Section A

I. Multiple choice Questions:

1. Which of the following blood vessels carry oxygen-rich blood from the lungs to the heart?

a) Pulmonary artery b) Pulmonary vein

c) Aorta d) Vena cava

Answer: b) Pulmonary vein

Explanation: The pulmonary vein carries oxygen-rich blood from the lungs to the left atrium of the heart. The pulmonary artery, on the other hand, carries oxygen-poor blood from the heart to the lungs.

2. What is the function of platelets in the blood?

a) To carry oxygen b) To fight infections

c) To help in blood clotting d) To transport carbon dioxide

Answer: c) To help in blood clotting

Explanation: Platelets are responsible for blood clotting. They help stop bleeding by forming a clot at the site of injury.

3. Which type of blood vessel is responsible for carrying oxygen and nutrients to the body's tissues?

a) Arteries b) Veins c) Capillaries d) Lymphatic vessels

Answer: a) Arteries

Explanation: Arteries carry oxygenated blood away from the heart to the rest of the body. They have thick walls to withstand the high pressure from the heart's pumping action.

4. Which blood component helps in fighting infections?

a) Red blood cells b) White blood cells

c) Plasma d) Platelets

Answer: b) White blood cells

Explanation: White blood cells (WBCs) are responsible for fighting infections. They recognize and destroy harmful microorganisms such as bacteria and viruses.

5. What is the name of the large artery that carries oxygenated blood from the heart to the body?

a) Pulmonary artery b) Carotid artery

c) Aorta d) Jugular vein

Answer: c) Aorta

Explanation: The aorta is the main artery that carries oxygen-rich blood from the left ventricle of the heart to the rest of the body.

6. Which of the following statements is true regarding veins?

a) They carry blood away from the heart

b) They carry oxygen-rich blood

c) They have thick, muscular walls

d) They have valves to prevent backflow of blood

Answer: d) They have valves to prevent backflow of blood

Explanation: Veins carry deoxygenated blood toward the heart and have valves to prevent blood from flowing backward, as the blood moves under low pressure.

7. The process by which oxygen and carbon dioxide are exchanged between blood and tissues is called:

a) Circulation b) Respiration c) Diffusion d) Filtration

Answer: c) Diffusion

Explanation: Diffusion is the process by which oxygen moves from the blood into the tissues, and carbon dioxide moves from the tissues into the blood in the capillaries.

8. The right atrium receives blood from which of the following?

a) Pulmonary vein b) Aorta c) Vena cava d) Pulmonary artery

Answer: c) Vena cava

Explanation: The right atrium receives deoxygenated blood from the body through the superior and inferior vena cava before pumping it to the right ventricle.

9. Which of the following is the correct pathway for the blood flow in the heart?

a) Right atrium → Right ventricle → Pulmonary artery → Lungs → Left atrium → Left ventricle → Aorta

b) Right atrium → Left atrium → Left ventricle → Aorta → Pulmonary artery → Lungs

c) Left atrium → Left ventricle → Pulmonary artery → Lungs → Right atrium → Right ventricle

d) Right atrium → Pulmonary vein → Left atrium → Left ventricle → Aorta → Body

Answer: a) Right atrium → Right ventricle → Pulmonary artery → Lungs → Left atrium → Left ventricle → Aorta

Explanation: This is the correct flow of blood in the heart. The right atrium receives deoxygenated blood and sends it to the right ventricle, which pumps it to the lungs via the pulmonary artery. Oxygenated blood returns to the heart through the pulmonary veins into the left atrium, and then it is pumped into the left ventricle, which sends it to the body through the aorta.

10. What is the name of the liquid component of blood that helps in transporting nutrients, hormones, and waste products?

a) Red blood cells b) Plasma

c) Platelets d) White blood cells

Answer: b) Plasma

Explanation: Plasma is the yellowish, liquid component of blood that makes up about 55% of its volume. It helps transport nutrients, hormones, proteins, and waste products.

11. Which of the following blood vessels carries deoxygenated blood from the heart to the lungs?

a) Aorta b) Pulmonary artery c) Pulmonary vein d) Carotid artery

Answer: b) Pulmonary artery

Explanation: The pulmonary artery carries deoxygenated blood from the right ventricle of the heart to the lungs for oxygenation.

