# Class 10 Solutions Science Chapter 5 Life Processes

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**Q1: Why is diffusion insufficient to meet the oxygen requirements of multicellular organisms like humans?**

**Ans:** Multicellular organisms such as humans possess complex body designs. They have specialized 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.

**Q2: What criteria do we use to decide whether something is alive?**

**Ans:**

If something shows the following characteristics then it is a requirement a living being:

**(i)** It can move on its own.

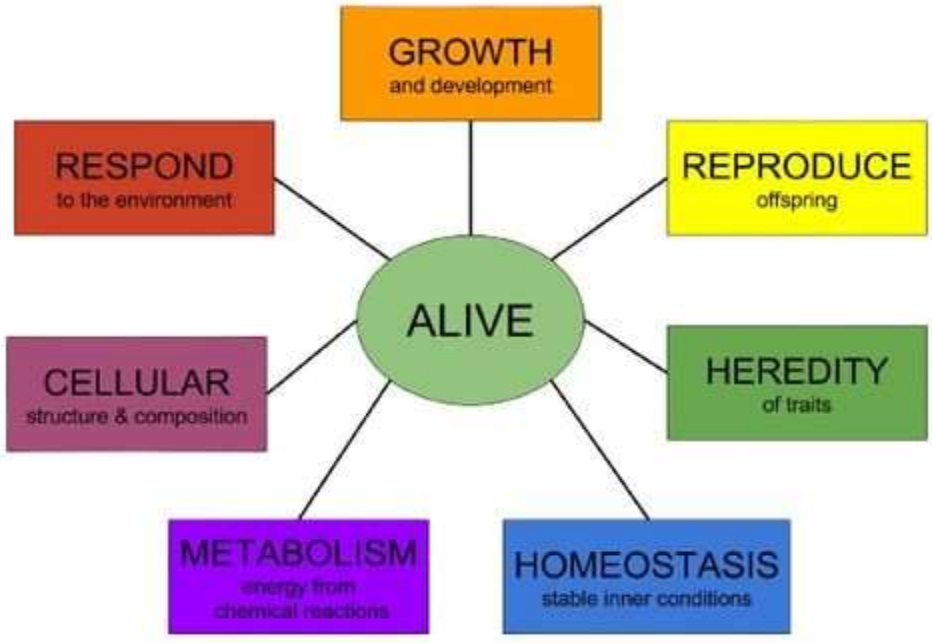
**(ii)** It needs food to get energy and nutrients.

**(iii)** It respires.

**(iv)** It responds to changes that take place in its surroundings.

**(v)** It exhibits growth and development.

**(vi)** It removes its metabolic wastes.




**Characteristics of life**

**Q3: What are outside raw materials used for by an organism?**

**Ans:** 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.

**Q4: What processes would you consider essential for maintaining life?**

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

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**Q1: What are the differences between autotrophic nutrition and heterotrophic nutrition?**
**Ans:**

| Autotrophic Nutrition | Heterotrophic Nutrition |
|---|---|
| Food is synthesised from simple inorganic raw materials such as $CO_2$ and water. | Food is obtained directly or indirectly from autotrophs. This food is broken down with the help of enzymes. |
| Chlorophyll is required. | Chlorophyll is not required. |
| Food is generally prepared during day time. | Food can be obtained at all time. |
| All green plants and some bacteria have this type of nutrition. | All animals and fungi have this type of nutrition. |

**Q2: Where do plants get each of the raw materials required for photosynthesis?**
**Ans:** The following raw materials are required for photosynthesis:

- Carbon Dioxide: Plants get $CO_2$ from the atmosphere through stomata.
- Water: Plants absorb water from the soil through roots and transport it to leaves.
- Sunlight: Sunlight, which is absorbed by the chlorophyll and other green parts of the plant.

**Q3: What is the role of the acid in our stomach?**
**Ans:** Following are the roles of acid in our stomach:
**(i)** It creates an acidic medium for the action of the proteolytic enzyme pepsin.
**(ii)** Kills harmful bacteria present in the food.
**(iii**) Inactivates salivary amylase.
**(iv)** Prevents fermentation of food.
**(v)** HCl converts inactive pepsinogen into active pepsin.

