

CHAPTER – 6

LIFE PROCESSES

LIFE PROCESS

The maintenance of living organisms must go on even at the conditions, when they are not physically active. Even when we sit idle and during sleeping, this maintenance job through cells functioning has to go on. The life process includes the activities performed by the different organs to maintain the body.

Some of the life processes in the living beings are described below:

- **Nutrition**
The process of obtaining energy through consumption of food is called as nutrition.
- **Respiration**
The process of acquiring oxygen through breathing and make it available to cells for the process of breaking down of organic substances into simpler compounds is called as respiration.
- **Transportation**
Transportation is the process by which the food and oxygen is carried from one organ to other organs in the body.
- **Excretion**
It is the process by which the metabolic waste by-products are removed from the different organs and released out from the body.

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Question 1: Why is diffusion insufficient to meet the oxygen requirements of multi-cellular organisms like humans?

Answer : Multicellular organisms such as humans possess complex body designs. They have specialised cells and tissues for performing various necessary functions of the body such as intake of food and oxygen. Unlike unicellular organisms, multicellular cells are not in direct contact with the outside environment. Therefore, diffusion cannot meet their oxygen requirements.

Question 2: What criteria do we use to decide whether something is alive?

Answer : Any visible movement such as walking, breathing, or growing is generally used to decide whether something is alive or not. However, a living organism can also have movements, which are not visible to the naked eye. Therefore, the presence of life processes is a fundamental criterion that can be used to decide whether something is alive or not.

Question 3: What are outside raw materials used for by an organism?

Answer : An organism uses outside raw materials mostly in the form of food and oxygen. The raw materials required by an organism can be quite varied depending on the complexity of the organism and its environment.

Question 4: What processes would you consider essential for maintaining life?

Answer : Life processes such as nutrition, respiration, transportation, excretion, etc. are essential for maintaining life.

NUTRITION

The process by which an organism takes food and utilizes it is called nutrition.

NEED OF NUTRITION

Organisms need energy to perform various activities. The energy is supplied by the nutrients. Organisms need various raw materials for growth and repair. These raw materials are provided by nutrients.

NUTRIENTS

Materials which provide nutrition to organisms are called nutrients. Carbohydrates, proteins and fats are the main nutrients and are called macronutrients. Minerals and vitamins are required in small amounts and hence are called micronutrients.

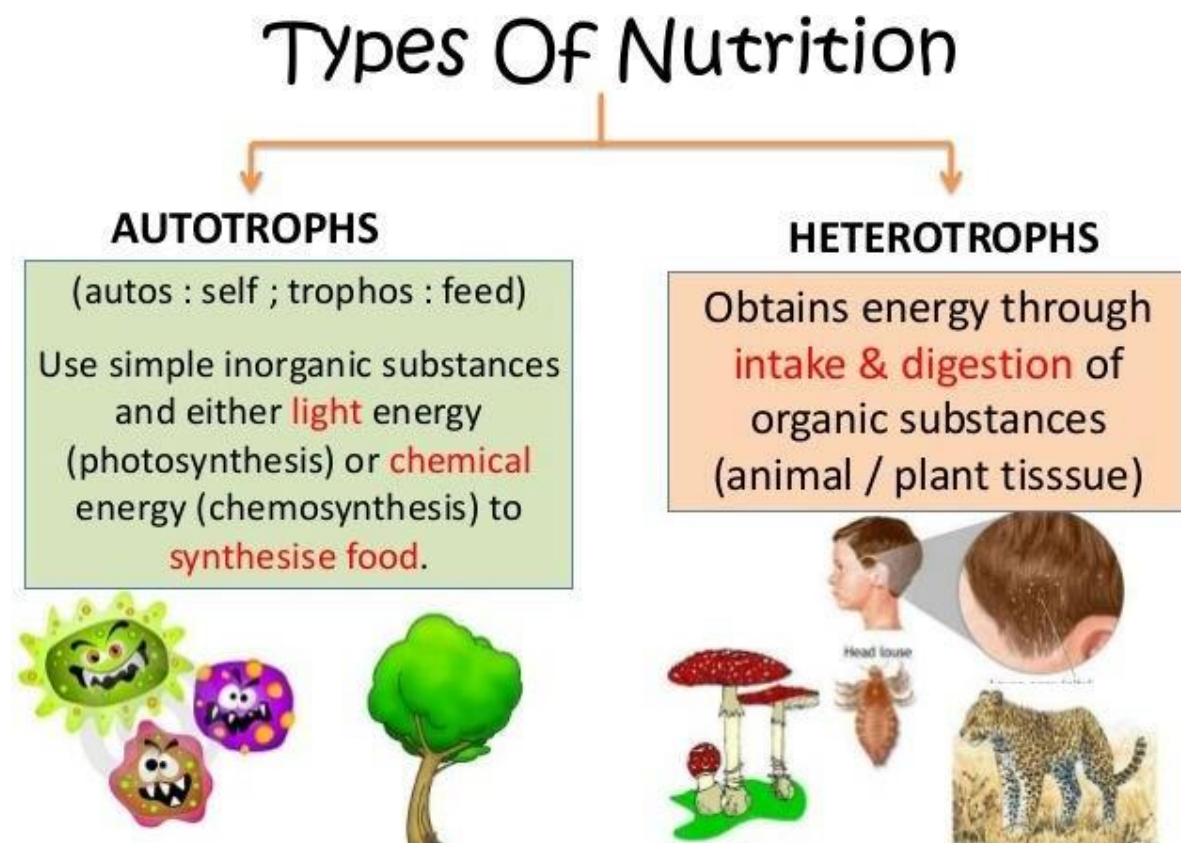
TYPES OF NUTRITION:

- **Autotrophic Nutrition:** The mode of nutrition in which an organism prepares its own food is called autotrophic nutrition. Green plants and blue-green algae follow the autotrophic mode of nutrition.
- **Heterotrophic Nutrition:** The mode of nutrition in which an organism takes food from another organism is called heterotrophic nutrition. Organisms; other than green plants and blue-green algae follow heterotrophic mode of nutrition.

AUTOTROPHIC NUTRITION

Autotrophic organisms are able to produce organic matter from simple inorganic materials. They consequently create their own food—but require a source of energy to do this.

- Photoautotrophs harvest energy from light to produce organic matter.
- Chemoautotrophs use energy from inorganic reactions in the environment to drive the creation of organic matter.



HETEROTROPHIC NUTRITION

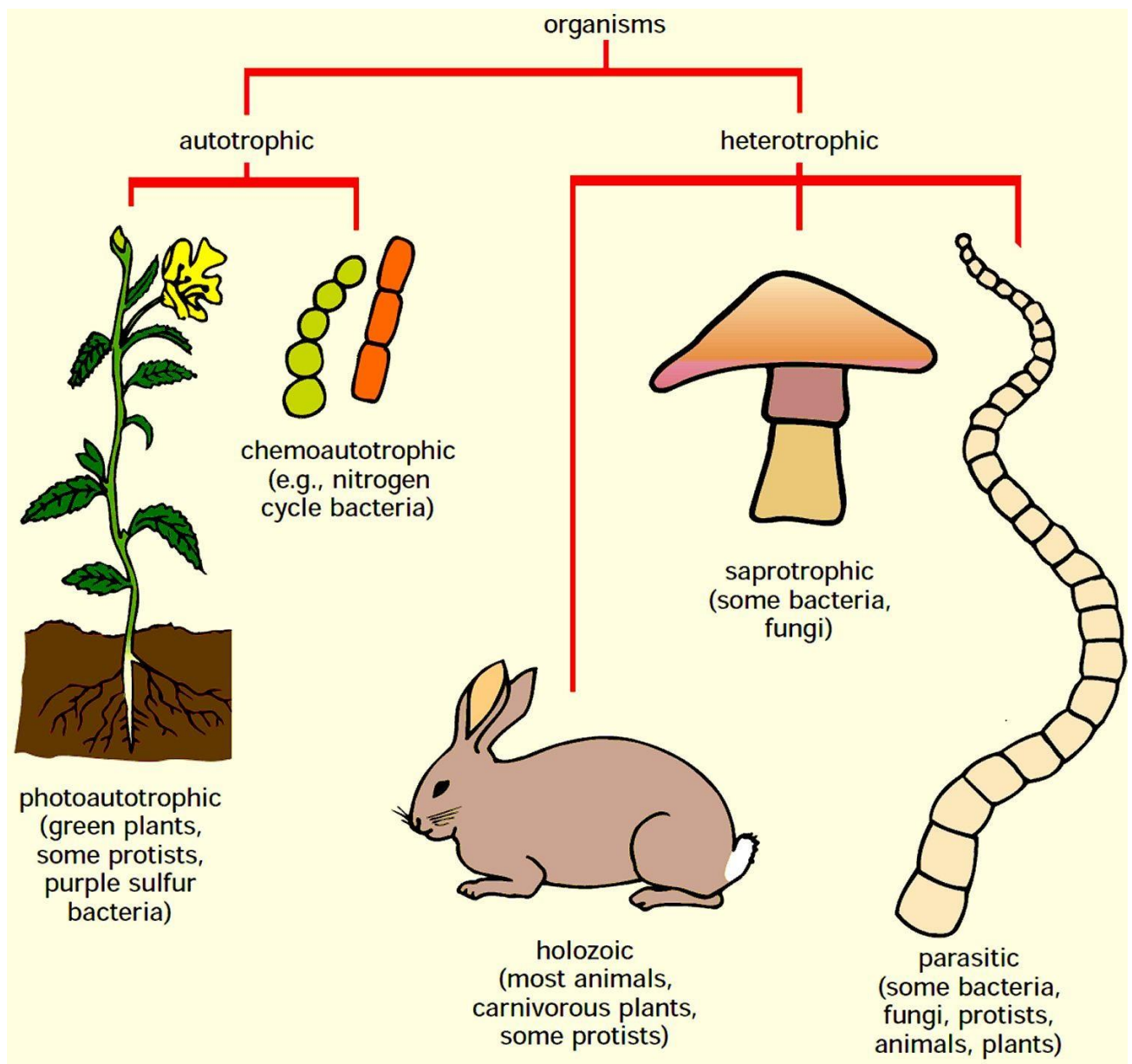
Heterotrophic nutrition is typical of animals. These organisms eat organic matter in other organisms—either alive (as hunters) or dead (as scavengers).

Saprotrophic organisms are the decay organisms. They digest dead materials using enzymes that they secrete externally. Fungi and many bacteria are saprotrophes.

Parasites (biotrophs) feed on living organisms without killing them.

