



# M.R. SAMARTH EDUCARE

COMPLETE CARE 4 YOUR EDUCATION



**PHYSICS**

**CHEMISTRY**

**MATHS**

**BIOLOGY**

**NEET**

**IIT/JEE**

**NTSE/  
OLYMPIAD**

**UPSC IAS FOUNDATION  
NDA/SCRA**

**PREFOUNDATION COURSE**  
For Students of Classes 6<sup>th</sup> to 8<sup>th</sup>

**FOUNDATION COURSE**  
For Students of Classes 9<sup>th</sup> & 10<sup>th</sup>

**TARGET COURSE**  
For Students of Classes 11<sup>th</sup> & 12<sup>th</sup>

**JANTA COLONY, NEAR VISHWAKARMA SCHOOL, JHAJJAR ROAD, ROHTAK**

Contact : 7206889632, 7206889633, 8950238300

Website : [www.mrsamarth.com](http://www.mrsamarth.com)

# SCIENCE

ॐ ऐं महासरस्वत्यै नमः।



**M  
R  
EDUCARE**



ॐ असतो मा सद्गमय।  
तमसो मा ज्योतिर्गमय।  
मृत्योर्मा अमृतं गमय।



**M.R. SAMARTH EDUCARE PVT. LTD.**  
COMPLETE CARE 4 YOUR EDUCATION



**M.R. SAMARTH EDUCARE**  
COMPLETE CARE 4 YOUR EDUCATION



**PHYSICS**

**CHEMISTRY**

**MATHS**

**BIOLOGY**

**NEET**

**IIT/JEE**

**NTSE/  
OLYMPIAD**

**UPSC IAS FOUNDATION  
NDA/SCRA**

**PREFOUNDATION COURSE**  
For Students of Classes 6<sup>th</sup> to 8<sup>th</sup>

**FOUNDATION COURSE**  
For Students of Classes 9<sup>th</sup> & 10<sup>th</sup>

**TARGET COURSE**  
For Students of Classes 11<sup>th</sup> & 12<sup>th</sup>

**JANTA COLONY, NEAR VISHWAKARMA SCHOOL, JHAJJAR ROAD, ROHTAK**  
Contact : 7206889632, 7206889633, 8950238300 Website : [www.mrsamarth.com](http://www.mrsamarth.com)

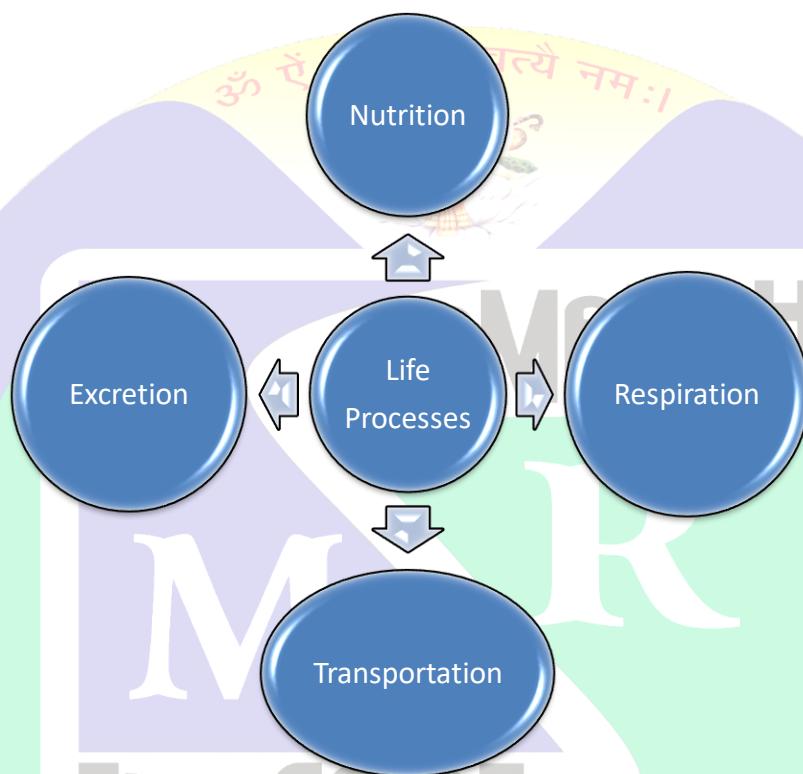
## (Biology)



## Life Processes

The basic functions performed by organisms to maintain their life on Earth are called **life processes**.

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 live and perform the job of body maintenance are called life processes.



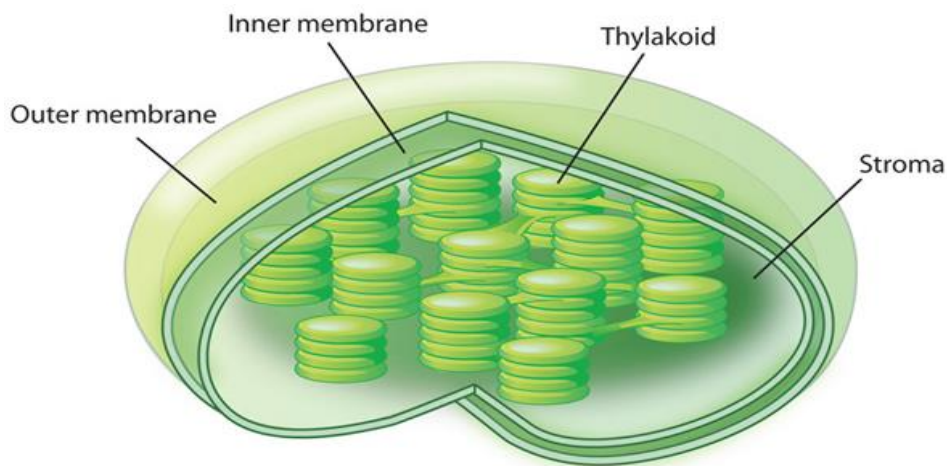
### Nutrition

#### 1. Autotrophic Nutrition

- It is the mode of nutrition in which organisms synthesise their own food from simple inorganic substances such as water and carbon dioxide.
- Green plants are autotrophs. They synthesise food by the process of photosynthesis.
- **Photosynthesis** is a physiological process by which plant cells containing chlorophyll produce food in the form of carbohydrates using carbon dioxide, water and light energy. Oxygen is released as a by- product of this process.
- **Chlorophyll** is the green pigment found in green plants.
- Chlorophyll is present in chloroplasts.
- **Chloroplast** is a membrane-bound oval cell organelle.
- It is enclosed by a double membrane. Its interior contains closely packed flattened sacs called **thylakoids**. Chlorophyll is present in the thylakoids.
- Thylakoids are arranged in piles called **grana** lying in a colourless ground substance called **stroma**.



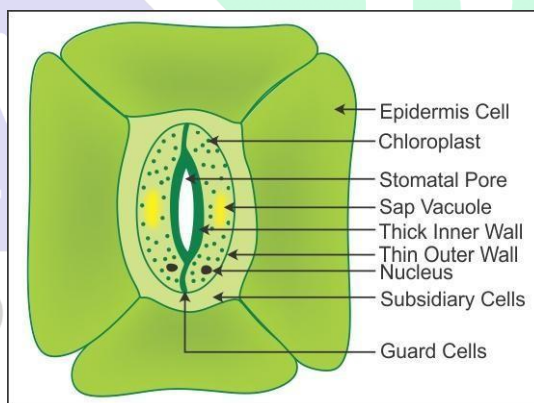
- Cells present in the spongy mesophyll layer and the palisade layer contain chloroplasts; therefore, they are the site of photosynthesis.



Chloroplast

### Stomata

- Stomata are minute openings present in the epidermal layers of leaves.
- They are responsible for gas exchange during photosynthesis.



### Process of Photosynthesis

- The **palisade layer** is the centre for photosynthesis. Light energy is trapped in the chlorophyll of the mesophyll cells in the palisade layer of leaves.
- The chemical equation for photosynthesis is



Light is absorbed by chlorophyll.

Light energy absorbed is converted into chemical energy.

At the same time photolysis of water takes place i.e. a water molecule is split into hydrogen and oxygen.

Carbon dioxide is converted into glucose by using ATP and NADPH produced during the light reaction.

Chlorophyll, light, carbon dioxide and water are necessary for photosynthesis.

## 2. Heterotrophic Nutrition

- It is the mode of nutrition of organisms which cannot synthesise their own food, but they are dependent on other organisms for food.

- Organisms exhibiting heterotrophic nutrition are called **heterotrophs**.

Examples: yeasts, fungi, bacteria, human beings, tiger, monkey, birds, lion, cow etc.

### Types of Heterotrophic Nutrition

- Saprotrophic Nutrition:** Organisms obtain their food from dead, decaying plants and animals. Example: Mushrooms
- Parasitic Nutrition:** Organisms obtain their food from the bodies of other living organisms. Parasites usually harm the host while obtaining their food.
- Example: Leech
- Holozoic Nutrition:** It is a mode of nutrition in which organisms feed on solid food. The food is complex organic material which when ingested is broken down into simple inorganic substances by the process of digestion.

Example: Humans

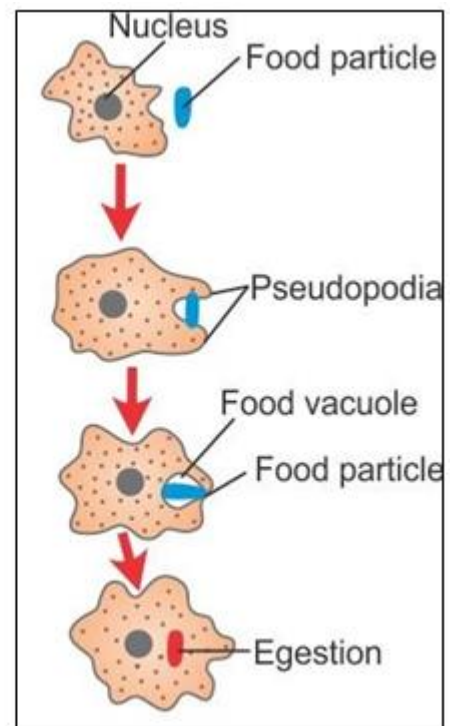
## 3. Nutrition in Amoeba

Amoeba engulfs its food by temporary finger-like projections of its body surface called pseudopodia.

When a pseudopodium fuses with the food particle, it forms a food vacuole.

