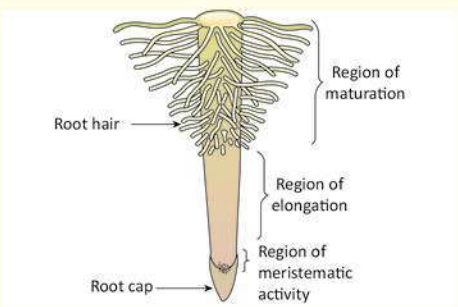
UNIT

14

Transportation in Plants and Circulation in Animals

POINTS TO REMEMBER

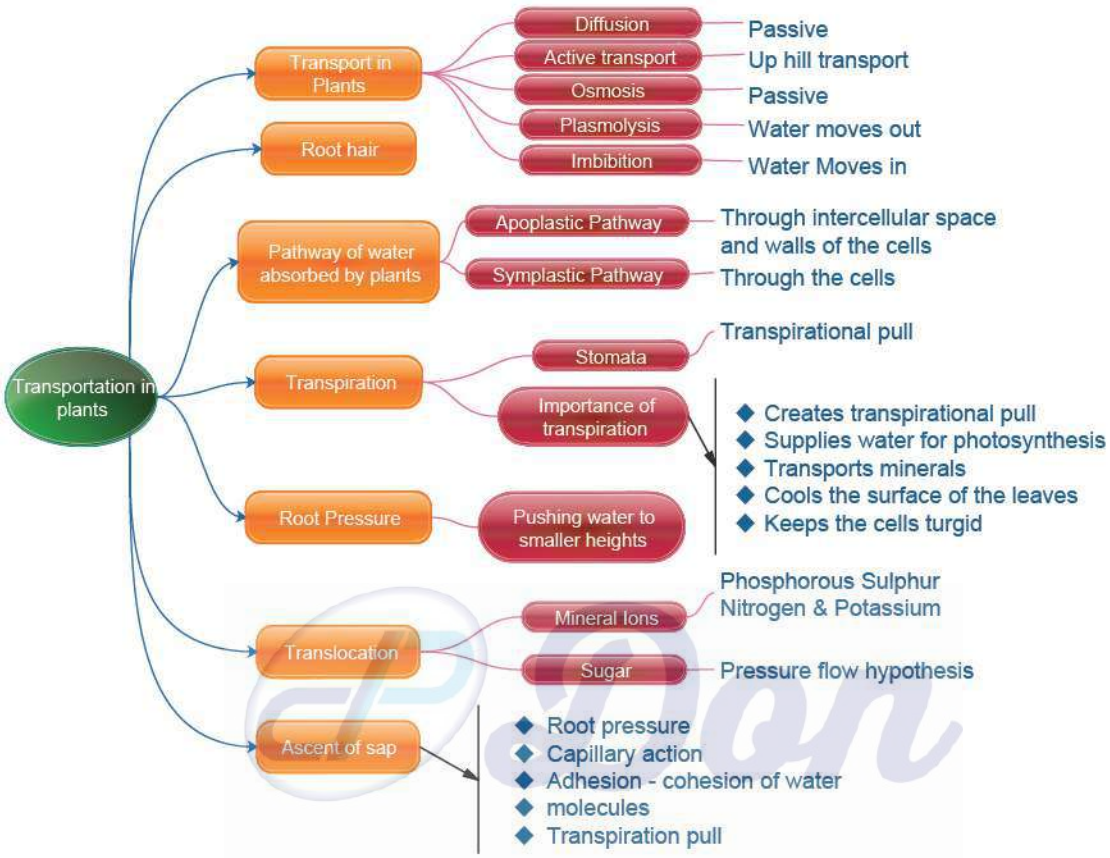
- Transport of materials in and out of the cells is carried out by diffusion and active transport in plants.
- **Diffusion:** The movement of molecules in liquid and solid from a region of higher concentration to a region of lower concentration without the utilization of energy is called **diffusion**. This is a **passive** process.
- **Active transport :** The movement of molecules against the concentration gradient is called **active transport**. This movement utilizes energy.
- **Proteins** use energy to carry the substances across the membrane and hence are called as **pumps**.
- **Uphill transport :** These pumps transport substances from a low concentration to higher concentration called the '**uphill**' transport.
- **Osmosis** is the movement of solvent or water molecules from the region of higher concentration to a region of lower concentration through a semipermeable membrane. This is a passive process.
- **Plasmolysis** occurs when water moves out of the cell resulting in the shrinkage of the cell membrane away from the cell wall.
- **Imbibition** is a type of diffusion in which a solid absorbs water and gets swelled up. Eg. Absorbtion of water by seeds and dry grapes.
- The three regions in the root hair are **Region of meristematic activity, Region of elongation** and **Region of maturation.**
- **Root cap** is present in the tip of the root hair.

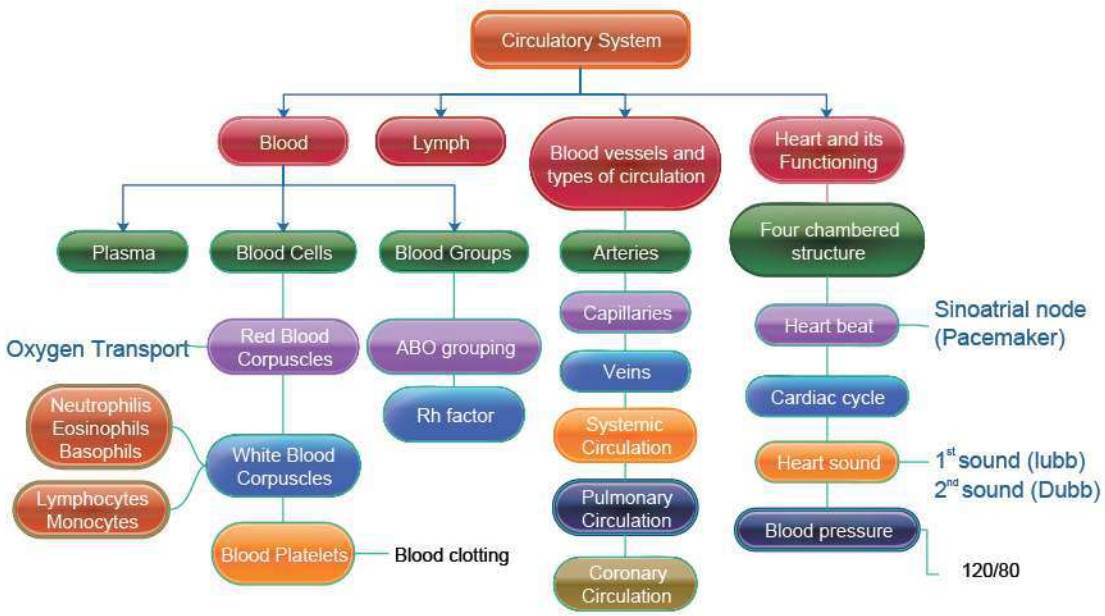


Root Tip with Root Hairs

- The pathway of water entering the root hairs to the stem and leaves is given here.
- Root hair -cortex - xylem - stem & leaves

