

X- Biology Chapter-1. Life Process

Exercise Solution (Part-1)

SUBJECTIVE QUESTIONS

1. Bowman's capsule is a cup-like sack at the beginning of the tubular component of a nephron in the mammalian kidney that performs the first step in the filtration of blood to form urine. The glomerulus is a tuft of small blood vessels called capillaries located within Bowman's capsule within the kidney.
2. The major nitrogenous waste product in human beings is urea - mainly excreted as urine. Urea is excreted from the blood circulation by ultra-filtration in the kidneys. It is this filtrate that forms urine which is then excreted via the urinary organs.
3. From the kidneys through the ureters to the urinary bladder; from there through the urethra to be expelled from the body.
4. Filtration, Reabsorption, Secretion: The Three Steps of Urine Formation
The Glomerulus Filters Water and Other Substances from the Bloodstream.
The Filtration Membrane Keeps Blood Cells and Large Proteins in the Bloodstream.
Reabsorption Moves Nutrients and Water Back into the Bloodstream.
5. Kidneys play a very large role in human osmoregulation by regulating the amount of water reabsorbed from glomerular filtrate in kidney tubules, which is controlled by hormones such as antidiuretic hormone (ADH).
6. Sol same as ques no. 4.
7. Sol same as ques no. 5.
8. The renal tubule is the portion of the nephron containing the tubular fluid filtered through the glomerulus. After passing through the renal tubule, the filtrate continues to the collecting duct system.
The components of the renal tubule are:
 - 1) PCT - The filtrate in the Bowman's space enters the first duct in the renal tubule. This duct is called the proximal convoluted tubule, which is a section of the renal tubule located in the kidney's cortex that is responsible for the reabsorption of the majority of ultrafiltrate.
 - 2) Loop of Henle - The next duct of the renal tubule in line to collect the scraps left by the proximal tubule is called the loop of Henle. The loop of Henle is a long duct mainly located in the kidney's medulla that creates a concentration gradient, called a countercurrent exchange system, that allows for the reabsorption of water. While the majority of water, like the rest of the ultrafiltrate, was reabsorbed by the proximal convoluted tubule, the loop of Henle is involved in absorbing even more water in order to create concentrated urine.
 - 3) DCT - Once the filtrate passes through the thick ascending limb of Henle, it enters the distal convoluted tubule, which is a duct of the renal tubule located in the kidney's cortex that reabsorbs calcium, sodium, and chloride and regulates the pH of urine by secreting protons and absorbing bicarbonates.
9. The Bowman's capsule, a cup-shaped structure, is found in the cortex region of the kidney.
10. Having two kidneys work like a backup. You die quickly without functional kidneys, but one is enough for most purposes, so having two gives you a backup if one fail.
11. Photolysis is the splitting of water molecules in the presence of light into proton, electron and oxygen. It takes place during non-cyclic photophosphorylation. The protons are used to reduce NADP and electrons are fed to photosystem II. Oxygen is released as a waste product.
12. Oxygen is produced by photolysis of water. This photolysis of water is brought about by the light, usually sunlight. Photolysis is a part of the light-dependent reactions of photosynthesis. The electrons released during the photolysis is picked up by the photosystem I during light reaction.
13. Digestion in *Amoeba* is said to be intracellular because *amoeba* is a single celled organism, so the digestion takes place inside the cell. It obtains its nutrition in a heterotrophic mode. *Amoeba* can form pseudopodia. It engulfs the food with its pseudopodia. When the food enters its body, the *Amoeba* forms a food vacuole around it which contains certain enzymes to digest the food.
- 14.