**Q4: What is the function of digestive enzymes?**
**Ans:** Digestive enzymes such as amylase, lipase, pepsin, trypsin, etc. help in the breakdown 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.

**Q5: How is the small intestine designed to absorb digested food?**
**Ans:** 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 bloodstream. From the bloodstream, the absorbed food is delivered to each and every cell of the body.

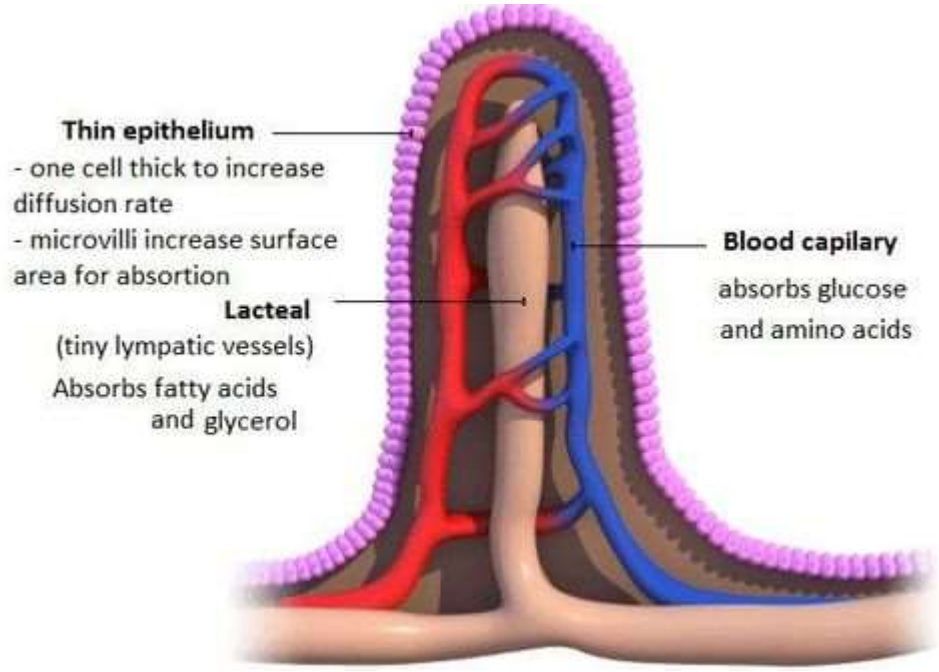


**Fig: Longitudinal section of villi**

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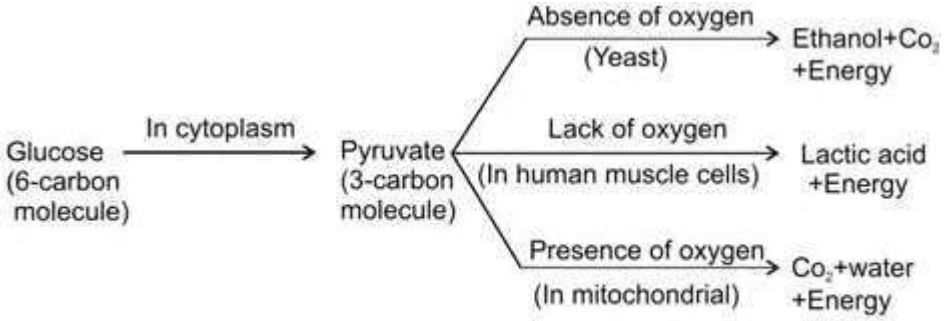
**Q1: What advantage over an aquatic organism does a terrestrial organism have with regard to obtaining oxygen for respiration?**

**Ans:** Terrestrial organisms take up oxygen from the atmosphere, whereas aquatic animals obtain oxygen from water. Air contains more $O_2$ as compared to water. Since the content of $O_2$ in the air is high, terrestrial animals do not have to breathe faster to get more oxygen. Therefore, unlike aquatic animals, terrestrial animals do not need adaptations for gaseous exchange.

