



X CBSE

BIOLOGY LIFE PROCESS
TRANSPORTATION

YOUR GATEWAY TO EXCELLENCE IN
IIT-JEE, NEET AND CBSE EXAMS

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LIFE PROCESS: TRANSPORTATION
 CBSE BIOLOGY ANIMALS

TRANSPORT SYSTEM IN HUMAN

All parts of multicellular organisms need a supply of different substances like oxygen, nutrients, etc. and the removal of metabolic wastes produced in them. Thus, the essential requirement of an organism is the transport of materials from the parts of the body where they are formed or taken up to other parts where they are consumed/needed or get rid of. This function is performed by some extracellular fluids which flow throughout the body. This flow is called circulation and the structures concerned with this circulation constitute Circulatory System or Transport System.

Transport system or circulatory system in human beings consists of:

- A pumping organ - heart
- System of blood vessels - arteries and veins
- Circulatory medium - blood and lymph.

Pumping organ - Heart

The heart is a hollow muscular pumping organ about the size of one's fist. It lies obliquely in the thorax between the lungs immediately above the diaphragm. Its lower conical part is tilted to the left. It is enclosed in a bony cage formed of ribs, backbone and sternum bones.

Heart is enclosed in a double-layered membranous sac called pericardium. Between the two layers of pericardium lies the pericardial injury and friction.

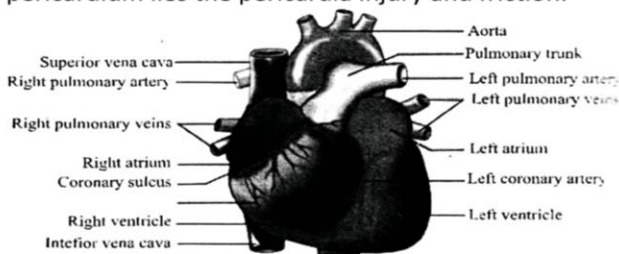


Fig. External features of human heart.

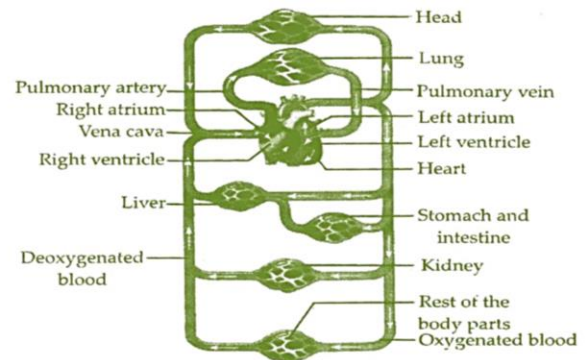
Human heart is divided into right and left half. Each half consists of upper thin-walled atrium or auricle and lower comparatively thick-walled ventricle. The auricles are receiving chambers and ventricles act as pumping chambers. Walls of auricles are thinner because they have to receive the blood, while walls of ventricles are thick because they have to pump the blood.

Four chambers of the heart are left auricle, left ventricle, right auricle and right ventricle.

Auricles are externally demarcated from ventricles by an irregular groove called coronary sulcus.

The ventricles are externally demarcated by an oblique groove known as interventricular sulcus. Internally the two auricles are separated by interauricular septum while partition between two ventricles is known as interventricular septum.

Left auricle receives oxygenated blood from lungs by pulmonary veins. Right auricle receives the deoxygenated blood from upper and lower parts of the body by superior vena cava and inferior vena cava, respectively. Auricles relax while receiving the blood (auricles are said to be in a diastole condition).



Net both the auricles contract (auricles are said to be in a systole condition). The Fig.: Circulation of blood in human body blood from left auricle is passed to left ventricle through the opening guarded by bicuspid valve (valve having two cusps or flaps) or mitral valve. Similarly the blood from right auricle is passed to right ventricle, the opening is guarded by tricuspid valve. Both the ventricles relax while receiving the blood from the auricles.

Then both the ventricles contract (ventricular systole), both bicuspid and tricuspid valves close, so that blood can't move back to auricles. Oxygenated blood from left ventricle is passed to the body by aorta (largest artery) and deoxygenated blood from right ventricle is passed to lungs for oxygenation by pulmonary aorta, which divides into left and right pulmonary artery. At the base of each aorta and pulmonary aorta are present three semilunar cusps (semilunar valves) which prevent backward flow of blood from aorta.

Vertebrate heart

The separation of right and left sides of heart is useful to keep oxygenated deoxygenated blood from mixing. Such a supply is useful for animals which have to use energy constantly to maintain their body temperature like birds and mammals. The animals which do not use energy to maintain their body temperature and their body temperature varies with environmental temperature like, amphibians have three-chambered heart and tolerate some mixing of oxygenated and deoxygenated blood. Fishes have only two chambered heart. The deoxygenated blood is pumped to the gills, where it is oxygenated and directly passed to the body parts.

Thus, in fishes blood is passed only once to the heart in one circulation. In human beings deoxygenated blood is passed to heart, then it is oxygenated in lungs and carried back again to heart. From heart, oxygenated blood is passed to all body parts. Thus,

blood flows twice in heart during each cycle. This is known as double circulation.