15. The glands associated with the digestion of starch are:
Salivary glands: They secrete salivary amylase that breaks starch into maltose.
Gastric glands: The parietal cells of the gastric glands secrete HCl and hydrolyzes sucrose to some extent.
Pancreatic glands: Secrete pancreatic juice that contains pancreatic amylase that breaks down polysaccharides into maltose and isomaltose.
16. Fungi are heterotrophic. They get their nutrition by absorbing organic compounds from the environment. Fungi, along with bacteria that are found in soil, are the primary decomposers of organic matter in terrestrial ecosystems.
17. Glucose is the end product of the dark reaction.
The dark reaction is one of the carbon fixing mechanism in plants. It is a light-independent process. In this process the sugar molecules are formed from the carbon dioxide and water. This process takes place in the stroma of the chloroplast. This reaction utilizes the products of the light reaction.
In this process the ATP and NADPH produced in the light reaction are used to convert the carbon dioxide into six carbon sugar that is glucose which is the product of the dark reaction.
18. Hydrochloric acid is secreted by the glands present on the stomach walls. It dissolves bits of food and creates an acidic medium. The acidic medium allows pepsinogen to be converted into pepsin. Pepsin plays an important role in the digestion of proteins. Therefore, if HCl were not secreted in the stomach, then pepsin would not be activated. This would affect protein digestion. A pH of about 1.8 is necessary for proteins to be digested. This pH is achieved by HCl.
19. The digestive enzyme salivary amylase begins the digestion of carbohydrates. An amylase is an enzyme that catalyses the hydrolysis of starch into sugars. Salivary amylase breakdown starch into maltose. Gastric juice contains pepsin, lipase. Pepsin is secreted in an inactive form as pepsinogen, which is activated by HCl. Pepsin digests proteins into peptones. Lipase breaks down fats into fatty acids.
20. Saliva contains the enzyme amylase, also called ptyalin, which is capable of breaking down starch into simpler sugars such as maltose and dextrin that can be further broken down in the small intestine.
Trypsin, amylase and lipase are the three enzymes in the pancreatic juice. They help in breakdown of all the food components which need digestion.
Trypsin converts proteins into peptones.
Amylase converts starch into maltose.
Lipase acts on emulsified fats in droplet form, converting them into fatty acids and glycerol.
21. The diaphragm is a muscular sheet that separates the thoracic cavity, containing the heart and lungs, from the abdominal cavity and performs an important function in respiration: as the diaphragm contracts, the volume of the thoracic cavity increases, creating a negative pressure there, which draws air into the lungs. Thus it helps in breathing.
22. The carbon dioxide diffuses into the blood vessels surrounding the tissues and is carried to the lungs, from where they are exhaled out.
23. Gas exchange takes place in the millions of alveoli in the lungs and the capillaries that envelop them. The inhaled oxygen moves from the alveoli to the blood in the capillaries, and carbon dioxide moves from the blood in the capillaries to the air in the alveoli.
24. The anaerobic respiration takes place in organisms like yeast, some bacteria (*Clostridium* sp.), and parasitic worms.
25. There are small openings on the lower surface of the leaves. These pores are called stomata. These openings are surrounded by guard cells.

FUNCTIONS OF STOMATA:

1. It helps in the transpiration of water, i.e., the loss of excess water from the plant.
2. Loss of water from the stomata creates an upward pull, i.e., suction pull which helps in absorption of water from the roots.
3. Stomata are responsible for the interchange of gases for respiration and photosynthesis.
4. The stomata allow for the loss of excess water in the form of water vapour, which also allows cooling.

26. During heavy exercise or running.
During exercise, the muscle cells need more oxygen to sustain their work. This results in an increase in breathing and heart rate because both the lungs and the heart work extra to keep up with the ever-growing need of oxygen.

Fermentation takes place in the muscle cells during exercise which results in an increase in the amount of lactic acid, hydrogen ion. This stimulates the respiratory system more and it results in an increase in the heart rate so that the heart pumps more blood. The blood pressure increase which leads to more blood flow in the alveoli.

The lungs absorb more oxygen and the muscle cells receive more blood and thus the oxygen demand is satisfied.

27. Aerobic respiration is a type of respiration in which the breakdown of organic compounds takes place with the presence of oxygen and release a large amount of energy in the form of ATP.

In anaerobic respiration, the partial breakdown of organic compound takes place without using oxygen and release only a fraction of energy.

The first breakdown of glucose takes place through glycolysis which is the common pathway between the aerobic and anaerobic respiration and it takes place in the cytoplasm.

28. Human beings normally obtain energy by aerobic respiration. But when we need extra energy, anaerobic respiration can take place in our muscles for a short time. When we do a heavy physical exercise, our muscles need more oxygen. But the supply of oxygen through blood is limited and hence insufficient. During heavy exercise, some of our muscles respire anaerobically. The anaerobic respiration by muscles brings about the partial breakdown of glucose to form lactic acid. This lactic acid accumulates in the muscles. The accumulation of lactic acid in the muscles causes muscle cramps.

