Science Class X

Chapter - 6 : Life Processes (Biology)

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Chapter-6 : Life Process

Introduction

Something which is 'living' (not dead) is said to be 'alive'. All the plants and animals (including human beings) are alive or living things.

Q) What criteria do we use to decide whether something is alive?

Ans: The most important criterion to decide whether something is alive (or not) is the movement. Presence of life processes and the presence of a cellular structure is used to determine whether something is alive or not.

The important life processes in living organism are:

(a) Nutrition
(b) Respiration
(c) Transportation
(d) Excretion
(e) Control and co-ordination
(f) Growth and reproduction.

Q) What processes would you consider essential for maintaining life?

Ans) Life processes essential for maintaining life are nutrition, respiration, transportation, excretion and control and co-ordination.

6.1 What are Life Processes?

Q) Define Life Process.

Ans) All living things perform certain life processes like growth, excretion, respiration, circulation etc. All the processes like respiration, digestion, which together keep the living organisms alive and perform the job of the body maintenance are called life processes.

Life Process

Growth | Digestion | Respiration | Circulation | Excretion

6.1 What are life Processes? (cont...)

Energy required to carry out the different life process, is obtained from carbon-based food sources through nutrition.

Metabolism: It is the sum total of all the chemical reactions which occur in a living being due to interaction amongst its molecules. It has two components - Anabolism (build-up reaction) and Catabolism (breakdown reactions).

Respiration: The process of acquiring oxygen from outside the body, and to use it in the process of break-down of food sources for cellular needs, is what we call respiration.

In the case of a single-celled organism, no specific organ for taking in food, exchange of gases or removal of wastes may be needed because the entire surface of the organism is in contact with the environment.

Q) Why is diffusion insufficient to meet the oxygen requirements of multi-cellular organisms like humans?

Ans) In multi-cellular organisms, all the cells may not be in direct contact with the surrounding environment. Thus, simple diffusion will not meet the requirements of all the cells.

Transportation System

In multi-cellular organisms, various body parts have specialised in the function they perform. Uptake of food and oxygen will also be the function of specialised tissues. Since the food and oxygen are now taken up at one place in the body of the organisms, while all parts of the body need them. This situation creates a need for a transportation system for carrying food and oxygen from one place to another in the body.

Excretion

When chemical reaction use the carbon source and oxygen for energy generation, they create by-products that are not only useless for the cells of the body, but could even be harmful. These waste by-products are therefore needed to be removed from the body and discarded outside by a process called excretion.

(Q) What are outside raw material used for by an organism?

Ans) An organism uses outside raw material mainly in the form of food, water and oxygen. The raw materials are used by the organism for performing important functions in the body and vary according to the complexity of the organism and its environment.

1. Food is used for providing energy and nutrients for the cells in the body.
2. Water is the most important medium in which cellular reactions take place. Water is also required for digestion and is the major constituent of blood and protoplasm.
3. Oxygen is used for aerobic respiration so as to release

6.2 Nutrition

Energy required to carry out the different life process, is obtained from carbon based food sources through nutrition. Nutrition is the process by which living beings procure food for obtaining energy and body building materials.

Q) How do living things get their food?

Ans) Depending on the mode of obtaining nutrition, organisms are classified as autotrophs or heterotrophs.

(a) Autotrophs : Some organisms use simple food material obtained from inorganic sources in the form of carbon dioxide and water. These organisms are called autotrophs which include green plants and some bacteria.

(b) Heterotrophs : Heterotrophs use bio-catalysts called enzymes which break down complex substances into simpler ones before they can be used for the upkeep and growth of the body.
Heterotrophs cannot synthesis their own food and is dependent on the autotrops for obtaining complex organic substance for nutrition (e.g. animals).

6.2.1 Autotrophic Nutrition.

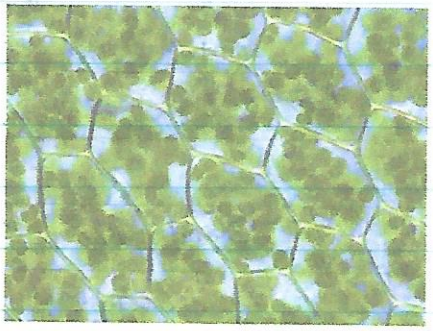
Green plants prepare their food by the process of photosynthesis. Here, they utilise CO_2, H_2O and sunlight, with the help of chlorophyll, giving out O_2 as a product.

Thus, photosynthesis is the synthesis of organic food from inorganic raw material with the help of light energy inside chlorophyll containing cell.

$$6CO_2 + 6H_2O \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} C_6H_{12}O_6 + 6O_2$$
(Glucose)

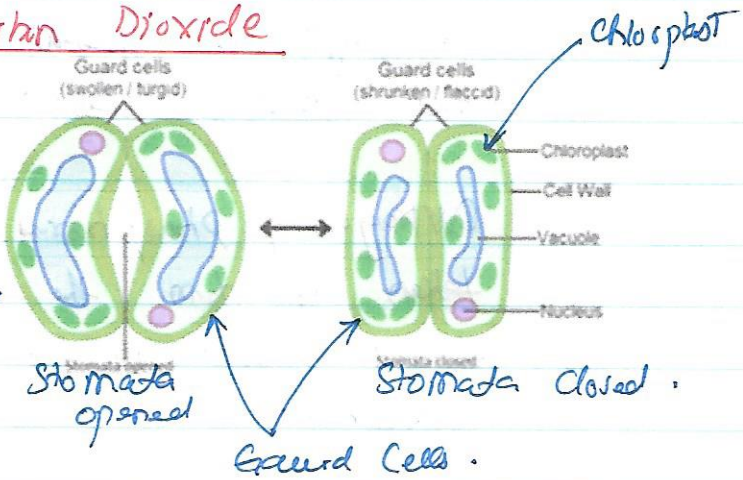
The following events occur during the process of photosynthesis:
(i) Absorption of light energy by chlorophyll.
(ii) Conversion of light energy to chemical energy and splitting of water molecules into hydrogen and oxygen.
(iii) Reduction of carbon dioxide to carbohydrates.

If you carefully observe a cross section of leaf under the microscope you will notice that some cells contain green dots.
These green dots are cell organelles called chloroplasts which contain chlorophyll.



How Plant obtain Carbon Dioxide

Massive amounts of gaseous exchange takes place in leaves through tiny pore called stomata, for the purpose of photosynthesis.



Since large amount of water can be lost through these stomata, the plant closes these pores when it does not need carbon dioxide for photosynthesis.
The opening and closing of the pore is a function of the guard cells. The guard cells swell when water flows into them, causing the stomatal pore to open. Similarly the pore closes if the guard cells shrink.

(Q.) Where do plants get each of the raw material required for photosynthesis?

(Ans) The following raw materials are required for photosynthesis: Carbon dioxide, Water, Sunlight, Chlorophyll, Nitrogen, phosphorus, iron and magnesium.