12. What is the function of the septum in the heart?

a) To separate oxygenated and deoxygenated blood

b) To pump blood into the lungs

c) To produce heartbeats

d) To regulate blood pressure

Answer: a) To separate oxygenated and deoxygenated blood

Explanation: The septum is a thick muscular wall that divides the heart into two halves, preventing the mixing of oxygen-rich blood and oxygen-poor blood.

13. Which of the following is a characteristic of capillaries?

a) They have thick muscular walls

b) They carry oxygen-rich blood

c) They are the site of exchange of gases and nutrients

d) They have valves to prevent backflow of blood

Answer: c) They are the site of exchange of gases and nutrients

Explanation: Capillaries are tiny blood vessels that facilitate the exchange of oxygen, carbon dioxide, nutrients, and waste products between the blood and tissues.

14. Which of the following is true about the pulmonary circulation?

a) It circulates blood between the heart and the lungs.

b) It supplies blood to the body's organs.

c) It is responsible for delivering oxygen to the heart.

d) It moves blood only through arteries.

Answer: a) It circulates blood between the heart and the lungs.

Explanation: Pulmonary circulation refers to the movement of blood from the heart to the lungs and back, where it picks up oxygen and releases carbon dioxide.

15. Which of the following structures in the heart controls the flow of blood between the left atrium and the left ventricle?

a) Tricuspid valve
b) Pulmonary valve
c) Aortic valve
d) Bicuspid valve (Mitral valve)

Answer: d) Bicuspid valve (Mitral valve)

Explanation: The bicuspid (mitral) valve controls the flow of blood between the left atrium and the left ventricle, ensuring that blood flows in one direction.

16. What is the primary function of the coronary arteries?

a) To supply blood to the brain
b) To supply oxygenated blood to the heart muscle
c) To carry blood from the heart to the lungs
d) To remove waste products from the body

Answer: b) To supply oxygenated blood to the heart muscle

Explanation: The coronary arteries supply oxygen-rich blood to the heart muscle (myocardium). If these arteries become blocked, it can lead to a heart attack.

17. The "lub-dub" sound of the heartbeat is caused by:

a) The closing of the heart valves
b) The flow of blood through the arteries
c) The contraction of the heart muscles
d) The pumping of blood into the veins

Answer: a) The closing of the heart valves

Explanation: The "lub" sound is caused by the closing of the atrioventricular valves (tricuspid and bicuspid) when the ventricles contract. The "dub" sound is caused by the closing of the semilunar valves (pulmonary and aortic) when the ventricles relax.

18. What is the name of the large vein that carries deoxygenated blood from the lower part of the body to the heart?

a) Jugular vein b) Pulmonary vein c) Superior vena cava d) Inferior vena cava

Answer: d) Inferior vena cava

Explanation: The inferior vena cava carries deoxygenated blood from the lower part of the body (legs, abdomen, etc.) to the right atrium of the heart.

19. What is the function of the tricuspid valve in the heart?

a) To prevent the backflow of blood from the left ventricle to the left atrium

b) To prevent the backflow of blood from the right ventricle to the right atrium

c) To regulate blood pressure

d) To pump blood into the lungs

Answer: b) To prevent the backflow of blood from the right ventricle to the right atrium

Explanation: The tricuspid valve is located between the right atrium and right ventricle, and it prevents blood from flowing backward into the atrium when the ventricle contracts

20. What is the role of the heart's pacemaker?

a) To regulate the flow of blood into the lungs

b) To produce red blood cells

c) To generate electrical impulses that control the heartbeat

d) To filter waste from the blood

Answer: c) To generate electrical impulses that control the heartbeat

Explanation: The pacemaker (sinoatrial node) generates electrical impulses that trigger the contraction of the heart, setting the rhythm of the heartbeat.

21. What is the process of blood clotting called?

a) Hemostasis b) Hemophilia c) Oxygenation d) Diffusion

Answer: a) Hemostasis

Explanation: Hemostasis is the process by which the body prevents blood loss through clotting. Platelets help form a clot at the site of injury.