29. Transport of soluble product of photosynthesis or food from leaves to other parts of plants is called translocation.

For translocation, food molecules enter the part of the phloem called the sieve tubes where they can be transported upwards or downwards to all parts of the plant including roots. Translocation is achieved by utilizing energy from the ATP that provides osmotic pressure required for upward and downward movement of food.

30. Differences between arteries and veins:

Artery	Vein
vessels carry blood from the heart to various body parts.	vessels carry blood from the various body parts to the heart.
carry oxygenated blood from the heart to the pulmonary artery.	carry deoxygenated blood from the body parts to the pulmonary vein.
flows under high pressure.	flows under low pressure.
absence of valves.	are present to prevent the backward flow of blood.

31. The phloem tissue transports food from the leaves to the other parts of the plant. Translocation is the conduction of materials from leaves to other tissues throughout the plant by the vascular bundles. Plants produce carbohydrates (sugars) in their leaves by photosynthesis, which is further conducted to different parts of the plant for proper functioning.

32. Human blood is grouped into four types: A, B, AB, and O. Each letter refers to a kind of antigen, or protein, on the surface of red blood cells. For example, the surface of red blood cells in Type A blood has antigens known as A-antigens.

33. Bicuspid valve is located between left atrium and left ventricle. Tricuspid valve is located between right atrium and right ventricle. Their function is to prevent backward flow of blood from ventricles to atria.

34. The pericardium is the membrane that surrounds and protects the heart. The inner layer is firmly attached to the heart wall and is known as the visceral layer. The outer layer is composed of relatively inelastic connective tissue and is termed the parietal layer.

The heart has four chambers: two upper atria and two lower ventricles. The right atrium receives oxygen-poor blood from the body and pumps it to the right ventricle. The right ventricle pumps the oxygen-poor blood to the lungs. The left atrium receives oxygen-rich blood from the lungs and pumps it to the left ventricle.

35. Minerals are absorbed by plant roots from the soil solution. The minerals are present in the soil in two forms bound form and solution form. The roots have root hair. The root hair increase the surface area of the root for the absorption of mineral nutrients dissolved in water. Plants absorb the minerals from the soil with the help of root hairs. The minerals are absorbed in the form of ions. The mineral absorption by plant roots take place in two phases-
- 1) Initial phase- The rapid uptake of ions into outer free spaces of the plant cells (apoplast). free spaces include the intercellular spaces and the cell wall. The entry of ions into the outer space is passive absorption, i.e no energy is required.
 - 2) Metabolic phase- The mineral ions diffuse into the cell cytoplasm and vacuoles (symplast). entry of ions into the cell requires energy, therefore, is called active absorption.
36. Thylakoids are tiny compartments found inside of chloroplasts. Their role is to help absorb sunlight in order for photosynthesis to occur. They contain all of the chlorophyll that the plant has which, in turn, allows for the absorption of sunlight.
37. As chloroplast contain chlorophyll in them and this pigment helps in trapping sunlight and preparing food. This prepared food stored in leaves is utilized and the energy is released. So, chloroplasts are called energy convertors.
38. The leaves in the shade need the additional chlorophyll to help them produce food. Getting less sun on a regular basis, the additional chlorophyll compensates for the reduced sunshine. This allows leaves in the shade to be more productive in making food for the tree.
39. One of the important requirements of photosynthesis is sunlight. Rate of photosynthesis depends on the amount of sunlight available. On a cloudy day, very little sunlight is available. So the rate of photosynthesis will be very low. On the other hand, a bright sunny day will provide bright sunlight, leading to a high rate of photosynthesis.
40. Bile, or gall, is a dark-green-to-yellowish-brown fluid produced by the liver of most vertebrates that aids the digestion of lipids in the small intestine. In humans, bile is produced continuously by the liver (liver bile) and stored and concentrated in the gallbladder.
41. Gastric mucus is a glycoprotein that serves two purposes: the lubrication of food masses in order to facilitate movement within the stomach and the formation of a protective layer over the lining epithelium of the stomach cavity so as to protect stomach lining from degradation due to HCl.
42. The mucus and hair of our nose trap the dust particles in air and hence make it clean. Our nose is enriched with a network of blood capillaries whose activities make the air warm.
43. Breathing through nose is better than breathing through the mouth. The hairs inside nostrils filter any microbe in the air and it only lets the clean air pass through. The air gets warm and humidified as it passes into our bodies, making it less shocking to our systems. Each nostril takes part in filtering, warming, moisturizing, dehumidifying, and smelling the air. Lungs can extract oxygen from the air we breathe primarily on the exhale. Because the nostrils are smaller than the mouth, air exhaled through the nose creates back pressure when one exhales. Work of lung movement would get doubled.
44. i) Trachea, Bronchus and the alveoli are a part of the respiratory tract. The diaphragm is not a part of the respiratory tract and helps in the external exchange of gases. So, the odd one out is 'Diaphragm'.
ii) The correct answer is Malpighian corpuscles. Its because the rest others are present in the respiratory system while malpighian corpuscles is the part of excretory system.
45. The typical respiratory rate for a healthy adult at rest is 12–18 breaths per minute. A respiration rate under 12 or over 25 breaths per minute while resting is considered abnormal. A newborn baby has a normal breathing rate of 30-60 breaths per minute. This rapid breathing continues as the baby begins to grow and starts slowing down at around six months of age. School-aged children have a normal breathing rate, also known as respiratory rate, of 18-30 breaths a minute while resting. When a person is engaged in different activities such as exercise breathing takes around 35-45 breaths per minute, while in some endurance sports athletes may breathe 60-70 times a minute. As people age, they tend to breathe more shallowly and therefore more often to get enough oxygen in the blood.
46. The typical respiratory rate for a healthy adult at rest is 12–18 breaths per minute. The rate of breathing increases during vigorous exercise. This is because the body needs more energy which can be released only if greater amounts of oxygen reach the cells. For this purpose, the rate of breathing