- CO_2 enters from the atmosphere through stomata. Aquatic plants obtain CO_2 that is present in dissolved form in water
- Water is absorbed from the soil by the plant roots
- Sunlight, an important component to manufacture food, is absorbed by the chlorophyll and other green parts of the plant.
- Chlorophyll is present in all green parts of the plant but mainly leaves.
- Nitrogen, phosphorus, iron and magnesium are taken up from the soil. Nitrogen is an essential element used in the synthesis of proteins and other compounds.

6.2.2 Heterotrophic Nutrition

Some organisms break-down the food material outside the body and then absorb it. Example, are fungi like bread moulds, yeast and mushroom.

Others take in whole material and break it down inside their bodies.

Heterotrophic Nutrition is that mode of nutrition in which the organisms obtain food from outside sources.

Parasitic Nutrition is a mode of heterotrophic nutrition where a parasitic organism lives on the body surface or inside the body of another type of organism (a host) and gets nutrition directly from the body of the host. Example, cuscuta (amar-bel), orchids, ticks, lice, leeches and tape-worms.

These organisms derive nutrition from plants or animals without killing them.

6.2.3 How do Organisms obtain their Nutrition?

In single-celled organisms, the food may be taken in by the entire surface. Amoeba takes in food using temporary finger-like extensions of the cell surface which fuse over the food particle forming a food-vacuole. Inside the food-vacuole, complex substances are broken down into simpler ones which then diffuse into the cytoplasm. The remaining undigested material is moved to the surface of the cell and thrown out.

6.2.4 Nutrition in Human Beings.

The alimentary canal is basically a long tube extending from the mouth to the anus. In human, digestion of food takes place in the alimentary canal, made up of various organ and glands.

Various regions are specialised to perform different functions.

What happens to the food once it enters our body?

Mouth → Intake of whole food.

↓

Teeth → Chewing / grinding of food.

↓

Tongue → Rolling of food + Tasting of food + Swallowing / Pushing down of the food.

Secrete saliva + Mucus

Starch $\xrightarrow[\text{amylase (Saliva)}]{\text{Salivary}}$ Salivary.

↓

Oesophagus → Taking food from mouth to stomach by Peristaltic movements.
[Contraction and expansion of muscle

↓

Stomach → Gastric Glands $\xrightarrow{\text{Secrete}}$ Gastric Juice

Gastric Juice

- ↓ PEPSIN (Enzyme that Breaks down Protein)
- ↓ HCl (Make medium acidic)
- ↓ Mucus (Protect inner lining of the stomach)

Small Intestine → (a) Intestinal enzyme convert

- Carbohydrate → Glucose
- Fats → fatty acid + Glycerol
- Protein → Amino Acids

(b) Villi (finger like projection) → Helps in absorption of food into the blood.

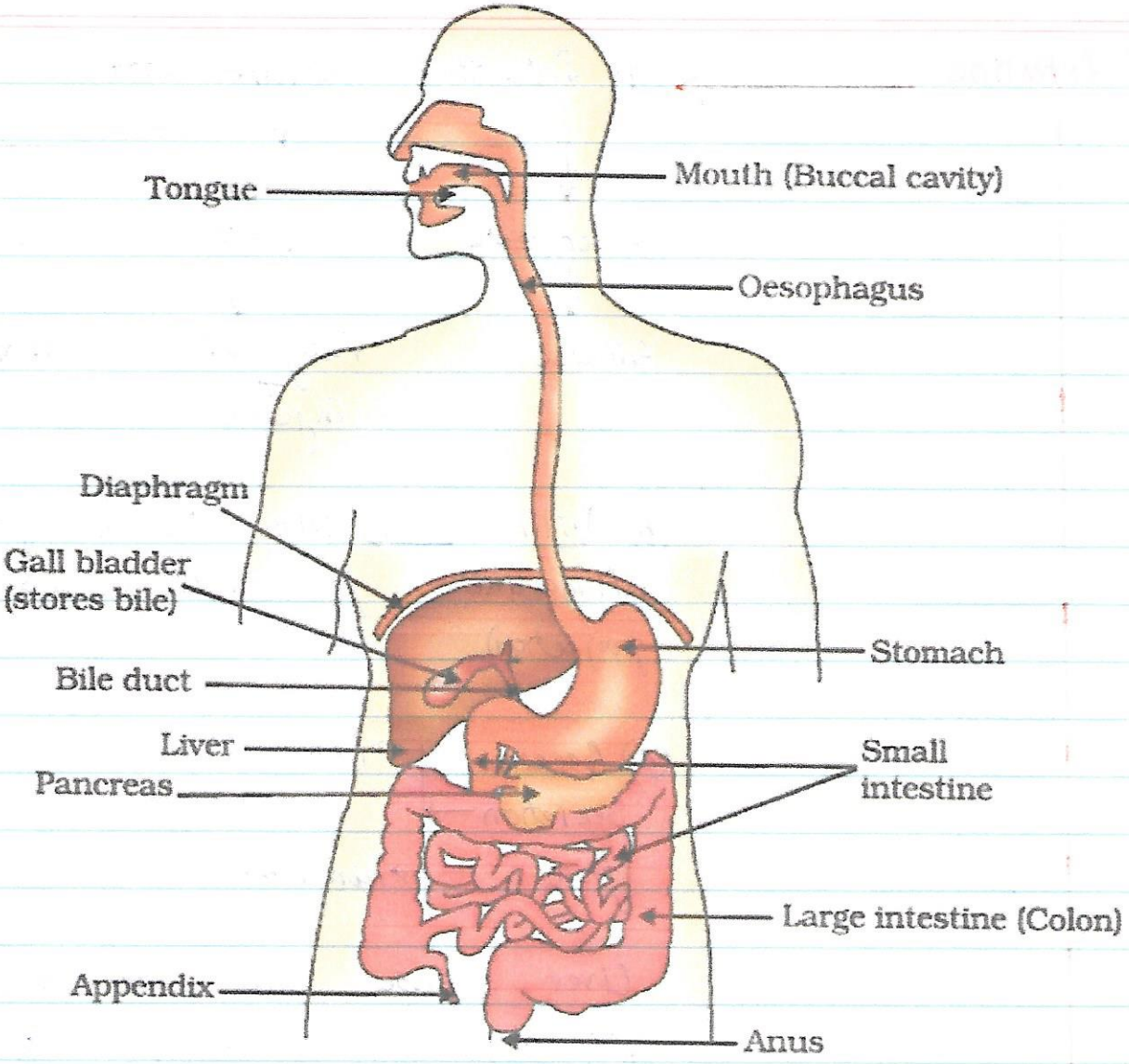
(c) Receives Secretion from → Liver, Pancreas

Liver secretes bile which are critical for digestion and absorption of fats.

Pancreas : produce insulin and other important enzymes and hormon that helps break down foods.

Large Intestine → Absorb excess of water

The rest of the Material is removed from the body via the anus.