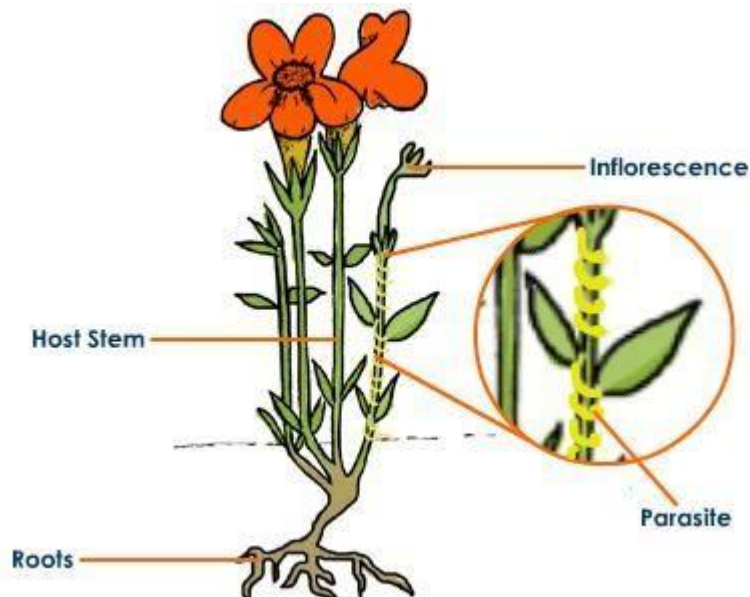
Heterotrophic nutrition can be further divided into two types, viz. saprophytic nutrition and holozoic nutrition.

- **Saprophytic Nutrition:** In saprophytic nutrition; the organism secretes the digestive juices on the food. The food is digested while it is still to be ingested. The digested food is then ingested by the organism. All the decomposers follow saprophytic nutrition. Some insects; like houseflies; also follow this mode of nutrition.
- **Holozoic Nutrition:** In holozoic nutrition; the digestion happens inside the body of the organism, i.e. after the food is ingested. Most of the animals follow this mode of nutrition.

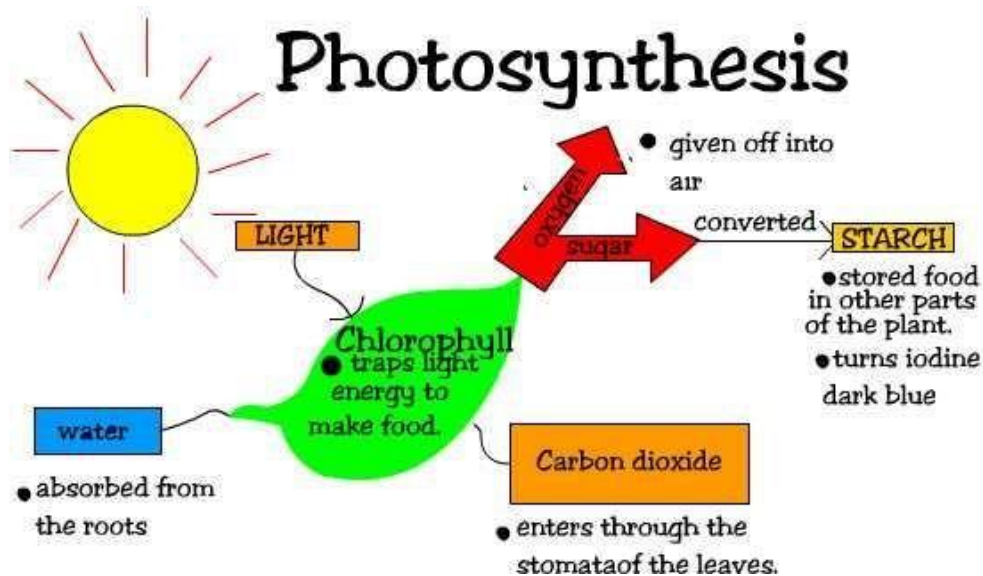
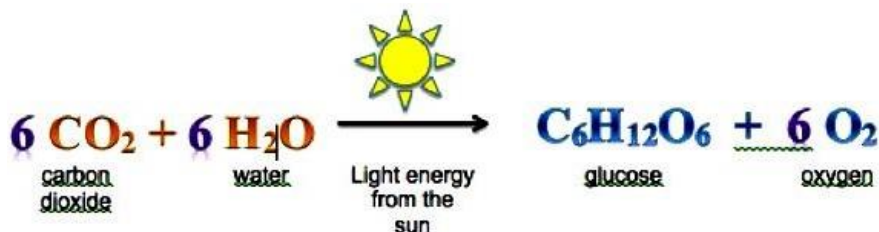


PLANT NUTRITION

Green plants prepare their own food. They make food in the presence of sunlight. Sunlight provides energy, carbon dioxide and water are the raw materials and chloroplast is the site where food is made.



PHOTOSYNTHESIS: The process by which green plants prepare food is called photosynthesis. During this process; the solar energy is converted into chemical energy and carbohydrates are formed. Green leaves are the main sites of photosynthesis. The green portion of the plant contains a pigment chloroplast; which contains chlorophyll. The whole process of photosynthesis can be shown by following equation:



STEPS OF PHOTOSYNTHESIS:

- Sunlight activates chlorophyll; which leads to splitting of water molecule.

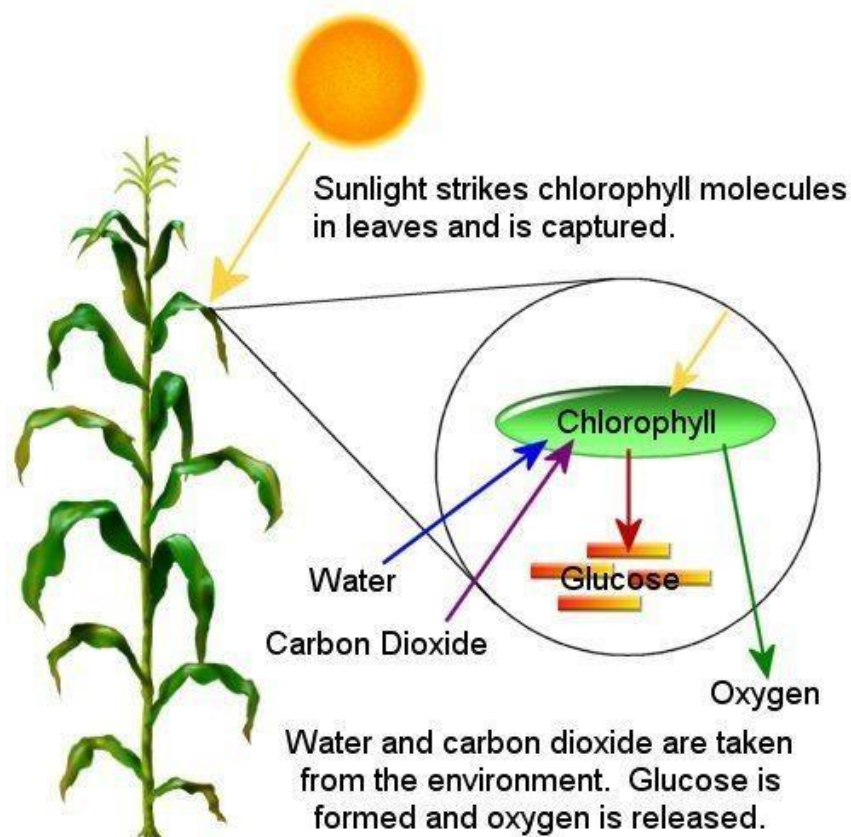
- The hydrogen; released by splitting of water molecule is utilized for reduction of carbon dioxide to produce carbohydrates.
- Oxygen is the byproduct of photosynthesis.
- Carbohydrate is subsequently converted into starch and is stored in leaves and other storage parts.
- The splitting of water molecules is part of the light reaction.
- Other steps are part of the dark reaction during photosynthesis.

HOW DO RAW MATERIALS FOR PHOTOSYNTHESIS BECOME AVAILABLE TO THE PLANT?

- Water comes from soil; through the xylem tissue in roots and stems.
- Carbon dioxide comes in the leaves through stomata.

SIGNIFICANCE OF PHOTOSYNTHESIS:

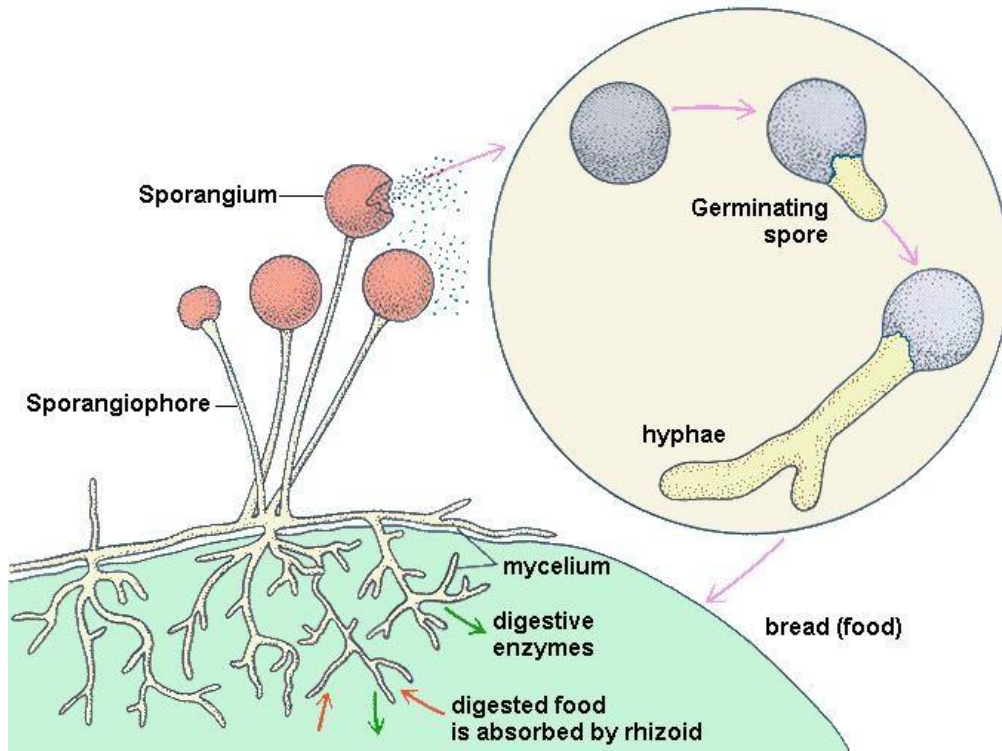
- Photosynthesis is the main way through which the solar energy is made available for different living beings.
- Green plants are the main producers of food in the ecosystem. All other organisms directly or indirectly depend on green plants for food.
- The process of photosynthesis also helps in maintaining the balance of carbon dioxide and oxygen in the air.