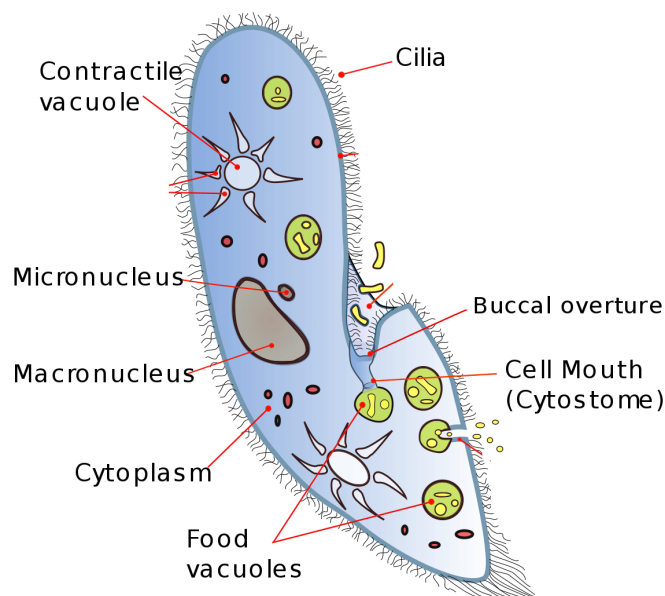
Complex substances are broken down into simple substances inside the food vacuole. These simple substances are then diffused into the cytoplasm.

The remaining unwanted material is transported to the cell surface and is thrown out.



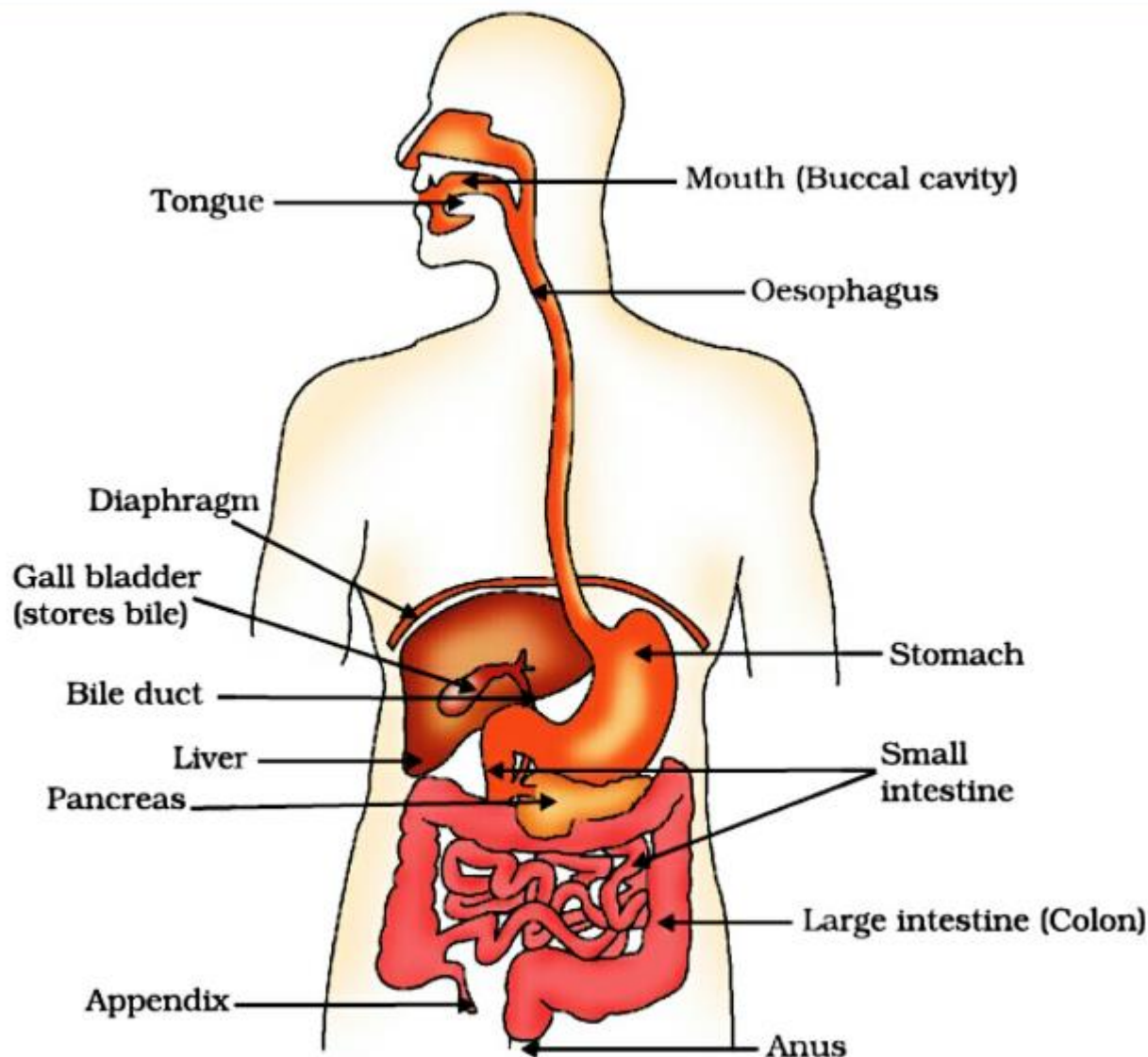
### Nutrition in Paramecium

- The food is taken in at a specific spot, i.e. the oral groove.
- The food is brought close to the oral groove by the cilia present on the body surface of paramecium.



### 4. Nutrition in Human Beings





The alimentary canal is the long tube extending from the mouth to the anus.

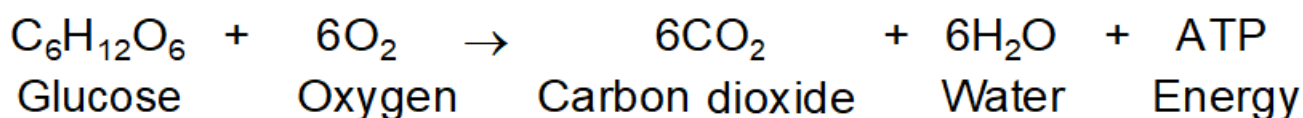
- Food is chewed and mixed with saliva in the mouth with the help of tongue and teeth.
- Saliva which contains salivary amylase acts on the starch present in food.
- Saliva is secreted by 3 pairs of salivary glands.
- The food is converted into smaller particles and made smooth by mixing it with mucus and saliva. It is now called bolus.
- The bolus moves down through the esophagus by peristaltic movements of the esophageal wall.
- Once the bolus reaches the stomach, it is acted upon by HCl, gastric juices and pepsin.
- HCl creates an acidic medium for the action of pepsin.
- Mucus prevents the lining of the stomach wall from the acidic environment.
- Pepsin converts proteins into peptides.
- The exit of food from the stomach is regulated by a sphincter muscle called the pyloric sphincter or pylorus which releases small amounts of partially digested food into the small intestine.
- The small intestine is a very long tube found in the abdomen. It is about 6–7 metre in

length and about 2.5–3 cm wide.

- Bile and pancreatic juices are secreted into the small intestine.
- Bile acts on the fat molecules and breaks them into small flat droplets. This eases the action of lipase on the fats. This process is called **emulsification**.
- Pancreatic juices contain different enzymes such as trypsin, lipase, maltase, peptidases, sucrose, which act on the food to convert it into simpler units of carbohydrates, proteins and fats.
- Intestinal glands also secrete intestinal juices which also contain enzymes, which act on the carbohydrates, proteins and fats.
- The digested food is then absorbed by the walls of the small intestine.
- Presence of brush-like borders called microvilli increase the surface area for absorption.
- The unabsorbed food is sent to the large intestine where water is absorbed into the blood stream.
- The left over material in the large intestine is sent to the rectum.
- It is excreted out through the anus.
- The opening of the anus is controlled by the anal sphincters.

### Respiration

- Respiration is a catabolic process of releasing energy from the simple sugar glucose for carrying out various life processes.



The energy required for all cellular activities is obtained by the oxidation of glucose.

- If glucose is not available, then the cells may break down proteins and fats to produce glucose. This glucose is then oxidised further to fulfil the respiratory needs of the cell.
- The first step towards obtaining energy is that the six-carbon glucose is broken down into two molecules of three-carbon pyruvate. This process takes place in the cytoplasm.

### Aerobic Respiration

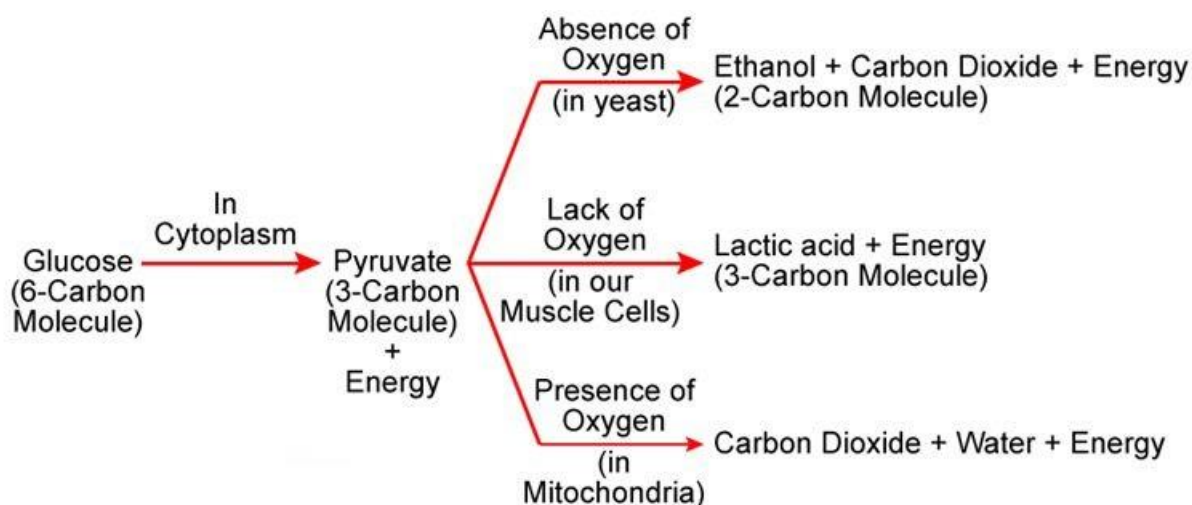
- The breakdown of glucose in the presence of oxygen is called **aerobic respiration**.
- The process of aerobic respiration releases carbon dioxide, water and energy.
- The energy released in aerobic respiration is 686 kcal or 38 ATP of chemical energy and 420 kcal of heat energy.
- Most of the animals, plants, human beings, several bacteria and fungi are aerobic.

### Anaerobic Respiration

- The breakdown of glucose in the absence of oxygen is called **anaerobic respiration**.
- The process of anaerobic respiration results in the formation of ethanol (in plants) or lactic acid (in animals), along with the release of carbon dioxide and energy.
- Water is not released in this process.
- 2 ATPs are released during anaerobic respiration.