The digestive system in human consists of an alimentary canal and associated digestive glands. The human alimentary canal is a continous muscular digestive tube about 8 to 10 m long that runs through the body. It is open at two ends with the openings, which are mouth at the interior and anus at the posterior end. It performs the function of digestion of the food. It breaks the food into smaller substances and absorbs the digested food.

The main parts of the alimentary canal are:

(1) Mouth and Buccal Cavity

- The mouth is the entry for food. Mouth is used to ingest the food.
- Salivary Glands: Saliva is released by the salivary glands into buccal cavity when we smell food. Once the food enters the mouth, chewing breaks food into smaller particles it helps enzymes in saliva to attack the broken down food.
- Teeth: Our teeth can perform a cutting as well as grinding function to accomplish the task of the breaking of food.
- Tongue: The tongue helps in mixing the food with the saliva and then the tongue and roof of the mouth help to move the food into the pharynx and esophagus.

(2) Pharynx (or throat):

- It is a common passage for the inhaled air and the swallowed food. It is the transition area from the mouth to the esophagus.

(3) Oesophagus

- It is a narrow muscular tube arising from pharynx, continuing through the thorax and ending in stomach. It is about 25 cm long.
- The wall of canal has muscles that contract rhythmically in order to push the food forward. These peristaltic movements occur all along the gut.
- Once the food approaches the stomach, a muscular valve relaxes and lets the food passes into the stomach.

(4) Stomach

- From the mouth, the food is taken to the stomach through the food-pipe or oesophagus. The stomach is a large organ which expands when food enters it. The muscular walls of the stomach help in mixing the food thoroughly with more digestive juices.

- These digestion functions are taken care of by the gastric glands present in the wall of the stomach. These release hydrochloric acid, a protein digesting enzyme called pepsin, and mucus. The hydrochloric acid creates an acidic medium which facilitates the action of the enzyme pepsin.

- The mucus protects the inner lining of the stomach from the action of the acid under normal conditions.

- At the end of this process, the food is transformed into a thick creamy fluid called chyme. Then the food is pushed into the small intestine.

(5) Small intestine

- This is the longest part of the alimentary canal which is fitted into a compact space because of extensive coiling. Herbivores eating grass need a longer small intestine to allow the cellulose to be digested. Meat is easier to digest, hence carnivores like tigers have a short small intestine.

- The small intestine is the site of the complete digestion of carbohydrates, proteins and fats. It receives the secretions of the liver and pancreas for this purpose.

- The food coming from the stomach is acidic and has to be made alkaline for pancreatic enzymes to act. Bile juice from the liver accomplishes this in addition to acting on fats.

- Bile salts break down fats present in intestine into small globules increasing the efficiency of enzyme action.

- The pancreas secretes pancreatic juice which contains enzymes like trypsin for digesting protein and lipase for breaking down emulsified fats.

- The walls of the small intestine contain glands which secrete intestinal juice. The enzymes present in it finally convert the proteins to amino acids, complex carbohydrates into glucose and fats into fatty acids and glycerol.

- The digested food is taken up by the walls of the intestine. The inner lining of the small intestine has numerous finger-like projections called villi which increase the surface area for absorption. The villi are richly supplied with blood vessels which take the absorbed food to each and every cell of the body, where it is utilised for obtaining energy, building up new tissues and repair of old tissues.

(6) Large Intestine : The unabsorbed food is sent into the large intestine where more villi absorb water from this material.

(7) Anus : The rest of the material is removed from the body via anus. The exist of this waste material is regulated by the anal sphincter.

Q) What is the difference between autotrophic nutrition and heterotrophic nutrition?

Ans

	Autotrophic Nutrition	Heterotrophic Nutrition.
1)	Food is synthesized from simple inorganic raw material such as CO_2 and water	Food is obtained from complex organic sources such as plants or animal. This food is broken down with the help of enzymes.
2)	Presence of green pigment (chorophyll) is necessary	No pigment is required in this type of nutrition
3)	Food is generally prepared in presence of sunlight (photosynthesis)	Food can be obtained at all times.
4)	All green plants and some bacterial have this type of nutrition.	All animals and fungi have this type of nutrition.

Q.) What is the role of the ... acid in our stomach?

Ans) The hydrochloric acid present in our stomach dissolves bits of food and creates an acidic medium. In this acidic medium, enzyme pepsinogen is converted to pepsin, which is a protein-digesting enzyme and can function optimally only in acidic pH. The acid also kills microorganism that enter the stomach along with food.

Q.) Which tissue transport soluble products of photosynthesis?

Ans) Phloem.

Q) What is the function of degestive enzymes?

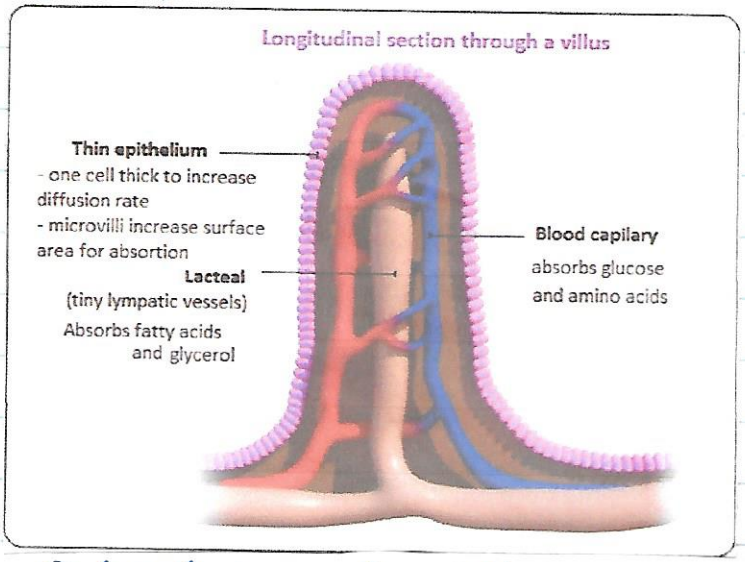
Ans) Digestive enzymes such a amylase, lipase, pepsin, trypsin etc, help in the breaking down of complex food into simpler molecules which can be easily absorbed by the cells of the body. These enzymes act as biocatalysts speedig up the rate of breakdown of complex food. In absence of these enzymes a sigle meal would take a very long time to digest.

Q.) How is small intestine designed to absorb digested food.

Ans) The small intestine has millions of tiny finger-like projection called villi. These villi increase the surface area for more efficient food absorption. The villi are covered with a single-cell thick layer of epithelium to allow easy assorption of food from the intestine to the blood and lymph vessels. Within these villi, many blood vessels and a lymph vessel (lacteal) are present that absorb the digested food and carry it to the blood stream. From the blood stream, the absorbed food is delivered to each and every cell of the body.

(Villus - singular, Villi - plural)

Additionally, the small intestine is highly convoluted and lengthy. This further increases the surface area for absorption.



Enlarged view of a villus.

Q.) The kidneys in human beings are a part of the system for excretion.

