4. The process involved in transporting food prepared by photosynthesis to other parts of the plant is called translocation. It occurs in the phloem and involves the movement of sugars (mainly sucrose) from the leaves (source) to storage organs or growing parts (sinks). The process is driven by pressure flow, where sugars are actively loaded into the phloem, causing water to enter by osmosis. This creates high pressure, pushing the sugar solution to the sink, where it is utilised or stored.

5. *Amoeba* exhibits holozoic nutrition, where it engulfs food particles using finger-like projections called pseudopodia through phagocytosis, forming a food vacuole. Inside the vacuole, digestive enzymes break down complex food into simpler substances, which are absorbed into the cytoplasm for energy and growth. The undigested material is expelled out of the cell by exocytosis.

6. Athletes sometimes suffer from muscle cramps while running due to the accumulation of lactic acid in their muscles. This happens when the oxygen supply to the muscles is insufficient, forcing them to switch from aerobic respiration to anaerobic respiration for energy production.

In aerobic respiration, glucose is completely broken down in the presence of oxygen, producing carbon dioxide, water, and a large amount of energy. However, in anaerobic respiration, glucose is only partially broken down, resulting in the formation of lactic acid and a smaller amount of energy. The buildup of lactic acid in the muscles causes pain and cramps.

7. The other name for lymph is tissue fluid or interstitial fluid.

Functions of Lymph:

(i) It carries digested and absorbed fats from the intestine to the bloodstream.

(ii) It drains excess fluid from the extracellular spaces back into the blood.

8. The pathway of urine in our body starting from the organ of its formation to its excretion is

Kidney → Ureters → Urinary bladder → Urethra.

If the tubular part of the nephron does not work properly, the following issues can occur:

(i) Reduced Filtration: Impaired tubular function can decrease the filtration of waste products, leading to the accumulation of toxins in the body.

(ii) Electrolyte Imbalance: Tubules play a crucial role in maintaining electrolyte balance; malfunction can cause disruptions in levels of sodium, potassium, and other ions.

9. (i) Vena Cava:

Type of Blood: Deoxygenated

Path: From the body (various organs and tissues) to the right atrium of the heart.

(ii) Pulmonary Artery:

Type of Blood: Deoxygenated

Path: From the right ventricle of the heart to the lungs for oxygenation.

10. (i)

Glucose (6-Carbon Molecule) —(In Cytoplasm)→ Pyruvate (3-Carbon Molecule) + Energy

Pyruvate (3-Carbon Molecule) —(Presence of Oxygen, in Mitochondria)→ Carbon Dioxide + Water + Energy

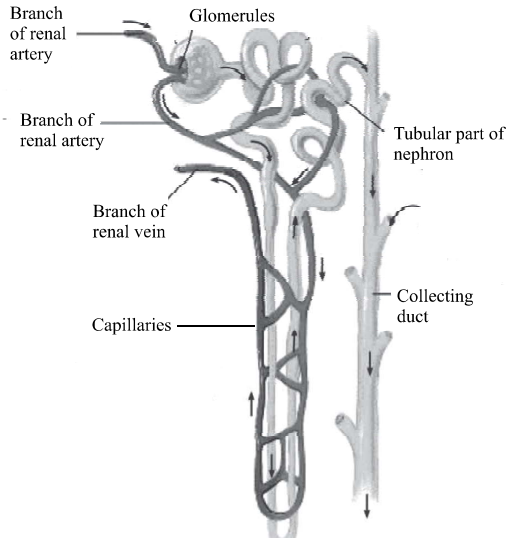
(ii)

Glucose (6-Carbon Molecule) —(In Cytoplasm)→ Pyruvate (3-Carbon Molecule) + Energy

Pyruvate (3-Carbon Molecule) —(Lack of Oxygen, in our Muscle Cells)→ Lactic acid (3-Carbon Molecule) + Energy

11. The part of the human excretory system where nephrons are found are Kidneys.

Structure of Nephron: Nephron is the basic filtration unit in the kidney. It consists of a tubule which is connected with a collecting duct at one end and a cup shaped structure at the other end, called Bowman's capsule. Every Bowman's capsule contains a cluster of capillaries called glomerulus within the cup-shaped structure.