MIND MAP





- There are two distinct pathways by which the water moves from the root hairs into the root layers. They are Apoplast pathway and symplast pathway.
- **Apoplast pathway:** This type of movement occurs through intercellular spaces and walls of the cells . Here, the water does not cross the cell membrane. Movement is dependent on the gradient.
- **Symplast pathway:** A narrow thread of cytoplasm that passes through the cell walls of adjacent cells is called plasmodesmata. Here water travels through the cytoplasm. Water enters the cells through the cell membrane.
- **Transpiration:** Evaporation of water in plants through stomata in the leaves is called transpiration.

Turgid and flaccid

- The opening and closing of stomata is due to the change in the turgidity of guard cells. When water enters the guard cells, it becomes turgid and the stoma opens. When the guard cells lose water it becomes flaccid and the stoma closes.
- **Transpiration pull :** As water evaporates through the leaves, pressure is created at the top to pull more water from the xylem to the mesophyll cells. Transpiration through stomata creates a vacuum which creates suction. This process is called transpiration pull.

Root pressure

- As ion from the soil are actively transported into the vascular tissue of the root, water moves along and increases the pressure inside the xylem. This pressure is called the root pressure.
- Movement of food materials in phloem is always bidirectional (upwards and downwards).
- Movement of water and minerals in xylem is always unidirectional (upwards only).
- **Capillary action:** Water from any liquid rises in a capillary tube because of physical forces. This phenomenon is called capillary action.
- **Cohesion:** The force of attraction between the molecules of water is called cohesion.
- **Adhesion:** The force of attraction between the molecules of different substances is called adhesion.

Guttation

- Excess of water is exudated in the form of a liquid due to root pressure. This is seen as dews on the leaves of grass. This phenomenon is called **Guttation** which takes place through specialised cells called **hydathodes**.
- **Blood** is a fluid connective tissue.
- The two main components of blood are the fluid **plasma** and the **blood cells** which are suspended in the plasma.
- **Plasma** is alkaline substance and substances like proteins, glucose, urea, enzymes, hormones, vitamins and minerals are present in plasma. 55% of blood is plasma.

- **Blood cells** or blood corpuscles are of three types.
  (i) **Red blood corpuscles** or **Erythrocytes.**
  (ii) **White blood corpuscles** or **Leucocytes.**
  (iii) **Blood platelets** or **Thrombocytes.**
- RBCs are formed in bone marrow.
- RBCs impart red colour due to the presence of the respiratory pigment haemoglobin.
- Mammalian RBCs do not have cell organelles and nucleus.
- Life span is 120 days and are involved in the transport of oxygen from lungs to tissues.
- White blood corpuscles are colourless. They are nucleated. They are capable of amoeboid movement.
- **Granulocytes and Agranulocytes**
- White blood cells are of two types. **Granulocytes** and **Agranulocytes**.
- Granulocytes contain granules in the cytoplasm. They are of 3 types.
  (i) Neutrophils (ii) Eosinophils (iii) Basophils
- **Neutrophils** have 2-7 lobed nucleus. They increase in number during infection and inflammation.
- **Eosinophils** has bilobed nucleus . They increase in number during allergy and parasitic infections. It brings about detoxification of toxins.
- **Basophils** have lobed nucleus. They release chemicals during the process of inflammation.
- **Agranulocytes:** Granules are absent. Agrunulocytes are of two types:
  (i) Lymphocytes (ii) Monocytes.
- **Lymphocytes** produce antibodies during bacterial and viral infections.
- **Monocytes** are the largest of the leucocytes and are amoeboid in shape. They are phagocytic and can engulf bacteria.
- **Blood platelets** or **thrombocytes** – They are small and colourless. They do not have nucleus. They play an important role in clotting of blood.
- **Anemia** is decrease in number of erythrocytes.
- **Leucocytosis** is increase in number of leukocytes.
- **Leukopenia** is decrease in number of leukocytes.
- **Thrombocytopenia** is decrease in the number of thrombocytes.
- Threre are three types of blood vessels. They are **arteries**, **veins** and **capillaries**.
- **Arteries** are thick, elastic vessels which carry blood away from the heart to various organs of the body. All the arteries carry oxygenated blood except pulmonary artery which carries deoxygenated blood.
- **Veins** are thin, non elastic vessels that transport blood to the heart from different organs. All veins carry deoxygenated blood except the pulmonary vein which carries oxygenated blood.

- **Capillaries** are formed by branching of arterioles which then unite to form the venules and veins.
- **Open** and closed type are two types of circulatory system.
- In open type, blood is pumped by heart into blood vessels that open into blood spaces called sinuses. These sinuses are body cavities called haemocoel.
- In **closed** type, the blood flows in a complete circuit around the body through specific blood vessels.
- Heart is a muscular pumping organ that pumps the blood into the blood vessels.
- Heart is present above the **diaphragm** in the thoracic cavity.
- Heart is made of specialised type of muscle called the **cardiac muscle.**
- Heart is enclosed by a double membrane called **pericardium.**
- It contains **pericardial fluid** to reduce the friction during heart beat.
- The human heart is four chambered. Upper thin walled auricle or atria and lower thick walled chambers called ventricles.
- The chambers are separated by a partition called **septum** which prevents the mixing of oxygenated and deoxygenated blood.
- The two auricles are separated by **interatrial septum.**
- The right atrium receives the blood from different parts of the body through **superior vena cava**, **inferior vena cava** and **coronary sinus.**
- **Pulmonary veins** bring oxygenated blood to the left atrium from the lungs.
- The two ventricles are separated by **interventricular septum.**
- Right ventricle gives rise to the **pulmonary trunk** which carries the deoxygenated blood to the lungs.
- Left ventricle gives rise to the aorta which carries the oxygenated blood to various organs of the body.
- **Coronary arteries** supply blood to the heart.
- Heart contains three types of valves.
- The valves are the muscular flaps to regulate the flow of blood in a single direction and prevent the back flow of blood.
- **Right atrioventricular valve** is located between the right auricle and the right ventricle and has three flaps and hence called as **tricuspid valve.**
- The apices of the flaps are held in position by **chordae tendinae** arising from **papillary muscles.**
- Left **atrioventricular valve** is located between the left auricle and left ventricle and had two cusps and hence called as bicuspid valve.