**Q2: What are the different ways in which glucose is oxidized to provide energy in various organisms?**

**Ans:** At first, glucose (6 carbon molecules) is broken in the cytoplasm of cells of all organisms. This process yields a 3-carbon molecule compound called pyruvate.

Further breakdown of pyruvate takes place in different manners in different organisms.




**(Break down of glucose by various pathways)**

- Anaerobic Respiration: This process takes place in the absence of oxygen, e.g., in yeast during fermentation. In this case, pyruvate is converted into ethanol and carbon dioxide.

- Aerobic Respiration: In aerobic respiration, the breakdown of pyruvate takes place in the presence of oxygen to give rise to 3 molecules of carbon dioxide and water. The release of energy in aerobic respiration is much more than anaerobic respiration.
- Lack of Oxygen: Sometimes, when there is a lack of oxygen, especially during vigorous activity, in our muscles, pyruvate is converted into lactic acid (3-carbon molecule compounds). The formation of lactic acid in muscles causes cramps.

**Q3: How is oxygen and carbon dioxide transported in human beings?**
**Ans:** Haemoglobin transports oxygen molecules to all the body cells for cellular respiration. The hemoglobin pigment present in the blood gets attached to four $O_2$ molecules that are obtained from breathing.
It thus forms oxyhemoglobin and the blood becomes oxygenated. This oxygenated blood is then distributed to all the body cells by the heart. After giving away $O_2$ to the body cells, blood takes away $CO_2$, which is the end product of cellular respiration. Now, the blood becomes deoxygenated.
Since hemoglobin pigment has less affinity for $CO_2$, $CO_2$ is mainly transported in the dissolved form. This deoxygenated blood gives $CO_2$ to lung alveoli and takes $O_2$ in return.

**Q4: How are the lungs designed in human beings to maximize the area for the exchange of gases?**
**Ans:** 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 the 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.

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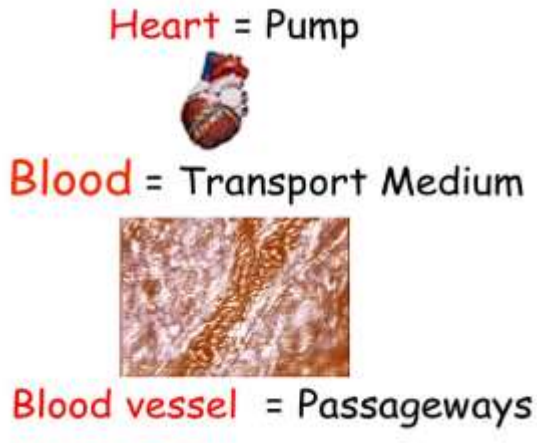
**Q1: What are the components of the transport system in human beings? What are the functions of these components?**
**Ans:** The main components of the transport system in human beings are the heart, blood, and blood vessels.




**Heart: The 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.
**Blood:** Blood helps in the transport of oxygen, nutrients, $CO_2$, and nitrogenous wastes.
**Blood Vessels:** 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.

**Q2: Why is it necessary to separate oxygenated and deoxygenated blood in mammals and birds?**
**Ans:** Warm-blooded animals such as birds and mammals maintain 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 ($O_2$) 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 deoxygenated blood so that their circulatory system is more efficient and can maintain their constant body temperature.

**Q3: What are the components of the transport system in highly organized plants?**
**Ans:** In highly organized 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. The phloem transports food materials from the leaves to different parts of the plant body.

**Q4: How are water and minerals transported in plants?**
**Ans:** 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.