System of vessels - Arteries and Veins

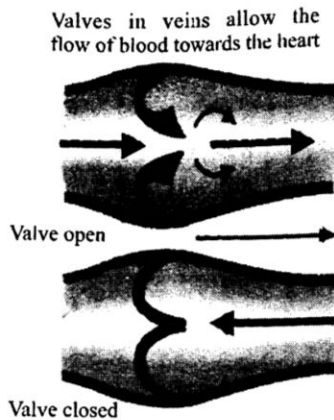
Blood vessels are a system of channels through which blood flows. Blood vessels are of three kinds, namely arteries, veins and capillaries.

Arteries are the blood vessels which carry blood from heart to various parts of the body. All arteries (except pulmonary artery) carry oxygenated blood. Pulmonary arteries carry deoxygenated blood from right ventricle to lungs.

Arteries have thick, elastic and muscular walls. They are not provided with valves. In arteries blood flows under pressure and with jerks.

Veins carry blood from body parts towards the heart. All veins (except pulmonary veins) carry deoxygenated blood. Pulmonary veins carry oxygenated blood from lungs to left auricle. Veins have thin, less elastic and muscular walls in comparison to arteries.

The lumen of veins are provided with valves to prevent the back flow of blood.



Capillaries are fine microscopic vessels. Arteries branch out into smaller and smaller arterioles which finally form capillaries. These capillaries join to form venules, veins and finally vena cava. Wall of capillaries is one cell thick. Through these thin walls, oxygen and carbon dioxide, dissolved food and excretory products are exchanged with tissues.

Measuring blood pressure

Blood pressure is the pressure against the wall of blood vessels produced by the discharge of blood into them by contraction of the left ventricle. The blood pressure is high in the arteries. It gradually drops in the capillaries, and becomes very low in the veins. Fluids always flow from area of high pressure to areas of lower pressure.

Blood pressure is generally measured by determining the millimeters of mercury (Hg) displaced in a pressure gauge called sphygmomanometer. A common sphygmomanometer has an inflatable bag-like cuff, a compressible bulb, a screw for releasing pressure, a mercury manometer and two rubber tubes connecting the bulb and manometer with cuff. Cuff is wrapped around the upper arm and is rapidly inflated with a hand pump. The sound of blood flow can be heard through a stethoscope. This sound of blood rushing through the arteries at peak pressure is due to vermicular contraction. This indicates systolic blood pressure (120 mm of Hg). A screw is used for releasing pressure, and pressure in cuff continues to drop. The sound fades, until it stops. The reading indicates the diastolic blood pressure (80 mm of Hg). The normal blood pressure of a human being is

written as $\frac{120}{80}$.

Blood

Blood is a liquid connective tissue. Blood has a fluid matrix called plasma and three kinds of blood corpuscles suspended in it.

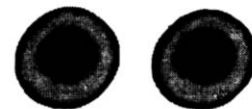
Plasma

It is pale coloured fluid which contributes 55% of blood volume. Plasma contains 90 to 92% of water and 8 to 10% of the following substances:

- Plasma proteins mainly albumin, globulins and fibrinogen.
- Nutrients like glucose, amino acids, fatty acids and glycerol.
- Respiratory gases like oxygen and carbon dioxide.
- Excretory substances like ammonia, urea, uric acid, creatinine, etc.
- Mineral ions such as Na^+ , K^+ , Ca^{2+} , Mg^{2+} , Cl^- , HCO_3^- , PO_4^{3-} .
- Enzymes, hormones, antibodies.

Blood corpuscles

They form 45% of blood and remain suspended in blood plasma. These are of three types: Red blood corpuscles (RBCs) or erythrocytes, white blood corpuscles (WBCs) or leucocytes and blood platelets or thrombocytes.



Red blood corpuscles

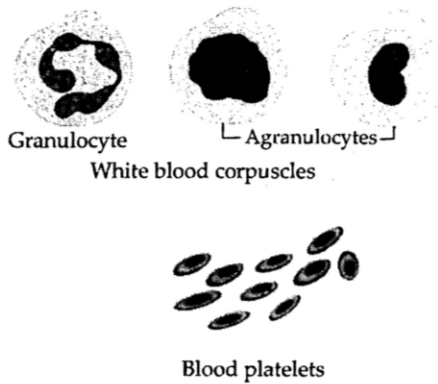


Fig. Blood corpuscles in human blood

- Red blood corpuscles:** These are biconcave disc-like structures. Their number is 5 to 5.5 million/mm³ in human males and 4.5 to 5 million/mm³ in human females. They contain iron pigment haemoglobin, which impart red colour to the blood. RBCs are manufactured in bone marrow. Their life-span is about 120 days after which they are destroyed by liver and spleen. Their small size helps in absorbing oxygen and enables them to travel in very fine blood capillaries throughout the body of a person.
- White blood corpuscles:** These are nucleated and amoeboid cells. Leucocytes are of two types - granulocytes containing granular cytoplasm and lobed nucleus and agranulocytes, containing smooth cytoplasm and unlobed nucleus. Leucocytes are capable of squeezing out of capillaries to destroy foreign matter. WBCs also manufacture antibodies, which fight against disease-causing germs and are responsible for immunity. In fact white blood corpuscles are called soldiers of the body. They are manufactured in bone marrow.
- Blood platelets:** These are small, disc-like bodies. These are enucleated and are manufactured in the bone marrow. They are $2.5-3.5 \times 10^5 / \text{mm}^3$ in number. When we get some injury and blood vessel is ruptured, the blood flows through it. If bleeding does not stop, the excessive loss of blood may lead to death. To avoid this situation, the body has its own natural device. The blood loss is prevented by forming a blood clot which plugs the injury and checks the blood leakage. The platelets play a major role in forming the blood clot.

