Chapter: Body fluids and circulation

Exercise

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

Answer:
(1) Erythrocytes:
These are the most numerous cells in the blood and include hemoglobin, a red pigment.They carry oxygen combined with haemoglobin to all parts of the body via arteries. Some parts of the body, including the marrow of long bones and ribs, produce red blood cells. Each cubic millimeter of blood contains between 4 and 6 million RBCs.
(2) Leukocytes
Leukocytes are colorless cells. These cells are devoid of hemoglobin. They are the body's largest cells and are classified into two types.
(a) Granulocytes
These leukocytes, which include neutrophils, eosinophils, and basophils, have granules in their cytoplasm. Neutrophils are phagocytic cells that protect the body from various pathogens. Eosinophils are linked to allergic reactions, whereas basophils are linked to inflammatory responses.
(b) Agranulocytes
Agranulocytes include lymphocytes and monocytes. Lymphocytes produce immune responses against invading agents, whereas monocytes are phagocytic.
(3) Platelets
Platelets are tiny irregular bodies found in the blood. They contain important chemicals that aid in clotting. Platelets' primary function is to promote clotting.

Question 2. What is the importance of plasma proteins?

Answer: Plasma is a colorless fluid found in the blood that aids in the transport of nutrients, CO_2, waste products, and salts. It accounts for approximately 55% of total blood volume. Proteins such as fibrinogens, globulins, and albumins make up approximately 6.8 percent of the plasma. Fibrinogen is a plasma glycoprotein that the liver produces. It aids in the clotting of blood. Globulin is a major plasma protein. It protects the body from invading agents. Albumin is a major plasma protein. It aids in the maintenance of 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)	Contractions of hearts
(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)	Contractions of hearts

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

Answer: Cells in connective tissues are dispersed throughout an extracellular matrix. They connect various body systems. Blood is classified as a type of connective tissue for two reasons.

- Blood, like the other connective tissues, is derived from the mesoderm.
- It joins the body systems, transports oxygen and nutrients to all areas of the body, and eliminates waste. Blood contains an extracellular matrix called plasma, which contains red blood cells, white blood cells, and platelets.

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

Answer:

Lymph	Blood
1. It is a colorless fluid that is devoid of RBCs.	1. It is a blood-red fluid containing RBCs.
2. It contains plasma as well as a lower concentration of WBCs and platelets.	2. It is made up of plasma, RBCs, WBCs, and platelets.
3. It contributes to body defense and is a component of the immune system.	3. It is linked to the exchange of oxygen and carbon dioxide.
4. Its plasma is protein-deficient.	4. Proteins, calcium, and phosphorus are found in its plasma.
5. Through lymphatic vessels, it transports nutrients from tissue cells to the blood.	5. It moves nutrients and oxygen from one organ to another.
6. The lymphatic fluid flow is slow.	6. The flow of blood through the blood vessels is rapid.

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

Answer: The process by which blood passes twice through the heart in one complete cycle is known as double circulation. Amphibians, reptiles, birds, and mammals all have this type of circulation. It is

more noticeable in birds and mammals because their hearts are completely divided into four chambers – the right atrium, the right ventricle, the left atrium, and the left ventricle.
Blood movement in an organism is divided into two parts:

1. Systemic circulation
2. Pulmonary circulation

Systemic circulation: The movement of oxygenated blood from the left ventricle of the heart to the aorta is referred to as systemic circulation. It is then carried to the tissues by blood through a network of arteries, arterioles, and capillaries. The venules, veins, and vena cava collect deoxygenated blood from the tissues and empty it into the left auricle.

Pulmonary circulation: Pulmonary circulation refers to the change of deoxygenated blood from the right ventricle to the pulmonary artery, which then transports blood to the lungs for oxygenation. The pulmonary veins are responsible for transporting oxygenated blood from the lungs to the left atrium. As a result, blood must alternately pass through the lungs and the tissues in double circulation.

Significance of double circulation:
The distinction between oxygenated and deoxygenated blood allows for a more efficient supply of oxygen to the body's cells. Blood is circulated throughout the body via systemic circulation and to the lungs via 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

Blood	Lymph
1. RBCs are found in blood, which is a red fluid.	1. Lymph is a colorless fluid that is devoid of RBCs.
2. It is made up of plasma, RBCs, WBCs, and platelets. It also has proteins in it.	2. It contains plasma as well as a lower concentration of WBCs and platelets. It is protein-deficient.
3. Blood carries nutrients and oxygen from one organ to the next.	3. Lymph is a component of the body's defense system and is an integral part of the immune system.

(b) Open and Closed system of circulation

The open system of circulation	The closed system of circulation
1. The heart pumps blood through large vessels into body cavities known as sinuses in this system.	1. The heart pumps blood through a closed network of vessels in this system.
2. The tissues of the body are in direct contact with the blood.	2. The tissues of the body are not in direct contact with the blood.

3. Blood circulates at low pressure. As a result, it is a slower and less efficient circulation system.	3. Blood is under high pressure. As a result, it is a faster and more efficient circulation system.
4. The flow of blood through the tissues and organs is uncontrolled.	4. Blood flow can be controlled by valves.
5. Arthropods and mollusks have this system.	5. Annelids, echinoderms, and vertebrates all have this system.

(c) Systole and Diastole

Systole	Diastole
1. It is the contraction of the heart chambers that causes blood to flow into the aorta and pulmonary arteries.	1. It is the relaxation of the heart chambers that occurs between two contractions. The chambers fill with blood during diastole.
2. Systole reduces the volume of the heart chambers and forces blood out.	2. Diastole restores the heart chambers to their original sizes, allowing them to receive more blood.