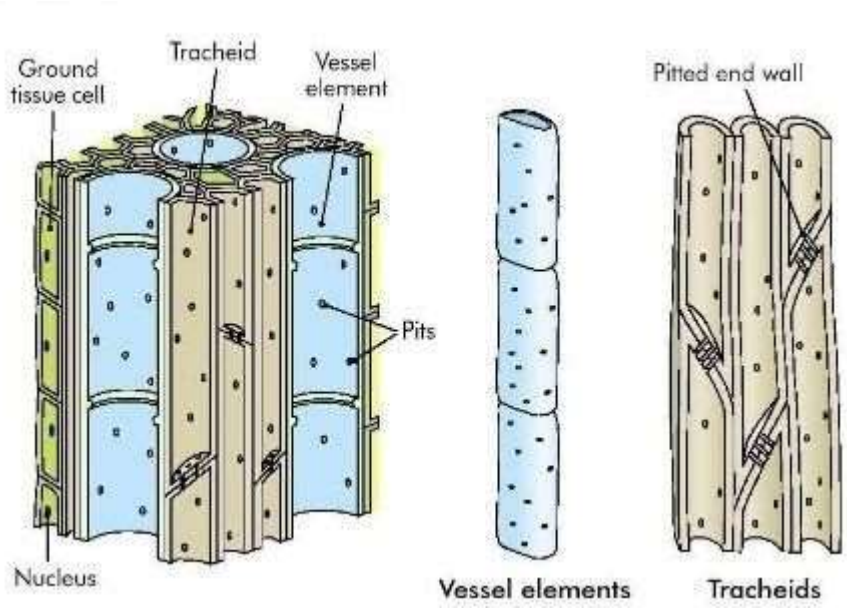


Fig: Xylem tissue

**Q5: How is food transported in plants?**
**Ans:** 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

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**Q1: Describe the structure and functioning of nephrons.**
**Ans:** Nephrons are the basic filtering units of the kidneys. Each kidney possesses a large number of nephrons, approximately 1-1.5 million. The main components of the nephron are the glomerulus, Bowman's capsule, and a long renal tubule.

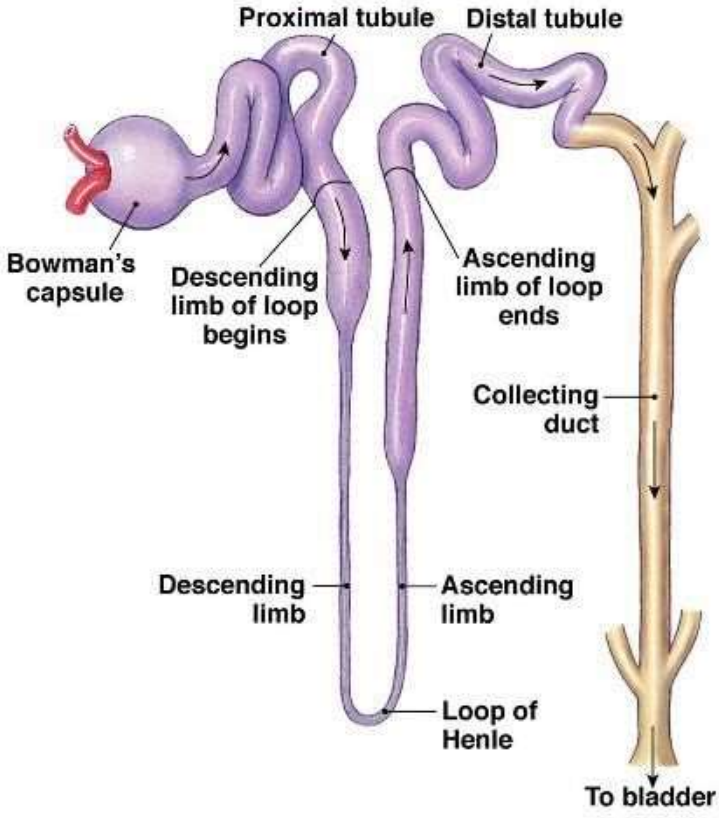

**Fig: Structure of Nephron**

**Functioning of a nephron:**
The blood enters the kidney through the renal artery, which branches into many capillaries associated with the 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 a ureter. From the ureter, it gets transported to the urinary bladder and then into the urethra.