Lymph

When blood flows into thin capillaries some amount of plasma filters out of thin capillaries.

This fluid is called interstitial fluid or tissue fluid or lymph. As it bathes the cells and lies outside the cells, lymph is also called extracellular fluid. It is colourless and contains lymphocytes.

Unlike blood, lymph does not contain red blood corpuscles, platelets and plasma proteins.

Lymph flows only in one direction that is from tissues to heart.

From the intercellular space, lymph drains into lymphatic capillaries, which join to form large lymph vessels that finally open into larger veins.

The functions of lymph are as under:

- It transports fatty acids and glycerols from small intestine to blood.
- Lymphocytes present in it destroy harmful pathogens.
- It drains excess tissue fluid from intercellular spaces back into the blood.
- It carries lymphocytes and antibodies from lymph nodes to the blood.
- Lymph nodes localize the infection and prevent it from spreading to other body parts.

Lymph vessels along with lymph nodes and lymph glands constitute lymphatic system.

Table: Differences between blood and lymph.

Characteristic	Blood	Lymph
1. Colour	Red in colour	Colourless
2. Components	<ul style="list-style-type: none"> Consists of plasma, erythrocytes, leucocytes and platelets. Contains several plasma proteins and high concentration of calcium and phosphorus. 	<ul style="list-style-type: none"> Consists of plasma and leucocytes only. Contains fewer plasma proteins and low concentration of calcium and phosphorus.
3. Flow	Flow rapidly.	Flow is very slow.
4. Direction of flow	Path of circulation is heart to body organs and from body organs back to heart.	Path of circulation is body tissues to heart.

ILLUSTRATION

23. What are the components of the transport system in human beings? What are the functions of these components?

Ans. The components of the human transport system are – blood vascular system and lymphatic system.

Blood vascular system: It consists of heart, blood vessels and blood.

(i) Heart: It is a muscular pumping organ which keeps the circulating medium (blood) in a state of contiguous movement.

(ii) Blood vessels: These are channels through which blood flows. Blood vessels are of three types.

(a) Arteries: They carry oxygenated blood from the heart to different parts of the body.

(b) Veins: They transport deoxygenated blood from different parts of the body back to the heart.

(c) Capillaries: Help in exchange of material between blood and living cells through tissue fluid.

(ii) Blood: It consists of plasma and corpuscles (RBCs, WBCs and platelets)

(a) Plasma: It is the liquid part of the blood which helps in transport of hormones, nutrients, excretory matter, etc.

(b) RBCs: Help in transport of respiratory gases $-O_2$ and CO_2 .

(c) WBCs. Act as soldiers of the body

(d) Platelets: Help in blood clotting.

Lymphatic system: It is a network of thin walled vessels. It consists of lymph, lymphatic vessels and lymph nodes.

(i) Lymph: Helps in transport of respiratory gases, fatty glycerol, vitamins, etc. inside body.

(ii) Lymphatic vessels: Collect lymph and transport it to the veins.

(iii) Lymph node: Helps in formation of lymphocytes.

24. Why is it necessary to separate oxygenated and deoxygenated blood in mammals and birds?

Ans. Mammals and birds are warm-blooded animals. The metabolic rate of their body is higher than those of the other animals and so such their energy requirement is also more. For this, they need energy to maintain the body temperature. Thus, it is necessary to separate oxygenated and deoxygenated blood so that the required amount of oxygen could be available to the cells and tissues.

25. What are the components of the transport system in highly organized plants?

Ans. Transport system in highly organized plants consists of two main components – xylem and phloem.

(i) Xylem: It is responsible for transport of water and minerals and its components are –

xylem vessels, xylem tracheids, and xylem parenchyma and xylem fibres

(ii) Phloem: It is responsible for transport of blood substances and its components are – sieve tubes, companion cells, and phloem parenchyma and phloem fibres.

26. How are water and minerals transported in plants?

Ans. The upward movement of water and minerals salts from roots of the aerial parts of the plant leaves, shoots, flowers, etc. against the gravitational force occurs through the process of ascent of sap. In xylem tissue, vessels and tracheids of the roots, stems and leaves are interconnected to form a continuous system of water conducting channels reaching all parts of the plant.

The water, along with dissolved minerals from root hairs, passes into xylem vessels through cells of the cortex endodermis and pericycle and then ascent of sap takes place from xylem of the roots to the xylem of stem and leaves through vessels and tracheids. Evaporation of water molecules from the cells of leaves (transpiration) creates a suction which pulls the water from the root towards the upper parts of the plant.