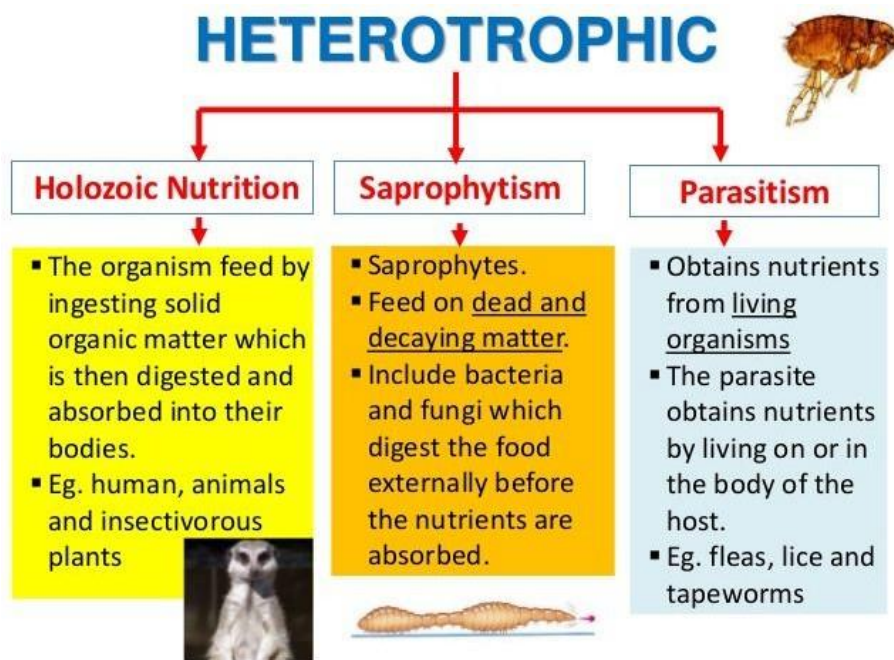
ANIMAL NUTRITION

Heterotrophic Nutrition: When an organism takes food from another organism, it is called heterotrophic nutrition. Different heterotrophic organisms follow different methods to take and utilize food. Based on this, heterotrophic nutrition can be divided into two types:

- **Saprophytic Nutrition:** In saprophytic nutrition, the digestion of food takes place before ingestion of food. This type of nutrition is usually seen in fungi and some other microorganisms. The organism secretes digestive enzymes on the food and then ingests the simple substances. Saprophytes feed on dead materials and thus help in decomposition dead remains of plants and animals.



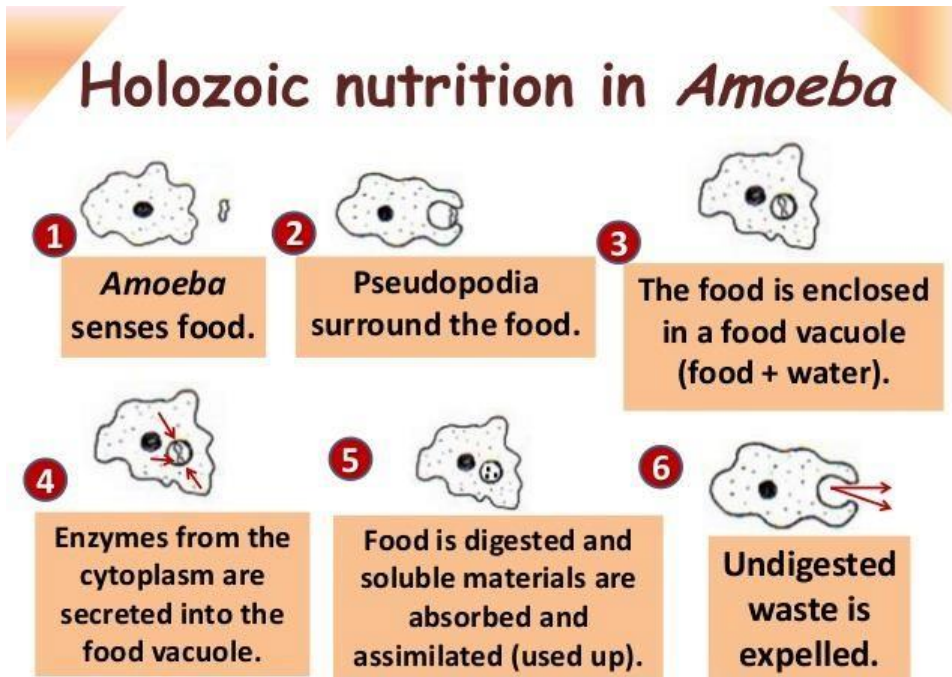
- **Holozoic Nutrition:** In holozoic nutrition, the digestion of food follows after the ingestion of food. Thus, digestion takes place inside the body of the organism. Holozoic nutrition happens in five steps, viz. ingestion, digestion, absorption, assimilation and egestion.



STEPS OF HOLOZOIC NUTRITION

- Ingestion: The process of taking in the food is called ingestion.
- Digestion: The process of breaking complex food substances into simple molecules is called digestion. Simple molecules; thus obtained; can be absorbed by the body.
- Absorption: The process of absorption of digested food is called absorption.
- Assimilation: The process of utilization of digested food; for energy and for growth and repair is called assimilation.
- Egestion: The process of removing undigested food from the body is called egestion.

NUTRITION IN AMOEBIA:



Amoeba is a unicellular animal which follows holozoic mode of nutrition. The cell membrane of amoeba keeps on protruding into pseudopodia. Amoeba surrounds a food particle with pseudopodia and makes a food vacuole. The food vacuole contains the food particle and water. Digestive enzymes are secreted in the food vacuole and digestion takes place. After that, digested food is absorbed from the food vacuole. Finally, the food vacuole moves near the cell membrane and undigested food is expelled out.

NUTRITION IN HUMAN BEINGS

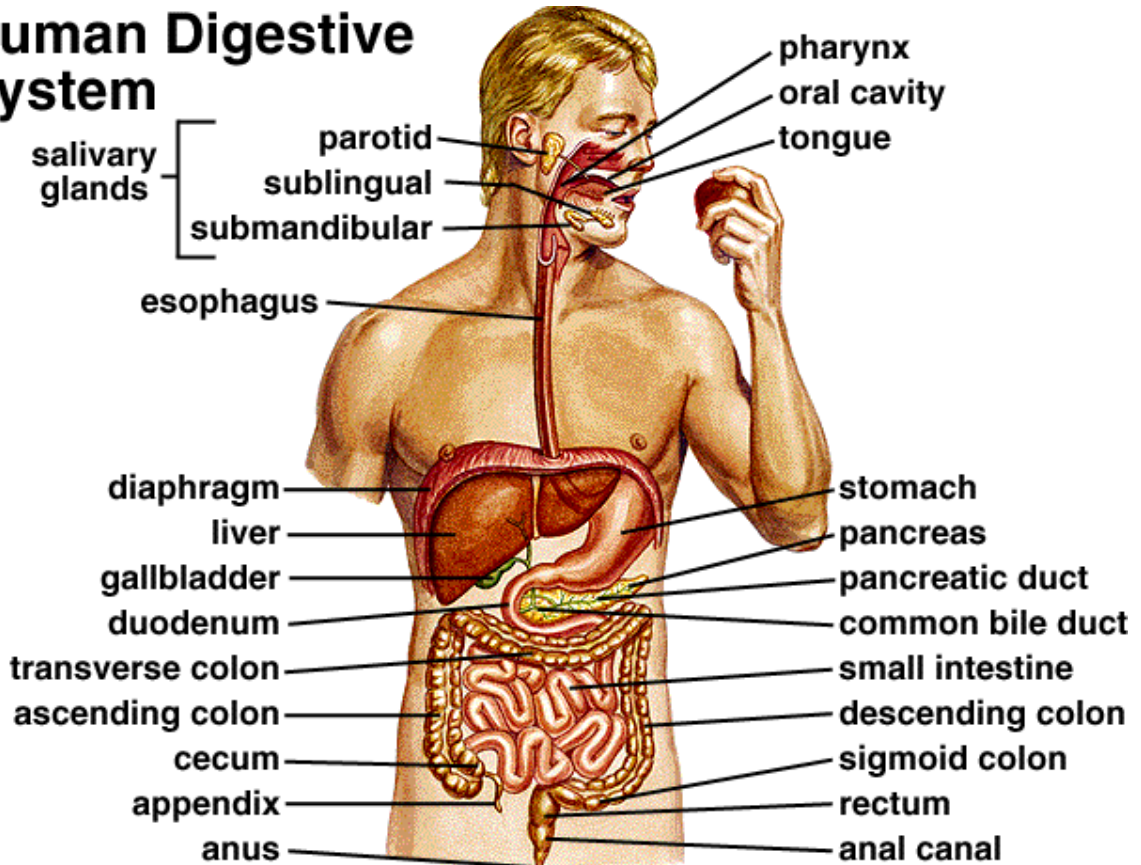
Human beings are complex animals; which have a complex digestive system. The human digestive system is composed of an alimentary canal and some accessory glands. The alimentary canal is divided into several parts, viz. oesophagus, stomach, small intestine, large intestine, rectum and anus. Salivary gland, liver and pancreas are the accessory glands which lie outside the alimentary canal.

STRUCTURE OF THE HUMAN DIGESTIVE SYSTEM

Mouth or Buccal Cavity: The mouth has teeth and tongue. Salivary glands are also present in the mouth. The tongue has gustatory receptors which perceive the sense of taste. Tongue helps in turning over the food, so that saliva can be properly mixed in it.

Teeth help in breaking down the food into smaller particles so that swallowing of food becomes easier. There are four types of teeth in human beings. The incisor teeth are used for cutting the food. The canine teeth are used for tearing the food and for cracking hard substances. The premolars are used for coarse grinding of food. The molars are used for fine grinding of food. Salivary glands secrete saliva. Saliva makes the food slippery which makes it easy to swallow the food. Saliva also contains the enzyme salivary amylase or ptyalin. Salivary amylase digests starch and converts it into sucrose.

Human Digestive System



Stomach: Stomach is a bag-like organ. Highly muscular walls of the stomach help in churning the food. The walls of stomach secrete hydrochloric acid. Hydrochloric acid kills the germs which may be present in food. Moreover, it makes the medium inside stomach as acidic. The acidic medium is necessary for gastric enzymes to work. The enzyme pepsin; secreted in stomach; does partial digestion of protein. The mucus; secreted by the walls of the stomach saves the inner lining of stomach from getting damaged from hydrochloric acid.

Small Intestine: It is a highly coiled tube-like structure. The small intestine is longer than the large intestine but its lumen is smaller than that of the large intestine. The small intestine is divided into three parts, viz. duodenum, jejunum and ileum.

Liver: Liver is the largest organ in the human body. Liver manufactures bile; which gets stored in gall bladder. From the gall bladder, bile is released as and when required.

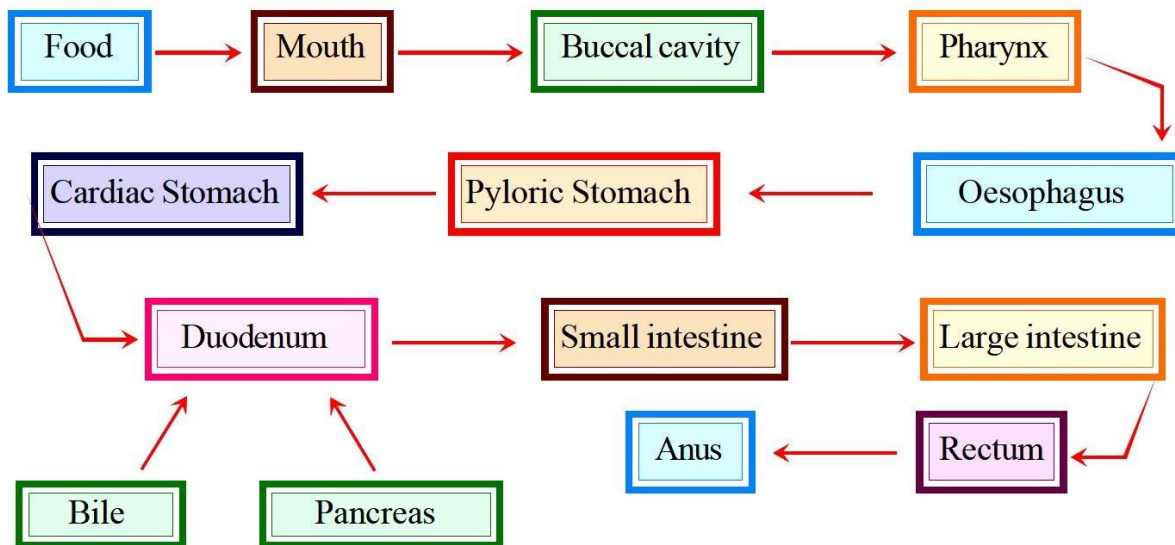
Pancreas: Pancreas is situated below the stomach. It secretes pancreatic juice which contains many digestive enzymes.