Q) The xylem in plants are responsible for transport of water.

Q) The autotrophic mode of nutrition requires: carbon dioxide, water, chlorophyll and sunlight.

Q.) The breakdown of pyruvate to give carbon dioxide, water and energy takes in: mitochondria.

Q) How are fats digested in our bodies? Where does the process take place?

Ans) Fats are present in the form of large globules in the small intestine. The small intestine gets the secretions in the form of bile juice and pancreatic juice respectively from the liver and the pancreas. The bile salts (from the liver) break down the large fat globules into smaller globules so that the pancreatic enzymes (lipases) can easily act on them. This is referred to as emulsification of fats. The bile juice also neutralize the acidic pH of the chyme to allow the pancreatic and intestinal enzymes to act. It takes in the small intestine.

Q.) What is the role of saliva in the digestion of food?

Ans) Saliva is secreted by the salivary glands, located under the tongue. It moistens the food for easy chewing and swallowing. It contains a digestive enzyme called salivary amylase, which breaks down starch into sugar.

Chap 6 - Life Process

Respiration

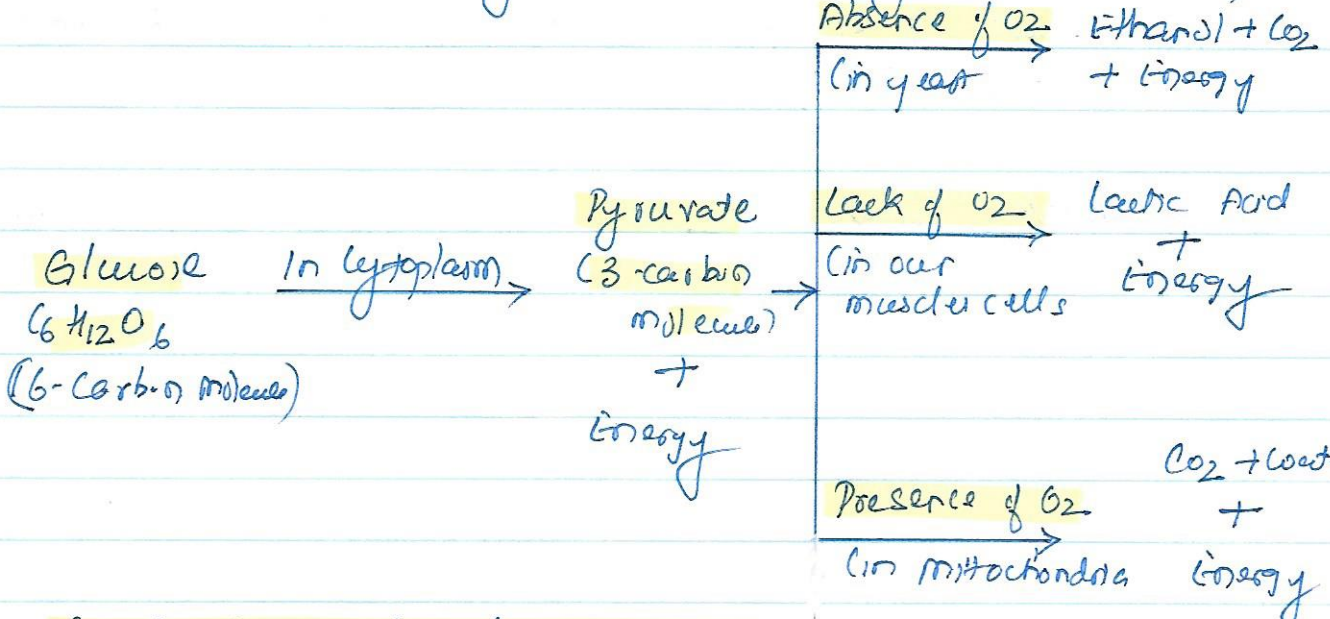
Respiration involves :

(i) Breathing : Gaseous exchange of O_2 from the atmosphere and release of CO_2

(ii) Cellular Respiration : Breakdown of simple food in order to release inside the cell.

Q.) What are the different ways in which glucose is oxidised to provide energy?

Ans) The food material taken in during the process of nutrition is used in cells to provide energy for various life process. (1) The first step is the break-down of glucose, a six-carbon molecule, into a three-carbon molecule called pyruvate in cytoplasm. (2) Pyruvate may be converted into ethanol and CO_2 in absence of air (oxygen) in yeast during fermentation. (3) Break down of pyruvate using oxygen take place in the mitochondria which breaks three-carbon pyruvate molecule to give three molecule of CO_2 and water. (4) Sometimes the pyruvate is converted into lactic acid in absence of oxygen. This build-up of lactic acid in our muscles during sudden activity causes cramps.



Break-down of glucose by various pathways.

Respiration	
Aerobic	Anaerobic
Takes place in the presence of oxygen	Take place in the absence oxygen
Occurs in mitochondria	occurs in cytoplasm
End products are CO_2 and H_2O	End products are alcohol or lactic acid.
More amount of energy is released	Less amount of energy is released.

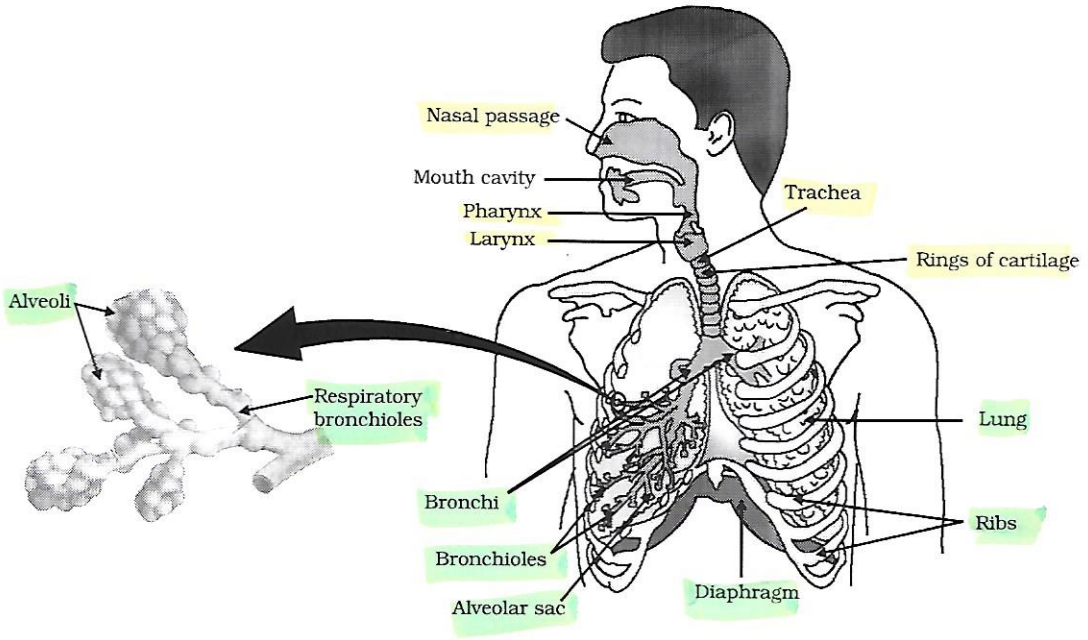
The energy released during cellular respiration is immediately used to synthesise a molecule called ATP (Adenosine Triphosphate is the energy currency of life).