27. How is food transported in plants?

Ans. Food molecules are synthesized in the green parts of the plant (leaves), from where it is transported to all the parts of plant through phloem. Food from the area of its manufacture enters into sieve tubes of phloem and gets transported as a dilute aqueous solution the movement of nutrients may be in upward or downward direction. Companion cells of the phloem help in this process. The transport of food from leaves to different parts of the plant is termed as translocation. The transport of nutrients occurs through physical forces but enter and exit of nutrients from the phloem occurs only through an active process utilizing energy form ATP. Entry of nutrients into phloem increases the osmotic pressure of the tissue, causing water to move into it due to endosmosis. The pressure moves the material in the phloem to tissues which have less pressure. In this way, according to the plant's requirement, the nutrients get translocated.

28. Why is the fish heart called a venous heart? What type of blood circulation does it represent?

Ans. Fish heart is two-chambered-one auricle and one ventricle. Since the heart always contains deoxygenated (impure) blood, the fish heart is called a venous heart.

Fish heart represents single blood circulation, as the blood passes only once through the heart during a single cardiac cycle.

29. Why are plants growing in arid regions mostly deep rooted?

Ans. Water is unavailable in the top layer of the soil in arid conditions. Therefore, plant roots go deep in the arid soil in order to absorb maximum amount of water. Shallow rooted plants cannot survive in arid zone.

30. Water fails to translocate in gymnosperms. Give reason.

Ans. The xylem vessel system is the principal pathway by which water is translocated in

angiosperms. The vessels of xylem tissue form a network of ducts that extends to all parts of the plant and provides an easy accessible supply of water. However, xylem vessels are not present in gymnosperms and in this group, the tracheids form the principal pathway of water translocation.

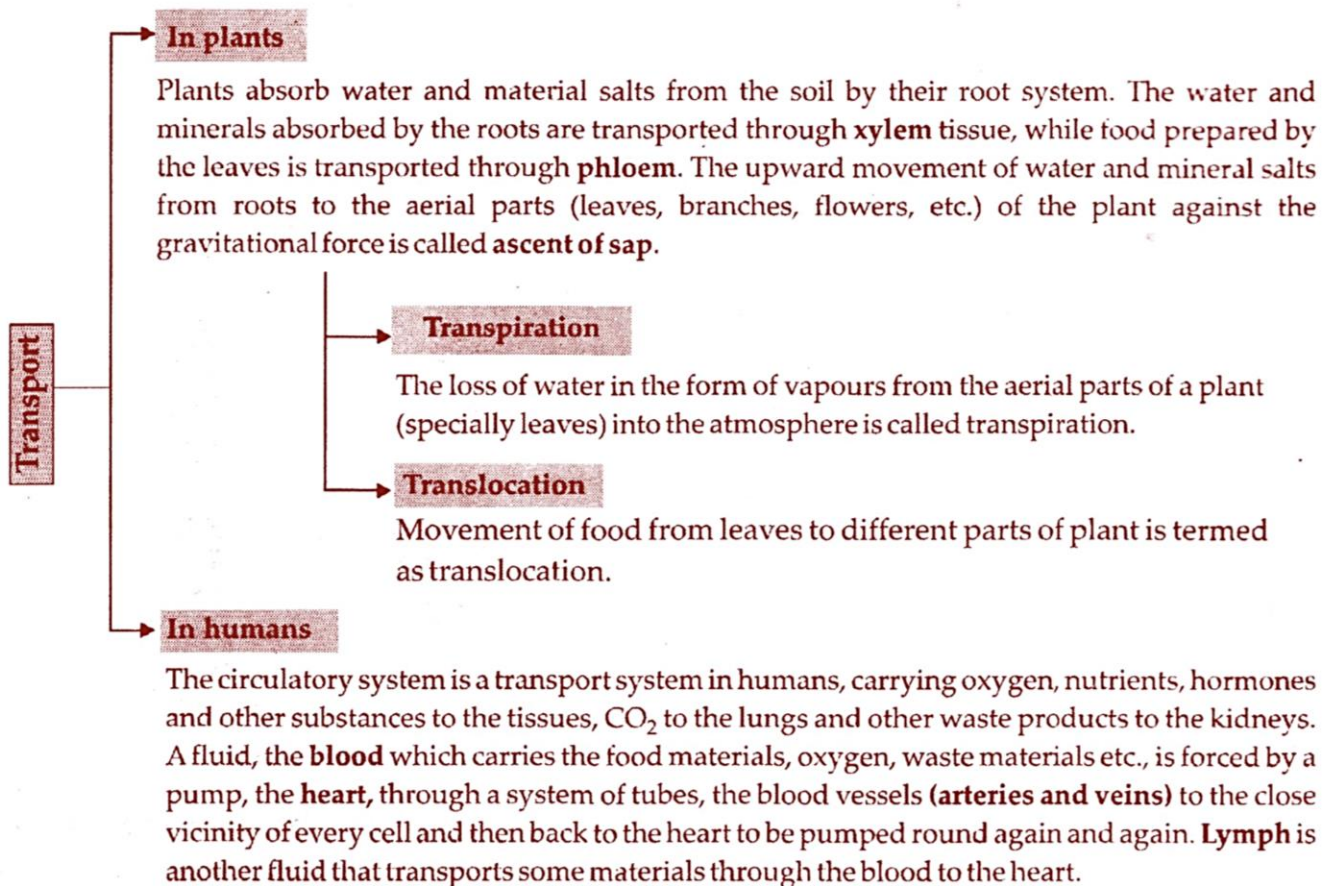
31. Deficiency of vitamin K causes late clotting of blood. Give reason.

