
18. Body Fluids and Circulation

Question 1. Name the components of the formed elements in the blood and mention one major function of each of them.

Answer: Functions of formed elements of blood are as follows:

(i) Function of Erythrocytes (RBCs): transport of respiratory gases.

(ii) Functions of Leucocytes (WBCs):

Neutrophils and monocytes are phagocytic cells and they destroy foreign materials.

Basophils are involved in inflammatory reactions.

Eosinophils resist infections and are also involved in allergic reactions.

Lymphocytes are responsible for immune response.

(iii) Function of Platelets: Coagulation of blood.

Question 2. What is the importance of plasma proteins?

Answer: Plasma is the colourless fluid of blood which helps in the transport of food, CO₂, waste products, and salts. It constitutes about 55% of blood. About 6.8% of the plasma is constituted by proteins such as fibrinogens, globulins, and albumins.

Fibrinogen is a plasma glycoprotein synthesised by the liver. It plays a role in the clotting of blood.

Globulin is a major protein of the plasma. It protects the body against infecting agents.

Albumin is a major protein of the plasma. It helps in maintaining the fluid volume within the vascular space.

Question 3. Match Column I with Column II :

Column I	Column II
(a) Eosinophils	(i) Coagulation
(b) RBC	(ii) Universal recipient
(c) AB Group	(iii) Resist infections
(d) Platelets	(iv) Contraction of heart
(e) Systole	(v) Gas transport

Answer:

Column I	Column II
(a) Eosinophils	(iii) Resist infections
(b) RBC	(v) Gas transport
(c) AB Group	(ii) Universal recipient
(d) Platelets	(i) Coagulation
(e) Systole	(iv) Contraction of Heart

Question 4. Why do we consider blood as a connective tissue?

Answer: We consider blood as connective tissue because of these reasons:

- Connective tissues bind, link or support the other organs of the body.
- They are the most abundant and widely distributed tissue in the body.
- Blood transports gases, nutrients, and hormones from one body organ to the other.
- It flows throughout the body.
- Hence, blood is considered connective tissue.

Question 5. What is the difference between lymph and blood?

Answer:

Lymph	Blood
It consists of plasma, erythrocytes, leucocytes and platelets.	It consists of plasma and leucocytes.
It has red colour because of the presence of haemoglobin.	It is colourless as haemoglobin is absent.
Plasma has more proteins, calcium and phosphorus.	Plasma has fewer proteins, less calcium and phosphorus.
Glucose concentration is less in blood.	Glucose concentration is high.

Question 6. What is meant by double circulation? What is its significance?

Answer: Double circulation is a process by which blood moves twice through the heart to complete one cycle. It is found in amphibians, reptiles, birds, and mammals. However, it is more prominent in birds and mammals as their heart has four chambers – the right atrium, the right ventricle, the left atrium, and the left ventricle.

The circulation of blood in an organism is divided into two parts:

- (i) Systemic circulation
- (ii) Pulmonary circulation

Systemic circulation: In this case, the movement of oxygenated blood occur from the left ventricle of the heart to the aorta. Then, blood is carried out through a network of arteries, arterioles, and capillaries to the tissues. From the tissues, the deoxygenated blood is reached to the left auricle through the veins and vena cava.

Pulmonary circulation: In this case, the deoxygenated blood flows from the right ventricle to the pulmonary artery and then carries to lungs for oxygenation. From the lungs, the oxygenated blood is transported via pulmonary veins into the left atrium.

Hence, in double circulation, blood has to pass alternately through the lungs and the tissues.

Significance of double circulation:

Blood is circulated to the body tissues via systemic circulation and to the lungs by pulmonary circulation.

Question 7. Write the differences between:

- (a) Blood and Lymph
- (b) Open and Closed system of circulation
- (c) Systole and Diastole
- (d) P-wave and T-wave

Answer:

- (a) Blood and lymph

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(b) Open and closed system of circulation

Open system of circulation	Closed system of circulation
In this system, blood is pumped by the heart, through large vessels, into body cavities called sinuses.	In this system, blood is pumped by the heart, through a closed network of vessels.
The body tissues are in direct contact with blood.	The body tissues are not in direct contact with blood.
Blood flows at low pressure. Hence, it is a slower and less efficient system of circulation.	Blood flows at high pressure. Hence, it is a faster and more efficient system of circulation.
The flow of blood is not regulated through the tissues and organs.	The flow of blood can be regulated by valves.
This system is present in arthropods and molluscs.	This system is present in annelids, echinoderms, and vertebrates.

(c) Systole and diastole

Systole	Diastole
It is the contraction of the heart chambers to drive blood into the aorta and the pulmonary artery.	It is the relaxation of the heart chambers between two contractions. During diastole, the chambers are filled with blood.
Systole decreases the volume of the heart chambers and forces the blood out of them.	Diastole brings the heart chambers back into their original sizes to receive more blood.

(d) P-wave and T-wave

P-Wave	T-Wave
In an electrocardiogram (ECG), the P-wave indicates the activation of the SA node.	In an electrocardiogram (ECG), the T-wave represents ventricular relaxation.
During this phase, the impulse of contraction is generated by the SA node, causing atrial depolarisation.	During this phase, the ventricles relax and return to their normal state.
It is of atrial origin.	It is of ventricular origin.