ATP is used to fuel all other activities in the cell.

ATP is broken down giving rise to a fixed amount of energy which can drive the endothermic reaction taking place in cells

Plants release CO_2 at night and oxygen during day.

Human Respiratory System



The human respiratory system is composed of a pair of lungs. These are attached to a system of tubes which open on the outside through the nostrils. Following are the main structures in the human respiratory system.

Nostrils: There are two nostrils which converge to form a nasal passage. The inner lining of the nostril is lined by hairs and remain wet due to mucus secretion. The mucus and the hairs help in filtering the dust particles out of from inhaled air. Further, air is warmed up when it enters the nasal passage.

Pharynx: It is a tube like structure which continues after the nasal passage.

Larynx : This part comes after the pharynx which is also called the voice box.

Trachea : This is composed of rings of cartilage. Cartilaginous rings prevent the collapse of trachea in the absence of air.

Bronchi : A pair of bronchi comes out from the trachea; with one bronchus going to each lung.

Bronchioles : A bronchus divides into branches and sub-branches, inside the lung.

Alveoli : Within the lung, the passage divides into smaller and smaller tubes which finally terminate in ballon-like structures called alveoli. The alveoli provides a surface where the exchange of gases can take place. The walls of the alveoli contain an extensive network of blood-vessels.

Air is sucked into the lungs and fills the expanded alveoli. The blood brings CO_2 from the rest of the body for release into the alveoli, and the O_2 in the alveolar air is taken up by blood in the alveolar blood vessels to be transported to all the cells in the body.

During the breathing cycle, when air is taken in and let out; the lungs always contain a residual volume of air so that there is sufficient time for oxygen to be absorbed and for the carbon dioxide to be released.

When body size of animals is large, the diffusion pressure alone cannot carry O_2 to all parts of body. Instead, respiratory pigments take up O_2 from air in the lungs and carry it to tissues. In human beings, the respiratory pigment is haemoglobin which has a very high affinity for oxygen.
This pigment is present in the red blood corpuscles.

Q.) What advantage over an aquatic organism does a terrestrial organism have with regard to obtaining oxygen for respiration?

Ans) Terrestrial organism take up O_2 from the atmosphere whereas aquatic animals need to utilize O_2 present in the water. Air contain more O_2 as compared to water. Since the content of O_2 in air is high, the terrestrial animals do not have to breathe faster to get more oxygen. Also, unlike aquatic animals, terrestrial animals do not have to show various adaptations for better gaseous exchange between blood and water.

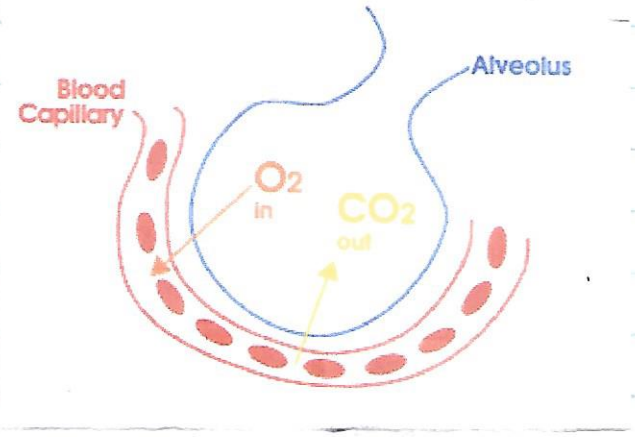
Q.) How is oxygen and CO_2 transported in human beings?

Ans) O_2 and CO_2 are transported in human beings through blood. The red pigment haemoglobin present in the erythrocytes transports oxygen molecules to all the body cells for cellular respiration.
The haemoglobin pigment gets attached to O_2 molecule that are obtained through breathing. It then forms oxy-haemoglobin and blood becomes oxygenated.

This oxygenated blood is then distributed to all the body cells by the heart. After giving away O_2 to the body cells, blood takes away CO_2 which is the end product of cellular respiration. Now the blood becomes de-oxygenated. Since hemoglobin pigment has less affinity for CO_2, CO_2 is mainly transported in the dissolved form. This de-oxygenated blood give CO_2 to lung alveoli and take O_2 in return.

Q:) How are the lungs designed in human beings to maximize the area for exchange of gases?

Ans) The exchange of gases take place between the blood of the capillaries that surround the alveoli and the gases present in the alveoli. Thus, alveoli are the site for exchange of gases. Each lung contains 300 - 350 million alveoli. These numerous alveoli increase the surface area for gases exchange making the process of respiration more efficient. The lungs get filled up with air during the process of inhalation as ribs are lifted up and diaphragm is flattened. The air that is rushed inside the lungs fills the numerous alveoli present in the lungs.



(8.) What would be the consequences of a deficiency of haemoglobin in our bodies?

Ans) Haemoglobin is the respiratory pigment that transport oxygen to the body cells for cellular respiration. Therefore, deficiency of haemoglobin in blood can affect the oxygen supplying capacity of blood. This can lead to deficiency of oxygen in the body cells. It can also lead to a disease called anaemia.

Respiration in Plants

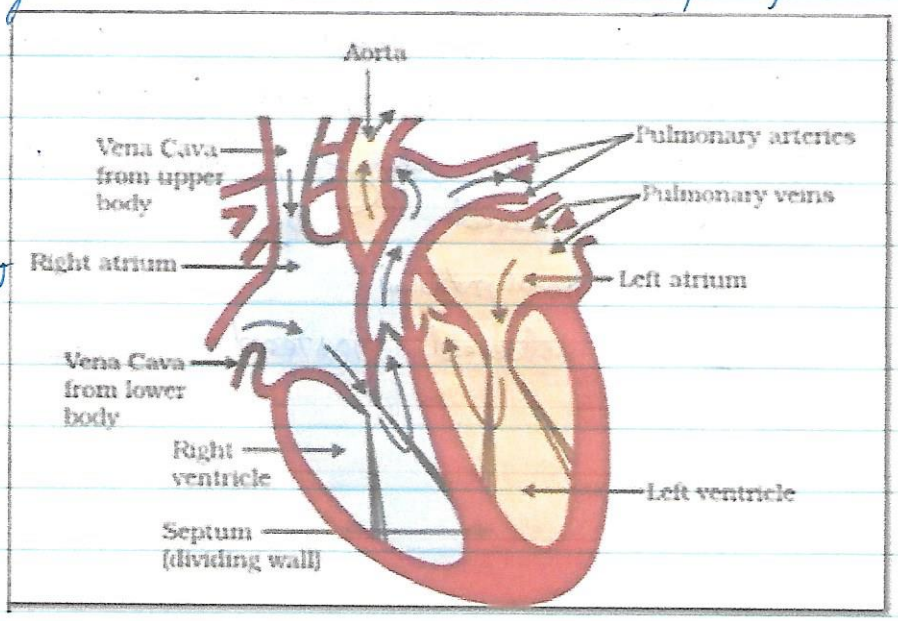
1) Plants exchange gases through stomata
2) The large inter-cellular spaces ensure that all the cells are in contact with air.
3) CO_2 and O_2 are exchanged in and out of the cells by the process of diffusion.
4) During night, in the absence of sunlight photosynthesis do not take place and hence CO_2 is released but not used up by the plant.
5) During the day, there is no CO_2 released because the released CO_2 is used up by the plants for photosynthesis
6) O_2 is released instead of CO_2 during day.