Ans. Prothrombin is an inactive enzyme which is produced continuously from the liver as its life is only 24 hours Vitamin K is necessary for the formation of prothrombin. Without prothrombin, clotting is not possible as its active form, thrombin, converts fibrinogen into fibrin which forms the clot. Hence, vitamin K deficiency causes lesser production of prothrombin, resulting in delayed clotting of blood at the site of wound or damaged tissues.

CONCEPT MAP

Transport of materials in body

The transport of substances like oxygen, food, water, enzymes, hormones, etc. inside the body of an organism is called internal transport and the organs which carry out this transport within the body together constitute the internal transport system.



Life Processes III : Transportation

Quick Revision

Transportation is a life process in which a substance absorbed (or made) in one part of the body of an organism is carried to other parts of the body through the circulating fluids like blood and lymph.

1. Components of Transport System in Humans

The transport system of human beings consists of a circulating fluid called **blood**, which is pumped by a muscular organ known as **heart** and a system of interconnecting tubes, i.e. **blood vessels**.

2. Blood

- It is a red-coloured fluid connective tissue that circulates in our body.
- It supplies nutrients and oxygen, to all living cells and collects waste products and carbon dioxide to be thrown out.
- It helps in regulation of pH and body temperature.

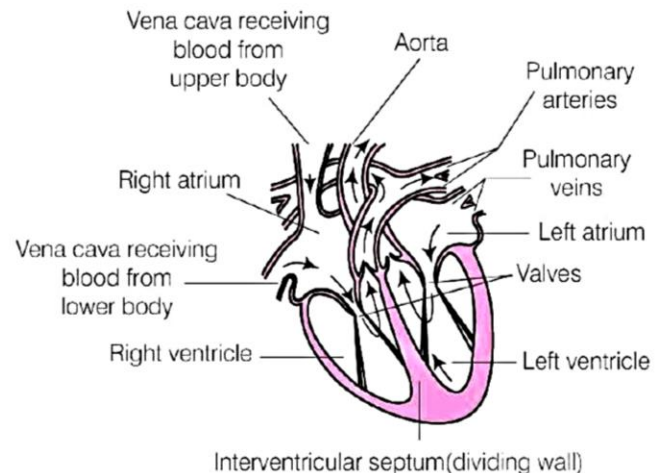
3. Maintenance by Platelets

- It is usually done in case of injury when there is bleeding and loss of blood has to be minimised.
- To prevent leakage, platelet cells in blood circulate around the body and form a mesh-like structure or clot at the site of injury.
- Blood clotting is a mechanism that prevents the loss of blood at the site of an injury or wound by forming a blood clot.

4. Heart

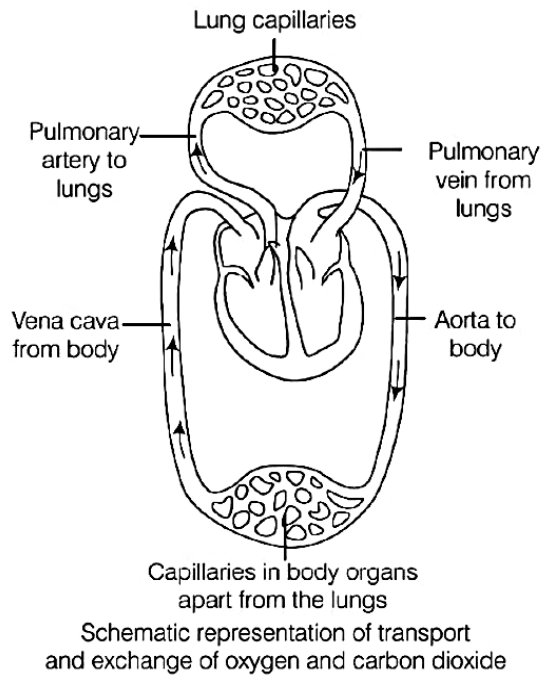
- The heart acts like a pumping machine in our body that pushes out the blood into the blood vessels.
- It is a muscular organ having size as big as our fist.

- The heart is situated between the lungs slightly towards the left side of the chest.
- Human heart is four-chambered (i.e. two **upper atria** and two **lower ventricles**).
- These different chambers are meant to prevent mixing of oxygenated (rich in oxygen) and deoxygenated (rich carbon dioxide) blood.



Schematic sectional view of the human heart

- Oxygen rich blood from lungs comes to thin-walled upper chamber of the heart, left atrium which relaxes (while collecting this blood) and contracts and transfer blood to left ventricle during which it expands, the left ventricle then contracts and blood is pumped to the body parts.
- Deoxygenated blood enters in right atrium and when it contracts, it transfers blood to right ventricle, which again pumps blood to the lungs for oxygenation.
- Ventricles have thick walls than atrium because they have to pump blood into various organs.