22. Which of the following blood components is responsible for clotting?

a) Plasma b) Red blood cells

c) Platelets d) White blood cells

Answer: c) Platelets

Explanation: Platelets help in blood clotting by forming a plug at the site of a wound and releasing chemicals that help in the clotting process.

23. Which of the following occurs when the heart contracts?

a) The atria fill with blood
b) Blood is pumped from the heart into the arteries
c) Blood enters the heart from the veins
d) The heart relaxes to receive blood

Answer: b) Blood is pumped from the heart into the arteries

Explanation: When the heart contracts (during systole), it pumps blood into the arteries, sending it to the lungs and the rest of the body.

24. The heart is located in which cavity of the body?

a) Thoracic cavity b) Abdominal cavity c) Pelvic cavity d) Cranial cavity

Answer: a) Thoracic cavity

Explanation: The heart is located in the thoracic cavity, specifically in a region called the mediastinum, between the lungs.

25. What is the function of the aortic valve in the heart?

a) To prevent the backflow of blood into the left atrium
b) To regulate the flow of blood into the aorta
c) To prevent the backflow of blood into the left ventricle
d) To regulate the flow of blood into the pulmonary artery

Answer: c) To prevent the backflow of blood into the left ventricle

Explanation: The aortic valve prevents the backflow of blood from the aorta into the left ventricle after the ventricle contracts.

26. Which of the following statements is true about blood pressure?

a) It is lower in arteries than in veins
b) It is higher in veins than in arteries
c) It is higher in arteries than in veins
d) Blood pressure is the same in all blood vessels

Answer: c) It is higher in arteries than in veins

Explanation: Blood pressure is higher in arteries because they carry blood away from the heart under high pressure. In veins, the pressure is lower as blood returns to the heart.

27. Which of the following helps to maintain the blood flow during the relaxation phase of the heart?

a) Capillaries b) Valves in veins c) Arteries d) Aorta

Answer: b) Valves in veins

Explanation: Valves in veins prevent the backflow of blood and ensure that blood continues to flow toward the heart, especially during the relaxation phase (diastole).

28. What is the correct sequence of blood flow through the heart starting from the body?

a) Right atrium → Left atrium → Right ventricle → Left ventricle
b) Right atrium → Right ventricle → Left atrium → Left ventricle
c) Left atrium → Right atrium → Left ventricle → Right ventricle
d) Left ventricle → Right atrium → Left atrium → Right ventricle

Answer: b) Right atrium → Right ventricle → Left atrium → Left ventricle

Explanation: Blood enters the right atrium from the body, is pumped to the right ventricle, moves to the lungs for oxygenation, then returns to the left atrium and is pumped to the body by the left ventricle.

29. Which of the following does NOT carry blood?

a) Arteries b) Veins c) Lymph vessels d) Capillaries

Answer: c) Lymph vessels

Explanation: Lymph vessels carry lymph, a clear fluid containing white blood cells, but they do not carry blood, unlike arteries, veins, and capillaries.

30. The heart has two main pumps. The left side pumps blood to the _____.

a) Lungs b) Heart c) Kidneys d) Body

Answer: d) Body

Explanation: The left side of the heart pumps oxygenated blood to the body through the aorta, supplying oxygen and nutrients to the tissues.

31. Which of the following diseases is caused by the narrowing of arteries?

a) Hypertension b) Atherosclerosis c) Anemia d) Leukemia

Answer: b) Atherosclerosis

Explanation: Atherosclerosis is a condition in which arteries become narrowed and hardened due to the buildup of plaque, which can restrict blood flow.

32. Blood group A has

a) antigen A and antibody B b) antigen B and antibody B

c) antigen A and antibody A d) antigen B and antibody A

Answer: antigen A and antibody B

Reason — Blood group A has antigen A and antibody B.

Section B

II. Reasoning Questions

Q1. Why do arteries have thicker walls than veins?

Answer: Arteries have thicker walls than veins because they carry blood under high pressure from the heart to the rest of the body. The thick muscular walls help to withstand and maintain the high pressure at which blood is pumped. Veins, on the other hand, carry blood back to the heart under lower pressure, so their walls are thinner. Additionally, veins have valves to prevent the backflow of blood, ensuring it flows in one direction.