- During heavy physical exercise such as cycling, running or lifting heavy weights, the body is often deprived of oxygen. The demand for energy is high, while the supply of oxygen to the body is limited. Therefore, muscle cells perform anaerobic respiration to fulfil the increasing energy demands of the body. In this case, glucose gets converted to lactic acid.



- Sometimes, lactic acid formed during anaerobic respiration in muscle cells gets accumulated, causing muscular cramps. This condition is called oxygen debt. In the presence of sufficient oxygen, lactic acid gets oxidised to carbon dioxide and water.

## Respiration in Plants

- All parts of a plant perform respiration.
- Plants exchange gases by diffusion through the stomata.
- Oxygen from the air diffuses into a leaf and reaches all the cells for respiration.
- Carbon dioxide produced during respiration is released into the air through the stomata.
- In plants, respiration occurs during the day as well as during the night.
- During the day, oxygen produced during photosynthesis is used for respiration and the extra amount of oxygen is given out through the stomata.
- The roots of plants take up oxygen from the air present between the roots and soil particles.
- In stems, the exchange of gases occurs through either the stomata or lenticels.

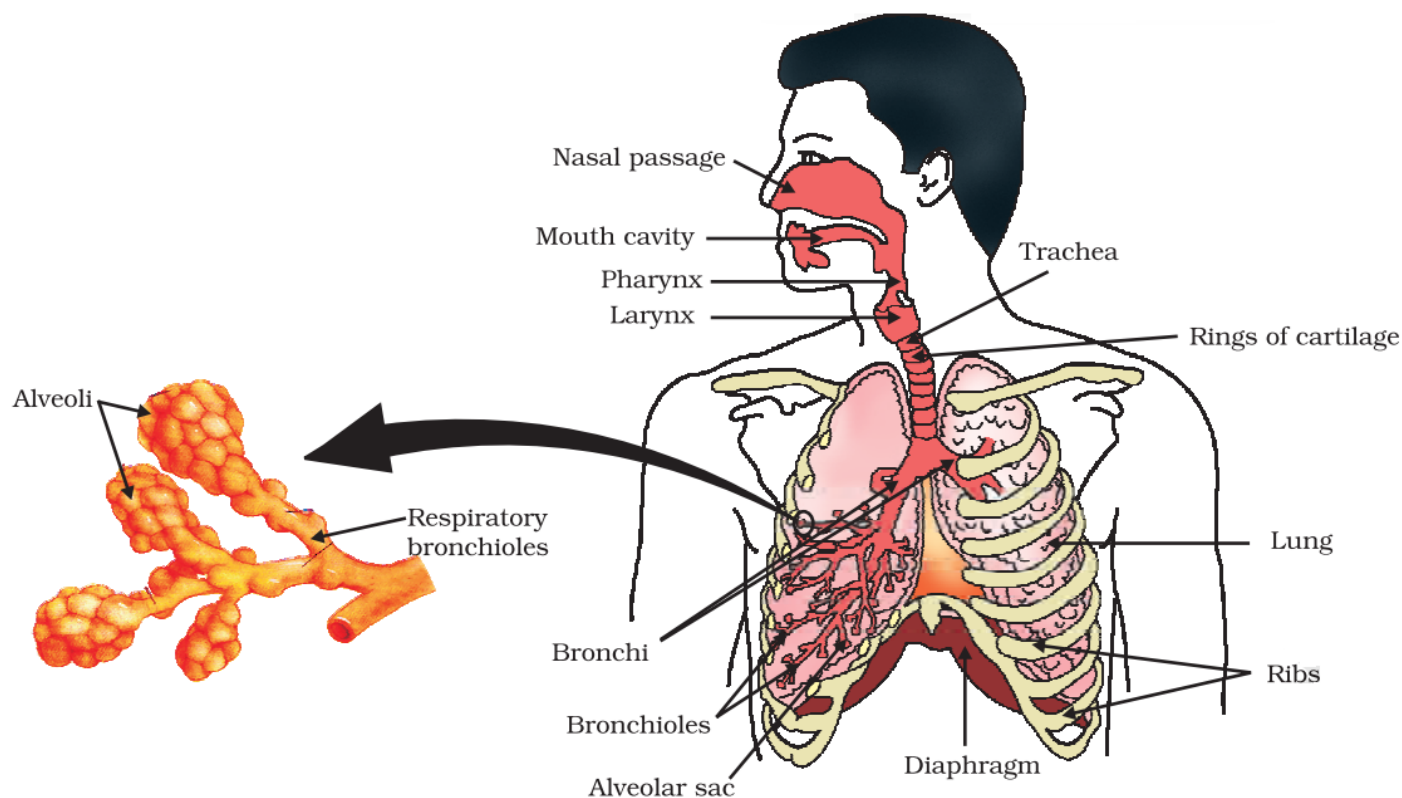
## Respiration in Animals

Different animals have evolved different respiratory organs:



## Human Respiratory System

The respiratory system in human beings consists of the nose, pharynx, larynx, trachea, bronchi and lungs.



Air is taken in through the nostrils.

- Hairs present in the nostrils prevent the entry of dust particles inside the nose.
- Nostrils further continue into the nasal cavity.
- Nostrils humidify the air passing through it.
- There is a bony plate called the palate, which separates the oral cavity from the nasal cavity.
- Nasal cavity opens into the pharynx.
- The pharynx is a muscular chamber acting as a common passage for the windpipe or trachea and the food pipe or esophagus.
- It is connected to the larynx through a slit-like opening called the glottis.
- The larynx is also called the voice-box or Adam's apple.
- The larynx connects the pharynx to the trachea.
- The trachea shows the presence of cartilaginous rings.
- The cartilaginous rings provide flexibility thus, facilitating continuous air flow.
- The inner wall of the trachea is lined by a mucous membrane consisting of ciliated columnar epithelium.
- The trachea divides into two branches or tubes called bronchi, one of which enters the right lung and the other enters the left lung.
- The bronchi have cartilaginous rings for distention.
- Each bronchus divides into fine secondary bronchi. These bronchi further divide into finer tertiary bronchi. In the lungs, each bronchus finally divides into finer and smaller branches called bronchioles.
- The bronchioles further divide to form smaller terminal bronchioles.

- The bronchioles divide repeatedly to form a cluster of tiny air chambers called air sacs or alveoli.
- Alveoli have thin and moist walls which enable gaseous diffusion with blood capillaries.
- The lungs are a pair of spongy and elastic respiratory organs protected by a bony rib cage.
- The base of the lungs rests on the diaphragm.
- Each lung is covered by two membranes. The inner membrane is called the inner or visceral pleura and the outer membrane is called the outer or parietal pleura.
- The diaphragm is a curved, musculo-fibrous sheath which separates the thoracic cavity from the abdominal cavity.
- The diaphragm plays a major role during respiration.
- The intercostal muscles found between the ribs and the radial muscles of the diaphragm bring about the breathing movements.
- When we breathe in, the ribs are pulled upwards and the diaphragm becomes flat which results in an increase in the volume of lungs.
- When we breathe out, the ribs come back to their normal position, the diaphragm is relaxed, lungs attain their normal size and air is expelled out of the body through the nostrils.



ॐ असतो मा सद्गमय।  
तमसो मा ज्योतिर्गमय।  
मृत्योर्मा अमृतं गमय।

M.R. COMPLETE CARE 4 YOUR EDUCATION  
SAMARTH EDUCARE PVT. LTD.



## Transportation

- All living organisms need a few necessary components like air, water, and food for their survival.
- On our regular basis, animals ensure these elements by breathing, drinking and eating.
- The required elements are transported to their body cells and tissues by a transportation system.
- In plants, the vascular tissue is responsible for transporting the substances.

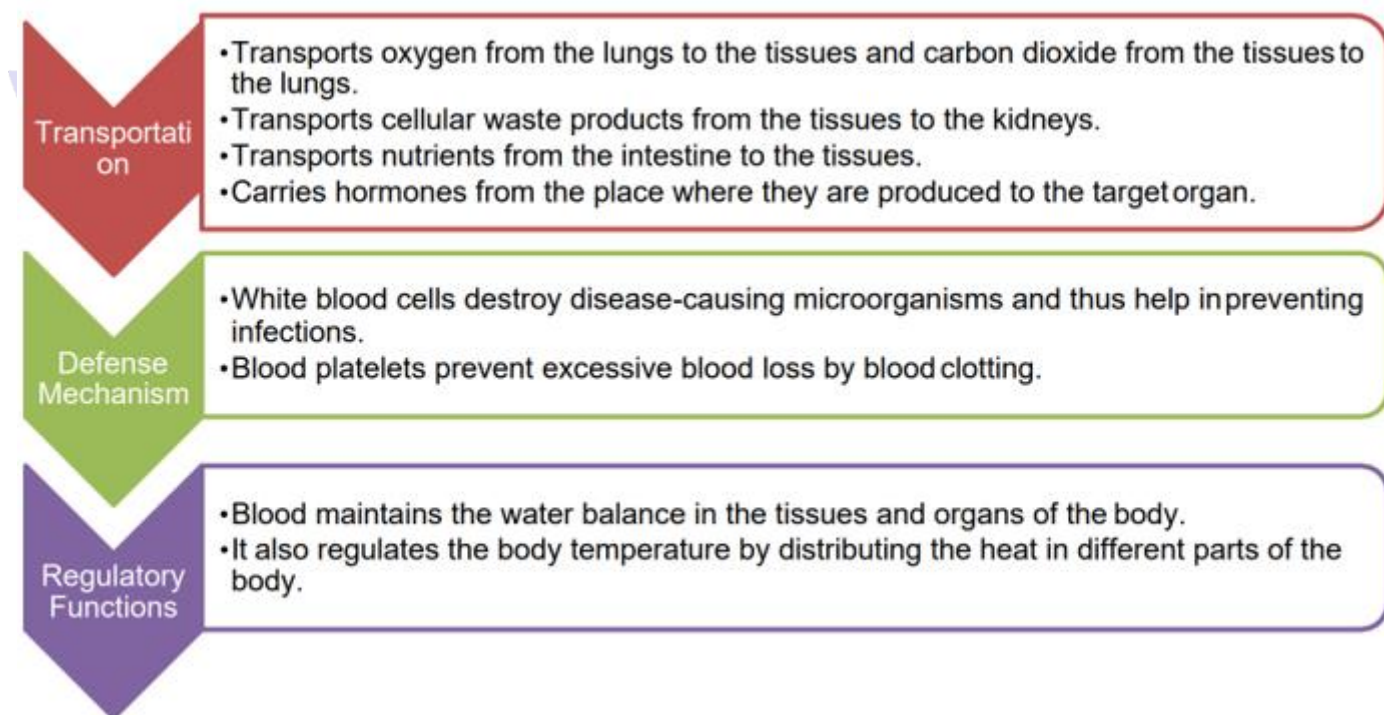
## Transportation in Human Beings

- Transportation in humans is done by the circulatory system.
- The circulatory system in humans mainly consists of blood, blood vessels and heart.
- It is responsible for the supply of oxygen, nutrients, removal of carbon dioxide and other excretory products.
- It also helps to fight the infections.