Function of Nephron: The blood enters into glomerulus through afferent arteriole of renal artery and leaves it through efferent arteriole. This causes filtration of the blood. Then the filtrate passes into the tubular part of the nephron. Here, useful substances such as glucose, amino acids, salts and some water are re-absorbed into the blood by the capillaries surrounding the nephron tubule. The filtrate which remains after the re-absorption is called the urine, which is collected from nephron by the collecting duct to carry it to the urinary bladder and then to the urethra.

12. (i) Birds and mammals are warm-blooded animals that can maintain a stable body temperature despite changes in the external environment. To do so, they need a higher energy output from cellular respiration, which requires more oxygen. The separation of oxygenated and deoxygenated blood in these animals is crucial for ensuring efficient oxygen delivery to tissues. This separation helps maintain a high metabolic rate, which is essential for regulating body temperature in varying climatic conditions.

(ii) Animals like amphibians (e.g., frogs) and reptiles (e.g., lizards) can tolerate some mixing of oxygenated and deoxygenated blood streams due to their three-chambered heart. The body temperature of these animals is dependent on the environment, as they are cold-blooded (ectothermic) animals. Their body temperature changes with external environmental conditions, as they lack internal mechanisms to regulate it. These animals often rely on behaviours like basking in the sun to warm up or seeking shade to cool down.

13. (i) Renal Artery: It brings the blood containing nitrogenous waste into the kidney.

(ii) Urethra: Urine can pass through this tube and leave the body.

(iii) Glomerulus: The glomerulus is a network of capillaries in the kidney where blood filtration occurs.

(iv) Tubular part of nephron: Selective reabsorption of useful materials. The necessary salts and water content from the filtered blood are absorbed and reabsorbed with its assistance. As a result, they preserve the blood's osmolarity.

14. The plant kept in the dark could not survive for long because it could not perform photosynthesis, which requires sunlight to produce glucose (food) and oxygen. Without sunlight, the plant was unable to generate its own food and oxygen, relying on the energy stored in its reserves. However, without photosynthesis, the plant could not replenish these reserves, leading to energy depletion. In contrast, the plant in sunlight continued to photosynthesise, producing both food and oxygen, which sustained its energy needs and survival.

15. The three events that occur during the process of photosynthesis are:

(i) Absorption of light energy by chlorophyll.

(ii) Conversion of light energy to chemical energy and splitting of water molecules into hydrogen and oxygen.

(iii) Reduction of carbon dioxide to carbohydrates.

16. Leaves help in excretion through two primary mechanisms:

(i) Transpiration: Leaves release water vapour into the atmosphere through tiny openings called stomata. This process not only helps in regulating water balance but also aids in the removal of some waste products. For example, excess salts and other small metabolic by-products can be expelled from the plant through transpiration.

(ii) Gaseous Exchange (Respiration): During respiration, plants release carbon dioxide (CO_2) as a waste product. This is excreted through small pores called stomata on the leaf surface.

17. In the human digestive system, the enzymes pepsin and trypsin are secreted by the stomach and pancreas respectively.

18. The enzyme present in the fluid in our mouth is salivary amylase.

Salivary amylase is produced by the salivary glands. If the salivary glands stops secreting salivary amylase, the digestion of starch in the mouth would be impaired. Salivary amylase breaks down starch into simpler sugars like maltose. Without this enzyme, starch would not be broken down efficiently in the mouth, leading to slower or incomplete digestion of starch.

SHORT ANSWER TYPE QUESTIONS (3 Marks)

1. (i) Variegated leaves are leaves that have both green and non-green (white or yellow) parts. The green parts contain chlorophyll, while the non-green parts do not. *Croton* or Money Plant.

(ii) When a leaf is boiled in alcohol, the leaf loses its green colour and becomes pale or colourless because alcohol removes chlorophyll. On the other hand, the solution turns green as the chlorophyll dissolves in the alcohol.

(iii) Carbohydrates produced during photosynthesis are stored in the plant as starch. Chlorophyll is necessary for photosynthesis because it absorbs sunlight, which provides the energy needed to convert carbon dioxide and water into glucose during the process. Without chlorophyll, photosynthesis cannot occur.