increases. (This will increase the supply of oxygen to the cells). However, after a while this strategy is also insufficient to meet the cell's need. This is because, there is a temporary shortage of oxygen being delivered to the working muscles. So muscles begin to respire anaerobically. Lactic acid is a by-product of producing energy anaerobically. When lactic acid accumulates at high levels in the blood, it causes muscular fatigue.

47. a) Arteries
b) Veins
48. Vitamin K plays a key role in helping the blood clot, preventing excessive bleeding. The body needs vitamin K to produce prothrombin, a protein and clotting factor that is important in blood clotting.

Long answer type questions

1. Fats are digested in the alimentary canal where it is broken down into simple fatty acids and glycerol. Fatty acids and glycerol being insoluble, cannot be absorbed into the blood. They are first turned into small droplets called micelles which move into intestinal. They are re-formed into very small protein coated fat globules called chylomicrons which are transported into the lacteals in the villi. Lacteals ultimately release the absorbed substances into the blood stream.
2. Bile is a fluid made up of cholesterol, bile salts, bilirubin, water, and bicarbonate ions. It is made in the liver and is stored in the gall-bladder. It is transported into the duodenum section of the small intestine through the common bile duct. In the small intestine, bile salt helps in emulsification of fats so that it can be digested by the lipases.
3. Catabolism is process of breakdown of any large substance into smaller ones. In respiration, glucose is broken down into carbon dioxide and water molecules. Thus it is referred to as a catabolic reaction.
4. The cardiac cycle is the performance of the human heart, beginning from one heartbeat to the beginning of the next. It consists of two phases:- 1) Diastolic phase, 2) Systolic phase.
In the diastolic phase, the heart ventricles are relaxed and the heart fills with blood.
In the systolic phase, the ventricles contract and pump blood out of the heart and to arteries.
It further proceeds in the following steps:
Atrial systole lasts about 0.1 seconds - both atria contract and forces the blood from the atria into the ventricles.
Ventricular systole lasts about 0.3 seconds - both ventricles contract, blood is forced to the lungs via the pulmonary trunk and the rest of the body via the aorta.
Atrial diastole lasts for about 0.7 seconds- relaxation of the atria, during which the atria fill with blood from the large veins (the vena cava).
Ventricular diastole lasts about 0.5 seconds - begins before atrial systole, allowing the ventricles to fill passively with blood from the atria.
5. The sino-atrial (SA) node is a specialised bundle of neurons located in the upper part of the right atrium of the heart. The cardiac impulse originating from the SA node triggers a sequence of electrical events in the heart, thereby controlling the sequence of muscle contraction that pumps blood out of the heart. Since the SA node initiates and maintains the rhythmicity of the heart, it is known as the natural pacemaker of the human body.
6. The heart receives deoxygenated blood from different parts of the body, and it pumps this blood to the lungs. The oxygenated blood from the lungs returns to the heart, which is pumped again into different parts of the body by the heart. Thus, the blood passes twice through the heart making one complete round through the body. This is called double circulation. The pulmonary circulation pertains to lungs. The blood flows from the right ventricle to the lungs. Pulmonary veins collect oxygenated blood from the lungs and carry it back to the heart (left auricle). The systemic circulation pertains to the major circulation of the body. The aorta receives the blood from the left ventricle and sends it to the various parts of the body. Veins collect the deoxygenated blood from the body parts and pour it back into the right auricle.