## Blood

Blood being a fluid connective tissue. Blood consists of a fluid medium called plasma in which the cells are suspended. Plasma transports food, carbon dioxide and nitrogenous wastes in dissolved form. Oxygen is carried by the red blood corpuscles. Many other substances like salts, are also transported by the blood. We thus need a pumping organ to push blood around the body, a network of tubes to reach all the tissues and a system in place to ensure that this network can be repaired if damaged.

## Functions of Blood



## Composition of Blood Plasma

- It is a light yellow-coloured or straw-coloured liquid.

- It constitutes 55% of the total blood volume.

### Blood Cells

- Blood cells constitute 45% of the total blood volume.
- Three kinds of cells are found in the blood.

### Red Blood Cells (RBCs/erythrocytes)

- RBCs are circular, disc-shaped and biconcave.
- They are produced in the bone marrow of long bones.
- Mature RBCs do not have nuclei.
- The lifespan of RBCs is 120 days.
- RBCs are made up of a iron- containing respiratory pigment called hemoglobin. Hemoglobin transports oxygen from the lungs to tissues.

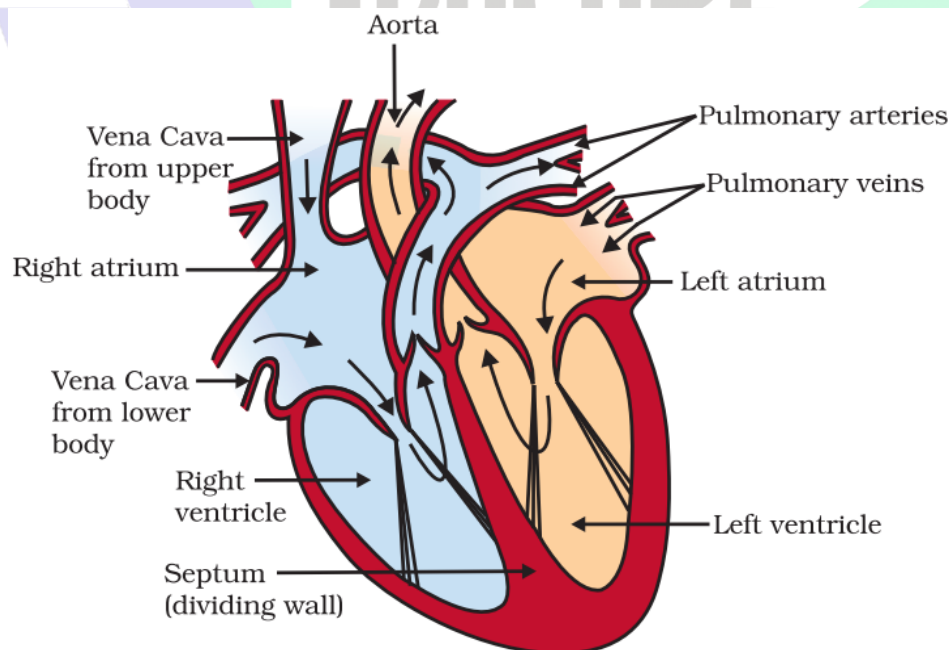
### White Blood Cells (WBCs/leucocytes)

- Irregular, colourless, larger than RBCs. They have a large and lobed nucleus.
- WBCs are produced in the bone marrow, lymph glands and spleen.
- WBCs provide immunity.

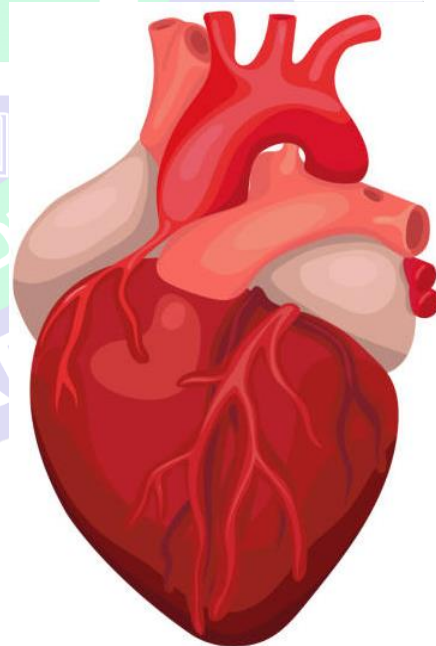
### Blood Platelets (Thrombocytes)

- Blood platelets are minute, oval or round, non- nucleated cells.
- Platelets are formed in the bone marrow.
- Blood platelets play an important role in blood clotting.

### Heart – The Pumping Organ



**Schematic sectional view of the human heart**



**Human heart**

#### Location

- The heart is a muscular organ located in the chest cavity towards the

	left side.
<b>Size</b>	<ul style="list-style-type: none"> <li>In adult humans, it is about the size of one's fist.</li> </ul>
<b>Covering</b>	<ul style="list-style-type: none"> <li>Covered by a double membrane called <b>pericardium</b>. It contains the lubricating <b>pericardial fluid</b>.</li> <li>The pericardial fluid provides lubrication during the contraction and relaxation of the heart.</li> <li>It also protects the heart from mechanical injuries.</li> </ul>
<b>Chambers of the heart</b>	<ul style="list-style-type: none"> <li>Internally, the heart is divided into four chambers:               <ul style="list-style-type: none"> <li>Two thin-walled upper chambers-left atrium and right atrium.</li> <li>Two thick-walled lower chambers-left ventricle and right ventricle.</li> </ul> </li> </ul>
	<ul style="list-style-type: none"> <li>The superior vena cava brings deoxygenated blood from the anterior part of the body, i.e. head, chest and arms, to the right atrium.</li> <li>The inferior vena cava brings blood from the posterior region of the body, including the abdomen and legs, to the right atrium.</li> <li>The blood from the right atrium enters the right ventricle.</li> <li>From the right ventricle, the blood is sent to the lungs through the pulmonary artery.</li> </ul>
<b>Blood vessels leaving the heart</b>	<ul style="list-style-type: none"> <li>Four pulmonary veins carry oxygenated blood from the lungs to the left atrium.</li> <li>From the left atrium, the blood enters the left ventricle.</li> <li>From the left ventricle, oxygenated blood is sent to all parts of the body through the aorta.</li> </ul>
<b>Heart valves</b> Heart valves prevent the backflow of blood or regulate the flow of blood in a single direction.	<ul style="list-style-type: none"> <li>The tricuspid valve which has three projections or cups is located between the right atrium and the right ventricle.</li> <li>The bicuspid valve/mitral valve has two projections or cups and is located between the left atrium and the left ventricle.</li> <li>The opening of the left ventricle into the aorta and the opening of the right ventricle into the pulmonary artery is guarded by semilunar valves.</li> </ul>

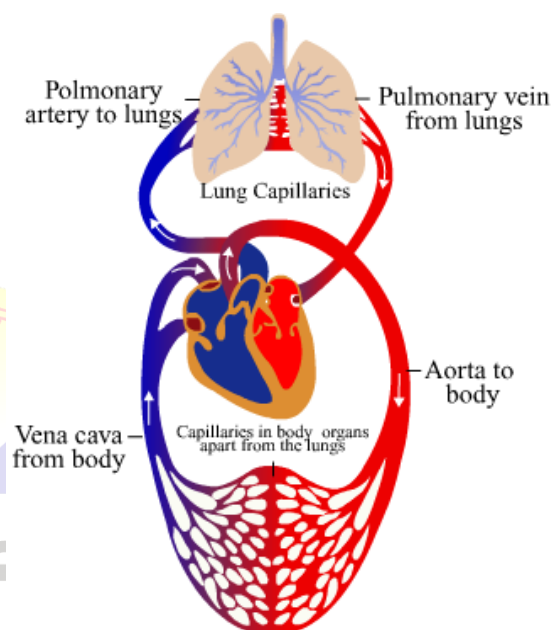


## Double Circulation

The heart receives deoxygenated blood from different parts of the body, and it pumps this blood to the lungs. The oxygenated blood from the lungs returns to the heart, which is pumped again into different parts of the body by the heart. Thus, the blood passes twice through the heart making one complete round through the body. This is called **double circulation**.

The pulmonary circulation pertains to lungs. The blood flows from the right ventricle to the lungs. Pulmonary veins collect oxygenated blood from the lungs and carry it back to the heart (left auricle).

The systemic circulation pertains to the major circulation of the body. The aorta receives the blood from the left ventricle and sends it to the various parts of the body. Veins collect the deoxygenated blood from the body parts and pour it back into the right auricle.



## Blood Pressure

- **Blood pressure** is the pressure which the blood exerts on the walls of the blood vessels.
- The blood pressure in the arteries during ventricular systole is called **systolic pressure**, and the blood pressure in the arteries during the ventricular diastole is called **diastolic pressure**.
- A person's blood pressure is usually expressed in systolic pressure over diastolic pressure.
- The normal blood pressure for an adult human is 120/80 mm Hg.
- Blood pressure varies according to the age and health of a person.
- A sphygmomanometer is an instrument used to measure blood pressure.
- High blood pressure is also called hypertension, while low blood pressure is called hypotension.

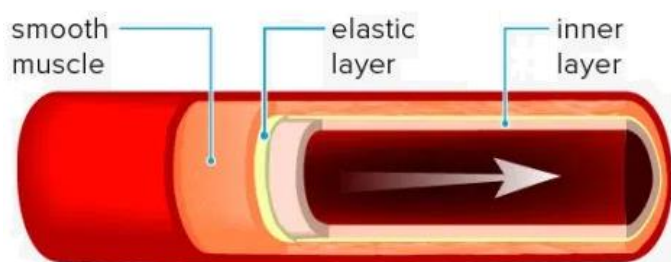
## Blood Vessels

- The blood vessels are tubes from which blood from the heart is carried to all parts of the body and again brought back to the heart.
- There are three types of blood vessels.