2. The process that allows water to reach the topmost leaves of a plant is called ascent of sap, which occurs through transpiration pull and involves the following steps:

(i) Absorption by roots: Water is absorbed by root hairs from the soil through osmosis and enters the xylem vessels in the roots.

(ii) Transportation through xylem: The water moves upward through the xylem vessels due to transpiration pull, capillary action, and root pressure.

(iii) **Transpiration pull:** Water evaporates from the stomata in the leaves during transpiration. This creates a suction force (transpiration pull) that draws water up from the roots to the leaves.

(iv) **Cohesion and adhesion:** The cohesion (water molecules sticking together) and adhesion (water molecules sticking to xylem walls) help maintain the continuous column of water as it travels upward.

3. (i) The alveoli in the lungs are responsible for gas exchange, primarily oxygen and carbon dioxide, between the air and blood. They are surrounded by a rich network of blood capillaries to ensure efficient gas exchange. Oxygen inhaled into the alveoli diffuses into the blood through these capillaries, while carbon dioxide produced during cellular respiration diffuses from the blood into the alveoli for exhalation. The close proximity of capillaries to the alveoli allows for quick and efficient exchange of gases, facilitating oxygen absorption and carbon dioxide removal.

(ii) The respiratory pigment haemoglobin in the blood has a high affinity for oxygen because of its ability to form an oxygen-haemoglobin complex in the presence of high oxygen concentration in the lungs. Haemoglobin carries oxygen efficiently to body tissues. Carbon dioxide is primarily transported in the blood as bicarbonate ions or dissolved in plasma, with only a small amount binding to haemoglobin.

(iii) During anaerobic respiration in human beings, lactic acid (a 3-carbon molecule) is formed as the end product instead of CO_2. This happens because, in the absence of oxygen, glucose is only partially broken down to generate energy. The process does not involve the complete breakdown of glucose into carbon dioxide, as in aerobic respiration.

4. (i) The movement that occurs all along the gut in the human digestive system is called peristalsis. It helps in digestion by:

(a) Pushing food along the digestive tract from the oesphagus to the stomach, intestines, and eventually the anus.

(b) Mixing food with digestive juices in the stomach and intestines, aiding in the breakdown of food into smaller molecules for absorption.

(c) Facilitating the absorption of nutrients by keeping the food in contact with the intestinal walls.

(ii) Bile juice is stored in the gall bladder in the human body.

Two roles of bile juice:

(a) Bile juice emulsifies fat and breaks down large fat globules into smaller droplets, increasing the surface area for the enzyme lipase to act upon, aiding in fat digestion.

(b) Bile is alkaline and helps neutralise the acidic food coming from the stomach, creating an optimal pH for enzymes in the small intestine to function efficiently.

5. (i) ATP serves as the main energy currency in cellular respiration, storing and transferring energy for various cellular activities. Adenosine Triphosphate (ATP) plays a crucial role in the process of cellular respiration, which is the process by which cells generate energy.

(ii) Plants take in oxygen through stomata, which are tiny pores on their leaves that regulate gas exchange with the atmosphere. To optimise oxygen intake, plants adjust the size and number of stomata based on environmental conditions like light, temperature, and humidity. Additionally, plants use their root systems to absorb oxygen from the soil and have symbiotic relationships with soil microorganisms to help absorb and fix atmospheric nitrogen. Oxygen intake is essential for plant respiration, which releases energy from stored sugars to support growth and metabolism. Overall, plants have evolved various adaptive mechanisms to ensure adequate oxygen intake for their survival and metabolic processes.

(iii) The direction of gas diffusion in plants depends on the concentration gradient of the gases:

Concentration Gradient: Gases move from areas of higher concentration to lower concentration. For example, CO_2 diffuses into the leaf when its concentration is higher outside, and O_2 diffuses out when its concentration is higher inside.

Stomatal Opening: The opening and closing of stomata, regulated by factors like light and humidity, influence gas exchange. Open stomata allow gases to diffuse based on the concentration gradients.