Bile and pancreatic juice go to the duodenum through a hepato-pancreatic duct. Bile breaks down fat into smaller particles. This process is called emulsification of fat. After that, the enzyme lipase digests fat into fatty acids and glycerol. Trypsin and chymotrypsin are enzymes which digest protein into amino acids. Complex carbohydrates are digested into glucose. The major part of digestion takes place in the duodenum.

No digestion takes place in jejunum. The inner wall in the ileum is projected into numerous finger-like structures; called villi. Villi increase the surface area inside the ileum so that optimum absorption can take place. Moreover, villi also reduce the lumen of the ileum so that food can stay for longer duration in it; for optimum absorption. Digested food is absorbed by villi.

Large Intestine: Large intestine is smaller than small intestine. Undigested food goes into the large intestine. Some water and salt are absorbed by the walls of the large intestine. After that, the undigested food goes to the rectum; from where it is expelled out through the anus.

Flow chart of human digestive system



Health aspects of the alimentary canal

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Question 1: What are the differences between autotrophic nutrition and heterotrophic nutrition?

Answer :

Autotrophic nutrition	Heterotrophic nutrition
1. Food is synthesised from simple inorganic raw materials such as CO ₂ and water.	1. Food is obtained directly or indirectly from autotrophs. This food is broken down with the help of enzymes.
2. Presence of green pigment (chlorophyll) is necessary.	2. No pigment is required in this type of nutrition.
3. Food is generally prepared during day time.	3. Food can be prepared at all times.
4. All green plants and some bacteria have this type of nutrition.	4. All animals and fungi have this type of nutrition.

Question 2: Where do plants get each of the raw materials required for photosynthesis?

Answer : The following raw materials are required for photosynthesis:

- The raw material CO₂ enters from the atmosphere through stomata.
- 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 plants.

Question 3: What is the role of the acid in our stomach?

Answer : Following are the roles of acid in our stomach:

1. 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.

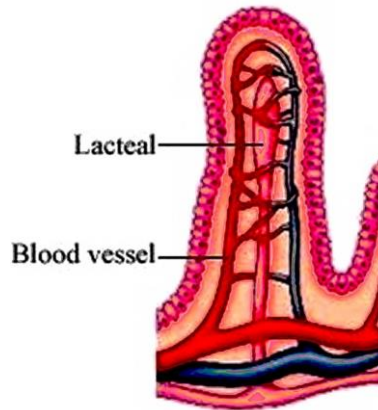
2. The hydrochloric acid kills the harmful microbes that enter with food and thus prevents infection of digestive tract.

Question 4: What is the function of digestive enzymes?

Answer : Digestive enzymes such as amylase, lipase, pepsin, trypsin, etc. help in the breaking down of complex food particles into simple ones. These simple particles can be easily absorbed by the blood and thus transported to all the cells of the body.

Question 5: How is the small intestine designed to absorb digested food?

Answer : The small intestine has millions of tiny finger-like projections called villi. These villi increase the surface area for more efficient food absorption. Within these villi, many blood vessels 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.



RESPIRATION

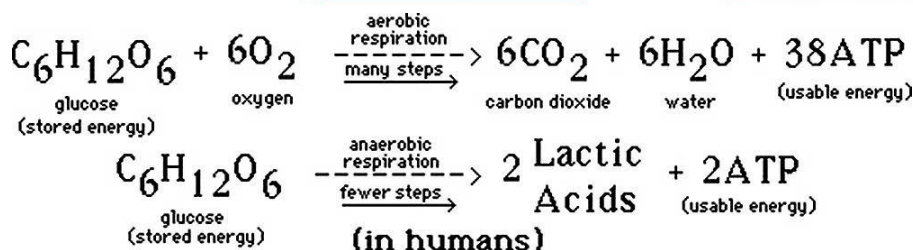
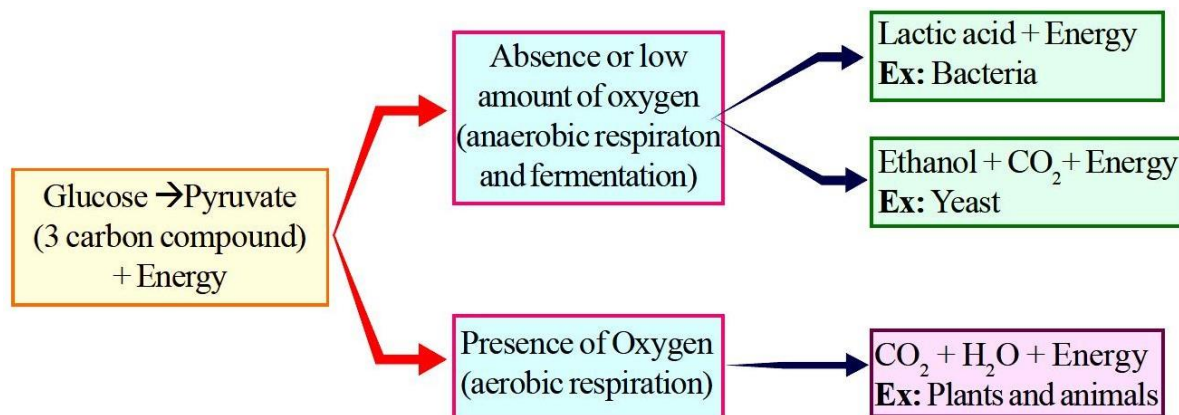
The process by which a living being utilizes the food to get energy is called respiration. Respiration is an oxidation reaction in which carbohydrate is oxidized to produce energy. Mitochondrion is the site of respiration and the energy released is stored in the form of ATP (Adenosine triphosphate). ATP is stored in mitochondria and is released as per need.

STEPS OF RESPIRATION:

- **Breaking down glucose into pyruvate:** This step happens in the cytoplasm. Glucose molecule is broken down into pyruvic acid. Glucose molecule is composed of 6 carbon atoms, while pyruvic acid is composed of 3 carbon atoms.
- **Fate of Pyruvic Acid:** Further breaking down of pyruvic acid takes place in mitochondria and the molecules formed depend on the type of respiration in a particular organism. Respiration is of two types, viz. aerobic respiration and anaerobic respiration.

TYPES OF RESPIRATION:

- **Aerobic Respiration:** This type of respiration happens in the presence of oxygen. Pyruvic acid is converted into carbon dioxide. Energy is released and water molecule is also formed at the end of this process.
- **Anaerobic Respiration:** This type of respiration happens in the absence of oxygen. Pyruvic acid is either converted into ethyl alcohol or lactic acid. Ethyl alcohol is usually formed in case of anaerobic respiration in microbes; like yeast or bacteria. Lactic acid is formed in some microbes as well as in the muscle cells.



Pain in Leg Muscles on Running: When someone runs too fast, he may experience a throbbing pain in the leg muscles. This happens because of anaerobic respiration taking place in the muscles. During running, the energy demand from the muscle cells increases. This is compensated by anaerobic respiration and lactic acid is formed in the process. The deposition of lactic acid causes the pain in the leg muscles. The pain subsides after taking rest for some time.

Exchange of Gases: For aerobic respiration; organisms need a continuous supply of oxygen, and carbon dioxide produced during the process needs to be removed from the body. Different organisms use different methods for intake of oxygen and expulsion of carbon dioxide. Diffusion is the method which is utilized by unicellular and some simple organisms for this purpose. In plants also, diffusion is utilized for exchange of gases. In complex animals, respiratory system does the job of exchange of gases. Gills are the respiratory organs for fishes. Fishes take in oxygen; which is dissolved in water; through gills. Since availability of oxygen is less in the aquatic environment so the breathing rate of aquatic organisms is faster. Insects have a system of spiracles and tracheae which is used for taking in oxygen.

Terrestrial organisms have developed lungs for exchange of gases. Availability of oxygen is not a problem in the terrestrial environment so breathing rate is slower compared to what it is in fishes.

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 nostrils is lined by hairs and remains wet due to mucus secretion. The mucus and the hairs help in filtering the dust particles out 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.

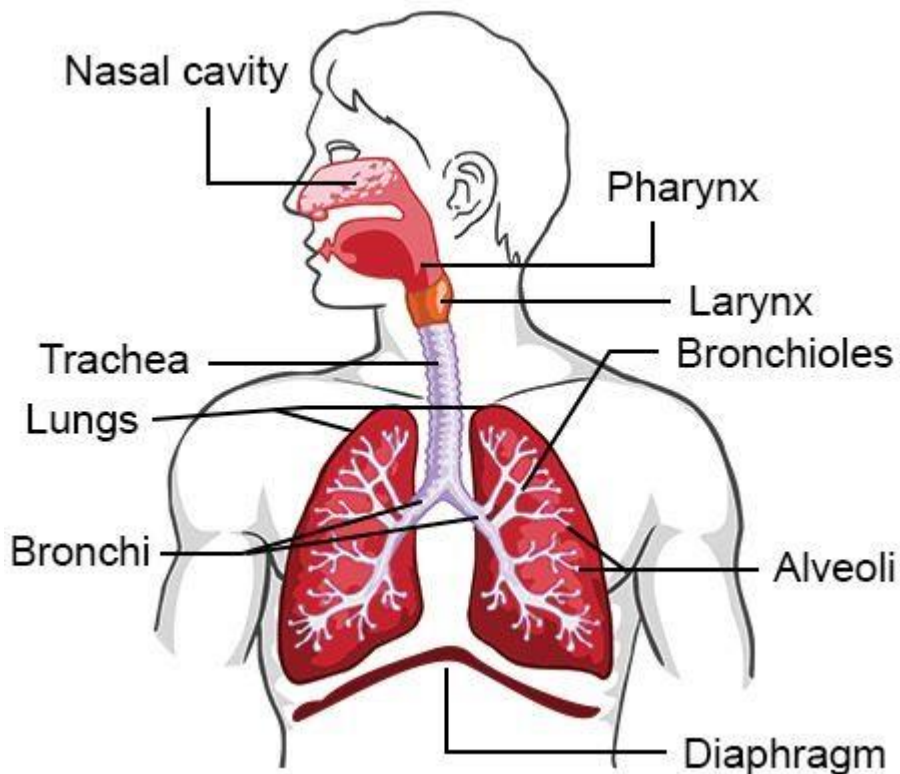
Larynx: This part comes after the pharynx. This is also called the voice box.