- Heart chambers in vertebrate animals

Two chambers	*Fishes*
Three chambers	*Amphibians*
Incomplete four chamber	*Reptiles*
Four chamber	*Aves, mammals, crocodiles.*

- Pulmonary and aortic semilunar valves are present in the pulmonary artery and aorta.
- There are three types of blood circulation. **Systemic**, **pulmonary circulation** and **coronary circulation.**
- **Systemic circulation:** Circulation of oxygenated blood from the left ventricle to the various organs of the body and return the deoxygenated blood to the right atrium. Aorta carries oxygenated blood to all the organs of the body.
- **Pulmonary circulation :** Pulmonary artery starts from the right ventricle and carries the deoxygenated blood to the lungs. Pulmonary veins collect the oxygenated blood from the lungs and supplies it to the left atrium of the heart.
- **Coronary circulation:** The supply of blood to the heart muscles is called coronary circulation. Cardiac muscles receive oxygenated blood from coronary arteries that originate from the aortic arch. Deoxygenated blood from the cardiac muscles drains to the right atrium by the coronary sinuses.
- Since the blood circulates twice through the heart in one complete cycle it is called double circulation.
- In some animals, oxygenated and deoxygenated blood is mixed and passes through the heart only once. This type of circulation is called single circulation.
- **Heart Beat:** One complete contraction (systole) and relaxation (diastole) of the atrium and ventricles of heart constitute heartbeat
- The heart normally beats 72-75 times per minute.
- **Neurogenic** heart beat is initiated by a nerve impulse caused from a nerve ganglion. Eg. Annelids, most arthropods.
- **Myogenic** heart beat is initiated by a specialised group of modified heart muscle fibres. Eg. Mollusca and Vertebrates.
- Human heart is myogenic in nature.
- Contraction is initiated by a special portion of heart muscle called sino-atrial node (SA) .
- **Sino-atrial node** acts as a 'pace maker' of heart.
- Normal pulse rate ranges from 70-90 / min
- **Cardiac cycle:** The sequence of events occurring from the beginning to completion of one heart beat is called cardiac cycle.
- Each cardiac cycle lasts about 0.8 second.
- Atrial systole: contraction of auricles. (0.1 sec)

- **Ventricular systole:** Contraction of ventricles (0.3 sec)
- **Ventricular diastole:** Relaxation of ventricles (0.4 sec)
- The first sound LUBB is of longer duration and the second DUPP is of shorter duration.
- **Blood pressure** is the force exerted during the flow of blood against the lateral walls of the arteries.
- Blood pressure is expressed in terms of the **systolic pressure** and **diastolic pressure**.
- In an healthy adult during normal resting condition, systole and diastole blood pressure is expressed as 120mm/80mm Hg.
- A prolonged or constant elevation of blood pressure is a condition known as **hypertension** (High blood pressure).
- A **stethoscope** is used to detect the sound produced by the internal organs of human body.
- **Sphygmomanometer** is a clinical instrument used to measure blood pressure when a person is an a relaxed and resting condition.
- Monometric and modern digital types are the apparatus used to measure blood pressure.
- Human blood contains **agglutinogens** or antigens and **agglutinins** or **antibodies** (Ab)
- Persons with 'AB' blood group are called **'Universal Recipient'.**
- Persons with 'O' blood group are called **'Universal donor'.**
- Lymphatic capillaries unite to form large **lymphatic vessels.**
- Lymph is a colourless fluid which drains into the **lymphatic capillaries.**

Distribution of Antigen (RBC) and Antibody (Plasma) in different Blood Groups

Blood Group	Antigens on RBC	Antibodies in Plasma	Can donate to	Can receive from
A	Antigen A	anti- b	A and AB	A and O
B	Antigen B	anti- a	B and AB	B and O
AB	Antigen A and B	No antibody	AB	A, B, AB and O (Universal Recipient)
O	No Antigen	Both anti a and b	A, B, AB and O (Universal Donor)	O

Scientists

- Closed circulatory system was discovered by William Harvey (1628) who is regarded as the Father of Modern Physiology.
- Concept of blood grouping was developed by Karl Landsteiner (1900). He identified the blood groups A, B and O. AB blood group was recognized by Decastello and Steini (1902).
- Rh factor was discovered by Landsteiner and Wiener in 1940 in Rhesus monkey.
- Atrioventricular bundle was discovered by His (1893). So is called the Bundle of His.

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. Active transport involves ★★
- a) Movement of molecules from lower to higher concentrations
- b) Expenditure of energy
- c) It is an uphill task
- d) All of the above

2. Water which is absorbed by roots is transported to aerial parts of the plant through
- a) Cortex
- b) Epidermis
- c) Phloem
- d) Xylem

3. During transpiration there is loss of ★★
- a) Carbon dioxide
- b) Oxygen
- c) Water
- d) None of the above

4. Root hairs are
- a) Cortical cell
- b) Projection of epidermal cell
- c) Unicellular
- d) Both b and c

5. Which of the following process requires energy?
- a) Active transport
- b) Diffusion
- c) Osmosis
- d) All of them

6. The wall of the human heart is made of
- a) Endocardium
- b) Epicardium
- c) Myocardium
- d) All of the above

7. Which is the sequence of correct blood flow? ★★
- a) Ventricle – atrium – vein – arteries
- b) Atrium – ventricle – veins – arteries
- c) Atrium – ventricle – arteries – vein
- d) Ventricles – vein – atrium – arteries

8. A patient with blood group O was injured in an accident and has blood loss. Which blood group the donor should effectively use for transfusion in this condition?
- a) O group
- b) AB group
- c) A and B group
- d) All blood group

9. 'Heart to Heart' is called ★
- a) SA node
- b) AV node
- c) Purkinge fibres
- d) Bundle of His

10. Which one of the following regarding blood composition is correct?
- a) Plasma – Blood + Lymphocyte
- b) Serum – Blood + fibrinogen
- c) Lymph – Plasma + RBC + WBC
- d) Blood – Plasma + RBC + WBC + Platelets

Ans:

1.	d	All of the above	6.	d	All of the above
2.	d	Xylem	7.	c	Atrium – ventricle – arteries – vein
3.	c	Water	8.	a	O group
4.	d	Both b and c	9.	a	SA node
5.	a	Active transport	10.	d	Blood – Plasma + RBC + WBC + Platelets

II Fill in the blanks:

1. _____ involves evaporative loss of water from aerial parts.
2. Water enters the root cell through a _____ plasma membrane.
3. Structure in roots that help to absorb water are _____
4. Normal blood pressure is _____ ✶✶
5. The normal human heart beat rate is about _____ time per minute. ✶✶

Ans:

1.	Transpiration	4.	120mm/80mm Hg
2.	Symplast	5.	72-75
3.	Root hair		

III Match the following

1.