Question 8. Describe the evolutionary change in the pattern of heart among the vertebrates

Answer: The heart among the vertebrates show different patterns of evolution. Different groups of animals have evolved different methods for this transport. All vertebrates possess a muscular chambered heart.

(i) Fishes have a two-chambered heart with an atrium and a ventricle. The heart pumps out deoxygenated blood which is oxygenated by the gills and supplied to the body parts from where

deoxygenated blood is returned to the heart.

(ii) Amphibians and the reptiles (except crocodiles) have a three-chambered heart with two atria and a single ventricle. The left atrium receives oxygenated blood from the gills/lungs/skin and the right atrium gets the deoxygenated blood from other body parts. However, they get mixed up in the single ventricle which pumps out mixed blood.

(iii) Crocodiles, birds and mammals possess a four-chambered heart with two atria and two ventricles. Oxygenated and deoxygenated blood received by the left and right atria respectively passes on to the ventricles of the same sides. The ventricles pump it out without any mixing up, i.e., two separate circulatory pathways are present in these organisms, hence, these animals have double circulation.

Question 9. Why do we call our heart myogenic?

Answer: In the human heart, contraction is initiated by a special modified heart muscle known as sinoatrial node. It is located in the right atrium. The SA node has the inherent power of generating a wave of contraction and controlling the heartbeat. Hence, it is known as the pacemaker. Since the heart beat is initiated by the SA node and the impulse of contraction originates in the heart itself, the human heart is termed myogenic. The hearts of vertebrates and molluscs are also myogenic.

Question 10. Sino-atrial node is called the pacemaker of our heart. Why?

Answer: The sino-atrial (SA) node is a specialised bundle of neurons located in the upper part of the right atrium of the heart. The cardiac impulse originating from the SA node triggers a sequence of electrical events in the heart, thereby controlling the sequence of muscle contraction that pumps blood out of the heart. Since the SA node initiates and maintains the rhythmicity of the heart, it is known as the natural pacemaker of the human body.

Question 11. What is the significance of atrio-ventricular node and atrio-ventricular bundle in the functioning of heart?

Answer: The atrioventricular (AV) node is present in the right atrium, near the base of the inter-auricular septum that separates the right auricle from the ventricle. It gives rise to the bundle of His that conducts the cardiac impulses from the auricles to the ventricles. As the bundle of His passes the ventricle along the inter-ventricular septum, it divides into two branches – the right ventricle and the left ventricle. The end branches of this conducting system then forms a network of Purkinje fibres that penetrate into the myocardium. The auricular contraction initiated by the wave of excitation from the sino-atrial node (SA node) stimulates the atrio-ventricular node, thereby leading to the contraction of

ventricles through the bundle of His and Purkinje fibres. Hence, the atrio-ventricular node and the atrioventricular bundle play a role in the contraction of ventricles.

Question 12. Define a cardiac cycle and the cardiac output.

Answer: The cardiac cycle is all the activities of the heart through one complete heartbeat, it is through one contraction and relaxation of both atria and ventricles. The contraction event is called systole and relaxation event is diastole.

Cardiac output is the amount of blood which pumped by the heart in one minute. It is the product of the heart rate, which is the number of beats per minute, and the stroke volume, which is amount pumped per beat.

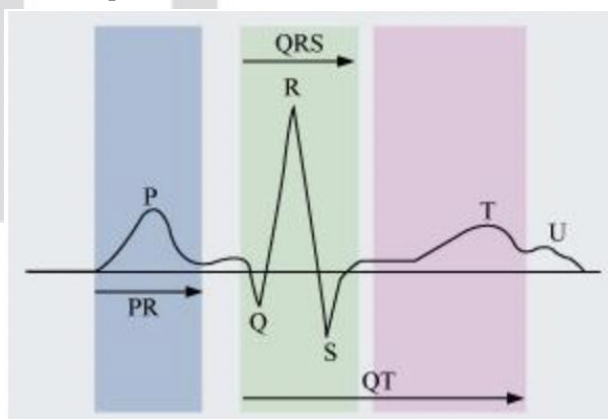
Cardiac Output = heart rate X stroke volume.

Question 13. Explain heart sounds.

Answer: Heart sounds are noises generated by the closing and opening of the heart valves. In a healthy individual, there are two normal heart sounds called lub and dub. Lub is the first heart sound. It is associated with the closure of the tricuspid and bicuspid valves at the beginning of systole. The second heart sound dub is associated with the closure of the semilunar valves at the beginning of diastole. These sounds provide important information about the condition and working of the heart.

Question 14. Draw a standard ECG and explain the different segments in it.

Answer: Electrocardiogram is a graphical representation of the cardiac cycle produced by an electrograph. The diagrammatic representation of a standard ECG is shown below.



A typical human electrocardiogram has five waves – P, Q, R, S, and T. The P, R, and T-waves are above the base line and are known as positive waves. The Q and S-waves are below the base line and

are known as negative waves. The P-wave is of atrial origin, while the Q, R, S, and T-waves are of ventricular origin.



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