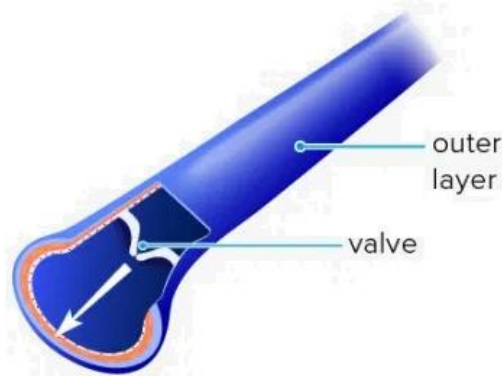
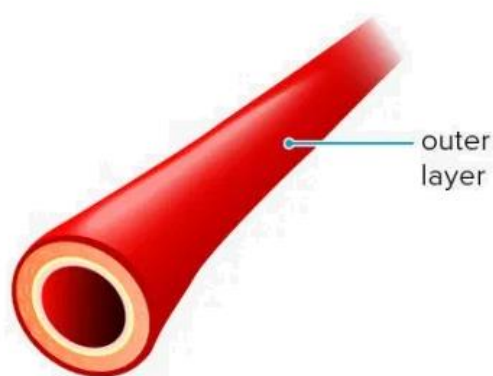
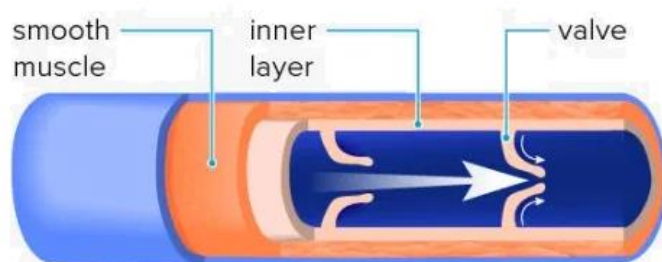
Artery	Vein	Capillaries
An artery is a blood vessel which carries blood away from the heart towards any organ.	A vein is a vessel which carries the blood away from an organ towards the heart.	A capillary is a very narrow blood vessel which is located within the tissue.

It has elastic and thick muscular walls.	It has thin muscular walls.	It has an extremely thin wall.
Narrow cavity through which the blood flows.	Broad cavity through which the blood flows.	-
-	The veins have valves which prevent the backflow of blood.	The arteries branch to form arterioles, and arterioles break up into capillaries.
The largest artery is the aorta.	-	The capillaries gradually reunite to form venules. Venules further combine to form veins.
-	-	Capillaries allow the exchange of materials such as nutrients, metabolic wastes and respiratory gases between the blood and cells.

Artery



Vein



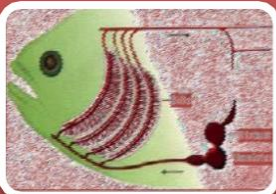
### Maintenance by platelets

Naturally the loss of blood from the system has to be minimised. In addition, leakage would lead to a loss of pressure which would reduce the efficiency of the pumping system. To avoid this, the blood has platelet cells which circulate around the body and plug these leaks by helping to clot the blood at these points of injury.

### Lymph and Lymphatic System

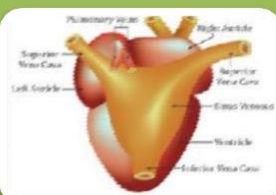
- As the blood flows through capillaries, the water, dissolved substances and a few white blood cells pass through the capillary walls into the spaces between the cells, i.e. intercellular spaces. This fluid is called **tissue fluid**.
- White blood cells in the lymph protect the body against diseases.
- The lymphatic system carries excessive tissue fluid back to the blood.

## Heart in Other Vertebrates



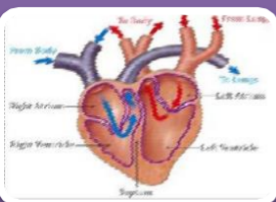
### Fish

- Two-chambered heart.
- One atrium and one ventricle.
- The heart pumps deoxygenated blood to the gills for oxygenation.
- The oxygenated blood from the gills is supplied to all the body parts.



### Amphibians and Reptiles

- Three chambered heart.
- Two atria and one ventricle.
- Due to incomplete division within the heart, oxygenated and deoxygenated blood mix to some extent.

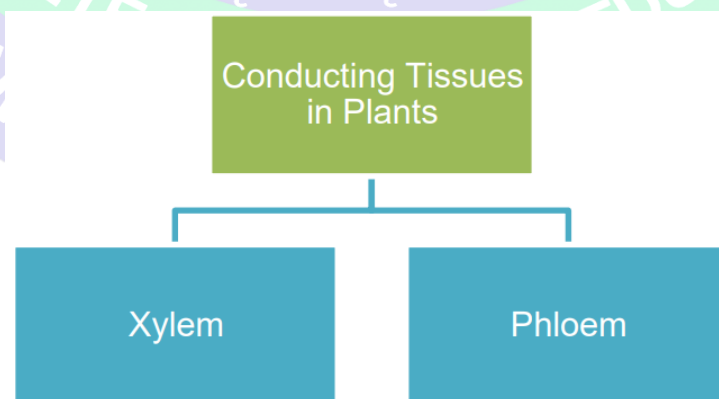


### Birds

- Four-chambered heart.
- Two atria and two ventricles.
- The left side of the heart is completely separated from the right side of the heart to prevent mixing of oxygenated and deoxygenated blood.

## Transportation in Plants

- **Transportation** in plants is the process by which a substance, absorbed or synthesised in one part of the plant, is transported to the other parts of the plant.
- Substances transported by the transport system are water, mineral and food prepared by plants.



### 1. Xylem

- It conducts water upwards in a plant.
- Xylem also provides strength to the stem and helps the plant to stand upright.



- It is located in the centre of the plant body.
- Xylem mainly consists of tracheids and vessels.

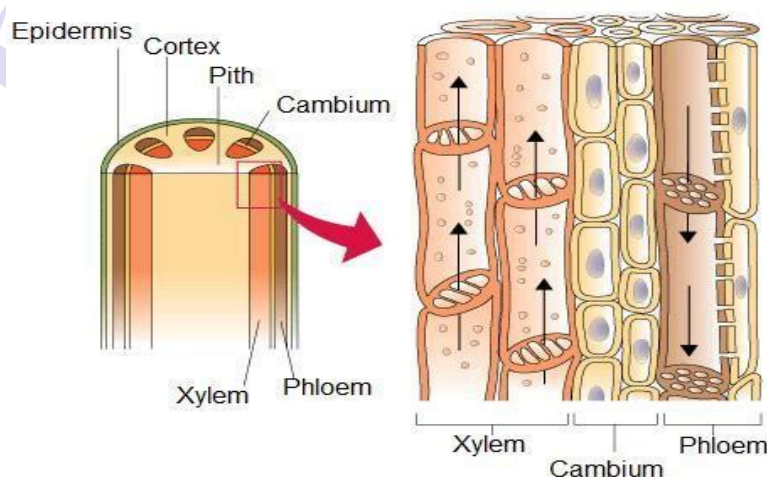
### Mechanism of Transport of Water and Minerals

#### A.

- Water enters the root hair through osmosis, and mineral ions enter the root cells by active transport.
- Both water and minerals move upward from cell to cell through the cortex of the root by osmosis.
- From the cortex, water and minerals are brought to the xylem.
- The sap which contains water and dissolved minerals move upwards from the root cells to xylem. The upward movement of sap is called the ascent of sap.
- The xylem vessels of the roots are in continuation with the xylem vessels of the stem.

#### B.

- **Transpiration** is the loss of water in the form of water vapour from the aerial parts of a plant.
- It occurs through openings called stomata.
- Water loss through evaporation lowers the concentration of water inside the mesophyll cells.
- Due to this, water enters mesophyll cells from neighbouring xylem vessels through osmosis.
- As water evaporates from the leaves, a suction force is created. This force helps to draw more water up through the stem which causes the roots to absorb more water from the soil.
- Higher the rate of transpiration, greater the rate of absorption of water and solutes from the soil.
- Transpiration also helps in maintaining the temperature of the plant body.



### 2. Phloem

- It conducts manufactured food from the leaves to different parts of the plant.
- The food in the phloem can move in the upward and downward directions.
- Phloem mainly consists of sieve tube cells and companion cells.
- Sieve tubes are living cells of the phloem. They contain cytoplasm but no nucleus.
- The end walls of the cells form sieve plates.
- Sieve plates have small pores in them which allow food to pass through the phloem.
- Each sieve tube cell has a companion cell next to it.

### Mechanism of Transport of Water and Minerals

- Food synthesised during photosynthesis is loaded into sieve tubes by utilising ATP.
- The presence of food inside the phloem develops the concentration gradient for water. Thus, water enters the phloem by osmosis.
- Osmosis develops high pressure inside the phloem which transports the food from the phloem to plant parts where the concentration of food is less.
- This process is called **translocation**.
- In spring, the sugar stored in the root or stem tissues is transported to the buds.

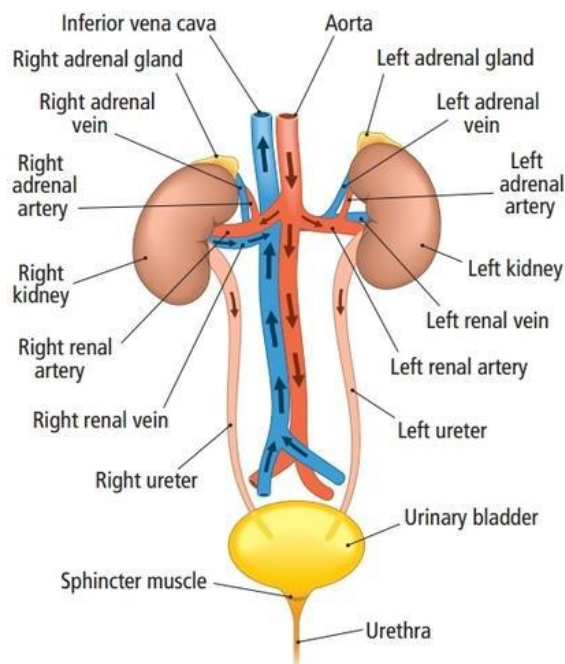
Xylem and phloem constitute the conducting tissues and are known as vascular tissues.

### Excretion

organisms get rid of gaseous wastes generated during photosynthesis or respiration. Other metabolic activities generate nitrogenous materials which need to be removed. The biological process involved in the removal of these harmful metabolic wastes from the body is called excretion. Different organisms use varied strategies to do this. Many unicellular organisms remove these wastes by simple diffusion from the body surface into the surrounding water.

Excretion is the removal of harmful and unwanted substances, especially nitrogenous wastes, from the body.