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: These are air-sacs at the end of bronchioles. Alveolus is composed of a very thin membrane and is the place where blood capillaries open. This is alveolus; where oxygen mixes with the blood and carbon dioxide exits from the blood. The exchange of gases; in alveoli; takes place due to pressure differential.



Breathing Mechanism: The breathing mechanism of lungs is controlled by the diaphragm and the intercostalis muscles. Diaphragm is a membrane which separates the thoracic chamber from the abdominal cavity. When diaphragm moves down, the lungs expand and air is inhaled. When diaphragm moves up, the lungs contract and air is exhaled.

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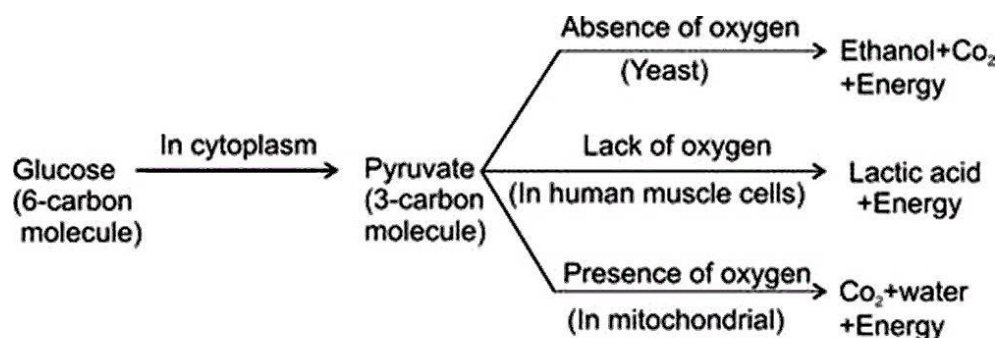
Question 1: What advantage over an aquatic organism does a terrestrial organism have with regard to obtaining oxygen for respiration?

Answer : Terrestrial organisms take up oxygen from the atmosphere whereas aquatic animals need to utilize oxygen present in the water. Air contains more O₂ as compared to water. Since the content of O₂ in air is high, the terrestrial animals do not have to breathe faster to get more oxygen. Therefore, unlike aquatic animals, terrestrial animals do not have to show various adaptations for better gaseous exchange.

Question 2: What are the different ways in which glucose is oxidized to provide energy in various organisms?

Answer : Glucose is first broken down in the cell cytoplasm into a three carbon molecule called pyruvate. Pyruvate is further broken down by different ways to provide energy.

The breakdown of glucose by different pathways can be illustrated as follows.



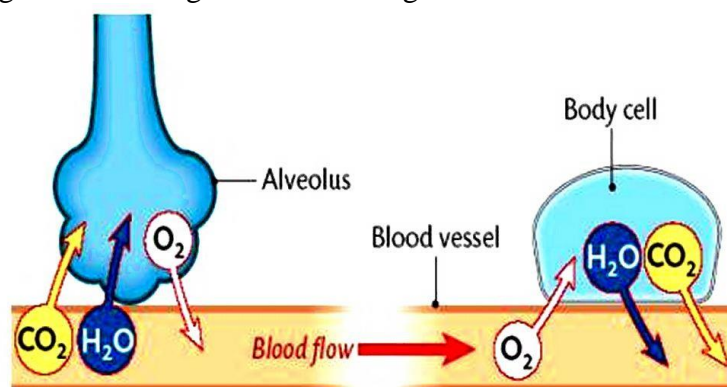
(Break down of glucose by various pathways)

In yeast and human muscle cells, the breakdown of pyruvate occurs in the absence of oxygen whereas in mitochondria, the breakdown of pyruvate occurs in the presence of oxygen.

Question 3: How is oxygen and carbon dioxide transported in human beings?

Answer : Haemoglobin transports oxygen molecule to all the body cells for cellular respiration. The haemoglobin pigment present in the blood gets attached to four O₂ molecules that are obtained from breathing. It thus forms oxyhaemoglobin and the blood becomes oxygenated. This oxygenated blood is then distributed to all the body cells by the heart. After giving away O₂ to the body cells, blood takes away CO₂ which is the end product of cellular respiration. Now the blood becomes de-oxygenated.

Since haemoglobin pigment has less affinity for CO₂, CO₂ is mainly transported in the dissolved form. This de-oxygenated blood gives CO₂ to lung alveoli and takes O₂ in return.



Question 4: How are the lungs designed in human beings to maximize the area for exchange of gases?

Answer : The exchange of gases takes 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. 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.

Each lung contains 300-350 million alveoli. These numerous alveoli increase the surface area for gaseous exchange making the process of respiration more efficient.

TRANSPORTATION IN ANIMALS

Circulatory System: The circulatory system is responsible for transport of various substances in human beings. It is composed of the heart, arteries, veins and blood capillaries. Blood plays the role of the carrier of substances.

HEART

Heart is a muscular organ; which is composed of cardiac muscles. It is so small that it can fit inside an adult's fist. The heart is a pumping organ which pumps the blood. The human heart is composed of four chambers, viz. right auricle, right ventricle, left auricle and left ventricle.

Systole: Contraction of cardiac muscles is called systole.

Diastole: Relaxation of cardiac muscles is called diastole.

Arteries: These are thick-walled blood vessels which carry oxygenated blood from the heart to different organs. Pulmonary arteries are exceptions because they carry deoxygenated blood from the heart to lungs; where oxygenation of blood takes place.

Veins: These are thin-walled blood vessels which carry deoxygenated blood from different organs to the heart. Pulmonary veins are exceptions because they carry oxygenated blood from lungs to the heart. Valves are present in veins to prevent backflow of blood.

Capillaries: These are the blood vessels which have single-celled walls.

Blood: Blood is a connective tissue which plays the role of the carrier for various substances in the body. Blood is composed of plasma, blood cells and platelets.

Blood Plasma: Blood plasma is a pale coloured liquid which is mostly composed of water. Blood plasma forms the matrix of blood.

Blood Cells: There are two types of blood cells, viz. Red Blood Cells (RBCs) and White Blood Cells (WBCs).

Red Blood Corpuscles (RBCs): These are of red colour because of the presence of haemoglobin which is a pigment. Haemoglobin readily combines with oxygen and carbon dioxide. The transport of oxygen happens through haemoglobin. Some part of carbon dioxide is also transported through haemoglobin.

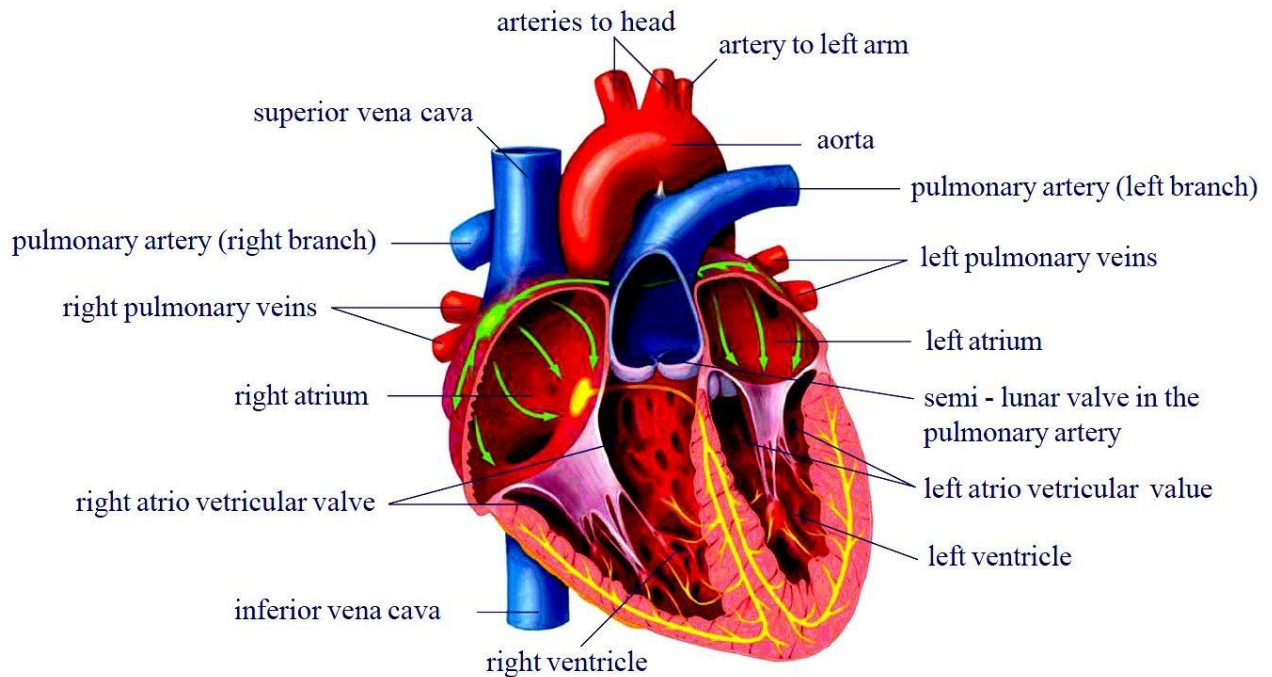
White Blood Corpuscles (WBCs): These are of pale white colour. They play an important role in the immunity.

Platelets: Platelets are responsible for blood coagulation. Blood coagulation is a defense mechanism which prevents excess loss of blood; in case of an injury.

Lymph: Lymph is similar to blood but RBCs are absent in lymph. Lymph is formed from the fluid which leaks from blood capillaries and goes to the intercellular spaces in the tissues. This fluid is collected through lymph vessels and finally returns to the blood capillaries. Lymph also plays an important role in the immune system.

Double Circulation: In the human heart, blood passes through the heart twice in one cardiac cycle. This type of circulation is called double circulation. One complete heart beat in which all the chambers of the heart contract and relax once is called cardiac cycle. The heart beats about

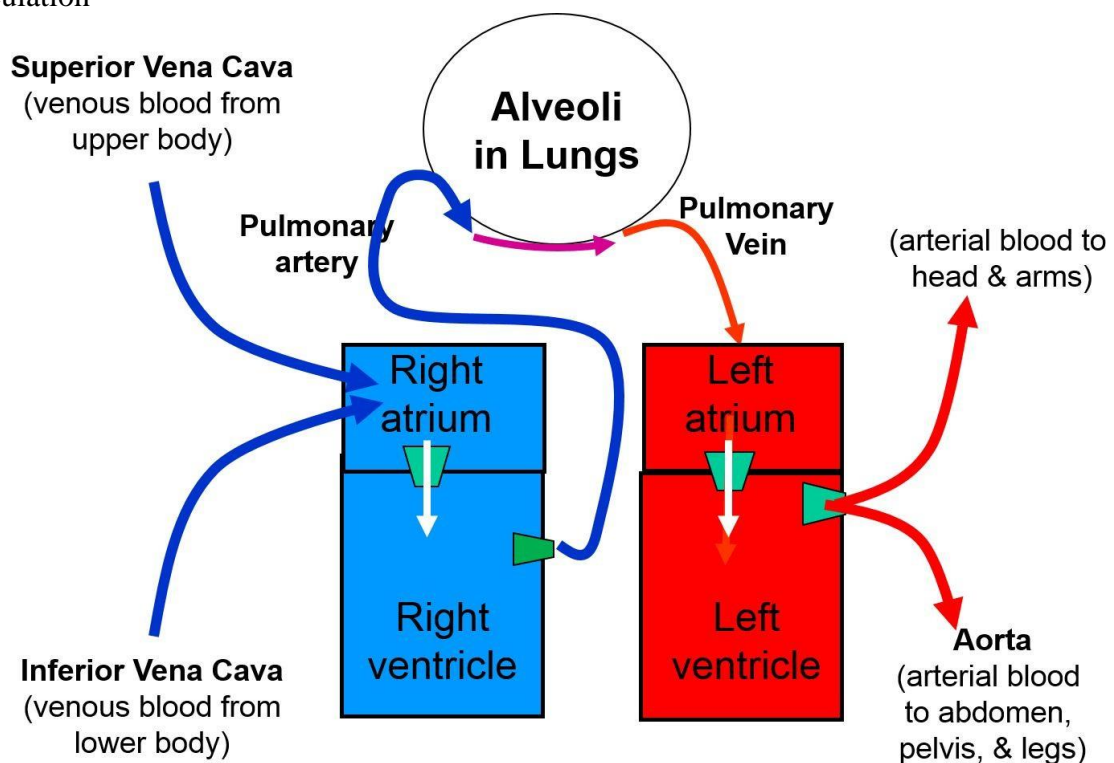
72 times per minute in a normal adult. In one cardiac cycle, the heart pumps out 70 mL blood and thus about 4900 mL blood in a minute. Double circulation ensures complete segregation of oxygenated and deoxygenated blood which is necessary for optimum energy production in warm-blooded animals.