**Q2: What are the methods used by plants to get rid of excretory products?**
**Ans:** Plants can get rid of excess of water by transpiration. Waste 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.

**Q3: How is the amount of urine produced regulated?**
**Ans:** The amount of urine produced depends on the amount of excess water and dissolved wastes present in the body. Some other factors, such as habitat of an organism and hormone such as Antidiuretic hormone (ADH), also regulates the amount of urine produced.

**Exercise: Page No. 99**

**Q1: The kidneys in human beings are a part of the system for**
**(a) nutrition**
**(b) respiration**
**(c) excretion**
**(d) transportation**
**Ans:** (c) In human beings, the kidneys are a part of the system for excretion.

**Q2: The xylem in plants are responsible for**
**(a) transport of water**
**(b) transport of food**
**(c) transport of amino acids**
**(d) transport of oxygen**
**Ans:** (a) In a plant, the xylem is responsible for transport of water.

**Q3: The autotrophic mode of nutrition requires**
**(a) carbon dioxide and water**
**(b) chlorophyll**
**(c) sunlight**
**(d) all of the above**
**Ans:** (d) The autotrophic mode of nutrition requires carbon dioxide, water, chlorophyll and sunlight.

**Q4: The breakdown of pyruvate to give carbon dioxide, water and energy takes place in**
**(a) cytoplasm**
**(b) mitochondria**
**(c) chloroplast**
**(d) nucleus**
**Ans:** (b) The breakdown of pyruvate to give carbon dioxide, water and energy takes place in mitochondria.
**Q5: How are fats digested in our bodies? Where does this process take place?**
**Ans:** Fats are present in the form of large globules in the small intestine. The small intestine

receives the secretions 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 enzyme lipase can easily act on them. This is referred to as emulsification of fats. This process takes place in the small intestine.

**Q6: What is the role of saliva in the digestion of food?**

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

**Q7: What are the necessary conditions for autotrophic nutrition and what are its by-products?**

**Ans:** 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 $O_2$ are the by-products of photosynthesis.

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

**Q8: What are the differences between aerobic and anaerobic respiration? Name some organisms that use the anaerobic mode of respiration.**

**Ans:**

| Aerobic respiration | Anaerobic respiration |
|---|---|
| It occurs in the presence of $O_2$. | It occurs in the absence of $O_2$. |
| It involves the exchange of gases between the organism and the outside environment. | Exchange of gases is absent. |
| It occurs in cytoplasm and mitochondria. | It occurs only in cytoplasm. |
| It always releases $CO_2$ and $H_2O$. | End products vary. |
| It always releases $CO_2$ and $H_2O$. | End products vary. |

**Q9: How are the alveoli designed to maximize the exchange of gases?**

**Ans:** The alveoli are the small balloon-like structures present in the lungs. The walls of the alveoli consist of an extensive network of blood vessels. Each lung contains 300−350 million alveoli, making it a total of approximately 700 million in both lungs. The alveolar surface, when spread out, covers about 80 $m^2$ area. This large surface area makes the gaseous exchange more efficient.