6.4 - Transportation

Blood transports food, oxygen and waste material in our bodies. Blood consist of a fluid medium called plasma in which the cells are suspended. Plasma transports food, carbon dioxide and nitrogenous waste in dissolved form. Oxygen is carried by the red blood cells.
We thus need a pumping organ to push blood around the body.

Our Pump - the Heart

1) Heart is the muscular pumping organ which pushes the blood around the body.
2) Blood transports carbon dioxide to the lungs for oxygen from the cells for removal and carries oxygen from the lungs to the heart and heart pump the blood to all the cells of the body.



3) Heart has different chambers such as
- right atrium
- left atrium
- right ventricle
- left ventricle

to prevent the mixing of oxygenated blood and carbon dioxide rich blood.

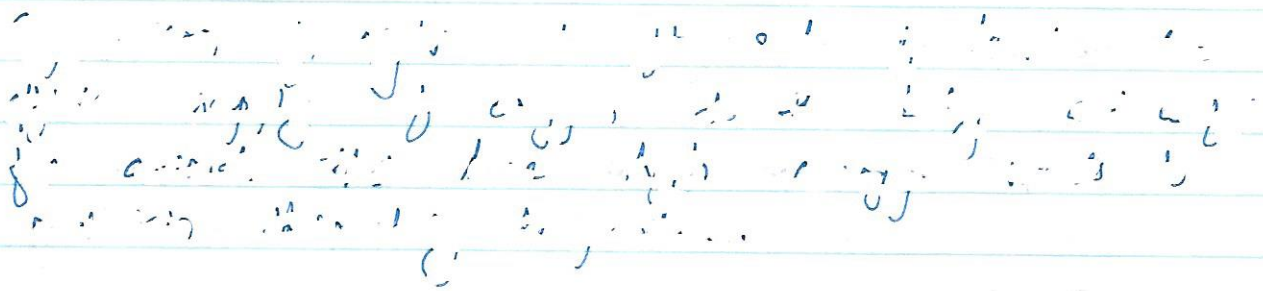
4) The thin walled upper chamber, left atrium, relaxes and oxygenated blood enters it.

5) Left atrium then contracts and the next chamber left ventricle, expands and thus blood enters it.

6) When the left ventricle contracts the blood is pumped out to all the cells of the body.

7) Deoxygenated blood from the body reaches the right upper chamber, right atrium when it expands.

8) As the right atrium contacts, the lower chamber, right ventricle, dilates.



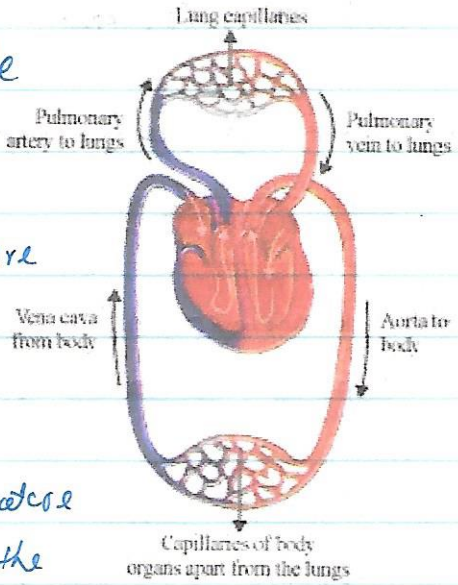
9) This transfers blood to the right ventricle, which in turn pumps it to the lungs for oxygenation.

10) Since ventricles have to pump blood into various organs, they have thicker muscular walls than the atria do.

11) Valves ensure that blood does not flow backward when the atria or ventricles contract.

Oxygen enters the blood in the lungs.

12) Separation of right and left side of heart allows efficient supply of oxygen to the body and useful for animals that have high energy needs to maintain their body temperature.



13) In some animals, body temperature depends on the temperature in the environment and thus they do not use energy to maintain body temperature.

14) Amphibian and reptiles have three chambered heart and allows some mixing of oxygen and deoxygenated blood.

15) Fishes have two chambered heart and the blood is pumped to the gills for oxygenation and transported directly to all the cells of the body.

16) When blood goes through the heart twice during each cycle, the process is called as double circulation.

17) In fish, blood goes only once through the heart and thus fish shows single circulation.

The tubes — Blood vessels.

- Blood vessels are the tube like structures which carry the blood through cells, tissues and organs.
- There are two types of blood vessels are arteries and vein which are connected to the heart for transporting blood.

(a) Arteries : (i) carry blood rich in O_2 from heart to all the cells of the body.

(ii) The pressure exerted by the arteries while blood leave heart is rapid and thus walls of arteries are thick.

(b) Veins : (i) Vein carry blood rich in CO_2 from all the cells of the body to the heart.

(ii) The pressure exerted by the walls of the veins is less and have thin walls.

- Valves present in the veins ensure that the blood flows only towards the heart.
- The arteries divide in to extremely small thin branches on reaching the tissues. These small branches are called as capillaries. Capillaries have walls which are one-cell thick.
- Exchange of material between the blood and surrounding cells takes place across this thin wall.
- The capillaries then join together to form veins that convey the blood away from the organ or tissues

Maintenance by Platelets

- Platelets are the colorless tiny blood cells without nucleus, circulate through the blood stream.
- During injury, the bleeding needs to minimize naturally
- Leakage of blood can also reduce the efficiency of the pumping system due to the loss of pressure.
- Platelet cells are present in the body to plug the leaks and to stop bleeding by clotting the blood at the point of injury.
- Platelets circulate around the body and clot the blood whenever wherever necessary.

Lymph

- Lymph is another fluid involved in transportation
- Some amount of plasma, proteins and blood cells escape into the intercellular spaces in the tissues to form lymph or tissue fluid.
- Lymph is similar to blood plasma but colorless and contains less protein.
- Lymph drains into lymphatic capillaries which join to form large lymph vessels and which open into larger vein.
- Function of lymph is to carry absorbed digested fat from intestine and it also drains excess fluid from extra cellular space back into the blood.
- Composition of lymph: water, Protein, fats, carbohydrate, other constituents like - urea, chlorides, calcium, enzymes and antibodies are also present.

