

Body Fluids and Circulation

Multiple Choice Questions

Q1. Which of the following cells does not exhibit phagocytic activity?

(a) Monocytes (b) Neutrophil (c) Basophil (d) Macrophage

Ans: (c) Basophils secrete histamine, serotonin, heparin, etc., and are involved in inflammatory reactions.

Q2. One of the common symptoms observed in people infected with Dengue fever is

(a) significant decrease in RBC count

(b) significant decrease in WBC count

(c) significant decrease in platelets count

(d) significant increase in platelets count

Ans: (c) One of the common symptoms observed in people infected with Dengue fever is significant decrease in platelets count.

Q3. Which among the followings is correct during each cardiac cycle?

(a) The volume of blood pumped out by the Rt and Lt ventricles is same

(b) The volume of blood pumped out by the Rt and Lt ventricles is different

(c) The volume of blood received by each atrium is different

(d) The volume of blood received by the aorta and pulmonary artery is different

Ans: (a) The volume of blood pumped out by the Rt and Lt ventricles is same.

Q4. The cardiac activity could be moderated by the autonomous neural system. Tick the correct answer

(a) The parasympathetic system stimulates heart rate and stroke volume

(b) The sympathetic system stimulates heart rate and stroke volume

(c) The parasympathetic system decreases the heart rate but increase stroke volume

(d) The sympathetic system decreases the heart rate but increase stroke volume

Ans: (b) A special neural centre in the medulla oblongata can moderate the cardiac function through autonomic nervous system (ANS). Neural signals through the sympathetic nerves (part of ANS) can increase the rate of heart beat, the strength of ventricular contraction and thereby the cardiac output. On the other hand, parasympathetic neural signals (another component of ANS) decrease the rate of heart beat, speed of conduction of action potential and thereby the cardiac output.

Q5. Mark the pair of substances among the following which is essential for coagulation of blood.

(a) Heparin and calcium ions (b) Calcium ions and platelet factors

(c) Oxalates and citrates (d) Platelet factors and heparin

Ans: (b) Calcium ions and platelet factors are essential for coagulation of blood.

Q6. ECG depicts the depolarisation and repolarisation processes during the cardiac cycle. In the ECG of a normal healthy individual one of the following waves is not represented.

(a) Depolarisation of atria (b) Repolarisation of atria

(c) Depolarisation of ventricles (d) Repolarisation of ventricles

Ans: (b) ECG depicts the depolarisation and repolarisation processes during the cardiac cycle. In the ECG of a normal healthy individual repolarisation of atria is not represented.

Q7. Which one of the following types of cells lack nucleus in humans

(a) RBC (b) Neutrophils (c) Eosinophils (d) Erythrocytes

Ans: (a and d) RBCs or erythrocytes lack nucleus in humans.

Q8. Which one of the following blood cells is involved in antibody production?

(a) B-lymphocytes (b) T-Lymphocytes

(c) RBC (d) Neutrophils

Ans: (a) B-lymphocytes cells are involved in antibody production.

Q9. The cardiac impulse is initiated and conducted further up to ventricle. The correct sequence of conduction of impulse is

- (a) S A Node → A V Node Purkinje fiber → A V Bundle**
- (b) S A Node → Purkinje fiber → A V Node → A V Bundle**
- (c) S A Node → A V Node → A V Bundle Purkinje fiber**
- (d) S A Node → Purkinje fiber → A V Bundle → A V Node**

Ans. (c) S A Node → A V Node → A V Bundle → Purkinje fiber

Q10. Agranulocytes responsible for immune response of the body are

(a) Basophils (b) Neutrophils (c) Eosinophils (d) Lymphocytes

Ans: (d) Lymphocytes (20-25%) are of two major types—'B' and 'T' forms. Both B and T lymphocytes are responsible for immune responses of the body.

Q11. The second heart sound (dub) is associated with the closure of

(a) Tricuspid valve (b) Semilunar valves
(c) Bicuspid valve (d) Tricuspid and bicuspid valves

Ans: (b) The first heart sound (lub) is associated with the closure of the tricuspid and bicuspid valves whereas the second heart sound (dub) is associated with the closure of the semilunar valves.

Q12. Which of the following correctly explains a phase/event in cardiac cycle in a standard electrocardiogram?

- (a) QRS complex indicates atrial contraction**
- (b) QRS complex indicates ventricular contraction**
- (c) Time between S and T represents atrial systole**
- (d) P-wave indicates beginning of ventricular contraction**

Ans: (b)

- P-wave—Atrial depolarisation (atrial systole/contraction)
- QRS complex—Ventricular depolarisation (ventricular systole/contraction)
- T-wave—Ventricular repolarisation (ventricular relaxation)

Q13. Which of the following statements is incorrect?