(d) P-wave and T-wave

P-wave	T-wave
1. The P-wave on an electrocardiogram (ECG) indicates that the SA node is activated.	1. The T-wave on an electrocardiogram (ECG) represents ventricular relaxation.
2. The SA node generates a contraction impulse during this phase, resulting in atrial depolarization.	2. The ventricles relax and return to their normal state during this phase.
3. It is atrial in origin.	3. It has ventricular origins.

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

Answer: Every vertebrate has a heart, which is a hollow muscular organ made up of cardiac muscle fibers. The heart's function is to deliver oxygen to all parts of the body. For efficient oxygen transport, the heart's evolution is based on the separation of oxygenated blood from deoxygenated blood.
The heart in fish was shaped like a hollow tube. In mammals, this evolved into the four-chambered heart.

Piscean heart
The heart of a fish has only two chambers: one auricle and one ventricle. Because the auricle and ventricle remain separate, only deoxygenated blood flows through it. From the ventricle, deoxygenated blood enters the gills for oxygenation. It has extra chambers such as the sinus venosus and the conus arteriosus.
Amphibian heart
Frogs, for example, have three-chambered hearts with two auricles and one ventricle. An inter-auricular septum divides the auricle into right and left chambers, while the ventricle remains undivided.
There are also additional chambers such as the sinus venosus and the conus arteriosus. The oxygenated blood from the lungs enters the left auricle, and the deoxygenated blood from the body

enters the right auricle at the same time. Both auricles empty into the ventricle, where oxygenated and deoxygenated blood mix to some extent.

Reptilian heart
Except for crocodiles, alligators, and gharials, reptiles have incomplete four-chambered hearts. They only have one accessory chamber known as the sinus venosus. The reptilian heart has mixed blood circulation as well.

Avian and mammalian hearts
They have two chambers that separate oxygenated and deoxygenated blood. The heart is made up of four different chambers. The upper two chambers are known as atria, while the lower two chambers are known as ventricles. The chambers are separated by a muscular wall that prevents oxygen-rich blood from mixing with carbon dioxide-rich blood.

Question 9. Why do we call our heart myogenic?

Answer: Contraction in the human heart is initiated by a specially modified heart muscle known as the sinoatrial node. It can be found in the right atrium. The SA node can generate a wave of contraction and control the heartbeat. As a result, it is known as the pacemaker. Because the SA node initiates the heartbeat and the impulse of contraction originates in the heart itself, the human heart is referred to as myogenic. Vertebrate and molluscan hearts are both myogenic.

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

Answer: The sino-atrial (SA) node is a specialized package of neurons in the upper part of the right atrium of the heart. The cardiac impulse generated by the SA node initiates a series of electrical events in the heart, controlling the sequence of muscle contractions that pumps blood out of the heart. The SA node is referred to as the human body's natural pacemaker because it begins and retains the rhythmicity of the heart.

Question 11. What is the significance of the atrioventricular node and atrioventricular bundle in the functioning of the heart?

Answer: The AV node is located in the right atrium, near the base of the interauricular septum that connects the right auricle to the ventricle. It generates the His bundle, which conducts cardiac impulses from the auricles to the ventricles. The bundle of His divides into two branches as it passes through the ventricle along the interventricular septum – the right ventricle and the left ventricle. The conducting system's end branches then form a network of Purkinje fibers that penetrate the myocardium. The auricular contraction caused by the wave of excitation from the sino-atrial node (SA node) stimulates the atrioventricular node, causing ventricles to contract via the bundle of His and Purkinje fibers. As a result, the atrioventricular node and atrioventricular bundle play a role in ventricle contraction.

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

Answer: The complete cycle of events in the heart from the start of one heartbeat to the start of the next is referred to as the cardiac cycle. It is divided into three stages: atrial systole, ventricular systole, and total cardiac diastole.
The amount of blood pumped out by the ventricles in a minute is referred to as cardiac output.

Question 13. Explain heart sounds.

Answer: Heart sounds are the noises created by the opening and closing process of the heart valves. There are two normal heart sounds in a healthy person: lub and dub. Lub is the first heartbeat. It is caused by the closure of the tricuspid and bicuspid valves at the start of the systole. The closure of the semilunar valves at the start of diastole is associated with the second heart sound dub. These sounds provide vital information about the heart's condition and operation.

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

Answer:
An electrocardiogram is a graphical depiction of the cardiac cycle obtained from an electrograph.
A standard ECG is depicted diagrammatically below.

The five waves of a typical human electrocardiogram are P, Q, R, S, and T. The P, R, and T- waves are positive waves because they are above the baseline. The Q and S-waves are negative waves because they are below the baseline. The P-wave originates in the atrium, whereas the Q, R, S, and T-waves originate in the ventricle.
(a) The presence of a P-wave indicates atrial depolarization. The SA node generates the contraction impulse during this wave. Atrial contraction is represented by the PQ wave.
(b) Ventricular contraction precedes the QR-wave. It represents the spread of the contraction impulse from the AV node to the ventricle wall. This results in ventricular depolarization.
(c) The RS-wave represents a 0.3-second ventricular contraction.
(d) The ST-wave represents 0.4 sec of ventricular relaxation. The ventricles relax and return to their normal state during this phase.
(e) The T-wave is a representation of ventricular relaxation.