6.4.2 Transportation in Plants.

There are two main conducting pathways in plant.

	Xylem		Phloem
1.	Carries water & minerals from the roots to other parts of the plant	1.	Carries product of photosynthesis from leaves to the other parts of the plant.
2.	No energy is used	2.	Energy is used from ATP.

Transpiration is the process of loss of water as vapour from aerial parts of the plant.

Q) Plant absorb water from soil. Explain how does the water reach the tree top?

Ans) Xylem (vessels) of roots, stems and leaves are interconnected to form a continuous column. Roots also take up minerals salts actively, water moves in and as a result, creating pressure which pushes the water up. Transpiration pull creates a suction force pulling up water.

Thus, transpiration helps in the absorption and upward movement of water and minerals dissolved in it from roots to the leaves. It also helps in temperature regulation. The effect of root pressure in transport of water is more important at night. During the day when the stomata are open, the transpiration pull becomes the major driving force in the movement of water in the xylem.

(Q.) What is translocation? How it take place in plants?

Ans.) Transport of soluble product of photosynthesis or food from leaves to other parts of plant is called translocation. For translocation, food molecules enter the part of phloem called the sieve tubes where they can be transported upwards or downwards to all the parts of the plant including roots.

Translocation is achieved by utilising energy from the ATP that provides osmotic pressure required for upward and downward movement of food.

This pressure moves the material in the phloem to tissues which have less pressure. This allows the phloem to move material according to the plant's needs. For example, in the spring, sugar stored in roots or stem tissue would be transported to the buds which need energy to grow.

(Q.) Why is it necessary to separate oxygenated and deoxygenated blood by mammals and birds?

Ans.) Mammals and birds are warm-blooded animals. They constantly use energy to maintain their body temperature. They have higher energy needs and so they required more oxygen to produce energy to maintain body temperature. Thus, it is necessary for them to separate oxygenated and de-oxygenated blood, so that their circulatory system is more efficient and can maintain their constant body temperature.

Q.) What are the components of the transport system in highly organised plants?

Ans) In highly organised plants, there are two different types of conducting tissues — xylem and phloem. Xylem conducts water and minerals obtained from soil (via roots) to the rest of the plant. Phloem transports food material from the leaves to different parts of the plant body.

Q.) What is the advantage of a four chambered heart in human?

Ans) The four chamber heart allows us to send our deoxygenated blood to the lungs and our clean blood to the rest of the body without mixing the two. The blood coming from the left side of the heart is oxygenated and ready to fuel the muscles. The blood coming to the right side of the heart is collected from all over the body is deoxygenated and carried towards the lungs for oxygenation.

Q.) Describe double circulation in human body. Why is it necessary?

Ans) Double circulation is the mechanism in which blood is passed through the heart twice in a single cycle of circulation. There are two components in double circulation — (i) pulmonary circulation and (ii) Systemic circulation.
In pulmonary circulation the blood is circulated between heart and the lungs.

In systemic circulation the blood is circulated between the heart and the rest of the body.

The human heart is divided into four chambers —
- the right atrium
- the right ventricle
- the left atrium
- the left ventricle.

Flow of blood in the heart:

The heart has superior and inferior vena cava, which carries de-oxygenated blood from the upper and lower regions of the body respectively and supplies this de-oxygenated blood to the right atrium of the heart.

Importance of double circulation:

The separation of oxygenated and de-oxygenated blood allows a more efficient supply of oxygen to the body cells. This efficient system of oxygen supply is very useful in warm-blooded animals such as human beings.

Warm-blooded animals have to maintain a constant body temperature by cooling themselves when they are in a hotter environment and by warming their bodies when they are in a cooler environment. Hence, they require more O_2 for more respiration so that they can produce more energy to maintain their body temperature. Thus, the circulatory system of humans is more efficient because of the double circulatory heart.

Q.) What is the difference between the transport of materials in xylem and phloem?

Soln

Transport of material in xylem	Transport of material in phloem
(i) Xylem tissue helps in the transport of water and minerals.	(i) phloem tissue help in the transport of food.
(ii) Water is transported only in the upward direction from roots to all other plant parts	(i) food is transported in both upward and downward direction.
(ii) Transport in xylem occurs with the help of simple physical forces such as transpiration pull	(ii) Transport of food in phloem requires energy in the form of ATP.

Q.) Why do Vein have thin walls as compared to arteries?

Ans) The walls of the arteries are found to be thicker then that of a Vein because the blood that is carried from the heart to the capallaries has more high pressure. As the blood flowing through the vein does not have much pressure as in that of the arteries their walls are thinner as compared to the artery walls.

6.5 Excretion

- The biological process of removal of harmful nitrogenous metabolic waste from the body is called excretion.

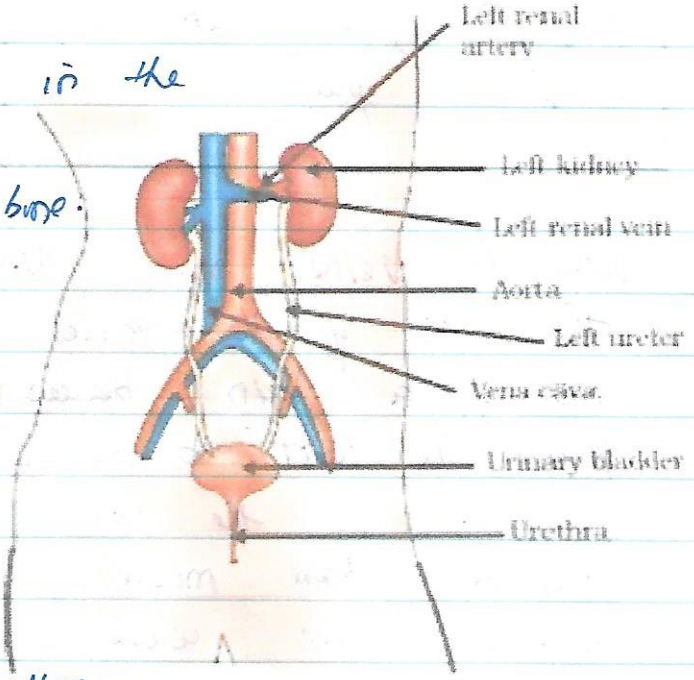
- Unicellular organisms excrete by diffusion and multicellular organism use specialized organ to perform same function.

6.5.1 Excretion in Human Beings:

(1) The excretory system of human beings include a pair of kidneys, a pair of ureters, a urinary bladder and a urethra.

(2) Kidneys are located in the abdomen, one on either side of the backbone.

(3) Urine produced in the kidneys passes through the ureters into the urinary bladder where it is stored until it is released through urethra.



