

Body Fluids and Circulation



ANSWERS

Topic 1

1. Blood corpuscles are the formed elements in the blood, they constitute 45% of the blood. Formed elements are - erythrocytes (RBCs or red blood corpuscles), leucocytes, (WBCs or white blood corpuscles) and thrombocytes or (blood platelets). The major function of RBCs is to transport oxygen from lungs to body tissues and CO_2 from body tissues to the lungs. WBCs provide immunity to the body. Platelets play an important role in blood clotting.

2. Plasma proteins constitute about 7 to 8 per cent of plasma. These mainly include albumin, globulin, prothrombin and fibrinogen. Albumins and globulins retain water in blood plasma and helps in maintaining osmotic balance. Certain globulins (immunoglobulins) act as antibodies. Prothrombin and fibrinogen are needed for blood clotting.

3. A connective tissue connects different tissues or organs of the body. It consists of living cells and extracellular matrix. Blood is a vascular connective tissue. It is a mobile tissue consisting of fluid matrix and free cells. Blood transports materials from one place to the other and thereby establishes connectivity between different body parts.

4. Differences between blood and lymph are :

S.No.	Blood	Lymph
(i)	It consists of plasma, erythrocytes, leucocytes and platelets.	It consists of plasma and leucocytes.
(ii)	It is red in colour due to the presence of haemoglobin in erythrocytes.	It is colourless as haemoglobin is absent.
(iii)	Its plasma has more proteins, calcium and phosphorus.	Its plasma has fewer proteins, less calcium and phosphorus.
(iv)	It carries materials towards and away from the tissue, therefore, it acts as a "vehicle".	It transfers materials from the blood to the body cells and <i>vice-versa</i> , therefore, it acts as a "middle-man".

Topic 2

1. (a) – (iii); (b) – (v); (c) – (ii); (d) – (i); (e) – (iv)

2. (a) Refer to answer 4 (Topic 1).

(b) The differences between open and closed circulatory system are:

S.No.	Open circulatory system	Closed circulatory system
(i)	Blood flows through open tissue spaces, the sinuses.	Blood flows in closed tubes, the blood vessels, with definite walls.
(ii)	Blood is in direct contact with the tissue cells.	Blood does not come in direct contact with the tissue cells.
(iii)	Exchange of materials occurs directly between blood and tissue cells.	Exchange of materials between tissue cells and blood occurs <i>via</i> tissue fluid.
(iv)	Blood flow is very slow.	Blood flow is quite rapid.
(v)	Respiratory pigment, if present, is dissolved in the plasma, no red corpuscles are present.	Respiratory pigment is present, and may be dissolved in the plasma but is usually held in red blood corpuscles.
(vi)	This system occurs in arthropods and most molluscs.	This system occurs in annelids and vertebrates.

(c) Systole is contraction of heart chambers in order to pump out blood while diastole is relaxation of heart chambers to receive blood. The contraction of a chamber or systole decreases its volume and forces the blood out of it, whereas relaxation or diastole brings chamber back to its original size to receive more blood.

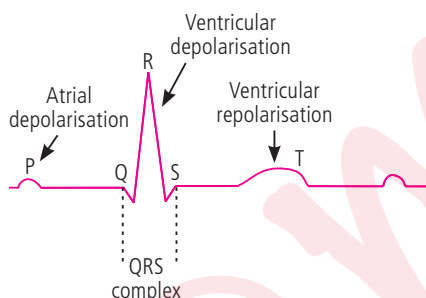
(d) P-wave is a small upward wave of electrocardiograph that indicates the atrial depolarisation (contraction of atria). It is caused by the activation of SA node. T-wave is a dome-shaped wave of electrocardiograph which represents ventricular repolarisation (ventricular relaxation).

3. Electrocardiogram (ECG) is a graphic record of the electric current produced by the excitation of the cardiac muscles. The instrument used to record the changes is an electrocardiograph.

A normal electrogram (ECG) is composed of a P wave, a QRS wave (complex) and a T wave.