1) Symplastic pathway	–	a) Leaf	(b)
2) Transpiration	–	b) Plasmodesmata	(a)
3) Osmosis	–	c) Pressure in xylem	(d)
4) Root pressure	–	d) Pressure gradient	(c)

2.

1) Leukemia	–	a) Thrombocytes	(d)
2) Platelets	–	b) Phagocyte	(a)
3) Monocytes	–	c) Decrease in leucocytes	(b)
4) Leucopenia	–	d) Blood cancer	(c)
5) AB blood group	–	e) Allergic condition	(h)
6) O Blood group	–	f) Inflammation	(g)
7) Eosinophil	–	g) Absence of antigen	(e)
8) Neutrophils	–	h) Absence of antibody	(f)

IV. State whether True or False. If false write the correct statement

1. The phloem is responsible for the translocation of food. — True
2. Plants lose water by the process of transpiration. — True
3. The form of sugar transported through the phloem is glucose. — False

   The form of sugar transported through the phloem is sucrose.

4. In apoplastic movement the water travels through the cell membrane and enter the cell. **False**

In symplastic movement the water travels through the cell membrane and enters the cell.

5. When guard cells lose water the stoma opens. **False**

When guard cells lose water the stoma closes.

6. Initiation and stimulation of heart beat takes place due to nerves. **False**

Initiation and stimulation of heart beat take place due to Sino atrial node.

7. All veins carry deoxygenated blood. **False**

All veins carry deoxygenated blood except pulmonary veins.

8. WBC defend the body from bacterial and viral infections. **True**

9. The closure of the mitral and tricuspid valve at the start of the ventricular systole produces the first sound 'LUBB'. **True**

V. Assertion and Reasoning

Direction: In each of the following questions a statement of assertion (A) is given and a corresponding statement of reason (R) is given just below it. Mark the correct statement as

a) If both A and R are true and R is correct explanation of A

b) If both A and R are true but R is not the correct explanation of A

c) A is true but R is false

d) Both A and R are false

1. **Assertion:** RBC plays an important role in the transport of respiratory gases.
Reason: RBC do not have cell organelles and nucleus.
Ans. a) If both A and R are true and R is correct explanation of A

2. **Assertion:** Persons with AB blood group are called universal recipients, because they can receive blood from all groups.
Reason: Antibodies are absent in persons with AB blood group.
Ans. b) If both A and R are true but R is not the correct explanation of A

VI. Answer in the word or sentence

1. Name the two layered protective covering of human heart. ✶ ✶
Pericardium

2. What is the shape of RBC in human blood?
RBCs are biconcave and **disc** shaped.

3. Why is the colour of the blood red? ✶ ✶
RBCs impart red colour to the blood due to the presence of the respiratory pigment **haemoglobin.**

4. Which kind of cells are found in the lymph?
Plasma, proteins and blood cells.

5. Name the heart valve associated with the major arteries leaving the ventricles.

Semilunar valves.

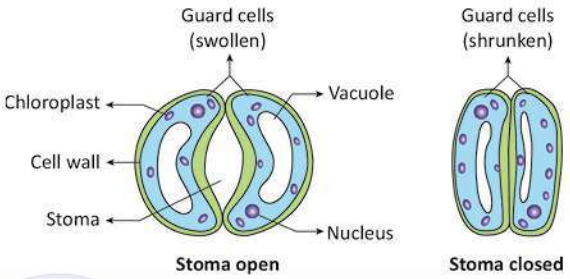
6. Mention the artery which supplies blood to the heart muscle.

Coronary artery.

VII. Short answer questions

1. What causes the opening and closing of guard cells of stomata during transpiration?

- The opening and closing of stomata is due to the change in turgidity of the guard cells.
- When water enters into the guard cells they become turgid and the stomata opens.
- When the guard cells lose water, it becomes flaccid and the stomata closes.



Guard cell in turgid and flaccid condition

2. What is cohesion?

The force of **attraction** between molecules of water is called cohesion.

3. Trace the pathway followed by water molecules from the time it enters a plant root to the time it escapes into the atmosphere from the leaf.

- Root pressure → capillary action → Adhesion → Transpiration pull → Transpiration.
- Once the water enters the root hairs, the concentration of water molecules in the root hair cells become more than that of the cortex.
- Thus water from the root hair moves to the cortical cells by osmosis and then reaches the xylem.
- From there the water is transported to the stem and the leaves.
- There are two pathways by which the water absorbed by the root hairs enters the deeper layers. Apoplast pathway and Symplast pathway.
- Apoplast pathway does not involve crossing the cell membrane and the movement is dependent on the gradient.
- In Symplast pathway, water enters the cell through the cell membrane.
- Transpiration is the evaporation of water in plants through stomata in the leaves.
- Water evaporates from mesophyll cells of leaves through stomata.

4. What would happen to the leaves of a plant that transpires more water than its absorption in the roots?

- Transpiration often results in water deficit which causes **injury** to the plants by desiccation.
- Excessive rate of transpiration leads to stunted growth of plants

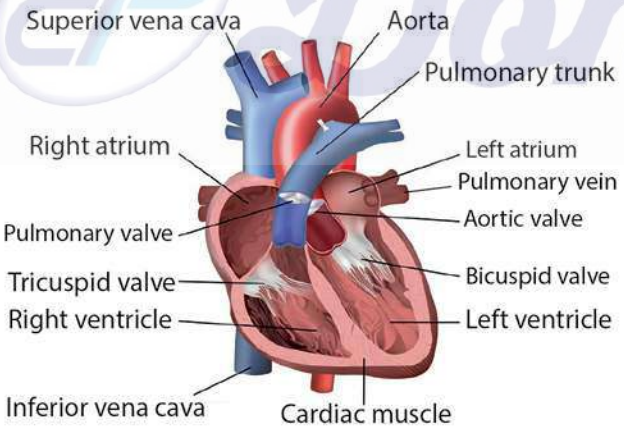
5. Describe the structure and working of the human heart.

Structure of heart:

- Heart is a muscular pumping organ that pumps out blood into the blood vessels.
- It is enclosed in a **double walled** sac called pericardium.
- The two upper thin walled chambers are called auricles and the two thick walled chambers are called ventricles.
- The chambers are separated by **septum**.
- Heart contains **pericardial** fluid.