Internal structure of heart

Circulation of Blood through the heart:

Systemic Vein → Sinus Venosus → Right Auricle → Right Ventricle → Pulmonary Artery → Lungs → Pulmonary Vein → Left Auricle → Left Ventricle → Trunchus Arteriosus → Systemic Circulation



TRANSPORTATION IN PLANTS

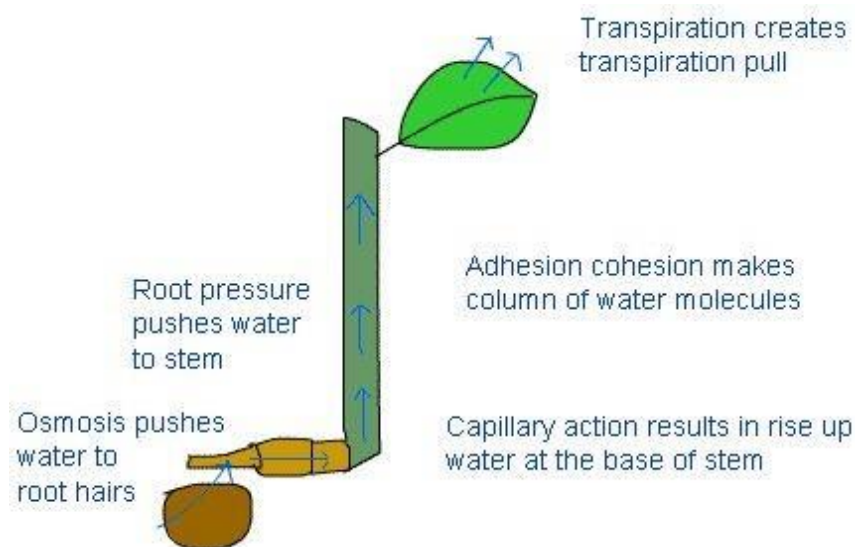
Plants have specialized vascular tissues for transportation of substances. There are two types of vascular tissues in plants, viz. xylem and phloem.

Xylem: Xylem is responsible for transportation of water and minerals. It is composed of trachieds, xylem vessels, xylem parenchyma and xylem fibre. Trachieds and xylem vessels are the conducting elements. The xylem makes a continuous tube in plants which runs from roots to stem and right up to the veins of leaves.

Phloem: Phloem is responsible for transportation of food. Phloem is composed of sieve tubes, companion cells, phloem parenchyma and bast fibres. Sieve tubes are the conducting elements in phloem.

Ascent of Sap

The upward movement of water and minerals from roots to different plant parts is called ascent of sap. Many factors are at play in ascent of sap and it takes place in many steps. They are explained as follows:



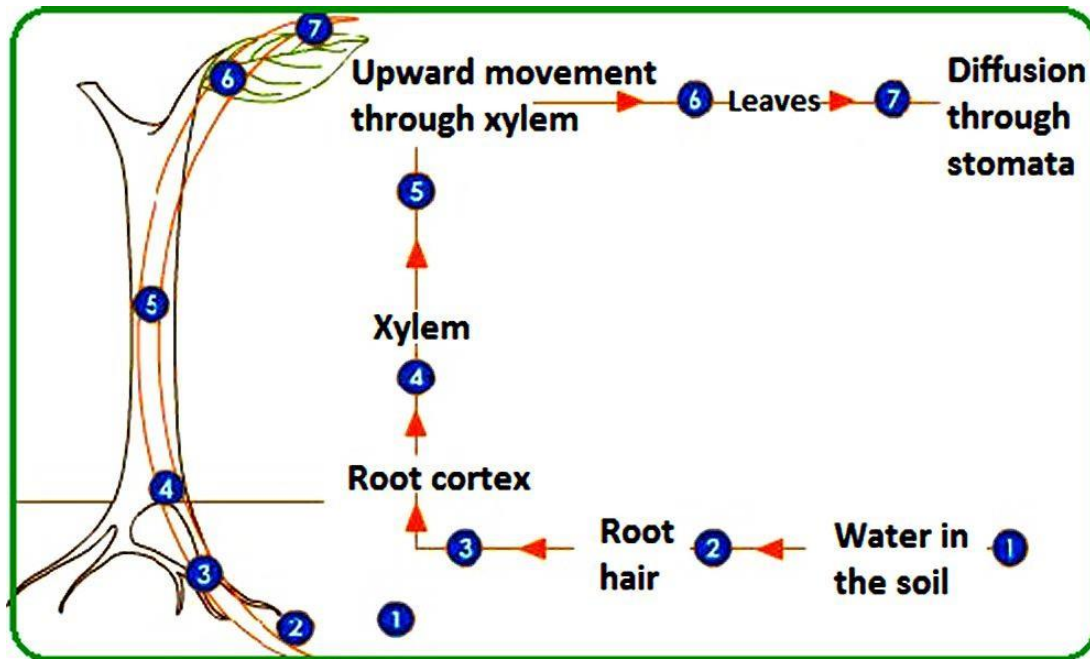
Root Pressure: The walls of cells of root hairs are very thin. Water; from soil; enters the root hairs because of osmosis. Root pressure is responsible for movement of water up to the base of the stem.

Capillary Action: A very fine tube is called capillary. Water; or any liquid; rises in the capillary because of physical forces and this phenomenon is called capillary action. Water; in stem; rises up to some height because of capillary action.

Adhesion-cohesion of Water Molecules: Water molecules make a continuous column in the xylem because of forces of adhesion and cohesion among the molecules.

Transpiration Pull: Loss of water vapour through stomata and lenticels; in plants; is called transpiration. Transpiration through stomata creates vacuum which creates a suction; called transpiration pull. The transpiration pull sucks the water column from the xylem tubes and thus water is able to rise to great heights in even the tallest plants.

Transport of Food: Transport of food in plants happens because of utilization of energy. Thus, unlike the transport through xylem; it is a form of active transport. Moreover, the flow of substances through phloem takes place in both directions, i.e. it is a two-way traffic in phloem.



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Question 1: What are the components of the transport system in human beings? What are the functions of these components?

Answer : The main components of the transport system in human beings are the heart, blood, and blood vessels.

Heart pumps oxygenated blood throughout the body. It receives deoxygenated blood from the various body parts and sends this impure blood to the lungs for oxygenation.

Being a fluid connective tissue, blood helps in the transport of oxygen, nutrients, CO₂, and nitrogenous wastes.

The blood vessels (arteries, veins, and capillaries) carry blood either away from the heart to various organs or from various organs back to the heart.

Question 2: Why is it necessary to separate oxygenated and deoxygenated blood in mammals and birds?

Answer : Warm-blooded animals such as birds and mammals 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, these animals require more oxygen (O₂) for more cellular respiration so that they can produce more energy to maintain their body temperature.

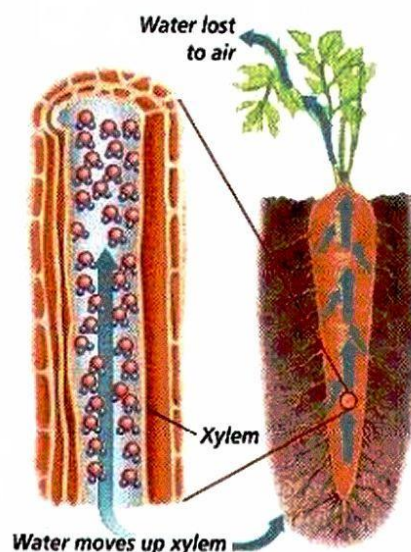
Thus, it is necessary for them to separate oxygenated and de-oxygenated blood, so that their circulatory system is more efficient and can maintain their constant body temperature.

Question 3: What are the components of the transport system in highly organised plants?

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

Question 4: How are water and minerals transported in plants?

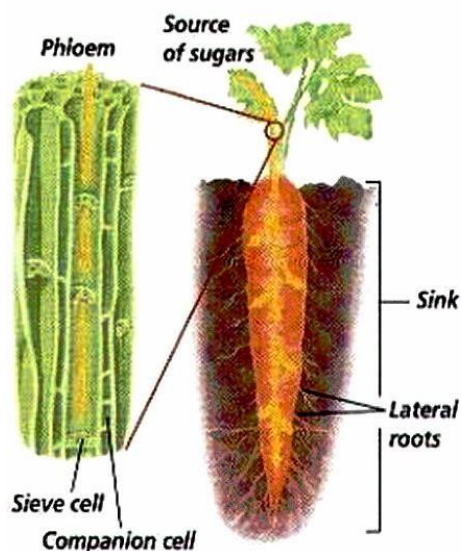
Answer : The components of xylem tissue (tracheids and vessels) of roots, stems, and leaves are interconnected to form a continuous system of water-conducting channels that reaches all parts of the plant. Transpiration creates a suction pressure, as a result of which water is forced into the xylem cells of the roots. Then there is a steady movement of water from the root xylem to all the plant parts through the interconnected water-conducting channels.



The open ends of xylem vessel cells form complete pipelike tubes.

Question 5: How is food transported in plants?

Answer : Phloem transports food materials from the leaves to different parts of the plant body. The transportation of food in phloem is achieved by utilizing energy from ATP. As a result of this, the osmotic pressure in the tissue increases causing water to move into it. This pressure moves the material in the phloem to the tissues which have less pressure. This is helpful in moving materials according to the needs of the plant. For example, the food material, such as sucrose, is transported into the phloem tissue using ATP energy.



Sugars in the phloem of this carrot plant are moving to sinks.