7. Hema's blood group – A – Can donate blood to Shikkha (as her blood type is AB which is universal recipient) and can receive blood from Vivek (as his blood type is O which is universal donor).
Vivek's blood group – O – Universal donor can donate blood to both Hema and Shikkha but cannot receive blood from any of them.
Shikkha's blood group – AB – Universal recipient can receive blood from both Hema and Vivek but cannot donate to any of them.
8. Lymphocytes are a type of white blood cell. The main function is that they serve as part of the immune system. Their various functions allow them to properly respond to foreign invaders in the body and eliminate them. They produce specific antibodies. This helps in the providing protection against the infectious diseases. The T- lymphocytes helps in cell-mediated response while the humoral immunity is provided by B- lymphocytes.
9. The waste material along with the blood is brought to the kidneys by the renal arteries (afferent arteriole). The renal artery divides into the arterioles and the blood is carried to the glomerulus in the Bowman's capsule. As the blood is under pressure in the arteries, it is filtered out from the blood capillaries into the Bowman's capsule. This process is known as ultrafiltration.
10. Osmoregulation is the active regulation of the osmotic pressure of an organism's fluids to maintain the homeostasis of the organism's water content; that is it keeps the organism's fluids from becoming too diluted or too concentrated. Organisms in both aquatic and terrestrial environments must maintain the right concentration of solutes and amount of water in their body fluids; this involves excretion (getting rid of metabolic wastes and other substances such as hormones that would be toxic if allowed to accumulate in the blood) via organs such as the skin and the kidneys; keeping the amount of water and dissolved solutes in balance is referred to as osmoregulation.
11. Photosynthesis is a process where compounds like carbohydrates are synthesized from simple inorganic compounds like carbon dioxide and water in the presence of chlorophyll and sunlight with the liberation of oxygen. It is a reductive, anabolic and endothermic reaction.
The events that occur during the process of photosynthesis are:
Absorption of light energy by chlorophyll and conversion of light energy to chemical energy and splitting of water molecules into hydrogen and oxygen (Light Reaction).
Reduction of carbon dioxide to carbohydrates (Dark reaction).
Role of stomata: Tiny openings in leaves called stomata. These help in the gaseous exchange between the plant and its atmosphere. The gas exchange that occurs when stomata are open facilitates photosynthesis. During photosynthesis, carbon dioxide is taken in from the atmosphere through the stomata and oxygen is released as a waste product. Both photosynthesis and the gas exchange that powers it are essential to the plant's survival.

MCQs Level 1

1. (b) In autotrophic nutrition, the organism prepares its food from simple substances present in the surroundings. Autotrophs are the producers in the food chain. There are two types of autotrophs: photoautotrophs and chemoautotrophs. Photoautotrophs get their energy from sunlight and convert it into usable energy (sugar). This process is called photosynthesis.
Chemoautotrophs are organisms that obtain energy from inorganic chemical processes.
2. (d) Putting the plant in dark for 48 hours would stop the process of photosynthesis as light is required for it. Photosynthesis produces organic sugars which are stored in form of starch in plants. The absence of photosynthesis would lead to consumption of all stored starch making the leaf starchless. The correct answer is option D.
3. (d) Food provides us energy, build our immunity to fight with the diseases and give us nutrition that helps in the repairing of body tissue.
4. (d) Fungi are saprophytic. They get their nutrition by absorbing organic compounds from the environment by feeding on dead and decomposing matter. Fungi, along with bacteria that are found in soil, are the primary decomposers of organic matter in terrestrial ecosystems.
5. (b) During photosynthesis, plants trap light energy with their leaves. Plants use the energy of the sun to change water and carbon dioxide into a sugar called glucose. Glucose is used by plants for energy.