6. (i) The carbohydrates like starch (in plants) and glycogen (in animals) serve as the internal energy reserve because they are polymer of glucose and their hydrolysis provide glucose molecules to provide energy at the time of need.

(ii) Desert plants perform photosynthesis using a special process called CAM photosynthesis. They keep their stomata closed during the day to prevent water loss and open them at night to take in carbon dioxide (CO_2). The CO_2 is stored in the form of acids. During the day, when sunlight is available, the stored CO_2 is released inside the plant and used for photosynthesis. This helps desert plants conserve water while still making their food.

7. (i) Glycolysis is the initial step in the breakdown of glucose in animal cells. It takes place in the cytoplasm of cells. After glycolysis, pyruvic acid enters into mitochondria and cycles through Krebs cycle.

(ii) ATP is the energy currency of the cell because it donates its phosphoryl groups to release energy, which is used for various cellular processes. Upon hydrolysis, ATP releases a high amount

of negative Gibbs free energy, driving important biosynthetic reactions in metabolic pathways.
The adenine and ribosyl groups in ATP enable it to attach to enzymes, regulating their activities and facilitating various biochemical processes.

(iii) The residual volume of air in a breathing cycle is the amount of air that remains in the lungs after maximum exhalation. It prevents lung collapse and ensures continuous gas exchange between breathes.

8.
- Take a healthy potted plant with variegated leaves (leaves that are partly green and partly white).
- Ensure the plant is kept in darkness for 24–48 hours to de-starch the leaves.
- Select a leaf from the plant and cover a part of it with black paper or aluminium foil, ensuring no sunlight reaches that part.
- Place the plant in sunlight for several hours to allow photosynthesis to occur in the exposed parts of the leaf.
- After sufficient exposure, pluck the covered leaf from the plant.
- Boil the leaf in water for a few minutes to kill it.
- Immerse the leaf in alcohol (using a water bath) to remove the chlorophyll, making it pale or white.
- Rinse the leaf in warm water to soften it.
- Place the leaf in an iodine solution.
- Areas that turn blue-black indicate the presence of starch, while areas without a colour change indicate the absence of starch.

9. (i) *Paramecium* is a single-celled protozoan. The hair-like structures called cilia present on the *paramecium* help in collecting the food and movement. They sweep the food inside the *paramecium* through the oral groove.

(ii) **(a) Hydrochloric acid:** The hydrochloric acid (HCl) present in the stomach creates an acidic pH, which is required to activate the enzyme pepsin from its inactive form pepsinogen. It also plays a role in killing any germs that may have entered the alimentary canal.

(b) Trypsin: Trypsin is an enzyme secreted by the pancreas into the small intestine. It helps to digest proteins by breaking them down into smaller peptides and amino acids.

(c) Muscular walls of stomach: The muscles of the stomach wall contract periodically and thereby help in the churning and mixing of food with the digestive enzymes and HCl acid. It pushes food forward by peristalsis. It helps in chemical digestion.

(d) Salivary amylase: Salivary amylase is an enzyme secreted by the salivary glands. It breaks down starch into smaller sugar molecules such as maltose.

10. (i) A mechanism in which blood circulates twice through the heart in one complete cycle is known as double circulation. Systemic circulation and pulmonary circulation are two pathways in which the blood flows in double circulation. Double circulation is present in birds and mammals.

(ii) The separation of the right and left sides of the human heart is crucial for maintaining efficient circulation and oxygenation of blood. This separation is achieved by a muscular wall called the septum, which divides the heart into two halves. The separation prevents oxygenated and deoxygenated blood from mixing allowing a highly efficient supply of oxygen to the body. This is useful in animals that have high energy needs (birds and mammals) which constantly use energy to maintain their body temperature.

11. (i) **Experiment:**
1. Take a boiled potato and mash it. Separate the mashed potato into three equal parts and place each part into test tubes A, B, and C.
2. In test tube A, add a few drops of iodine solution.
3. In test tube B, first add a few drops of iodine solution and then introduce saliva into the tube.
4. In test tube C, keep the mashed potato without adding any iodine or saliva as a control set.
5. Observe the changes in the test tubes.