EXCRETION

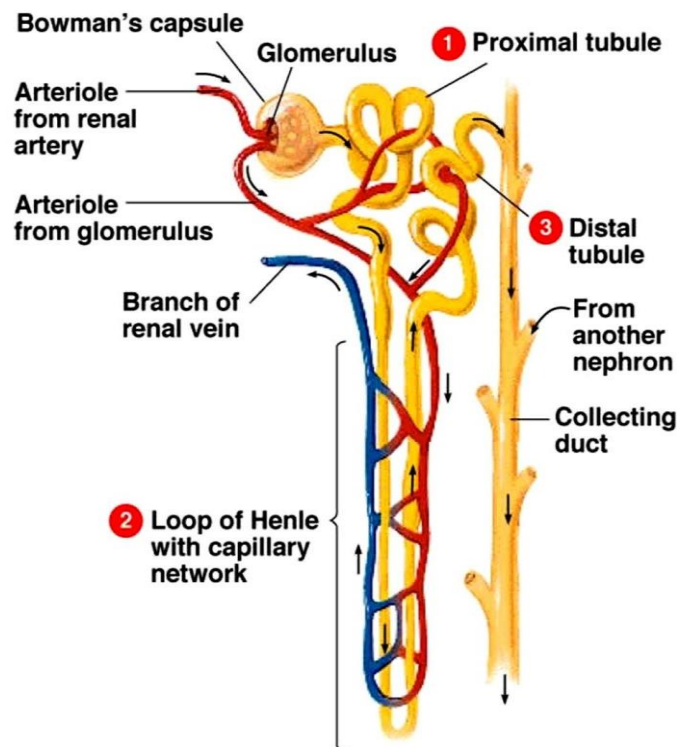
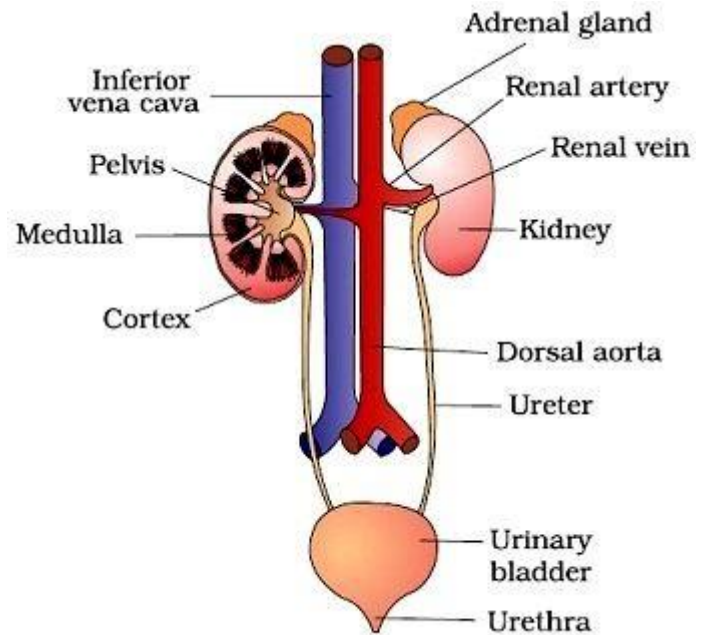
Removal of harmful waste from the body is called excretion. Many wastes are produced during various metabolic activities. These need to be removed in time because their accumulation in the body can be harmful and even lethal for an organism.

HUMAN EXCRETORY SYSTEM

The human excretory system is composed of a pair of kidneys. A tube; called ureter; comes out of each kidney and goes to the urinary bladder. Urine is collected in the urinary bladder, from where it is expelled out through urethra as and when required.

Kidney: Kidney is a bean-shaped organ which lies near the vertebral column in the abdominal cavity. The kidney is composed of many filtering units; called nephrons. Nephron is called the functional unit of kidney.

Nephron: It is composed of a tangled mess of tubes and a filtering part; called glomerulus. Glomerulus is a network of blood capillaries to which renal artery is attached. The artery which takes blood to the glomerulus is called afferent arteriole and the one receiving blood from the glomerulus is called efferent arteriole. Glomerulus is enclosed in a capsule like portion; called Bowman's capsule. The Bowman's capsule extends into a fine tube which is highly coiled. Tubes from various nephrons converge into collecting duct; which finally goes to the ureter.



Filtration in Glomerulus: Filtration happens because of very high pressure inside the glomerulus. The lumen of efferent arteriole is smaller than that of afferent arteriole. Due to this, the blood entering the glomerulus experiences very high pressure and due to this, the waste products are filtered out through the thin membrane of capillaries in the glomerulus. The filtered blood is sent to the systemic circulation through efferent arteriole and the filtrate goes to the Bowman's capsule. That is how urine is formed inside the kidneys. Reabsorption of water and some other filtrates takes place in the tubular part of the nephron. This increases the concentration of urine. The human urine is mainly composed of water and urea.

EXCRETION IN PLANTS

Plants have no special organs for removal of wastes. The waste products of respiration and photosynthesis are used as raw materials for each other. Oxygen gas produced as a by-product of photosynthesis is used up during respiration and carbon dioxide produced during respiration is used up during photosynthesis.

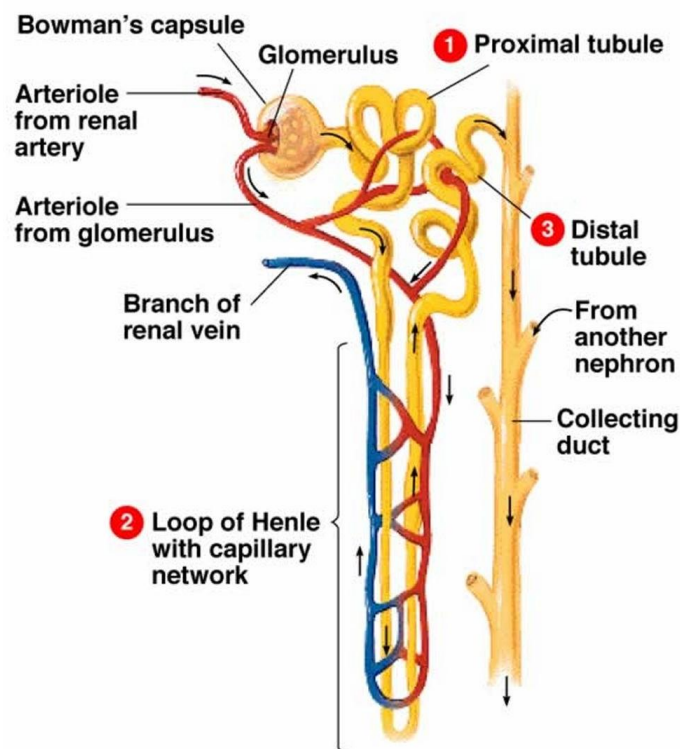
Excretion is carried out in the plants in the following ways:

- The gaseous wastes, oxygen, carbon dioxide and water vapour are removed through stomata of leaves and lenticels of stems.
- Some waste products collect in the leaves and bark of trees. When the leaves and bark are shed, the wastes are eliminated.
- Some waste products are rendered harmless and then stored in the plant body as solid bodies. Raphides, tannins, resins, gum, rubber and essential oils are some such wastes.

INTEXT QUESTIONS PAGE NO. 112

Question 1: Describe the structure and functioning of nephrons.

Answer : Nephrons are the basic filtering units of kidneys. Each kidney possesses large number of nephrons, approximately 1-1.5 million. The main components of the nephron are glomerulus, Bowman's capsule, and a long renal tubule.



Functioning of a nephron:

The blood enters the kidney through the renal artery, which branches into many capillaries associated with glomerulus.

The water and solute are transferred to the nephron at Bowman's capsule.

In the proximal tubule, some substances such as amino acids, glucose, and salts are selectively reabsorbed and unwanted molecules are added in the urine.

The filtrate then moves down into the loop of Henle, where more water is absorbed.

From here, the filtrate moves upwards into the distal tubule and finally to the collecting duct. Collecting duct collects urine from many nephrons.

The urine formed in each kidney enters a long tube called ureter. From ureter, it gets transported to the urinary bladder and then into the urethra.

Question 2: What are the methods used by plants to get rid of excretory products?

Answer : Plants can get rid of excess of water by transpiration. Waste materials 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.

Question 3: How is the amount of urine produced regulated?

Answer : The amount of urine produced depends on the amount of excess water and dissolved wastes present in the body. Some other factors such as habitat of an organism and hormone such as Anti-diuretic hormone (ADH) also regulates the amount of urine produced.

EXERCISE QUESTIONS PAGE NO. 113

Question 1: The kidneys in human beings are a part of the system for

- (a) nutrition.
- (b) respiration.
- (c) excretion.
- (d) transportation.

Answer : (c) In human beings, the kidneys are a part of the system for excretion.

Question 2: The xylem in plants are responsible for

- (a) transport of water.
- (b) transport of food.
- (c) transport of amino acids.
- (d) transport of oxygen.

Answer : (a) In a plant, the xylem is responsible for transport of water.

Question 3: The autotrophic mode of nutrition requires

- (a) carbon dioxide and water.
- (b) chlorophyll.
- (c) sunlight.
- (d) all of the above.

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

Question 4: The breakdown of pyruvate to give carbon dioxide, water and energy takes place in

- (a) cytoplasm.
- (b) mitochondria.
- (c) chloroplast.
- (d) nucleus.

Answer : (b) The breakdown of pyruvate to give carbon dioxide, water and energy takes place in mitochondria.

Question 5: How are fats digested in our bodies? Where does this process take place?

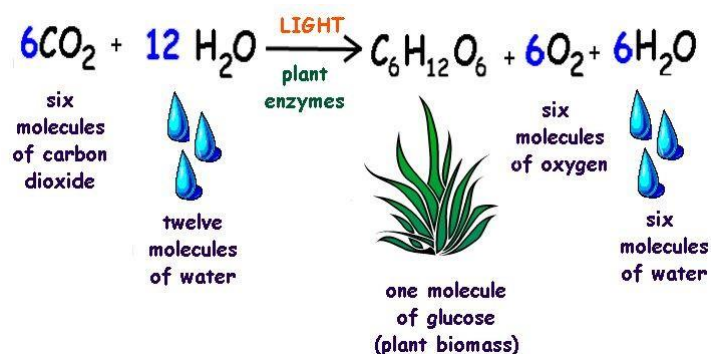
Answer : Fats are present in the form of large globules in the small intestine. The small intestine gets the secretions in the form of bile juice and pancreatic juice respectively from the liver and the pancreas. The bile salts (from the liver) break down the large fat globules into smaller globules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

Question 6: What is the role of saliva in the digestion of food?

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

Question 7: What are the necessary conditions for autotrophic nutrition and what are its by-products?

Answer : Autotrophic nutrition takes place through the process of photosynthesis. Carbon dioxide, water, chlorophyll pigment, and sunlight are the necessary conditions required for autotrophic nutrition. Carbohydrates (food) and O₂ are the by-products of photosynthesis.



Question 8: What are the differences between aerobic and anaerobic respiration? Name some organisms that use the anaerobic mode of respiration.