- The P wave is a small upward wave that represents electrical excitation or the atrial depolarisation which leads to contraction of both the atria (atrial contraction). It is caused by the activation of SA node. The impulses of contraction start from the SA node and spread throughout the atria.
- The QRS wave (complex) represents ventricular depolarisation (ventricular contraction). It is caused by the impulses of the contraction from AV node through the bundle of His and Purkinje fibres and the contraction of the ventricular muscles. Thus this wave is due to the spread of electrical impulse through the ventricles.
- The T wave represents ventricular repolarisation (ventricular relaxation). The potential generated by the recovery of the ventricle from the depolarisation state is called the repolarisation wave. The end of the T-wave marks the end of systole.

ECG gives accurate information about the heart. Therefore, ECG is of great diagnostic value in cardiac diseases. The given graph shows the diagrammatic representation of a standard ECG.



4. The heart of molluscs and vertebrates including humans is myogenic. It means heart beat is initiated in heart itself by a patch of modified heart muscle called sinoatrial node or pacemaker which lies in the wall of the right atrium near the opening of the superior vena cava.

5. Sinoatrial node (SAN) is a mass of neuromuscular tissue which lies in the wall of right atrium. It is responsible for initiating and maintaining the rhythmic contractile activity of the heart. Therefore, it is called the pacemaker.

6. Atrioventricular node (AVN) is a mass of neuromuscular tissue, which is situated in wall of right atrium, near the base of interatrial septum. AV node is the pacesetter of the heart, as it transmits the impulses initiated by SA node to all parts of ventricles.

Atrioventricular bundle (AV bundle) or bundle of His is a mass of specialised fibres which originates from the AVN. Within the myocardium of the ventricles the branches of bundle of His divide into a network of fine fibres called Purkinje fibres.

The bundle of His and the Purkinje fibres convey impulse of contraction from the AVN to the myocardium of the ventricles.

7. The sequential events in the heart which are repeated cyclically is called cardiac cycle and it consists of systole (contraction) and diastole (relaxation) of both the atria and ventricles.

The amount of blood pumped by heart per minute is called cardiac output. It is calculated by multiplying stroke volume, i.e., volume of blood pumped by one ventricle (conventionally the left) per minute with heart rate (number of beats per minute).

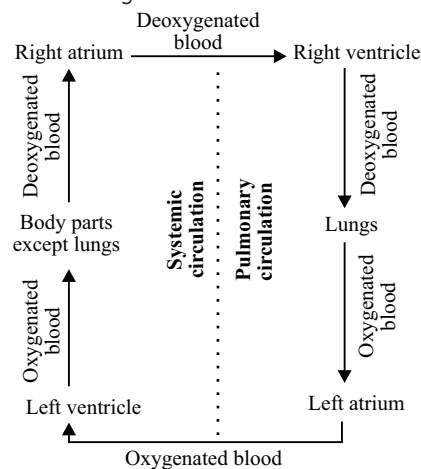
The heart of normal person beats 72 times per minute and pumps out about 70 mL of blood per beat. Therefore, cardiac output averages 5000 mL or 5 litres.

8. The beating of heart produces characteristic sounds which can be heard by using stethoscope. In a normal person, two sounds are produced per heart beat. The first heart sound 'lub' is low pitched, not very loud and of long duration. It is caused partly by the closure of the bicuspid and tricuspid valves and partly by the contraction of muscles in the ventricles.

The second heart sound 'dub' is high pitched, louder, sharper and shorter in duration. It is caused by the closure of the semilunar valves and marks the end of ventricular systole.

Topic 3

1. The type of blood circulation in which blood is pumped and received twice in single cardiac cycle termed as double circulation. It includes systemic circulation and pulmonary circulation. The circulatory pathway of double circulation is given in the following flow chart :



Double circulation or separation of systemic and pulmonary circulations provides a higher metabolic rate to the body and also allows the two circulations to have different blood pressures according to the need of the organs they supply.