Working of heart:

- **Contraction** of heart is called **systole** and **relaxation** is called **diastole**.
- When the auricles are filled with blood they are in diastole. The tricuspid and bicuspid valves remain closed. This is called **atrial diastole.**
- When the auricles are full they contract. This leads to the **opening** of tricuspid and bicuspid valves. Blood from the auricles are pushed to the ventricles. This is called **atrial systole.**
- Now the valves are closed. The ventricles **contract**. The deoxygenated blood from the right ventricle enters the **pulmonary artery** and the oxygenated blood from the left ventricle enters the **aorta**. This is called **ventricular systole.**
- These three events constitute the cardiac cycle.



Internal structure of human heart

6. Why is the circulation in man referred to as double circulation? ✶

- When the blood circulates **twice** through the heart in **one complete cycle** it is called double circulation.
- In double circulation oxygenated blood **does not mix** with deoxygenated blood.

7. What are the heart sounds? How are they produced? ✶ ✶

- The rhythmic closure and opening of the valves cause the sound of heart.
- The first sound **LUBB** is of longer duration and is produced by the **closure** of the **tricuspid** and **bicuspid** valves after the beginning of the ventricular systole.
- The second sound **DUBB** is of a shorter duration and is produced by the **closure** of **semilunar valves** at the end of ventricular systole.

8. What is the importance of valves in the heart?

Valves are the muscular flaps that regulate the flow of blood in a **single direction** and **prevent back flow** of blood.

9. Who discovered Rh factor? Why was it named so?

Rh factor was discovered by Landsteiner and Wiener in 1940. It was named so because it was first discovered in Rhesus monkey.

10. How are arteries and veins structurally different from one another?

- Arteries are thick and elastic vessels that carry blood away from the heart.
- Veins are thin and non-elastic vessels that transport blood to the heart.

11. Why is the Sinoatrial node called the pacemaker of heart?

Sinoatrial node is called the pacemaker of heart because it is capable of initiating impulse which can stimulate the heart muscles to **contract** thereby pushing the blood into the ventricles.

12. Differentiate between systemic circulation and pulmonary circulation.

- Pulmonary circulation moves blood between the heart and the lungs.
- It transports deoxygenated blood to the lungs to absorb oxygen and release carbon dioxide. The oxygenated blood then flows back to the heart.
- Systemic circulation moves blood between the heart and the rest of the body.
- It sends oxygenated blood out to cells and returns deoxygenated blood to the heart.

13. The complete events of cardiac cycle last for 0.8 sec. What is the timing for each event?

Each cardiac cycle lasts for about 0.8 seconds. The events during a single cardiac cycle involves,

a) **Atrial systole:**	Contraction of auricles	0.1sec
b) **Ventricular systole:**	Contraction of ventricles	0.3 sec
c) **Ventricular diastole:**	Relaxation of ventricles	0.4 sec
	Total Time	**0.8 sec**

VIII. Give reasons for the following statements.

1. Minerals cannot be passively absorbed by the roots. ✶ ✶ ✶

- All the minerals cannot be passively absorbed by the roots as the concentration of minerals in the soil is usually **low** and they are present as **charged particles.**
- So, they cannot move across cell membranes.
- These move into the roots by using energy in the form of ATP.
- Since energy is used it is **active** absorption.

2. Guard cells are responsible for opening and closing of stomata transpiration.

- The opening and closing of stomata is due to the change in **turgidity** of the guard cells.
- When water **enters** into the guard cells they become turgid and the stomata **opens.**
- When the guard cells **lose water**, it becomes flaccid and the stomata **closes.**

3. The movement of substances in the phloem can be in any direction.

- Phloem **transports food** (sucrose) from a source to a sink.
- The source is part of the plant that synthesize food, i.e., the leaf, and sink, is the part that needs or stores the food.
- But, the source and sink may be **reversed** depending on the season, or the **plant's need.**
- Since the source-sink relationship is variable, the direction of movement in the phloem can be upwards or downwards, i.e., bidirectional.

4. Minerals in the plants are not lost when the leaf falls. ✶ ✶

- Minerals are **remobilised** from older dying leaves to younger leaves.
- Elements like phosphorous, sulphur, nitrogen and potassium are easily **mobilised**.
- Small amounts of material exchange takes place between xylem and phloem.
- Hence minerals in the plants are not lost when the leaf falls.

5. The walls of the right ventricle are thicker than the right auricle.

This is because blood is **pumped out** of the heart at greater pressure from these chambers compared to the atria.

6. Mature RBC in mammals do not have cell organelles. ✶ ✶

Mammalian RBC lack nucleus and makes the cells biconcave and increase surface area for **oxygen binding**, loss of mitochondria allows the RBC to **transport** all the **oxygen** to tissues, and loss of endoplasmic reticulum allows more **flexibility** for RBC to move through the narrow capillaries.

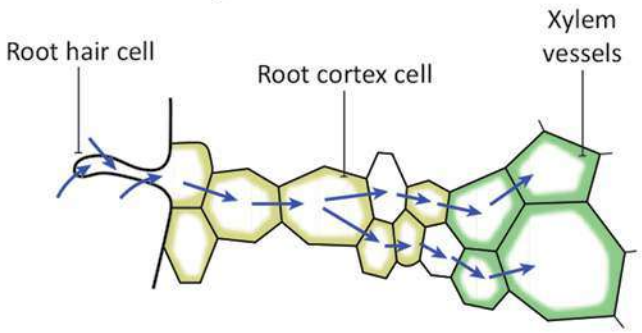
IX. Long answer questions

1. How do plants absorb water? Explain.

- Plants absorb water and minerals through root hairs present on the tip of the root by diffusion.
- Root hairs are thin walled, slender extension of epidermal cell that increase the surface area of absorption.

Pathway of water absorbed by roots:

- Once the water enters the root hairs, the concentration of water molecules in the root hair cells become more than that of the cortex.
- Thus, water from the root hair moves to the cortical cells by osmosis and then reaches the xylem.
- From there, the water is transported to the stem and leaves.



T.S. of the root showing movement of water from soil to xylem

2. What is transpiration? Give the importance of transpiration.

- Transpiration is **evaporation** of water in plants through **stomata** in the leaves.
- Creates transpirational pull for transport of water.
- **Supplies water** for photosynthesis.
- Transports **minerals** from soil to all parts of the plant.
- **Cools** the surface of the leaves by evaporation.
- Keeps the cells **turgid**, hence, maintains their **shape**.

3. Why are leucocytes classified as granulocytes and agranulocytes? Name each cell and mention its functions. ★★★

Granulocytes contain granules in their cytoplasm. They are of three types.