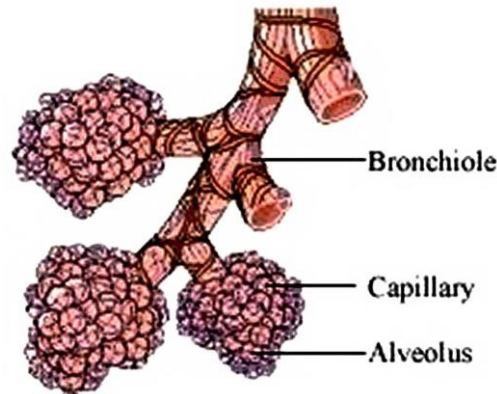
Answer :

Aerobic respiration	Anaerobic respiration
1. It occurs in the presence of O ₂ .	1. It occurs in the absence of O ₂ .
2. It involves the exchange of gases between the organism and the outside environment.	2. Exchange of gases is absent.
3. It occurs in cytoplasm and mitochondria.	3. It occurs only in cytoplasm.
4. It always releases CO ₂ and H ₂ O.	4. End products vary.
5. It yields 36 ATPs.	5. It yields only 2 ATPs.

Anaerobic respiration occurs in the roots of some waterlogged plants, some parasitic worms, animal muscles, and some micro-organisms such as yeasts.

Question 9: How are the alveoli designed to maximise the exchange of gases?

Answer : The alveoli are the small balloon-like structures present in the lungs. The walls of the alveoli consist of extensive network of blood vessels. Each lung contains 300–350 million alveoli, making it a total of approximately 700 million in both the lungs. The alveolar surface when spread out covers about 80 m² area. This large surface area makes the gaseous exchange more efficient.



Question 10: What would be the consequences of a deficiency of haemoglobin in our bodies?

Answer : Haemoglobin is the respiratory pigment that transports 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.

Question 11: Describe double circulation in human beings. Why is it necessary?

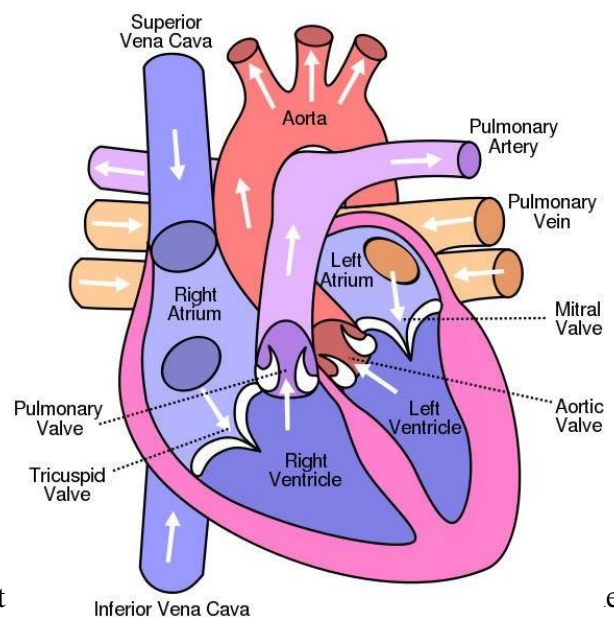
Answer : The human heart is divided into four chambers – the right atrium, the right ventricle, the left atrium, and the left ventricle.

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.

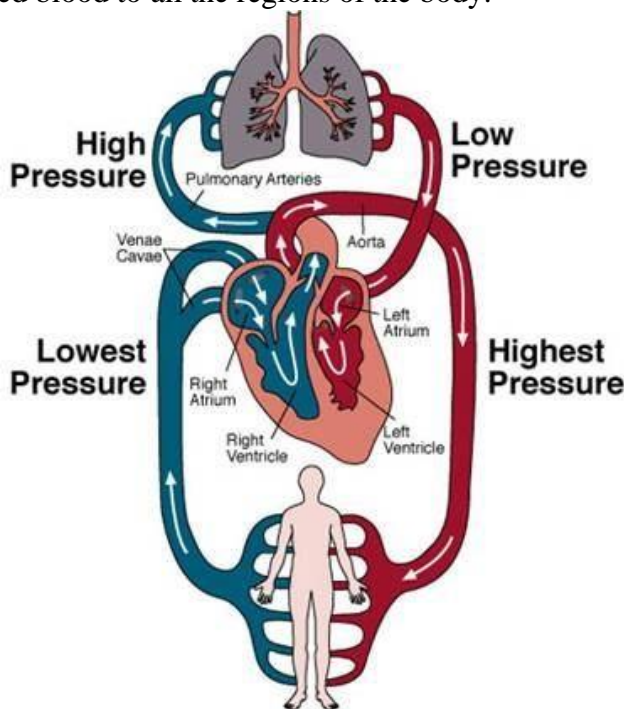
The right atrium then contracts and passes the de-oxygenated blood to the right ventricle, through an auriculo-ventricular aperture.

Then the right ventricle contracts and passes the de-oxygenated blood into the two pulmonary arteries, which pumps it to the lungs where the blood becomes oxygenated. From the lungs, the pulmonary veins transport heart.



Then the left atrium contracts and through the auriculo-ventricular aperture, the oxygenated blood enters the left ventricle.

The blood passes to aorta from the left ventricle. The aorta gives rise to many arteries that distribute the oxygenated blood to all the regions of the body.



Therefore, the blood goes twice through the heart. This is known as double circulation.

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.

As we know, 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 O₂ 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.

Question 12: What are the differences between the transport of materials in xylem and phloem?

Answer :

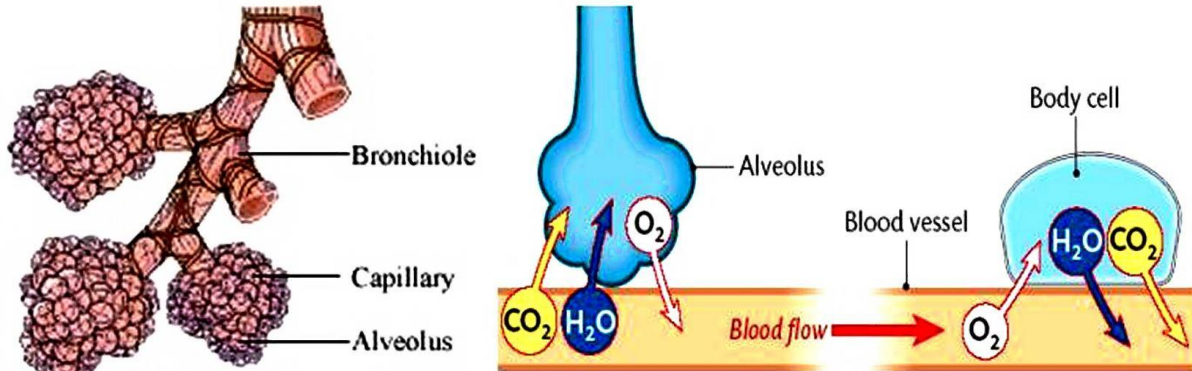
Transport of materials in xylem	Transport of materials in phloem
1. Xylem tissue helps in the transport of water and minerals.	1. Phloem tissue helps in the transport of food.
2. Water is transported upwards from roots to all other plant parts.	2. Food is transported in both upward and downward directions.
3. Transport in xylem occurs with the help of simple physical forces such as transpiration pull.	3. Transport of food in phloem requires energy in the form of ATP.

Question 13: Compare the functioning of alveoli in the lungs and nephrons in the kidneys with respect to their structure and functioning.

Answer : **ALVEOLI**

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.



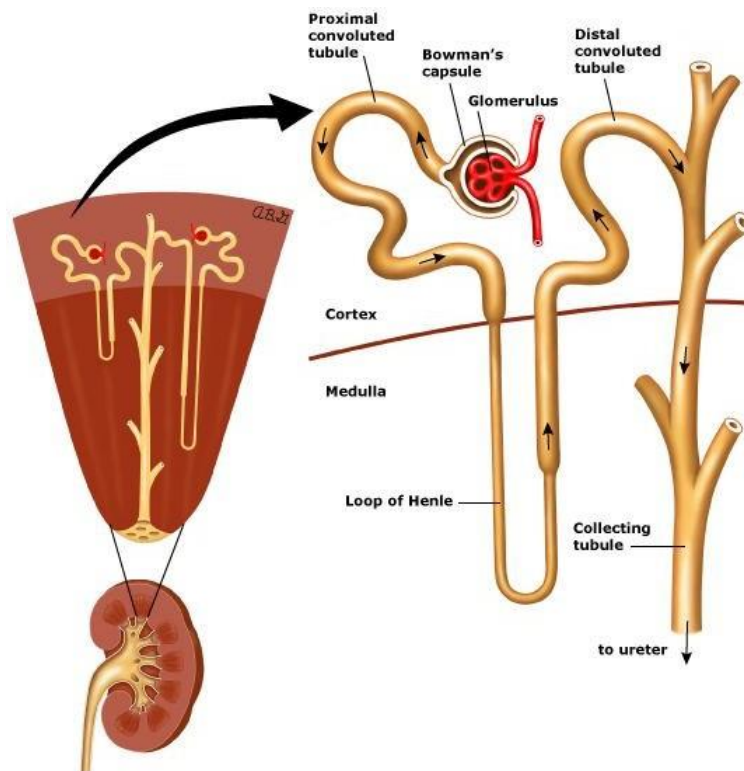
Function

- (i) The exchange of O_2 and CO_2 takes place between the blood of the capillaries that surround the alveoli and the gases present in the alveoli.
- (ii) Alveoli are the site of gaseous exchange.

NEPHRON

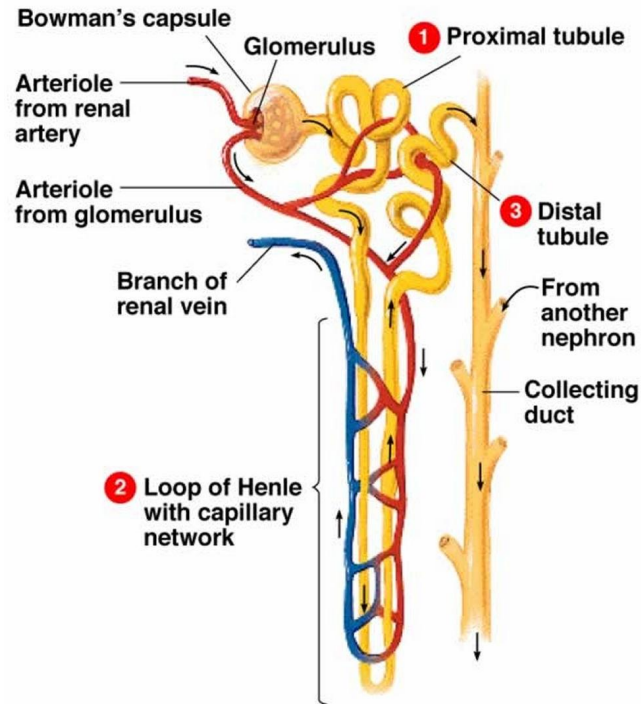
Structure

- (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 blood enters the kidneys through the renal artery which branches into many capillaries in the glomerulus. The water and solute are transferred to the nephron at Bowman's capsule. Then the filtrate moves through the proximal tubule and then down into the loop of henle. From henle's loop, filtrate passes into the distal tubule and then to the collecting duct. The collecting duct collects the urine from many nephrons and passes it to the ureter. During the flow of filtrate, some substances such as glucose, amino acids, and water are selectively re- absorbed.



(ii) Nephrons are the basic filtration unit.