Q2. Explain why the left ventricle has thicker walls than the right ventricle.

Answer: The left ventricle has thicker walls than the right ventricle because it needs to pump blood to the entire body, which requires more force and pressure. The right ventricle only pumps blood to the lungs, a much shorter distance and under lower pressure. To generate

enough force for systemic circulation, the left ventricle is muscular and thick-walled, while the right ventricle has relatively thinner walls.

Q3. Why does the heart have a septum? What is its importance?

Answer: The heart has a septum to separate the right and left sides of the heart, ensuring that oxygenated blood and deoxygenated blood do not mix. The septum divides the heart into two halves: the right side, which receives deoxygenated blood from the body and pumps it to the lungs, and the left side, which receives oxygenated blood from the lungs and pumps it to the rest of the body. This separation ensures the efficient circulation of oxygen-rich and oxygen-poor blood to the appropriate parts of the body.

Q4. Why are capillaries the most important type of blood vessels for nutrient and gas exchange?

Answer: Capillaries are the most important blood vessels for nutrient and gas exchange because they are very thin and have walls that are only one cell thick. This allows for the easy diffusion of gases like oxygen and carbon dioxide, as well as nutrients and waste products, between the blood and surrounding tissues. The large surface area and the close proximity of capillaries to cells make them ideal for efficient exchange.

Q5. Why do veins have valves, but arteries do not?

Answer: Veins have valves to ensure that blood flows in one direction towards the heart and to prevent the backflow of blood, especially in the lower parts of the body, where gravity can impede upward flow. Arteries, on the other hand, carry blood away from the heart under high pressure, and the force of blood flow is strong enough to prevent any backflow, so arteries do not need valves.

Q6. Why is it important that blood from the lungs is delivered to the left side of the heart rather than the right?

Answer: It is important that blood from the lungs is delivered to the left side of the heart because the left side of the heart pumps oxygenated blood to the entire body. After blood is

oxygenated in the lungs, it enters the left atrium and then the left ventricle, where it is pumped out to the aorta and throughout the body to deliver oxygen to tissues. If this oxygenated blood were delivered to the right side, it would only be pumped back to the lungs, not to the rest of the body, making oxygen delivery ineffective.

Q7. Why do we need to have both systemic and pulmonary circulations in the body?

Answer: The systemic and pulmonary circulations serve distinct but complementary functions. The pulmonary circulation transports deoxygenated blood from the heart to the lungs for oxygenation and the removal of carbon dioxide. The systemic circulation, on the other hand, carries oxygenated blood from the heart to the rest of the body to nourish tissues with oxygen and nutrients. Having both circulations ensures that oxygen and nutrients reach all body tissues, while waste products are effectively removed from the body.

Q8. Why are white blood cells important in the circulatory system?

Answer: White blood cells (WBCs) are important because they play a crucial role in defending the body against infections and foreign invaders such as bacteria, viruses, and other pathogens. They are part of the immune system and are constantly circulating in the blood, searching for harmful agents to neutralize. They protect the body from disease and infection by attacking and destroying pathogens, ensuring the body remains healthy.

Q9. During surgical operations or during accidents, the patient may be given blood from outside to save his life. What is the technical name of this process ? Briefly explain the precautions to be observed and taken in this process.

Answer: This process is known as **blood transfusion**. The following precautions are to be observed for blood transfusion:

1. Checking the compatibility of the donor's blood group with that of the recipient.
2. It should be made sure clinically that the blood of the donor is free from any infections.
3. The donor's hemoglobin level is checked.

Q10. Amit and Ankita's friend Navin is in need of blood for a surgery. Navin's blood test indicates that he has antibodies A and B but no antigen at all. Ankita's blood is found to be O- while Amit's blood is AB+. Find Navin's blood group and say who qualifies as his blood donor.

Answer:

Navin's blood test indicates that he has antibodies A and B but no antigen at all. This means that his blood group is O.

Ankita qualifies as his blood donor because her blood group is O- and she is an universal donor.

Q11. The ventricles have thick muscular walls whereas the auricles have thin walls. Why do you think thick muscular walls are necessary in the ventricles and not in the auricles.