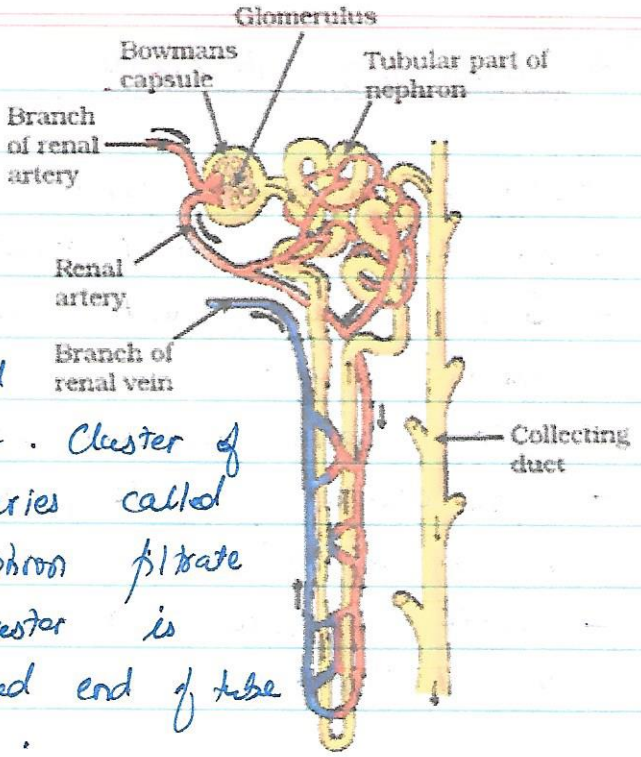
Excretory system in human beings

How is urine produced?

4) Urine is produced to filter out waste products from blood.

5) Basic filtration unit in kidneys, is a cluster of very thin-walled blood capillaries.

6) Each kidney has large numbers of (these) filtration units called nephrons packed close together.



7) Nephrons are basic structural and functional unit of kidney. Cluster of thin walled blood capillaries called glomerulus in the nephron filtrate the urine and each cluster is associated with cup shaped end of tube called Bowman's capsule.

8) Substances like glucose, amino acids, salts and major amount of water is selectively reabsorbed from the initial filtrate as the urine flows along the tube. Reabsorption depends on the amount of excess water in the body and dissolved waste to be excreted.

9) The urine from kidney enters the long tube called ureter. Ureter connects the kidney with the urinary bladder and urine from the kidney is passed to urinary bladder and stored in the bladder.

10) Urine is stored in the urinary bladder until the pressure of the expanded bladder leads to the urge to pass it out through the urethra.

6.5.2 Excretion in Plants

- Oxygen, a waste product of photosynthesis is released.
- Excess water is removed by transpiration.
- Some waste products may get stored in the leaves which fall off.
- Many waste products are stored in vacuoles
- Some waste products are stored as resins and gums in old xylem
- Plants excrete some waste material into the soil around them.

Q.) What is the filtering unit of kidney? Why is it called so?

Ans) Nephron is the filtering unit of kidney
Nephron is called, so because it filters the blood and removes the poisonous nitrogenous waste like urea and uric acid, excess of water from it.
These harmful products get filtered and useful products are reabsorbed by tubular part of nephron.
Thus harmful waste is excreted out as urine from the body.

Q.) What are the methods used by plants to get rid of excretory products?

Ans) Plants can get rid of excess of water by transpiration. Waste material may be stored in the cell vacuoles or as gum and resin, especially in old xylem. It is also stored in the leaves that later fall off. Waste products of photosynthesis (oxygen) and respiration (CO_2) are released by diffusion through stomata.

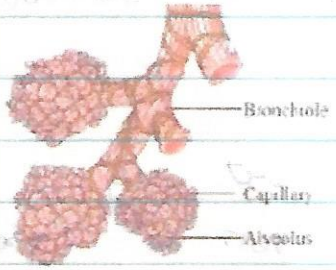
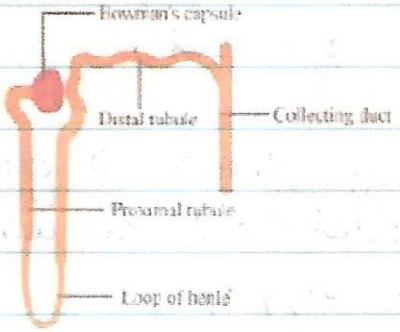
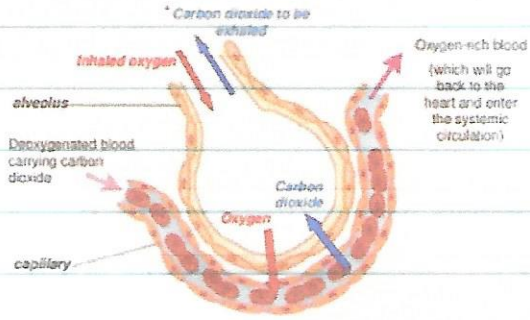
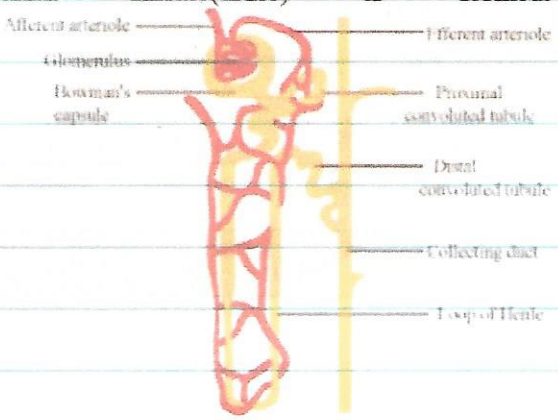
Q.) How is the amount of urine produced regulated?

Ans) The amount of urine produced depends on the amount of excess water and dissolved wastes present in the body. If there is excess water present in the body then less water is reabsorbed and more water is lost from the body and vice-versa. Some other factors such as habitat of an organism and hormone such as Antidiuretic hormone (ADH) also regulates the amount of urine produced.

(180 litres of filtrate is formed daily but only 2 litres is excreted out as urine so the rest is reabsorbed in the body.)

Q) Compare the functionality of alveoli in lungs and nephron in the kidneys with respect to their structure and functionality.

Solution 13:

Alveoli	Nephron
Structure (i) Alveoli are tiny balloon-like structures present inside the lungs. (ii) The walls of the alveoli are one cell thick and it contains an extensive network of blood capillaries.	**Structure** (i) Nephrons are tubular structures present inside the kidneys. (ii) Nephrons are made of glomerulus, bowman's capsule, and a long renal tube. It also contains a cluster of thin-walled capillaries.
	
Function (i) The exchange of O2 and CO2 takes place between the blood of the capillaries that surround the alveoli and the gases present in the alveoli. There is no selective reabsorption in alveoli	**Function** (i) Nephron functions in filtering the blood to remove wastes. In the initial filtration in the nephron all solutes and a lot of water are filtered out. The essential molecules like amino acids, sodium salts, glucose and water are then selectively reabsorbed before the final filtrate(urine) is formed.
	

(i) Alveoli are the site of gaseous exchange for respiration

(i) Nephrons are the basic filtration unit for excretion.