5. Blood Vessels

There are three types of vessels involved in blood circulation, i.e. arteries, veins and capillaries.

- (i) **Arteries** The arteries have thick, muscular and elastic walls which carry blood at high pressure. They do not have valves. They carry blood away from the heart to various organs of the body.
- (ii) **Veins** The veins have thin walls than arteries which carry blood at low pressure. They have valves to prevent the backflow of blood. They collect the blood from different organs and brings it back to the heart.
- (iii) **Capillaries** They are formed when artery divides into smaller tubes. They have valves to prevent the backflow of blood. The walls of capillaries are one cell thick. Exchange of materials between blood and surrounding thick cells takes place across the thin walls of capillaries.

6. Blood Circulation in Animals

- In birds and mammals, heart is four-chambered and oxygenated blood remains separated from deoxygenated blood.

- In fishes, two-chambered heart pumps blood to gills. There is no separation of pure and impure blood.
- In amphibians or reptiles, three-chambered heart is present. They can tolerate some mixing of oxygenated and deoxygenated blood.

7. Blood Circulation in Human

The blood circulatory system in human is an example of double circulation.

- (i) **Double circulation** The blood goes through the heart twice to supply blood once around the body. It is a **closed circulatory system**, i.e. blood travels around body inside the blood vessels. The following processes constitute the double circulation.
- (ii) **Pulmonary circulation** The movement of blood from heart to the lungs and back to the heart constitutes the pulmonary circulation.

Movement of blood in pulmonary circulation occurs in the following ways

Right ventricle pumps blood to the lungs for oxygenation *via* pulmonary artery.



Oxygenated blood then comes back to the left auricle of heart through four pulmonary veins, i.e. two from each lung.



The left atrium then contracts passing the blood to the corresponding expanded left ventricle (in the systemic circulation).

- (iii) **Systemic Circulation** The circulation of blood from heart to different parts of the body except lungs and back to the heart constitutes the systemic circulation. Movement of blood in systemic circulation occurs in the following ways

As the left ventricle fills up, it contracts forcing blood out.



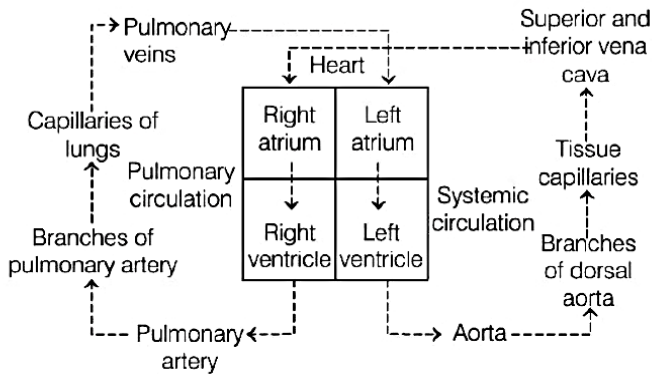
The blood is finally, pumped to the whole body *via* aorta as the muscular left ventricle contracts.



The deoxygenated blood from the different body parts enters into the right atrium.



As the right atrium contracts, the blood passes into the corresponding lower chamber, i.e. the right ventricle.



8. Blood Pressure

- It is the pressure of circulating blood on the walls of blood vessels.
- Blood pressure is maximum during contraction of left ventricle and is known as systolic pressure. It is 120 mm Hg.
- The diastolic pressure is specifically the minimum arterial pressure during relaxation and dilation of the ventricles. It is 80 mm Hg.
- Blood pressure is measured by **sphygmomanometer**.

9. Lymph

- Apart from blood, lymph in our body is another type of fluid involved in transportation. This is also called **tissue fluid**.
- It is also meant to transport any digested and absorbed fat from intestine and drains excess fluid from extracellular space back into the blood.
- Lymph drains into lymphatic capillaries from the intercellular spaces, which join to form large lymph vessels that finally open into larger veins.

10. Transportation in Plants

- Plants lack a circulatory system. Short distance transport of certain materials occurs *via* diffusion whereas long distance transport requires a proper transportation system.
- Roots absorb raw materials, water and minerals from soil *via* diffusion.
- Plant transport system transports both food and water.
- **Xylem** and **phloem** carry substances from one part of the plant body to the another.

- **Xylem** transports water and minerals obtained from the soil, whereas **phloem** (vascular tissue) transports products of photosynthesis from the leaves to the other parts of the plant.

11. Transport of Water

- Xylem consist of tracheids, xylem fibres, vessels and xylem parenchyma. Vessels and tracheids of the roots, stems and leaves that form continuous system of water conducting channels which reaches to all parts of a plant.
- There is a concentration gradient between roots and soil, so, water moves into roots from soil and creates a water column pushed upwards.
- Transport of water occurs also due to transpirational pull.

12. Transpiration

- Transpiration is the loss of water in the form of vapour from the aerial parts (i.e. stem, leaves) of the plant. It takes place through the special pores known as **stomata**.
- Transpiration helps in the absorption and upward movement of water and minerals dissolved in it from roots to the leaves.
- It also functions as a temperature regulator.
- In day time, transpiration pull is the major driving force in the movement of water in the xylem.