Answer: The Auricles have to receive blood and transfer it to the ventricles for which they do not require much force. So, they have thin walls. But the ventricles have thick walls because they need more force as they have to pump the blood out of the heart at greater pressure to the lungs (Right ventricle) and whole body (Left ventricle).

Section C

III. Short answer question:

Q1. The path which the blood flows through during pulmonary circulation is:

1. RA → RV → Pulmonary arteries → Lungs → Pulmonary veins → LA
2. LA → LV → Pulmonary veins → Lungs → Pulmonary arteries → RA
3. LA → LV → Aorta → Body → Vena Cava → RA
4. RA → RV → Vena Cava → Body → Aorta → LA

Answer: RA → RV → Pulmonary arteries → Lungs → Pulmonary veins → LA

Reason — Pulmonary circulation is the movement of blood from the heart to the lungs for oxygenation, then back to the heart again. At first, blood flows from the right side of the heart to the lungs and then returns to the left side of the heart (pulmonary circulation).

Q2. The scientist who identified different types of blood groups.

Answer: Karl Landsteiner

Q3. Name the four blood groups on the basis of antigens.

Answer: Four blood groups on the basis of antigen are:

1. A (A antigen)
2. B (B antigen)
3. AB (A and B antigens)
4. O (No antigens)

Q4. Name the three principal fluids of human body.

Answer: Three principal fluids of the human body:

1. Blood
2. Lymph
3. Tissue fluid

Q5. Define Lymph.

Answer: Lymph is the fluid contained within the lymph vessels and lymphatic organs. It is also a part of immune system and its main function is defence against germs.

Q6. Define Artificial pacemaker.

Answer: Sometimes a mechanical device called an artificial pacemaker is placed surgically in humans if their SA node is damaged or if the electrical conduction system of the heart has problems

Q7. Write important role/roles of Pericardial fluid.

Answer: Pericardial fluid protects the heart from shocks, jerks or any mechanical stress.

Q8. Give the functions of lymph.

Answer: Functions of lymph are —

1. **Drainage** — It drains away excess tissue fluid and metabolites and returns proteins to the blood from tissue spaces.
2. **Absorption** — Fats in the intestine are absorbed through lymph vessels (or lymphatics).
3. **Defence** — Lymphocytes and monocytes of the lymph function to defend the body. The lymphatics also remove bacteria from the tissues.

Q9. Explain — (a) Universal donor (b) Universal recipient

Answer:

(a) **Universal donor** — The blood of O group can be given to all the groups. Hence, a person with O blood group is called a universal donor.

(b) **Universal recipient** — The blood of AB group can only be given to AB group, but a person with AB type of blood can receive blood from all types, and is therefore called a universal recipient.

Q10. What is normal blood pressure in an adult?

Answer: The normal blood pressure in an adult is *120/80* mm Hg

Q11. Define Palpitation

Answer: Palpitation — Palpitation can be defined as a condition which is caused by anxiety, side effect of some medicine or some coronary heart disease and makes a person feel as if his heart is beating too fast, skipping a beat, or fluttering.

Q12. Define Hypertension.

Answer: Hypertension — Hypertension or high blood pressure is a medical condition which creates difficulty in the flow of blood due to constriction of arterioles.

Q13. What is double circulation?

Answer: For completing one round of circulation in the body, the blood passes twice through the heart. This is called double circulation. Double circulation involves two processes — Pulmonary circulation and Systemic circulation.

Q14. Difference between Blood and Lymph

Answer: Basically, lymph has all the elements of blood except RBCs and blood platelets. It is slightly yellowish in colour and contains special type of white blood cells called lymphocytes.

Q15. Given below is a table showing blood groups and their transfusion compatibility. Complete the table by filling in the blanks numbered 1 to 6.