- Neutrophils
- Eosinophils
- Basophils

Neutrophils:

- They are large in size and have 2-7 lobed nucleus.
- These corpuscles form 60% - 65% of the total leucocytes.
- Their numbers are increased during **infection** and **inflammation**.

Eosinophils:

- It has a bilobed nucleus and constitute 2% to 3% of the total leucocytes.
- Their number increases during conditions of allergy and **parasitic infections.**
- It brings about **detoxification** of toxins.

Basophils:

- Basophils have lobed nucleus.
- They form 0.5% to 1.0% of the total leucocytes.
- They release **chemicals** during the process of inflammation.

Agranulocytes:

- Granules are found in the cytoplasm of these cells.
- The agranulocytes are of two types.
- Lymphocytes and monocytes.

Lymphocytes:

- These are about 20-25% of the total leucocytes.
- They produce **antibodies** during bacterial and viral infections.

Monocytes:

- They are the largest of the leucocytes and are amoeboid in shape.
- These cells form 5-6% of the total leucocytes.
- They are **phagocytic** and can **engulf bacteria.**

4. Differentiate between systole and diastole. Explain the conduction of heart beat.

Systole pressure:

- During ventricular systole, the left ventricle contracts and forces blood into the aorta.
- The pressure rises to a peak which is referred to systolic pressure.

Diastole pressure:

- During diastole the ventricles relax and the pressure falls to the lowest value which is referred to diastolic pressure.

Initiation and conduction of heart beat:

- Human heart is myogenic in nature.
- Contraction is initiated by a specialised portion of the heart muscle, the sino-atrial node which is initiated in the wall of the right atrium near the opening of the superior vena cava.
- The Sinoatrial node acts as the pacemaker of the heart because it is capable of initiating impulse which can stimulate the heart muscles to contract.
- This impulse is spread by the contraction of right and the left atrial walls pushing the blood to the ventricles.
- The wave of contraction from SA node reaches the AV (atrio ventricular) node which is stimulated to emit an impulse of contraction spreading to the ventricular muscle through the atrioventricular bundle and the purkinje fibres.
- In an healthy adult during normal resting condition systolic and diastolic blood pressure is expressed as 120mm / 80mm Hg.

5. Enumerate the functions of blood. ★★★

- Transport of **respiratory gases** (Oxygen and CO_2).
- Transport of **digested food** materials to the different body cells.
- Transport of **hormones**.
- Transport of **nitrogenous** excretory **products** like ammonia, urea, and uric acid.
- It is involved in **protection** of the body and defense against diseases.
- It acts as **buffer** and also helps in regulation of pH and body temperature.
- It maintains proper **water balance** in the body.

IX. Higher Order Thinking skills (HOTS)

1. When any dry plant material is kept in water they swell up. Name and define the phenomenon involved in this change.

- Imbibition is a type of diffusion in which a solid absorbs water and gets swelled up.
- eg. Absorption of water by seeds and dry grapes.

2. Why are the walls of the left ventricle thicker than the other chambers of the heart?

The walls of the left ventricle is thicker than the other chambers of the heart because the ventricles have to pump out blood with force away from the heart.

3. Doctors use stethoscope to hear the sound of the heart. Why?

- A stethoscope is used to detect the sound produced by the internal organs of human body.
- It is a useful diagnostic tool to identify and localize health problems and diagnose disease.

4. How does the pulmonary artery and pulmonary vein differ in their function when compared to a normal artery and vein?

- Pulmonary artery carries **deoxygenated blood to the lungs** while all the other arteries carry oxygenated blood.
- Pulmonary vein carries **oxygenated blood from the lungs** while all the other veins carry deoxygenated blood.

5. Transpiration is a necessary evil in plants. Explain.

- Transpiration is essential for the movement of water and minerals from the root to the healthy parts of the plant.
- But excess transpiration may result in drying up of the leaves or wilting and loss of soil water.
- Hence it is termed as a necessary evil.

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. Process by which the water moves out of the cell resulting in the shrinkage of the cell membrane away from the cell wall.

a) Plasmolysis b) Osmosis c) Diffusion d) Imbibition

2. The force of attraction between the molecules of water is called.

a) Adhesion b) Imbibition c) Cohesion d) Diffusion

3. Excess of water is seen as dews on the leaves of grass. The phenomenon is called

a) Adhesion b) Cohesion c) Guttation d) Imbibition

4. RBCs impart red colour due to the presence of the respiratory pigment _____. ★

a) Haemoglobin. b) Granulocytes
c) Agranulocytes d) Leucocytes

5. Heart contains _____ fluid to reduce the friction during heart beat.

a) Haemocoel b) Pericardial
c) Protoplasm d) Haemoglobin

6. _____ is a colourless fluid which drains into the lymphatic capillaries. ★★

a) Haemocoel b) Pericardial
c) Haemoglobin d) Lymph

7. _____is a clinical instrument used to measure blood pressure when a person is in a relaxed and resting condition.

a) Stethoscope b) Sphygmomanometer
c) Thermometer d) Manometer

8. _____ acts as a 'pace maker' of heart.

a) Atrioventricular node b) Digital meter
c) Sphygmomanometer d) Sino-atrial node

9. **Rh factor was discovered by**
   a) Decastello and Steini b) Landsteiner and Wiener
   c) William Harvey d) His

10. **_____ is decrease in the number of erythrocytes.**
   a) Anemia b) Leukopenia c) Leucocytosis d) Thrombocytopenia

11. **Root hairs absorb water and minerals by _____.**
   a) Diffusion b) Osmosis c) Plosmosis d) Imbibition

12. **Blood corpuscles capable of amoeboid movement are _____.** ★
   a) Erythrocytes b) Leucocytes c) Blood Platelets d) R.B.C

13. **_____ release chemicals during the process of inflammation.**
   a) Eosinophils b) Basophiles c) Neutrophils d) Lymphocytes

14. **Closed type circulatory system is seen in _____.**
   a) Arthropods b) Molluscs c) Ascidians d) Vertebrates

15. **Antibodies are absent in _____ blood group.**
   a) 'A' group b) 'B' group c) AB group d) 'O' group

Ans:

1.	a	Plasmolysis	9.	b	Landsteiner and Wiener
2.	c	Cohesion	10.	a	Anemia
3.	c	Guttation	11.	a	Diffusion
4.	a	Haemoglobin	12.	b	Leucocytes
5.	b	Pericardial	13.	b	Basophils
6.	d	Lymph	14.	d	Vertebrates
7.	b	Sphygmomanometer	15.	c	AB group
8.	d	Sino-atrial node			

II Fill in the blanks:

1. **The two distinct pathways through which the water moves from the root hairs into the root layers are _____ and _____ pathway.**
2. **When water enters the guard cells, it becomes _____ and the stoma opens.** ★
3. **In symplast pathway, a narrow thread of cytoplasm that passes through the cell walls of adjacent cells is called _____.**
4. **Transpiration through stomata creates a vacuum which creates suction. This process is called _____ .**
5. **Guttation takes place through specialised cells called _____ .**
6. **The force of attraction between the molecules of different substances is called _____.**
7. **Heart is made up of specialised muscles called _____** ★★
8. **The supply of blood to the heart muscles is called _____ circulation.**

9. _____ is also called a extracellular fluid.
10. _____ movement of water occurs exclusively through the inter cellular spaces and the walls of the cells.
11. The opening and closing of the stomata is due to the change in turgidity of the _____.
12. Water in the soil is absorbed by root hairs by _____. ✶
13. Due to _____ the water column in xylem tubes is able to rise to great heights in tallest plants.
14. _____ is involved in the transport of oxygen from lungs to tissues.
15. _____ acts as buffer and helps in regulating pH of the body.
16. _____ play an important role in clotting of blood.
17. _____ is called as the Father of Modern physiology.
18. _____ has incomplete four chambered heart.
19. In fishes and amphibians the blood circulation is of _____ type.
20. _____ heart beat is found in Annelids.
21. Normal pulse rate in a minute in human is _____.
22. AB blood group was recognized by _____.
23. When an individual receives a mismatched blood group _____ of blood occurs.
24. Persons with _____ are called Universal Donor. ✶
25. _____ supplies nutrients and oxygen to those parts where blood cannot reach.
26. _____ is used to detect the sound produced by the internal organs of human body.

Ans:

1.	Apoplast and symplast	14.	Red blood corpuscles
2.	Turgid	15.	Blood
3.	Plasmodesmata	16.	Platelets (or) Thrombcytes
4.	Transpiration pull	17.	William Harvey
5.	Hydathodes	18.	Reptiles
6.	Adhesion	19.	Single circulation
7.	Cardiac muscles	20.	Neurogentic
8.	Coronary	21.	70 -90
9.	Lymph	22.	Decastello and Steini
10.	Apoplast pathway	23.	Agglutination or Clumping
11.	Guard cells	24.	'O' blood group
12.	Diffusion	25.	Lymph
13.	Transpiration pull	26.	Stethoscope

III Match the following

1. | | | |
|---|---|---|
| 1) Translocation of food | – a) Tissue fluid | (c) |
| 2) Lymph | – b) Evaporation of water through leaves | (a) |
| 3) Plasmolysis | – c) Phloem | (d) |
| 4) Transpiration | – d) Water moves out of the cell | (b) |

2. | | | |
|---|---|---|
| 1) Pulmonary artery | – a) Oxygenated blood | (a) |
| 2) Pulmonary vein | – b) Clotting of blood | (c) |
| 3) Monocytes | – c) Deoxygenated blood | (d) |
| 4) Thrombocytes | – d) Engulf bacteria | (b) |

3. | **Heart Chambers** | **Animals** | |
|---|---|---|
| 1) Two Chambers | – a) Aves | (d) |
| 2) Three Chambers | – b) Reptiles | (c) |
| 3) Incomplete four chambered | – c) Amphibians | (b) |
| 4) Four chambered | – d) Fishes | (a) |

4. | | | |
|---|---|---|
| 1) Neutrophil | – a) 8 -10 days ★ | (d) |
| 2) Eosinophil | – b) 120 days | (c) |
| 3) Red blood corpuscle | – c) Allergy | (b) |
| 4) Blood Platelets | – d) Infection | (a) |

IV. State whether True or False. If false write the correct statement

1. **Red blood corpuscles are capable of amoeboid movement.** — **False**
   White blood corpuscles are capable of amoeboid movement.

2. **The two ventricles are separated by interatrial septum.** — **False**
   The two ventricles are separated by interventricular septum.

3. **Persons with 'O' blood group are called 'Universal donor'** ★ — **True**

4. **Blood is a fluid involved in transportation of food is also called as tissue fluid.** — **True**

5. **Osmosis is an active process.** — **False**
   Osmosis is a passive process.

6. **The sinuses are the body cavities which are called haemoglobin.** — **False**
   The sinuses are the body cavities which are called haemocoel.

V. Assertion and Reasoning

Direction: In each of the following questions a statement of assertion (A) is given and a corresponding statement of reason (R) is given just below it. Mark the correct statement as

a) If both A and R are true and R is correct explanation of A

b) If both A and R are true but R is not the correct explanation of A

c) A is true but R is false

d) Both A and R are false

1. **Assertion:** Sphygmomanometer is a clinical instrument used to measure blood pressure.
Reason: It helps to estimate the state of blood circulation and the working of the heart.
Ans: a) If both A and R are true and R is correct explanation of A ★

2. **Assertion:** White blood cells are colourless.
Reason: They do not have haemoglobin.
Ans. a) If both A and R are true and R is correct explanation of A.

3. **Assertion:** Granulocytes contain granules in the cytoplasm.
Reason: Their nucleus is irregular or lobed.
Ans. b) If both A and R are true but R is not the correct explanation of A.

VI. Answer in the word or sentence

1. Name the three regions of the root hair.

The three regions in the root hair are region of meristematic activity, region of elongation and region of maturation.

2. What are the components of the blood?

The two main components of blood are the **fluid plasma** and the **blood cells** which are suspended in the plasma.

3. Name the three types of blood cells.

- Red blood corpuscles or Erythrocytes.
- White blood corpuscles or Leucocytes.
- Blood platelets or Thrombocytes

4. Name the three types of granulocytes.

Granulocytes are of 3 types.

- Neutrophils
- Eosinophils
- Basophils

5. Name the types of blood circulations.

- Systemic
- pulmonary circulation
- coronary circulation

6. What are the two types of Agranulocytes? ★

- Lymphocytes
- Monocytes

7. Name the fluid which is also involved in transportation apart from blood plasma.

Lymph

8. Which would help the seedlings to emerge out of seeds?

Imbibition

9. What increase the surface area of absorption?

Root hairs.

10. How does the transportation of food vary from transportation of water?

Food transportation is bidirectional in contrast to water transportation which is unidirectional.

11. What is the important function of Eosinophil? ★

Detoxification of toxins

12. What produce antibodies during bacterial and viral infections?

Lymphocytes

13. What is the type of heart beat, found in human heart?

Myogenic heart beat.

14. Where can you feel the 'Pulse'?

Pulse can be felt by placing the fingertip on the artery near the wrist.