Observation:
1. Test tube A: The iodine solution turns blue in colour, indicating the presence of starch.
2. Test tube B: After adding saliva, the blue colour starts to fade. This happens because the starch in the boiled potato is being broken down into simpler sugars, such as maltose, by the action of the enzyme salivary amylase present in saliva.
3. Test tube C: No colour change is observed since no iodine or saliva is added, and no reaction occurs.

Inference: The reduction in blue colour in test tube B shows that salivary amylase in saliva breaks down starch into simpler sugars, like maltose, during the digestion process. This demonstrates the role of saliva in the initial breakdown of starch in the mouth.

(ii) Bile is the digestive juice secreted by the liver. Although it does not contain any digestive enzymes, it plays an important role in the digestion of fats. Bile juice has bile pigments such as bilirubin and biliverdin. These pigments break down large fat globules into smaller globules so that the pancreatic enzymes can easily act on

them. The process is known as emulsification of fats. Bile juice also makes the medium alkaline due to the presence of $NaHCO_3$ and also activates lipase.

12. Humans have a type of circulation called double circulation, where the heart receives blood twice to complete one full round of circulation. This process involves two separate circuits: the pulmonary circuit and the systemic circuit.

(i) Pulmonary Circuit: This involves the circulation of blood between the heart and the lungs.

(ii) Systemic Circuit: This involves the circulation of blood between the heart and the rest of the body.

Process of Blood Circulation:

(i) Deoxygenated blood from the body cells is carried by the veins to the heart.

(ii) The right atrium (auricle) receives the deoxygenated blood and pumps it through the tricuspid valve into the right ventricle.

(iii) From the right ventricle, the blood is pumped through the pulmonary artery to the lungs, where it gets oxygenated.

(iv) Oxygenated blood returns from the lungs through the pulmonary veins to the left atrium.

(v) The left atrium pumps the oxygenated blood through the mitral valve into the left ventricle.

(vi) The aorta, originating from the left ventricle, carries the oxygenated blood to all parts of the body through the systemic circuit.

This double circulation ensures that oxygenated and deoxygenated blood are kept separate, allowing for efficient oxygen delivery to tissues and removal of carbon dioxide.

13. Photosynthesis is a process in which sunlight is used to convert carbon dioxide and water into glucose (food) and oxygen.

- The chloroplast is the organelle and the organs in which photosynthesis take place is the leaves of the plant.
- The oxygen liberated come from splitting or hydrolysis of water in the chloroplasts.
- Carbohydrates produced during photosynthesis are often stored as starch in in various parts of the plant, such as the roots, stems, or leaves.

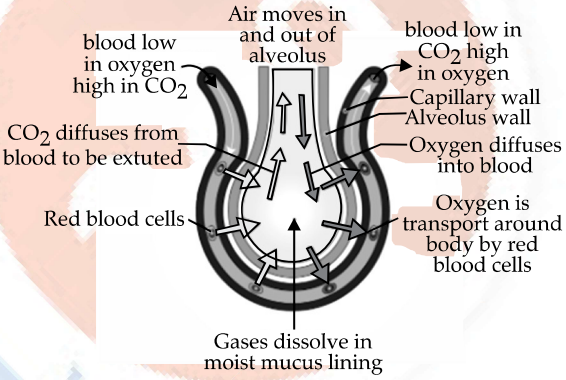
14. (i) The tiny sacs found in the lungs, which exchange carbon dioxide and oxygen are known as **alveoli**.

Structure of alveoli:

1. Alveoli are small, balloon-like structures that resemble clusters of grapes.
2. They are the smallest components of the respiratory system.
3. The alignment of alveoli takes place in the lungs, to maximise the surface are for gas exchange.
4. They are positioned at the ends of the bronchial branches (the bronchioles), forming the last part of the respiratory tree.
5. The walls of the alveoli are extremely thin, composed of a single layer of epithelial cells, facilitating efficient gas exchange between the air and the blood.