Blood group	Can donate blood to	Can receive blood from
1	A and AB	2
B	3	4
AB	5	AB, A, B and O
O	A, B, O and AB	6

Answer:

Blood group	Can donate blood to	Can receive blood from
A (1)	A and AB	A and O (2)
B	B and AB (3)	B and O (4)
AB	AB (5)	AB, A, B and O
O	A, B, O and AB	O (6)

Q16. Match the following terms with their correct locations:

Column A	Column B
1. Left Ventricle	A. Between right atrium and right ventricle.
2. Right Atrium	B. Pumps oxygenated blood to the body.
3. Tricuspid valve	C. Between left atrium and left ventricle.
4. Bicuspid valve	D. Receives deoxygenated blood from the body.
5. Aortic valve	E. Prevents backflow of blood from the left ventricle into the left atrium.

Answer:

1. Left Ventricle - B. Pumps oxygenated blood to the body.
2. Right Atrium - D. Receives deoxygenated blood from the body.
3. Tricuspid valve - A. Between right atrium and right ventricle.
4. Bicuspid valve - C. Between left atrium and left ventricle.
5. Aortic valve - E. Prevents backflow of blood from the left ventricle into the left atrium.

Section D

IV. Long Answer Questions

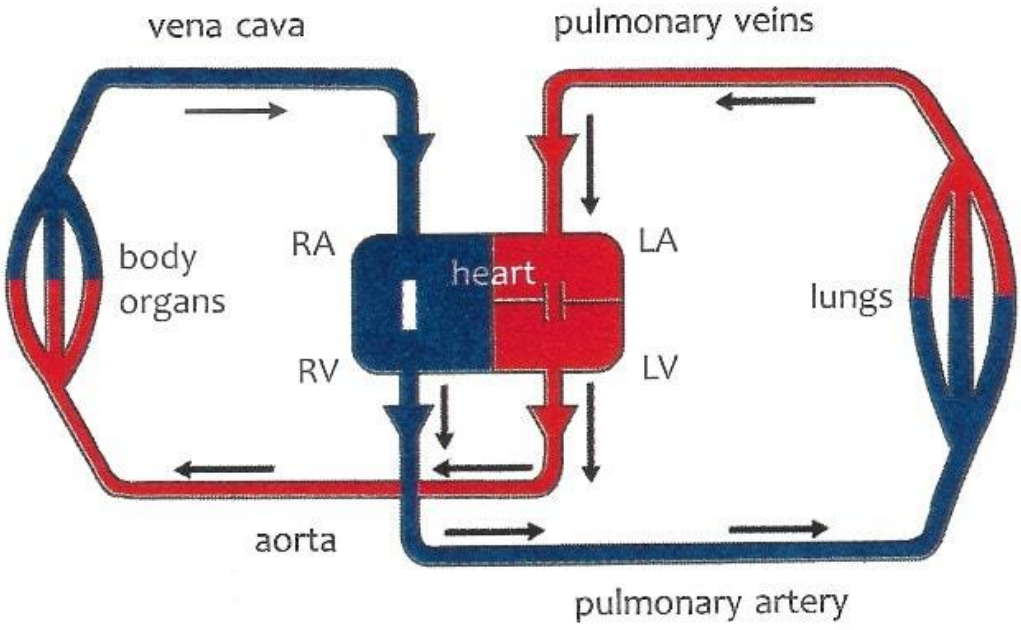
Q1. Explain the process of blood circulation in the body with the help of a schematic diagram.

Answer: For completing one round of circulation in the body, the blood passes twice through the heart. This is called double circulation. Double circulation involves two processes: pulmonary circulation and systemic circulation.

Pulmonary circulation — The circulation of blood between the heart and lungs is called pulmonary circulation. From the right auricle, the blood flows into the right ventricle and then to the lungs through the pulmonary arteries. The oxygenated or pure blood from the lungs is brought to the left auricle by the pulmonary veins.

Systemic circulation — The circulation of blood between the heart and other body organs is called systemic circulation. From the left auricle, the oxygenated blood flows into the left ventricle and from there it is pumped into the aorta, the largest artery in the body. The aorta divides further to supply blood to all body tissues.