13. Transport of Food and Other Substances

- Translocation is the phenomenon of transport or movement of soluble products (sugar) from the leaves to the other parts of the plant with the help of phloem.
- Sugar like sucrose is transferred into phloem tissue with the help of energy (ATP).
- It increases the osmotic pressure of the tissue causing material to move according to the plants need.
- Translocation of substances takes place in the sieve tubes with the help of adjacent companion cells both in upward and downward directions (materials move from high pressure to low pressure).

Objective Questions

Multiple Choice Questions

- 01.** The blood leaving the tissues becomes richer in
 (a) carbon dioxide (b) water
 (c) haemoglobin (d) oxygen
- 02.** surrounds the heart.
 (a) Septum (b) Pericardium
 (c) Valves (d) None of these
- 03.** Valves ensure that blood does not backflow inside the heart.
 (a) True (b) False
 (c) Can't say (d) Partially True/False
- 04.** In fishes, the heart receives only pure blood.
 (a) True (b) False
 (c) Can't say (d) Partially True/False
- 05.** Single circulation, i.e. blood flows through the heart only once during one cycle of passage through the body is exhibited by (NCERT Exemplar)
 (a) Labeo, chameleon, salamander
 (b) Hippocampus, Exocoetus, anabas
 (c) Ilyla, Rana, Draco
 (d) Whale, dolphin, turtle
- 06.** Crocodiles have chambered heart.
 (a) two (b) three
 (c) four (d) None of these
- 07.** Lymph does not comprise of
 (a) red blood corpuscles
 (b) lymphocytes
 (c) white blood corpuscles
 (d) nitrogenous waste
- 08.** and form a continuous system of water conducting channels that reaches all parts of the plant.
 (a) Xylem, phloem (b) Phloem, tracheids
 (c) Phloem, vessels (d) Tracheids, vessels
- 09.** Transpiration helps in regulation of temperature.
 (a) True (b) False
 (c) Can't say (d) Partially True/False
- 10.** The process of carrying food from the leaves to other parts of a plant is called
 (a) transpiration (b) transportation
 (c) translocation (d) transformation
- 11.** Translocation of substances takes place in the sieve tubes in downward direction only.
 (a) True (b) False
 (c) Can't say (d) Partially True/False
- 12.** Which of the following is accomplished in a plant by utilising the energy stored in ATP?
 (a) Transport of food
 (b) Transport of oxygen
 (c) Transport of water and minerals
 (d) Transport of water, minerals and food
- 13.** Match Column I with Column II and select the most appropriate option from the codes given.
- | Column I | Column II |
|----------------|-------------------------|
| A. Platelets | 1. Size of fist |
| B. Heart | 2. Warm-blooded animals |
| C. Veins | 3. Translocation |
| D. Birds | 4. Valves |
| E. Sieve tubes | 5. Blood clotting |
- Codes
 A B C D E
 (a) 1 3 5 4 2
 (b) 5 1 4 2 3
 (c) 5 1 4 3 2
 (d) 5 1 4 2 1

14. Match Column I with Column II and choose the most appropriate option from the codes given below.

Column I	Column II
A. Xylem	1. Night
B. Phloem	2. Sucrose
C. Root pressure	3. Necessary evil
D. Transpiration	4. Minerals
E. Translocation	5. Companion cells

Codes

	A	B	C	D	E
(a)	5	4	1	3	2
(b)	4	1	3	2	5
(c)	4	2	1	3	5
(d)	4	2	5	3	1

Assertion-Reasoning MCQs

Direction (Q.Nos. 15-19) For the following question numbers two statements are given one labeled **Assertion** (A) and the other labeled **Reason** (R). Select the correct answer to these question from the codes (a), (b), (c) and (d) as given below

- (a) Both A and R are true and R is the correct explanation of A
 (b) Both A and R are true but, R is not the correct explanation of the A
 (c) A is true, but R is false
 (d) A is false, but R is true
15. **Assertion** (A) Blood pressure is arterial blood pressure.
Reason (R) It is measured by sphygmomanometer.
16. **Assertion** (A) Interventricular septum separates left atrium from right atrium.

Reason (R) Interventricular septum separates left ventricle from right ventricle.

17. **Assertion** (A) All the arteries carry oxygenated blood from the heart to various organs.

Reason (R) Pulmonary vein carries deoxygenated blood to the heart.

18. **Assertion** (A) Translocation in phloem is mainly achieved by utilising energy.

Reason (R) Translocation takes place in sieve tubes.

19. **Assertion** (A) Transpiration is a necessary evil.

Reason (R) It causes water loss but helps in absorption and upward movement of water and minerals.

Cased Based MCQs

20. Read the following and answer questions from (i) to (v).

The general requirement for energy and materials is common in all organisms, but it is fulfilled in different ways. Organisms use simple food material obtained from inorganic sources in the form of carbon dioxide and water these organisms, called as autotrophs, include green plants and some bacteria other organisms utilise complex substances, known as heterotroph.