Functions:

1. The alveoli are the sites where the exchange of gases (oxygen and carbon dioxide) takes place during breathing. Oxygen moves from the alveoli into the blood, and carbon dioxide moves from the blood into the alveoli to be exhaled.
2. The oxygen inhaled passes through the alveolar walls and into the bloodstream, where it is then transported by red blood cells to tissues throughout the body.
3. Carbon dioxide, a waste product from metabolism in the body, diffuses from the blood into the alveoli, where it is expelled from the body during exhalation.



(ii) Residual volume (RV) is the volume of air remaining in the lungs after maximum forceful expiration. In other words, it is the volume of air that cannot be expelled from the lungs, thus causing the alveoli to remain open at all times.

15. The two ways by which plants obtain carbon dioxide are as follows:

(i) Diffusion through Stomata: Carbon dioxide from the atmosphere diffuses into the leaves of plants through small openings called stomata. These stomata are primarily found on the underside of leaves and allow gases to pass in and out of the leaf tissue.

(ii) Diffusion through the Leaf Surface: While stomata are the main entry point for carbon dioxide, some carbon dioxide can also diffuse directly through the leaf surface. This is especially true for aquatic plants or plants with thin leaves, where the surface area can also allow for some gas exchange.

The opening and closing of the guard cells is caused by a change in their turgidity. The inner walls of the guard cells are thick and elastic, while the outer walls are thin.

At the time of the opening of the stomata, the turgidity of the guard cells increases. As a

result, the outer walls bulge and the inner walls become crescent-shaped. The stomatal opening is facilitated by the radial arrangement of the microfibrils.

At the time of the closing of the stomata, the guard cells lose their turgidity, the outer and inner walls retain their original shapes, and the microfibrils get arranged longitudinally.

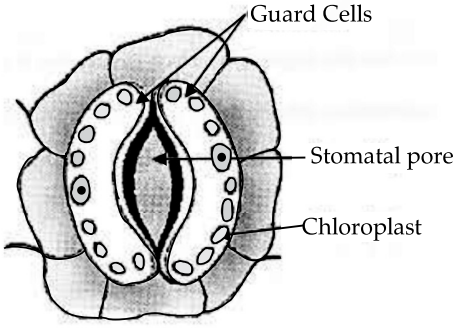
LONG ANSWER TYPE QUESTIONS (5 Marks)

1. **Aim:** To show that carbon dioxide (CO_2) is necessary for photosynthesis.
Procedure:
- Take a potted plant and keep it in complete darkness for 24 h to deplete its starch reserves.
- Insert one of the leaves into a conical flask containing potassium hydroxide (KOH) solution, which absorbs carbon dioxide from the air inside the flask.
- Seal the mouth of the flask with a cork split to allow only the leaf to stay inside the flask while the rest of the leaf remains outside.
- Cover the plant with a transparent polythene bag and seal it to prevent the entry of additional CO_2 from the surroundings.
- Allow another leaf from the same plant to remain outside the flask, exposed to normal air with carbon dioxide.
- Place the plant in sunlight for 4–6 h. After exposure, pluck both leaves and boil them in alcohol to remove chlorophyll. Rinse them in water and test for the presence of starch by adding iodine solution.

Observations: The leaf that was exposed to normal air (control) turns blue-black when iodine is applied, indicating the presence of starch.
The leaf inside the KOH flask does not turn blue-black and remains pale brown, indicating the absence of starch.
Conclusion: The leaf inside the conical flask with KOH does not photosynthesise because the carbon dioxide was absorbed by KOH. The control leaf turns blue-black, showing starch formation due to photosynthesis. This experiment proves that carbon dioxide is essential for photosynthesis.

2. **(i)** In diagram (I), atmospheric air contains a lower concentration of carbon dioxide (approximately 0.04%).
In diagram (II), exhaled air contains a higher concentration of carbon dioxide (approximately 4%).
Due to the higher concentration of CO_2 in exhaled air, the lime water in diagram (II) turns milky faster than in diagram (I).

(ii)



Two functions performed by stomata:

1. **Gas exchange:** Stomata allow the exchange of gases – oxygen and carbon dioxide between the plant and the atmosphere for photosynthesis and respiration.
2. **Transpiration:** Stomata facilitates the loss of water vapour from the plant, helping in the cooling of the plant and the uptake of nutrients.