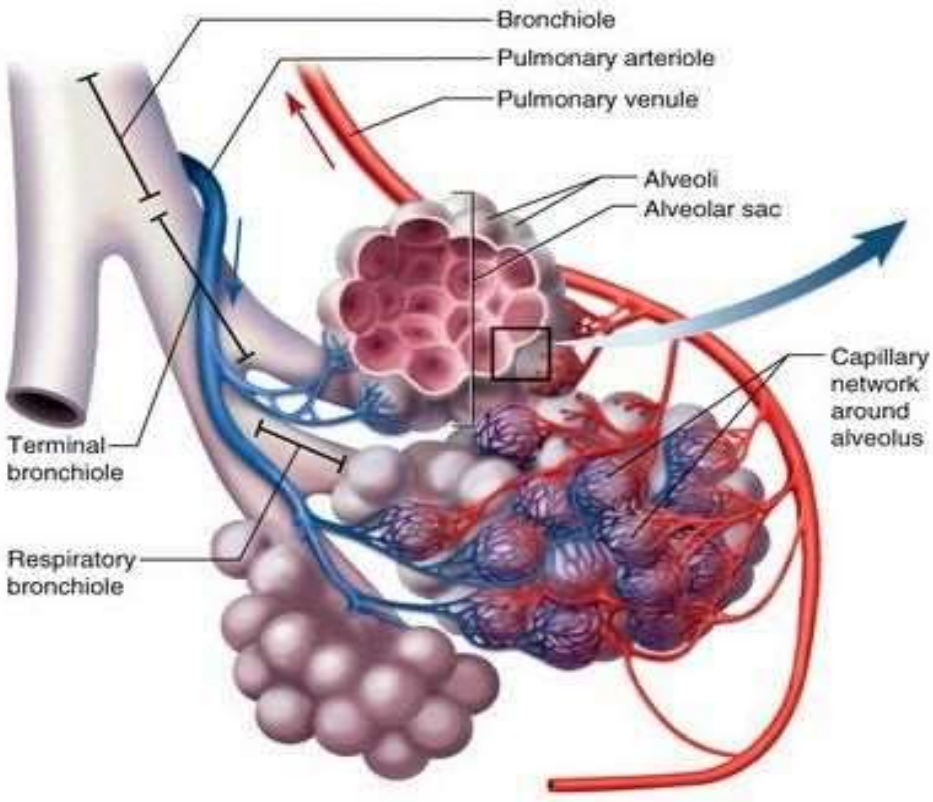


**Fig: Alveoli and capillaries**

**Q10: What would be the consequences of a deficiency of hemoglobin in our bodies?**
**Ans:** Haemoglobin is the respiratory pigment that transports oxygen to the body cells for cellular respiration. Therefore, a deficiency of hemoglobin in the blood can affect the oxygen-supplying capacity of blood. This can lead to a deficiency of oxygen in the body cells. It can also lead to a disease called anemia.

**Q11: Describe double circulation in human beings. Why is it necessary?**
**Ans:** 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 deoxygenated blood from the upper and lower regions of the body respectively and supplies this deoxygenated blood to the right atrium of the heart.

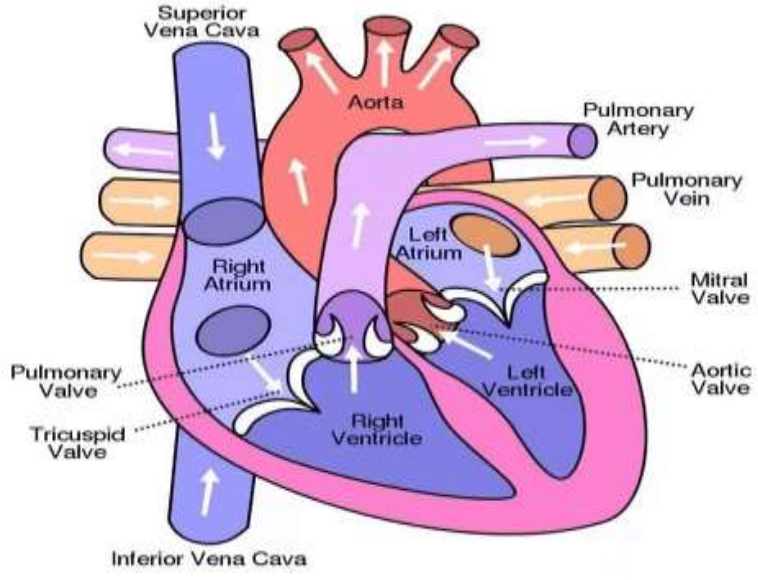


**Fig: Structure of heart**

**The flow of blood in the human heart**

- The right atrium then contracts and passes the deoxygenated 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 pump it to the lungs, where the blood becomes oxygenated. From the lungs, the pulmonary veins transport the oxygenated blood to the left atrium of the heart.
- Then, the left atrium contracts and through the auriculo-ventricular aperture, the oxygenated blood enters the left ventricle.
- The blood passes to the aorta from the left ventricle. The aorta gives rise to many arteries that distribute the oxygenated blood to all the regions of the body.