6. (c) The duodenum is the first part of the small intestine. The main role of the duodenum is to complete the first phase of digestion. In this section of the intestine, food from the stomach is mixed with enzymes from the pancreas and bile from the gallbladder.
7. (b) Cellulose is a polysaccharide which has strong glycosidic bonds. Its digestion takes a longer time. Hence, herbivores who eat grass/green leafy vegetables need a longer small intestine to allow complete digestion of cellulose. Carnivores animals cannot digest cellulose, hence, they have a shorter intestine.
8. (b) Carbohydrates, proteins, and fats are completely digested in the small intestine as it has all the enzymes needed for digestion. Here they are broken down into their basic units - Carbohydrates into sugars. Proteins into amino acids. Fats into fatty acids and glycerol.
9. (a) Villi are small finger-like projections present along the walls of the small intestine. They increase the surface area of the small intestine and help in absorption of nutrients from the digested food.
10. (c) Lacteals are lymphatic vessels found in small intestinal villi. While other nutrients such as amino acids and saccharides are absorbed into the blood stream, lacteals and the lymphatic system are used to absorb fats (fatty acids).
11. (d) The pancreas empties its secretions into the duodenum through the major pancreatic duct. Pancreatic juice contains enzymes that digest proteins, fats, and carbohydrates.
12. (b) Pancreatic juice is secreted by the pancreas, which contains a variety of enzymes, including trypsin, chymotrypsin, pancreatic lipase and amylase. Ptyalin/salivary amylase is not present in pancreatic juice. It is secreted by the salivary glands in the mouth.
13. (d) Excess glucose is stored in the liver as the large compound called glycogen. Glycogen is a polysaccharide of glucose, but its structure allows it to pack compactly, so more of it can be stored in cells for later use.
14. (b) It is a known fact that starch is not water soluble therefore; it doesn't alter the osmotic balance by increasing the water into storage cells. As compared to glucose which in fact is way more water soluble and will affect the water ratio in the cell. Starch is a polysaccharide and stores more energy than glucose, therefore it is used as a storage material.
15. (c) An adult human has 32 permanent teeth, which are of four different types, namely, incisors (I), canine (C), premolars (PM) and molars(M).
16. (a) Ptyalin is a form of amylase found in saliva of humans. Another name of ptyalin is salivary amylase. It is the most important amyolytic enzyme secreted in mouth (buccal cavity) by the salivary glands. The main function of ptyalin is to catalyze the hydrolysis of starch into maltose.
17. (b) Bile or gall is a dark green to yellowish brown fluid, produced by the liver of most vertebrates, that aids the digestion of lipids in the small intestine. In humans, bile is produced continuously by the liver (liver bile) and stored and concentrated in the gallbladder (gallbladder bile). After eating, this stored bile is discharged into the duodenum.
18. (c) Hydrochloric acid is secreted by the glands present on the stomach walls. It dissolves bits of food and creates an acidic medium. The acidic medium allows pepsinogen to be converted into pepsin. Pepsin plays an important role in the digestion of proteins. Therefore, if HCl were not secreted in the stomach, then pepsin would not be activated. This would affect protein digestion. A pH of about 1.8 is necessary for proteins to be digested. This pH is achieved by HCl.
19. (c) Plants require a number of mineral elements for optimum growth and activity. Phosphorous is an essential macro nutrient. It is a component of energy rich nucleotides like ATP, GTP etc. Phosphorous participates in all the reactions where energy is either evolved or consumed. Hence, phosphorous plays an indispensable role in energy metabolism of a cell.
20. (b) Physicochemical processes are the normal intracellular and extracellular physical and chemical processes that are crucial for maintenance of normal homeostasis of a cell. These reactions are vital for the wellbeing of the cell and provide essential energy for its survival. As respiration involves breathing (physical) and cellular release of energy (chemical), it can be called a physicochemical process.