3. **(i)** The parts of the alimentary canal and their enzymes are:
A (Mouth/Oral cavity): Contains the enzyme salivary amylase (or ptyalin), which begins the digestion of starch into maltose.
B (Stomach): Contains the enzyme pepsin, which breaks down proteins into peptides, and gastric lipase, which helps digest fats.
C (Pancreas) : The pancreatic juice has three pro-enzymes, i.e., trypsinogen, chymotrypsinogen, and procarboxypeptidase. These help in the digestion of starch, protein, fats, and nucleic acid.

(ii) The digested food is absorbed by the walls of the small intestine. The inner lining of the small intestine has numerous villi, which are finger-like projections that increase the surface area for absorption. The villi are richly supplied with blood vessels that transport the absorbed nutrients such as glucose, amino acids, fatty acids, and glycerol to every cell of the body via the bloodstream. These nutrients are utilised by the cells for obtaining energy, building new tissues, and repairing old tissues. This process ensures that the absorbed food is effectively distributed and used by the body for its various functions.

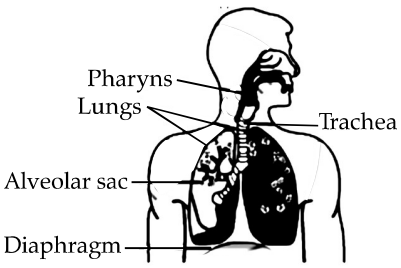
4. **(i)** **A:** Pulmonary artery
Function: Carries deoxygenated blood from the right ventricle to the lungs for oxygenation.
B: Aorta
Function: Carries oxygenated blood from the left ventricle to various parts of the body.
C: Capillaries in body organs
Function: Helps in material exchange such as gases, food etc. between blood and tissues.

(ii) The separation of the right and left side of the heart is useful for birds as it prevents the mixing of oxygenated and deoxygenated blood, ensuring a highly efficient supply of oxygen to the body. This is crucial for birds, as they have high energy needs to support activities like flying and maintaining their constant body temperature (warm-blooded nature). The efficient oxygen supply enables birds to meet their high metabolic demands. Unlike reptiles and amphibians with three-chambered hearts (which tolerate some mixing of blood), birds have a fully separated

four-chambered heart, which supports double circulation, making their circulatory system highly effective.

5. (i) The difference in the rate of breathing between aquatic and terrestrial organisms arises because the amount of dissolved oxygen in water is much lower compared to the oxygen available in the air. Aquatic organisms, such as fish, need to breathe at a much faster rate to extract sufficient oxygen from the water. Fishes take in water through their mouths and force it over their gills, where the dissolved oxygen is absorbed by the blood.
On the other hand, terrestrial organisms breathe air, which contains a much higher concentration of oxygen. They use specialised respiratory organs with large surface areas, such as lungs, to efficiently exchange oxygen and carbon dioxide. Since, oxygen is readily available in the air, terrestrial organisms do not need to breathe as rapidly as aquatic organisms.

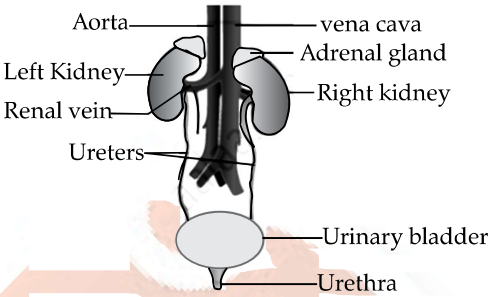
(ii)



6. (i) The human excretory system is composed of the following organs:

1. A pair of kidneys
2. A pair of ureters
3. A urinary bladder
4. A urethra

The typical structure of the human excretory system can be represented as follows:



(ii) Blood enters the kidneys through the renal artery, which branches into many capillaries associated with the glomerulus. Water and other solutes are transferred at the Bowman's capsule. In the proximal tubule, some substances such as amino acids, glucose and salts are selectively re-absorbed and unwanted molecules are removed. In the loop of Henle, water is re-absorbed. From here, the filtrate moves upwards into the distal tubule, and on to the collecting duct. This duct collects urine from many nephrons.