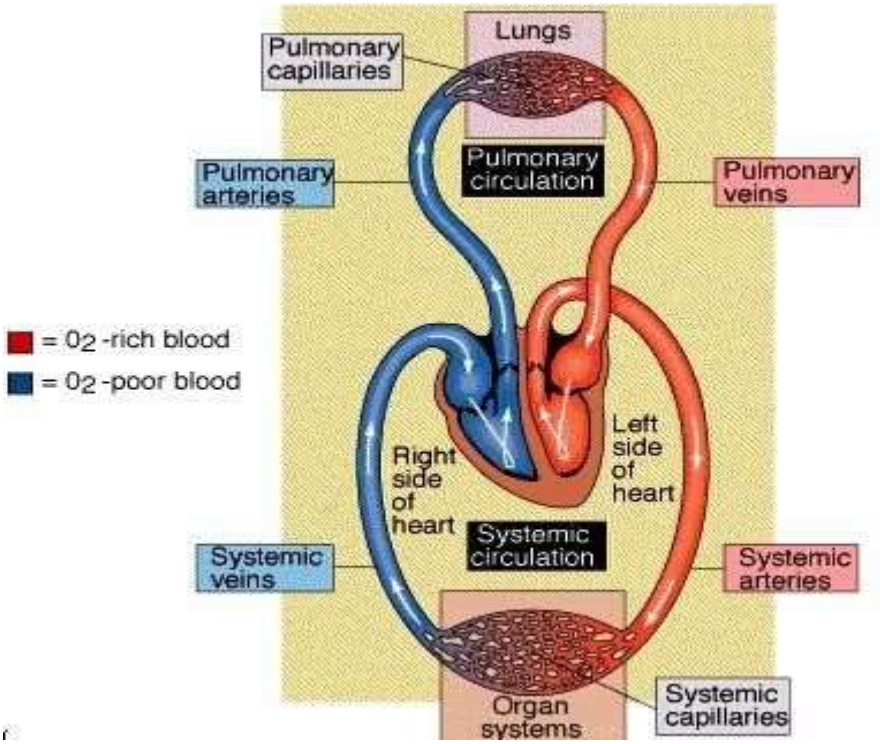


**Fig: Flow of blood**

**Schematic diagram of blood circulation in humans**

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 $O_2$ for more respiration so that they can produce more energy to maintain their body temperature. Thus, the circulatory system of humans is more efficient because of the double circulatory heart.

**Q12: What are the differences between the transport of materials in xylem and phloem?**
**Ans:**

| Transport of material in Xylem | Transport of material in Phloem |
|---|---|
| 1. The xylem supplies water from the roots to the stem and leaves. | 1. Phloem transports food resources from leaves to other plant portions. |
| 2. Water is transported from ascending roots to aerial parts of the plants. | 2. The movement of food in phloem is bidirectional. |
| 3. Physical forces such as transpiration pull are required for transport in the xylem. | 3. The transport of food through the phloem requires ATP (Adenosine triphosphate) energy. |

**Q13: Compare the functioning of alveoli in the lungs and nephrons in the kidneys with respect to their structure and functioning.**
**Ans:**

| **Alveoli** | **Nephrons** |
|---|---|
| **Structure** | **Structure** |
| Alveoli are tiny balloon-like structures present inside the lungs. | Nephrons are tubular structures present inside the kidneys. |
| The walls of the alveoli are one cell thick and it contains an extensive network of blood capillaries. | Nephrons are made of glomerulus, bowman's capsule, and a long renal tube. |
| **Function** | **Function** |
| The exchange of 02 and C02 takes place between the blood of the capillaries that surround the alveoli and the gases present in the alveoli. | The blood enters the kidneys through the renal artery. The blood is entered here and the nitrogenous waste in the form of urine is collected by collecting duct. |
| Alveoli are the site of gaseous exchange. | Nephrons are the basic filtration unit. |