### Excretion in Human Beings



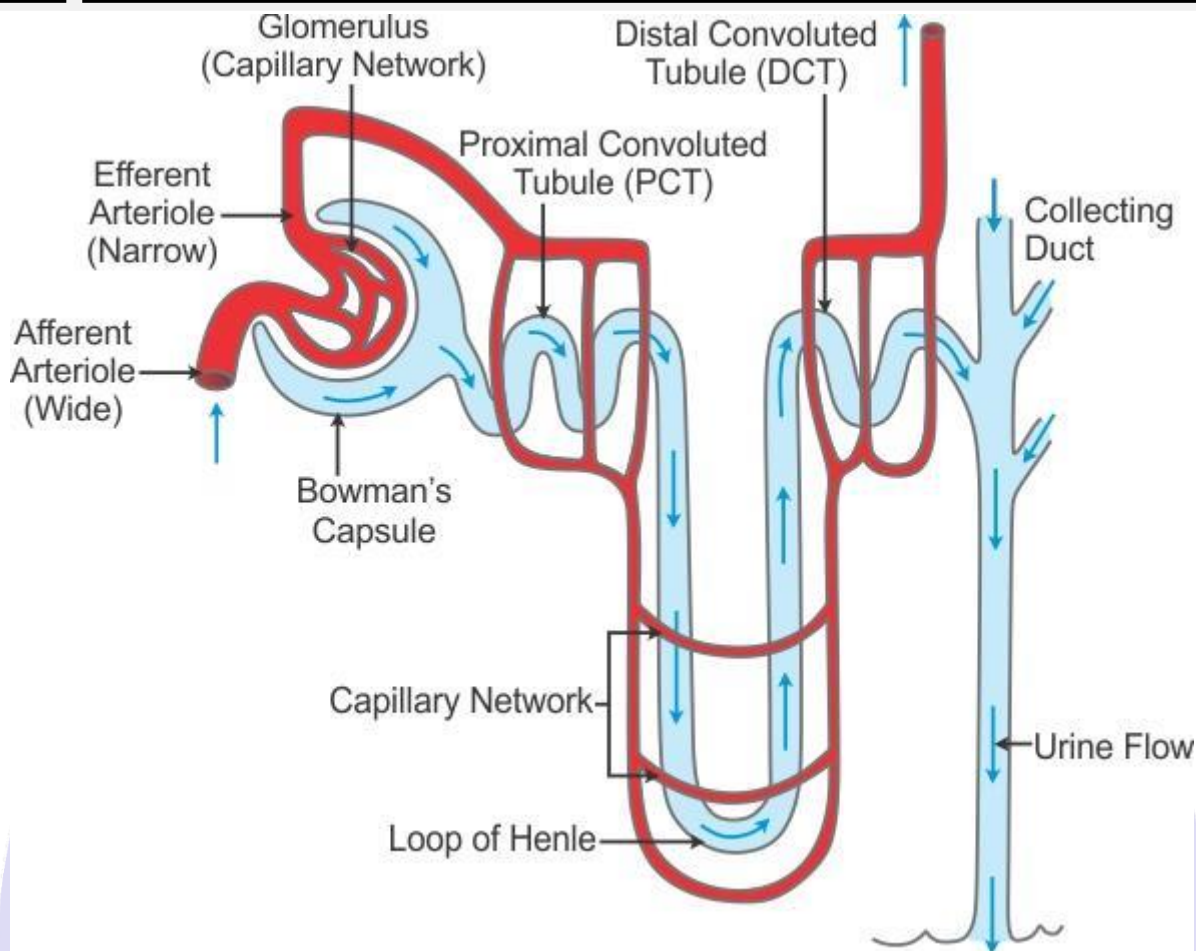
**Human Urinary System**

The human urinary system consists of-

<b>Pair of kidneys</b>	<ul style="list-style-type: none"> <li>• Dark red, bean-shaped, 10 cm long, 6 cm wide.</li> <li>• The right side of the kidney is slightly lower in position due to the presence of the liver.</li> </ul>
<b>Pair of ureters</b>	<ul style="list-style-type: none"> <li>• Ureters are tube-like structures which arise from the notch, i.e. the hilum of each kidney.</li> <li>• The ureters connect behind with the urinary bladder.</li> <li>• The ureters carry the urine produced to the urinary bladder.</li> </ul>
<b>Urinary bladder</b>	<ul style="list-style-type: none"> <li>• Muscular sac-like structure.</li> <li>• It stores urine temporarily.</li> <li>• Its opening is guarded by muscular sphincters.</li> <li>• The sphincters open at the time of micturition (urination).</li> </ul>
<b>Urethra</b>	<ul style="list-style-type: none"> <li>• Short muscular tube which expels urine out of the body.</li> <li>• The urethra is long in males and is very short in females.</li> <li>• The opening is guarded by sphincters which open at the time of urination.</li> </ul>

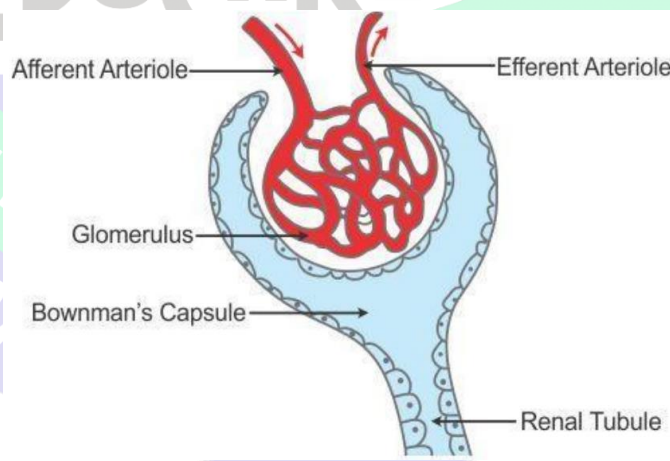
## Urinerous Tubule





### Uriniferous Tubule

- Each kidney is composed of an enormous number of uriniferous tubules.
- They are also known as nephrons, renal tubules or kidney tubules.
- Uriniferous tubules are the structural and functional units of the kidney.



### Malpighian Tubule

- Each nephron has a Malpighian body and body of tubules.
- Malpighian body is nothing but a cup-shaped Bowman's capsule. In its cup-shaped depression, a tuft of blood capillaries called glomerulus is situated.
- The body of tubules contains proximal convoluted tubule (PCT), loop of Henle and distal convoluted tubule (DCT).

- DCT opens into the collecting duct.

Approximately 2 million uriniferous tubules are present in both the kidneys. Each single uriniferous tubule is 4 to 5 cm long.

The great length of the uriniferous tubule provides a large surface area for the reabsorption of usable substances such as water.

Blood flow through the kidneys per minute = 1 litre

Glomerular filtrate produced in 24 hours = 160 litre

Urine produced from the glomerular filtrate after reabsorption per day = 1.2 litre

## Formation of Urine

The process of urine formation occurs in two major steps.

### Ultrafiltration

- The efferent arteriole is narrower than the afferent arteriole which develops a hydrostatic pressure on the blood.
- Thus, the blood flows through the glomerulus with a great pressure.
- Due to the pressure, the liquid part of the blood filters out from the glomerulus and passes into the Bowman's capsule.
- The glomerular filtrate consists of water, urea, salts, glucose and other plasma solutes.
- Blood corpuscles, proteins and other large molecules remain behind in the glomerulus.
- Therefore, the blood carried away by the efferent arteriole is relatively thick.

### Reabsorption

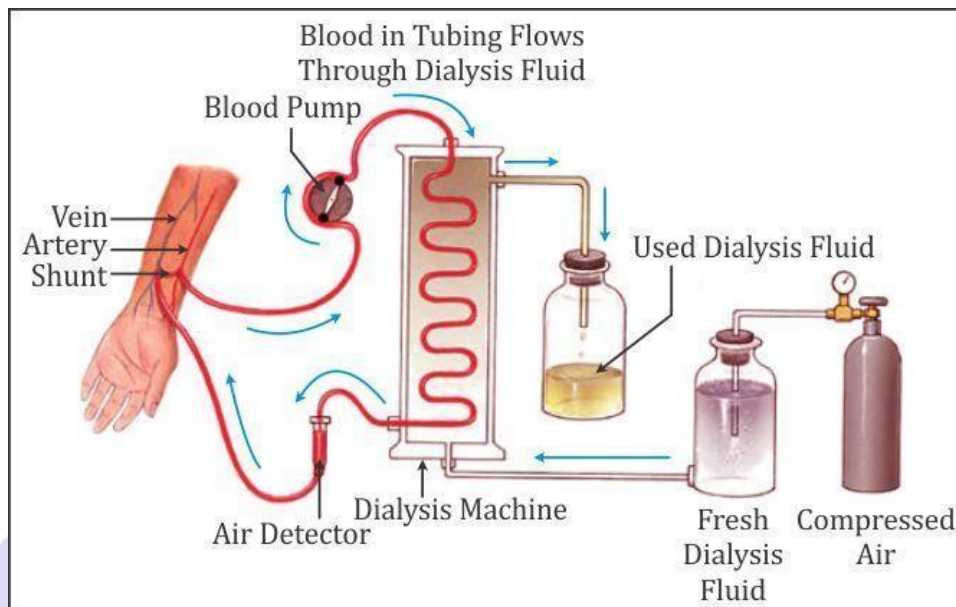
- The glomerular filtrate entering the renal tubule contains many useful substances.
- Hence, as the filtrate passes down the tubule, water and other substances required by the body are reabsorbed.
- Potassium ions and certain substances such as penicillin are passed into the forming urine through the distal convoluted tubule (DCT).
- The cells of the walls of DCT are involved in bringing potassium ions and other substances back into the renal tubule; hence, this process is known as tubular secretion.

### Urine Excretion

- The filtrate left after reabsorption and tubular secretion is called urine.
- The urine passes from the collecting duct into the pelvis of the kidney. From there it is sent to the urinary bladder through the ureters.
- By relaxing the sphincters present at the opening of the urethra, the urine is expelled from the body. This process is known as micturition or urination.