The process by which green plants make their food is called photosynthesis which occurs in chloroplast, after that food and minerals are transported to all parts of the plants with the help of xylem and phloem tissue and from various processes like translocation, absorption, osmosis, etc.

EXPLANATIONS

- The blood leaving the tissues is richer in carbon dioxide because the main artery carries oxygenated blood from heart to various organs from where it is passed through their capillaries and provides oxygen to body cells and at the same time, CO_2 which is a byproduct of respiration, enters into the blood. Thus, indicating gaseous exchange.

The deoxygenated blood then leaves the tissues and is passed to lungs for oxygenation.

- Pericardium is a double-layered membrane that surrounds the heart. It protects the heart and keeps it in place.
- Valves ensure the backflow of the blood inside the heart does not occur and that the blood flows unidirectionally only.
- False; Impure blood is received by the heart in case of fishes.
- The examples and the relation of animal group and heart are as

Animal Group	Heart	Examples
Fishes	2-chambered heart (one atrium and one ventricle) single circulation	<i>Labeo</i> , <i>Hippocampus</i> , <i>Exocoetus</i> , <i>Anabas</i> , etc. Fishes.
Amphibians and Reptiles	3-chambered heart (two atria and one ventricle) mixing of oxygenated and deoxygenated blood.	<i>Salamander</i> , <i>Hyla</i> , <i>Rana</i> (Amphibians) <i>Chameleon</i> , <i>Draco</i> , turtle (Reptiles)
Birds and Mammals	4-chambered heart (two atria and two ventricle) No mixing of blood	Pigeon, parrot (birds), whale, dolphins, humans (Mammals)

According to this chart, 2 chambered heart is present only in fishes and blood flows only once during one cycle. Group (b)-contain fishes, so correct answer is option 'b'.

- The heart of a crocodile is different from other reptiles because it is four chambered.

The blood sent to the lungs for gaseous exchange from the right ventricle, is pumped to the body *via* left ventricle post for oxygenation.

- Lymph does not contain RBCs and platelets, but it is rich in lymphocyte or WBC count.
- Xylem tissues of plants have an inter connected network of vessels and tracheids of stem, roots and leaves, forming a continuous system of water conducting channels throughout the plant.
- Plants lose water through the process of transpiration. The water that escapes into atmosphere, actually cools down the leaves thereby regulating temperature of the plant.
- The transport of soluble products (sugar) of photosynthesis from leaves to other parts of the plant is translocation.
- False, translocation of substances occurs in both upward and downward direction, i.e. bidirectional.
- Transport of food in a plant is accomplished by using the energy stored in ATP, whereas transport of water and minerals takes place *via* diffusion and transpiration pull.
- The correct matches are as follows
Platelets cause clotting of blood.
The size of the heart is the same as that of our fist.
Most of the veins have valves to prevent backflow of blood.
Birds are warm-blooded with a constant body temperature.
Translocation occurs in sieve tubes with the aid of companion cells.
- The correct matches are as follows Water and minerals are transferred in plants *via* xylem. Sucrose is transferred into phloem using ATP. Root pressure is critical during night time. Transpiration is a necessary evil as it helps the plant absorb more water.
Translocation occurs *via* companion cells.

- 15.** Both A and R are true, but R is not the correct explanation of A.

Blood pressure is the pressure exerted by circulating blood upon the walls of blood vessels and is measured within large arteries. The instrument used to measure blood pressure is sphygmomanometer.

- 16.** Both A and R are true but R is not the correct explanation of A.

There are four chambers in the human heart. The left atria and right atria are separated by an interauricular septum. The two inferior chambers of the heart, i.e. right and left ventricles are separated by an interventricular septum.

- 17.** A is false, but R is true.

The arteries carry oxygenated blood from the heart to various organs, except for pulmonary artery. The veins collect deoxygenated blood from different organs and bring it back to the heart, except for pulmonary vein that carries oxygenated blood.

- 18.** Both A and R are true but R is not the correct explanation of A.

Materials are translocated *via* phloem by utilising energy from ATP.

Translocation of substances takes place in sieve tubes with the aid of companion cells, lying adjacent to them, bi-directionally.

- 19.** Both A and R are true and R is the correct explanation of A.

Transpiration is a necessary evil. It is so because water is lost in the form of vapours from the aerial parts of the plant through transpiration.

But, it helps in absorption and upward movement of water and minerals creating a transpiration pull.

- 20.** (i) The palisade mesophyll cell (at (2)) and guard cell (at (4)) possess chloroplasts which absorb sunlight. Most chloroplasts are concentrated in the former area to acquire maximum sunlight in order to photosynthesise.
- (ii) When a plant shoot is left in ink solution for several hours, its xylem portion will get stained as it is the water conducting tissue.
- (iii) Sugars and amino acids are transported by phloem tissue, here, B. They are found alternating between central core of xylem.
- (iv) A young plant may wilt when dug up and re-planted because while digging up, the stem may break which hampers the transportation of water and other nutrients, causing wilting.
- (v) Higher water potential in roots as compared to soil, leads to movement of water into roots by osmosis. The intake of water in roots increases water potential in root xylem, which drives water up.