VII. Short answer questions

1. What is osmosis?

Osmosis is the movement of solvent or water molecules from the region of higher concentration to the region of lower concentration through a **semi-permeable** membrane.

2. What is plasmolysis?

Plasmolysis occurs when water **moves out of the cell** resulting in the shrinkage of cell membrane away from the cell wall.

3. What is imbibitions?

- Imbibition is a type of diffusion in which a solid absorbs water and gets swelled up.
- eg. Absorption of water by seeds and dry grapes.

4. What is transpiration?

Evaporation of water in plants through stomata in the leaves is called transpiration.

5. What is ascent of sap?

The **upward movement** of water and minerals from roots to **different parts of the plant** is called ascent of sap.

6. What is Guttation? ★★

The excess of water present in the plants is exudated in the form of a liquid. This is due to the root pressure. This phenomenon is called Guttation which takes place through specialised cells called **hydathodes**.

7. What is transpiration pull?

Transpiration through **stomata** creates vacuum which in turn creates a suction called transpiration pull.

8. What is leucopenia?

When there is decrease in the **number of leukocytes** in our body the condition is called leucopenia.

9. What is thrombocytopenia?

When there is decrease in the **number of thrombocytes** in our body, the condition is called thrombocytopenia.

10. Write notes on hypertension and hypotension

- In an healthy adult during normal resting condition systolic and diastolic blood pressure is expressed as **120mm/80mm Hg.**
- Blood pressure varies during conditions of physical exercise, anxiety, emotions, stress and sleep.
- A prolonged or constant elevation of blood pressure is a condition known as hypertension or High blood pressure.
- This can increase the risk of heart attack and stroke.
- Decrease in blood pressure is termed **hypotension** (Low blood Pressure).

VIII. Give reasons for the following statements.

1. Sino-atrial node acts as a 'pacemaker' of the heart.

Sino-atrial node acts as a 'pacemaker' of the heart because it is capable of initiating impulse which can **stimulate** the heart muscles to contract.

2. Valves are present in the heart.

The valves **regulate the flow of blood** in a single direction and prevent the backward flow of blood.

IX. Long answer questions

1. Differentiate between Artery and vein.

S.No	Artery	Vein
1.	**Distributing** vessel.	**Collecting** vessel.
2 .	**Pink** in colour.	**Red** in colour.
3 .	**Deep** location.	**Superficial** in location.
4.	Blood flow with **high pressure.**	Blood flow with **low pressure.**
5.	Wall of artery is **strong, thick and elastic.**	Wall of vein is **weak, thin and non-elastic.**
6.	All arteries carry **oxygenated** blood except pulmonary arteries.	All veins carry **deoxygenated** blood except pulmonary veins.
7.	Internal valves are **absent.**	Internal valves are **present.**

2. Describe the Pulmonary type of circulation

- The path of pulmonary circulation starts in the right ventricle.
- Pulmonary artery arises from the right ventricle and reaches the lungs with deoxygenated blood.
- Pulmonary veins collect the oxygenated blood from the lungs and supplies it to the left atrium of the heart.

3. Describe the coronary type circulation.

- The supply of blood to the **heart muscles** (cardiac muscles) is called as coronary circulation.
- Cardiac muscles receive oxygenated blood from coronary arteries that originate from the aortic arch.
- Deoxygenated blood from the cardiac muscles drains into the right atrium by the coronary sinuses.

4. Describe the sequence of events occurring in cardiac cycle.

- The sequence of events occurring from the beginning to the completion of **one heart beat** is called cardiac cycle.
- During cardiac cycle **blood flows** through the chambers of the heart in a specific direction.
- Each cardiac cycle lasts about **0.8 second.**
- The events during a single cardiac cycle involves

Atrial systole: Contraction of auricles (0.1 sec)

Ventricular systole: Contraction of ventricles (0.3 sec)

Ventricular diastole: Relaxation of ventricles (0.4 sec)

5. Enumerate the functions of lymph.

Functions of Lymph

- Supplies **nutrients and oxygen** to those parts where blood cannot reach .
- It drains away excess tissue fluid and metabolites and returns proteins to the blood from tissue spaces.
- The lymph also carries **absorbed fats** from small intestine to the blood.
- The lymphatic capillaries of intestinal villi (lacteals) absorb digested fats.
- Lymphocytes in the lymph defend the body from infections.

6. List the Antigens and Antibodies Present in the blood groups.

Distribution of Antigen (RBC) and Anti body (Plasma) in different blood groups.

Blood Group	Antigens on RBC	Antibodies in Plasma	Can donate to	Can receive from
A	Antigen A	anti – b	A and AB	A and O
B	Antigen B	anti – a	B and AB	B and O
AB	Antigen A and B	No antibody	AB	A,B,AB and O (Universal Recipient)
O	No Antigen	Both anti a and b	A,B,AB and O (Universal Donor)	O

IX. Higher Order Thinking skills (HOTS)

1. Why does the heart contain pericardial fluid?

The heart contains pericardial fluid to reduce friction during heart beat and protect it from mechanical injury.

Unit Test - 14

Tranportation in plants and Circulation in Animals

Time : 1 hr | Marks : 30

I. Choose the most suitable answer and write the code with the corresponding answer. 5 × 1 = 5

1. During transpiration there is loss of
   a) Carbon dioxide b) Oxygen c) Water d)None of the above
2. The wall of the human heart is made of
   a) Endocardium b) Epicardium c) Myocardium d) All of the above
3. Heart to Heart' is called
   a) SA node b) AV node c) Purkinge fibres d) Bundle of His
4. Excess of water is seen as dews on the leaves of grass. Phenomenon is called
   a) Adhesion b) Cohesion c) Guttation d) Imbibition
5. **Assertion:** Persons with AB blood group are called universal recipients, because they can receive blood from all groups.
   Reason: Antibodies are absent in persons with AB blood group.
   a) If both A and R are true and R is correct explanation of A
   b) If both A and R are true but R is not the correct explanation of A
   c) A is true but R is false
   d) Both A and R are false

II. Answer the following questions in one or two lines. 5 × 2 = 10

1. What is the importance of valves in the heart?
2. Who discovered Rh factor? Why was it named so?
3. How are arteries and veins structurally different from one another?
4. Why is the Sinoatrial node called the pacemaker of heart?
5. Differentiate between systemic circulation and pulmonary circulation.

III. Answer the following questions in brief. 2 × 4 = 8

1. Differentiate between Artery and vein.
2. Describe the Systemic type of circulation.

IV. Answer the following questions in detail. 1 × 7 = 7

1. i) Why does the heart contain pericardial fluid?
   ii) Describe the sequence of events occurring in cardiac cycle.