Below schematic diagram shows circulation of blood in the body:



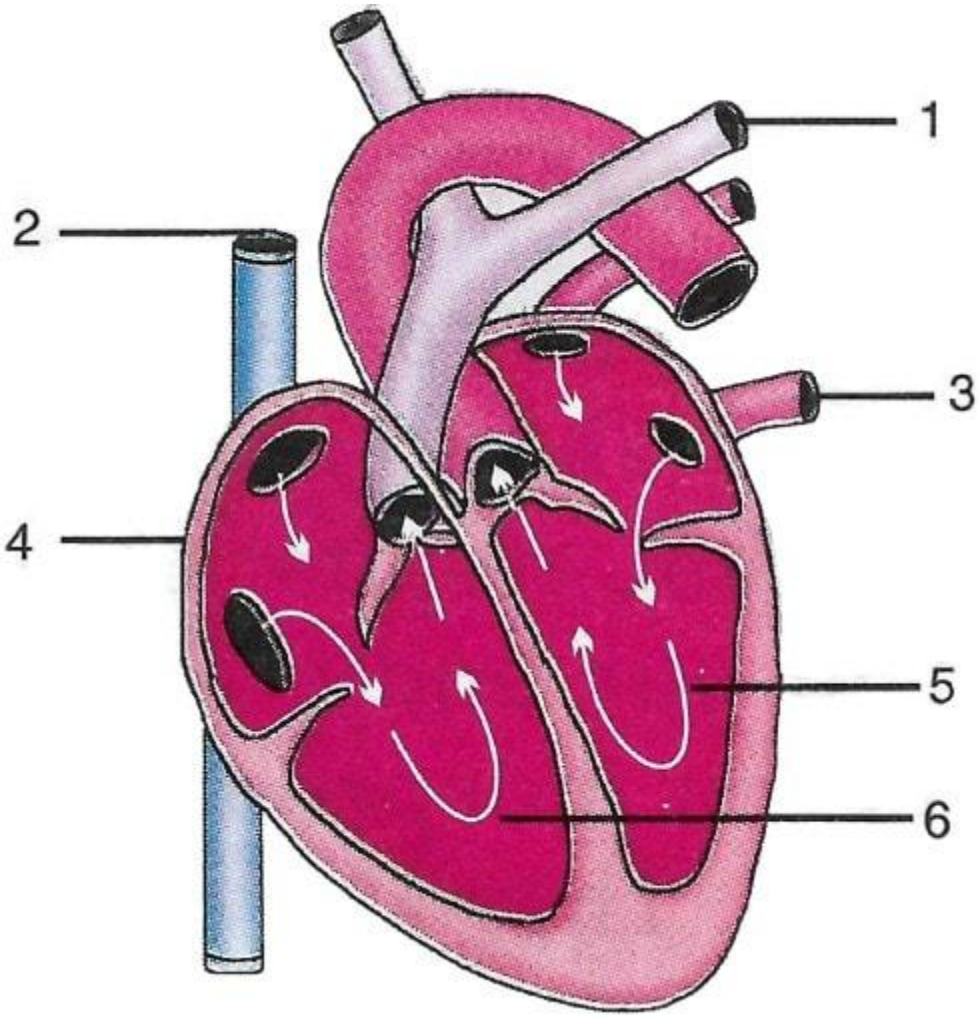
Q2. Why is a person with blood group O called a universal donor and a person with blood group AB called a universal recipient?

Answer: A person with blood group O is called a universal donor since his blood can be given to a person with any blood group. As blood group O has neither antigen A nor B so it doesn't cause self-clumping with any antibodies making it compatible with all blood groups. A person with blood group AB is called a universal recipient since he can receive blood from

a person with any blood group. As blood group AB has no antibodies, so there is no attack on the antigens of any blood group making it compatible to receive blood from all blood groups.

V. Picture study

Q1. Given alongside is a diagram of the human heart showing its internal structure. Label the parts marked 1 to 6, and answer the following questions.



(a) Which type of blood is carried by the blood vessel marked 2?

(b) Name the main artery which takes the blood from heart to different parts of the body?

(c) Which chamber of the heart receives deoxygenated blood from the body?

Answer:

The parts marked 1 to 6 are labelled below:

- 1 → Left pulmonary artery
- 2 → Superior vena cava
- 3 → Left pulmonary vein
- 4 → Right auricle
- 5 → Left ventricle
- 6 → Right ventricle

(a) Deoxygenated blood is carried by the blood vessel marked 2 (Superior vena cava).

(b) Aorta

(c) Right auricle