### Artificial Kidney

If one kidney is damaged or removed, then the other kidney alone can fulfil excretory



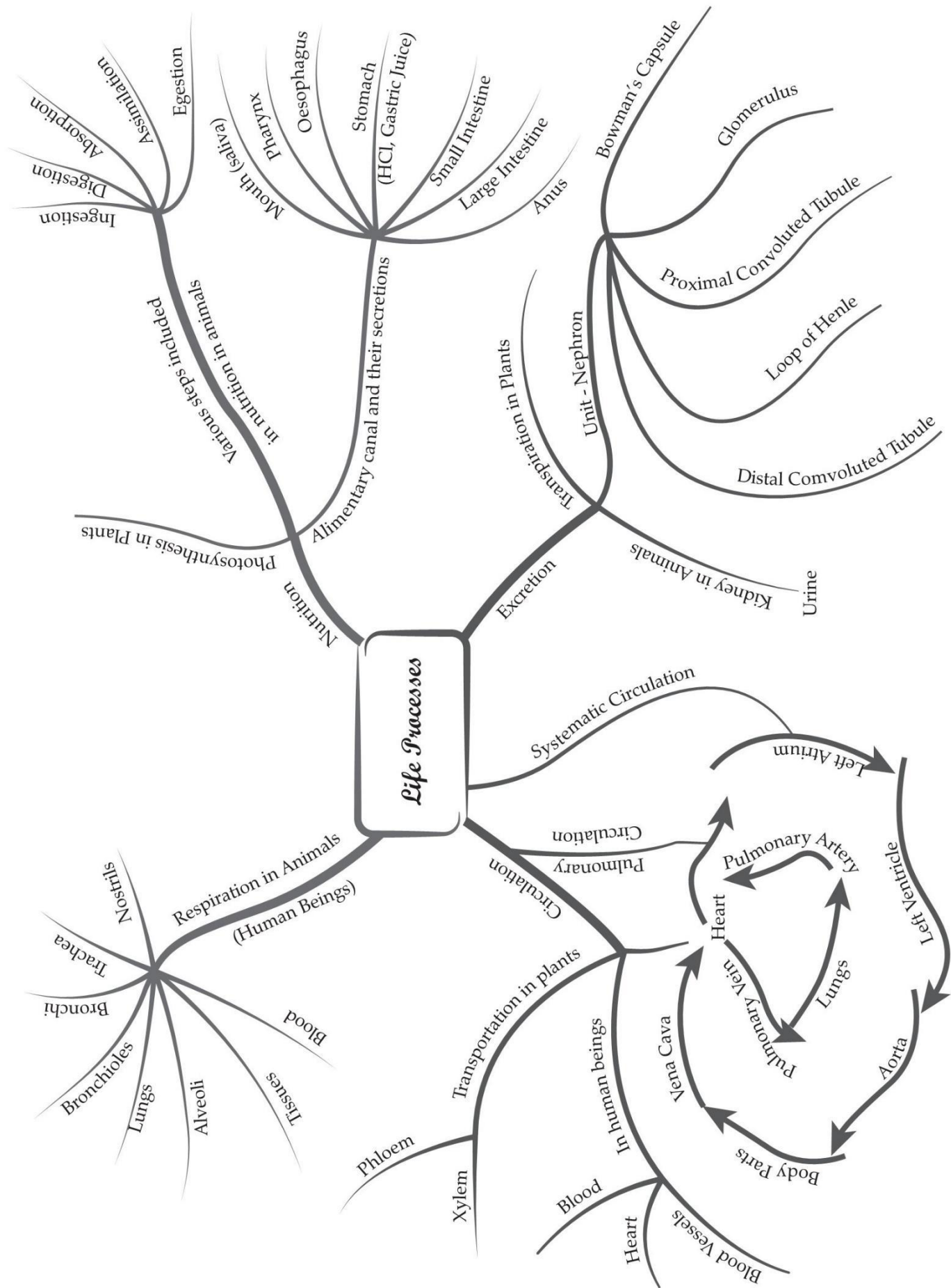
needs.

- However, the failure of both the kidneys allows urea and other wastes to accumulate in the blood.
- Such a patient undergoes dialysis.
- In dialysis, an artificial kidney is used.
- The artificial kidney contains tubes with a semi-permeable lining.
- These tubes are suspended in a tank filled with a dialysing solution.
- This fluid contains water and glucose in concentrations similar to those in blood.
- The patient's blood is led from the radial artery through the tubes of the artificial kidney where excess salts and urea are removed.
- The purified blood is returned through a vein in the same arm.
- The function of dialysis is similar to the function of the kidney, but the only difference is there is no reabsorption during dialysis.

### Excretion in Plants

- Plants also produce several waste products during their life processes.
- The major waste products are water, carbon dioxide and oxygen produced during respiration and photosynthesis.
- These wastes are excreted through the stomata and lenticels.
- Plants store some waste products in leaves which fall off.
  - Wastes such as gums and resins are stored in the old xylem.





## Important Questions

### ➤ Multiple Choice Questions:

1. The autotrophic mode of nutrition requires:

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

2. The largest gland in human body is:

- (a) liver
- (b) gastric glands
- (c) pancreas
- (d) salivary glands.

3. Number of salivary glands found in man are:

- (a) one pair
- (b) two pairs
- (c) three pairs
- (d) five pairs

4. Pancreatic juice helps in the digestion of:

- (a) proteins
- (b) proteins and fats
- (c) proteins and carbohydrates
- (d) proteins, carbohydrates, and fats

5. ATP and NADP 2H are produced in:

- (a) Mitochondria
- (b) Chloroplast
- (c) Peroxisomes
- (d) Lysosomes

6. Oxygen evolved during photosynthesis comes from:

- (a) water
- (b) CO<sub>2</sub>
- (c) soil
- (d) atmosphere.

7. Rate of photosynthesis is high in:
- (a) orange light
  - (b) green light
  - (c) red light
  - (d) yellow light
8. The ultimate source of all metabolic energy on our earth is:
- (a) green plants
  - (b) the sun
  - (c)  $O_2$
  - (d)  $O_2$  and  $H_2O$ .
9. Light reaction takes place in:
- (a) grana
  - (b) stroma
  - (c) mitochondria
  - (d) leucoplast.
10. Plants purify air by:
- (a) transpiration
  - (b) photosynthesis
  - (c) respiration
  - (d) absorption of water

➤ **Very Short Question:**

1. Name the term for transport of food from leaves to other parts of plants.
2. What process in plants is known as transpiration?
3. Name the tissue which transports soluble products of photosynthesis in a plant.
4. Name the tissue which transports water and minerals in a plant.
5. How do autotrophs obtain  $CO_2$  and  $N_2$  to make their food?
6. Which pancreatic enzyme is effective in digesting protein?
7. Which enzyme present in saliva breaks down starch?
8. What is the role of acid in our stomach?
9. What is the role of saliva in the digestion of food?
10. State the function of digestive enzymes.

➤ **Short Questions:**



1. (a) Name two different ways in which glucose is oxidized to provide energy in various organisms.
- (b) Write any two differences between the two ways of oxidation of glucose in organisms.
2. What is the function of trachea? Why do the walls not collapse even when there is less air in it?
3. Name any two digestive enzymes secreted in the human digestive system and write their function.
4. How do they take up carbon dioxide and perform photosynthesis?
5. (a) What will happen to guard cells and the stomatal pore when water flows into guard cells.
- (b) How do plants transmit information from cell to cell?
6. What are the different ways in which glucose is oxidized to provide energy in various organisms?
7. What is excretion? How do unicellular organisms remove their wastes?
8. What is internal energy reserve in plants? Do the animals have the same energy reserve? Justify your answer.

### ➤ Long Questions:

1. (a) List two differences between 'holozoic nutrition' and 'saprophytic nutrition'. Give two examples each of these two types of nutrition.
- (b) State the roles of liver and pancreas.
- (c) Name the organ which performs the following functions in humans:
  - Absorption of digested food
  - Absorption of water.
- (d) Explain the statement, "Bile does not contain any enzyme but it is essential for digestion."
2. (a) Draw a diagram to show the human alimentary canal and label on it the following: Gall bladder, Stomach. Name the longest part of the alimentary canal.
- (b) Why is it necessary to separate oxygenated and deoxygenated blood in mammals and birds?
3. (a) List three events that occur during the process of photosynthesis. State in brief the role of stomata in this process.
- (b) Describe an experiment to show that sunlight is essential for photosynthesis.

### ➤ Assertion Reason Questions:

1. For two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:
- Both A and R are true, and R is correct explanation of the assertion.
  - Both A and R are true, but R is not the correct explanation of the assertion.
  - A is true but R is false.
  - A is false but R is true.

**Assertion:** Ventricles have thicker walls than auricles.

**Reason:** Ventricles have to pump blood into various organs with great pressure.

2. For two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:
- Both A and R are true, and R is correct explanation of the assertion.
  - Both A and R are true, but R is not the correct explanation of the assertion.
  - A is true but R is false.
  - A is false but R is true.

**Assertion:** Ureters are the tubes which carry urine from kidneys to the bladder.

**Reason:** Urine is stored in the urethra.

### ➤ Case Study Questions:

1. Read the following and answer any four questions from (i) to (v).

Heterotrophic nutrition is a mode of nutrition in which organisms obtain readymade organic food from outside sources. The organisms that depend upon outside sources for obtaining organic nutrients are called heterotrophs. Heterotrophic nutrition is of three types: saprophytic, parasitic, and holozoic nutrition.

- In which of the following groups of organisms' food material is broken outside the body and absorbed?
  - Mushroom, green plants, Amoeba.
  - Yeast, mushroom, bread mould.
  - Paramecium, Amoeba, Cuscuta.
  - Cuscuta, lice, tapeworm.
- Which of the following is a parasite?
  - Yeast
  - Taenia

- c. Amoeba
- d. Earthworm
- iii. Which of the following is an example of saprotroph?
  - a. Grass
  - b. Mushroom
  - c. Amoeba
  - d. Paramecium
- iv. Heterotrophic nutrition involves:
  - a. Production of simple sugar from inorganic compounds.
  - b. Utilisation of chemical energy to prepare food.
  - c. Utilisation of energy obtained by plants.
  - d. All of these.
- v. In Paramecium, food enters the body through:
  - a. Mouth
  - b. Pseudopodia
  - c. Cilia
  - d. Cytostome.

2. Read the following and answer any four questions from (i) to (v).

All living cells need nutrients,  $O_2$  and other essential substances. Also, the waste and harmful substances need to be removed continuously for healthy functioning of cells. So, a well-developed transport system is mandatory for living organisms. Complex organisms have special fluids within their bodies to transport such materials. Blood is the most commonly used body fluid by most of the higher organisms. Lymph also helps in the transport of certain substances.

- i. Which of the following does not exhibit phagocytic activity?
  - a. Monocytes.
  - b. Neutrophils.
  - c. Basophil.
  - d. Macrophage.
- ii. Amount of blood corpuscles is changed in dengue fever. One of the common symptoms observed in people infected with dengue fever is:
  - a. Significant decrease in RBC count.
  - b. Significant decrease in WBC count.
  - c. Significant decrease in platelets count.



- d. Significant increase in platelets count.
- iii. Why are WBCs called soldiers of the body?
- They are capable of squeezing out of blood capillaries.
  - They are manufactured in bone marrow.
  - They fight against disease causing germs.
  - They have granular cytoplasm with lobed nucleus.
- iv. Name the blood cells, whose reduction in number can cause clotting disorder, leading to excessive loss of blood from the body.
- Erythrocytes.
  - Neutrophils.
  - Leucocytes.
  - Thrombocytes.
- v. Which of the following is the correct feature of lymph?
- It is similar to the plasma of blood but is colourless and contains less proteins.
  - It is similar to the WBCs of blood but is colourless and contain more proteins.
  - It is similar to the RB Cs of blood and red in colour.
  - It contains more fats.

### ✓ Answer Key-

#### ➤ Multiple Choice Answers:

- (d) all of the above
- (a) liver
- (c) three pairs
- (d) proteins, carbohydrates and fats
- (a) Mitochondria
- (a) water
- (c) red light
- (b) the sun
- (a) grana
- (b) photosynthesis

#### ➤ Very Short Answers:

- Answer: Translocation of food.

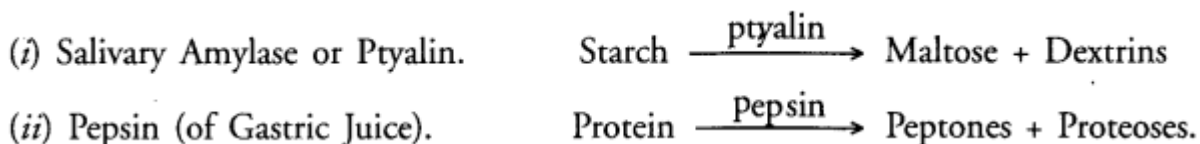
2. Answer: It is loss of water in the vapour form from the exposed parts of a plant.
3. Answer: Phloem.
4. Answer: Xylem.
5. Answer: Autotrophs obtain  $\text{CO}_2$  from air and  $\text{N}_2$  as nitrate or ammonium ion from soil.
6. Answer: Trypsin.
7. Answer: Ptyalin or salivary amylase.
8. Answer: HCl of gastric juice disinfects the food and acidifies it for proper functioning of proteolytic enzyme pepsin.
9. Answer: Saliva moistens the ingested food with mucus, sterilizes it with lysozyme and partially digests starch part of food into sugar with the help of salivary amylase or ptyalin.
10. Answer: Digestive enzymes are hydrolytic enzymes which cause breakdown of complex and insoluble components of food into simple, soluble, and absorbable substances.

### ➤ Short Answer:

1. Answer:
  - (a) Aerobic and anaerobic.
  - (b) Differences
2. Answer: Trachea is a tube that connects pharynx with lungs for carrying air to and from lungs. Trachea is lined by ciliated mucus secreting pseudostratified epithelium for trapping dust particles and microbes.

Trachea does not collapse in reduced air pressure due to support of C-shaped cartilaginous rings.

3. Answer:



4. Answer: Carbon dioxide is absorbed during night when stomata are open. It is fixed in malic acid from which the same is released during day time for performing Calvin cycle in light.
5. Answer:
  - (a) Guard cells swell up and a stomatal pore is created in between them.
  - (b) Information is transmitted from one plant cell to another through plasmodesmata and hormones.

6. Answer:

(i) Aerobic.  $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{Energy}$

(ii) Anaerobic,

(a)  $C_6H_{12}O_6 \rightarrow 2 \text{ Ethanol} + 2 CO_2 + \text{Energy}$ .

(b)  $C_6H_{12}O_6 \rightarrow 2 \text{ Lactic acid} + \text{Energy}$

7. Answer: Excretion is the biological process of removal of harmful metabolic waste products from the body.

In unicellular organisms, excretion occurs through simple diffusion from the surface.

8. Answer: The major internal energy reserve in plants is starch (a complex carbohydrate). Animals do not have the same energy reserve. Instead, they possess glycogen (and fat).

### ➤ Long Answer:

1. Answer:

(a) Differences between Holozoic Nutrition and Saprophytic Nutrition

Holozoic Nutrition	Saprophytic Nutrition
1. Type. It is ingestive type where solid food is taken in.	It is absorptive type of nutrition where simple soluble substances are taken in.
2. Digestion. It is internal.	Digestion is external.
Examples. Tiger, Cattle.	Examples. Rhizopus, Mushroom.

(b) Role of Liver: Decomposition of haemoglobin, formation and secretion of bile for emulsification of fat. Formation of urea, heparin fibrinogen and prothrombin. Detoxification of chemicals and elimination of pathogens.

Role of Pancreas: Secretion of pancreatic juice having lipase, trypsin and amylase; secretion of hormones, insulin and glucagon.

(c) Absorption of Digested Food. Ileum part of small intestine.

Absorption of Water. Large intestine.

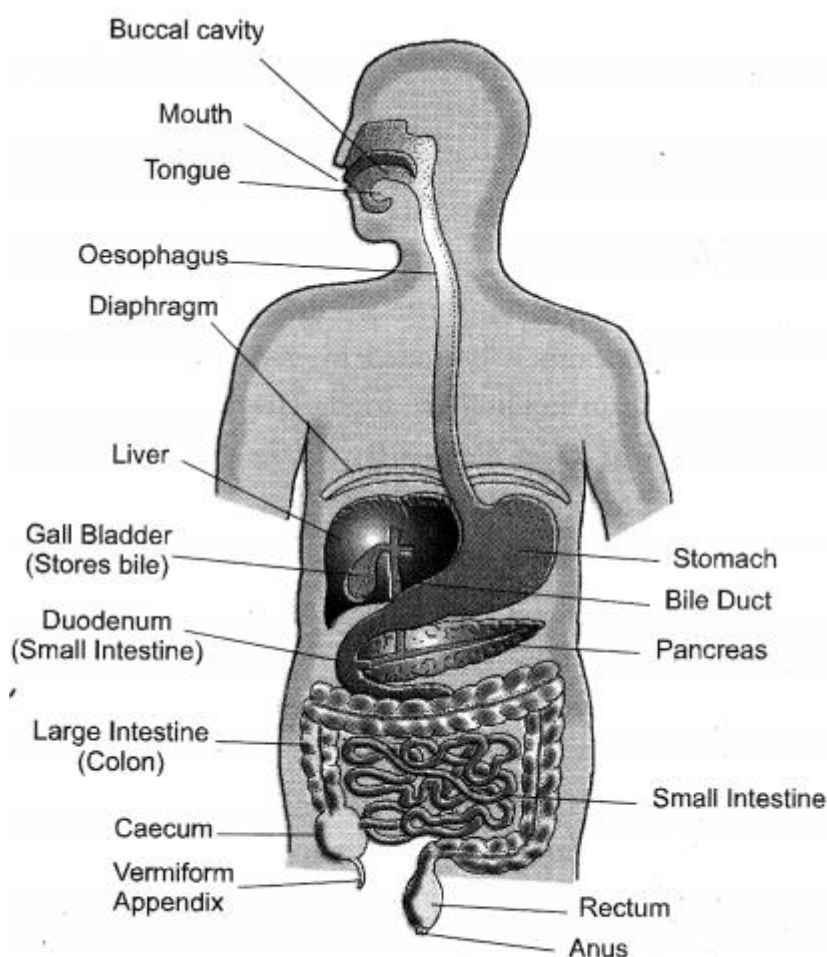
(d) Role of Bile in Digestion.

Breaking of fat into fine globules or emulsification,

Neutralisation of acidity and making food alkaline for action of pancreatic and other enzymes.



2. Answer:



**Fig. 1.13.** Human Alimentary Canal.

Longest Part. Small intestine (about 6 meters).

(b) Separation of Oxygenated and Deoxygenated Bloods in Birds and Mammals.

Energy needs of birds and mammals are higher due to thermoregulation of body and increased activity. They require regular and quicker supply of oxygenated blood for all body parts. This is possible only when there is complete separation of oxygenated blood and quicker oxygenation of deoxygenated blood.

3. Answer:

(a) Three Events of Photosynthesis: Information is transmitted from one plant cell to another through plasmodesmata and hormones.

Role of Stomata in Photosynthesis. Inward diffusion of carbon dioxide and outward diffusion of oxygen.

(b) Sunlight is Essential for Photosynthesis: It is the source of energy for photosynthesis. Light is visible part of the electromagnetic radiations. It has a wavelength of 390-760 nm. Photosynthetically active radiations or PAR are 400-700 nm. Natural source of light is sun but artificial light can also provide energy to plants for their photosynthesis. Plants absorb light mostly in violet-blue and red parts of visible light. Violet-blue light carries more energy as compared to red light.

Plants growing under shade of others receive mostly green and some violet light. They have lower rates of photosynthesis.

Light has two functions, photolysis of water and excitation of chlorophyll to emit electrons. Photolysis of water produces oxygen, protons, and electrons. Electrons and protons (Hydrogen ions) help in producing ATP and NADPH<sub>2</sub>, popularly called assimilatory power.

### ➤ Assertion Reason Answer:

1. (a) Both A and R are true, and R is correct explanation of the assertion.

#### Explanation:

Ventricles are larger and thick-walled chambers of the heart. These act as distribution chambers, as they supply blood to all parts of our body with high pressure.

2. A is true but R is false.

#### Explanation:

The bladder is a bag which stores urine till the time we go to toilet. The urine collected in the bladder is passed out from the body through the urethra.

### ➤ Case Study Answer:

1. i (b) Yeast, mushroom, bread mould.

#### Explanation:

Yeast, mushroom, and bread mould have a saprophytic mode of nutrition which is chemoheterotrophic in nature. They breakdown complex organic substances by secreting digestive enzyme outside their body and absorb simple molecules as nutrients.

- ii. (b) Taenia

- iii. (b) Mushroom

- iv. (c) Utilisation of energy obtained by plants.

#### Explanation:

Heterotrophic nutrition is mode of nutrition in which an organism depends on other living organisms for food.

- v. (d) Cytostome.

#### Explanation:

Feeding apparatus in Paramecium consists of peristome, vestibule, buccal cavity, cytostome (cell mouth) and cytopharynx.

2. i (c) Basophil.

#### Explanation:

Basophiles release heparin, serotonin, and histamine. They are like mast cells of connective tissue and are not phagocytic in nature.

- ii. (c) Significant decrease in platelets count.
- iii. (c) They fight against disease causing germs.

**Explanation:**

WBCs manufacture antibodies, which fight against disease causing germs and are responsible for immunity, thus called soldiers of the body.

- iv. (d) Thrombocytes.
- v. (a) It is similar to the plasma of blood but is colourless and contains less proteins.

**Explanation:**

Lymph is a colourless fluid, which contains blood plasma along with leucocytes and have fewer proteins.