- (a) A person of 'O' blood group has anti 'A' and anti 'B' antibodies in his blood plasma**
- (b) A person of 'B' blood group cannot donate blood to a person of 'A' blood group**
- (c) Blood group is designated on the basis of the presence of antibodies in the blood plasma**
- (d) A person of AB blood group is universal recipient**

Ans: (c) Blood group is designated on the basis of the antigen is present on the RBCs surface

Q14. What would be the cardiac output of a person having 72 heart beats per minute and a stroke volume of 50 mL?

(a) 360 mL (b) 3600 mL (c) 7200 mL (d) 5000 mL

Ans: (b) Cardiac output = Stroke volume x Heart rate = 50 x 72 = 3600 mL/min

Q15. Match the terms given under Column 'A' with their functions given under Column 'B' and select the answer from the options given below:

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	Column A		Column B
A.	Lymphatic system	(i)	Carries oxygenated blood
B.	Pulmonary vein	(ii)	Immune Response
C.	Thrombocytes	(iii)	To drain back the tissue fluid to the circulatory system
D.	Lymphocytes	(iv)	Coagulation of blood

- (a) A—(ii), B—(i), C—(iii), D—(iv)
 (b) A—(iii), B—(i), C—(iv), D—(ii)
 (c) A—(iii), B—(i), C—(ii), D—(iv)
 (d) A—(ii), B—(i), C—(iii), D—(iv)

Ans: (b)

A.	Lymphatic System	(iii)	To drain back the tissue fluid to the circulatory system
B.	Pulmonary vein	(i)	Carries oxygenated blood
C.	Thrombocytes	(iv)	Coagulation of blood
D.	Lymphocytes	(ii)	Immune Response

Q16. Read the following statements and choose the correct option.

Statement 1: Atria receive blood from all parts of the body which subsequently flows to ventricles.

Statement 2: Action potential generated at sino-atrial node passes from atria to ventricles.

- (a) Action mentioned in Statement 1 is dependent on action mentioned in Statement 2.
 (b) Action mentioned in Statement 2 is dependent on action mentioned in Statement 1.
 (c) Actions mentioned in Statements 1 and 2 are independent of each other.
 (d) Actions mentioned in Statements 1 and 2 are synchronous.

Ans: (b) Statement 1: Atria receive blood from all parts of the body which subsequently flows to ventricles.

Statement 2: Action potential generated at sino-atrial node passes from atria to ventricles.

Action mentioned in Statement 2 is dependent on action mentioned in Statement 1.

Very Short Answer Type Questions

Q1. Name the blood component which is viscous and straw coloured fluid.

Ans: Plasma .

Q2. Complete the missing word in the statement given below:

- a. Plasma without _____ factors is called serum.
 b. _____ and monocytes are phagocytic cells.
 c. Eosinophils are associated with _____ reactions.

d. _____ ions play a significant role in clotting.

e. One can determine the heart beat rate by counting the number of _____ in an ECG.

Ans: a. Plasma without clotting factors is called serum.

b. Neutrophils and monocytes are phagocytic cells.

c. Eosinophils are associated with allergic reactions.

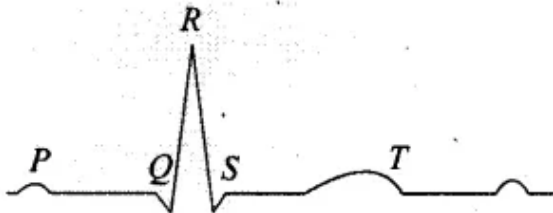
d. Calcium ions play a significant role in clotting.

e. One can determine the heart beat rate by counting the number of QRS complex in an ECG.

Q3. Given below is the diagrammatic representation of a standard ECG. Label its different peaks



Ans.



Presentation of a standard ECG

Q4. Name the vascular connection that exists between the digestive tract and liver.

Ans: Hepatic portal system

Q5. Given below are the abnormal conditions related to blood circulation. Name the disorders.

a. Acute chest pain due to failure of O_2 supply to heart muscles

b. Increased systolic pressure

Ans: a. Acute chest pain due to failure of O_2 supply to heart muscles—Angina

b. Increased systolic pressure—Hypertension/high blood pressure

Q6. Which is coronary artery diseases caused due to narrowing of the lumen of arteries?

Ans: Atherosclerosis

Q7. Define the following terms and give their-locations?

a. Purkinje fibre

b. Bundle of His

Ans: a. Purkinje fibre—Right and left bundles give rise to minute fibres throughout the ventricular musculature of the respective sides and are called purkinje fibres. .

b. Bundle of His—Purkinje fibres alongwith right and left bundles are known as bundle of His and present in ventricles.

Q8. State the functions of the following in blood:

a. Fibrinogen b. Globulin

c. Neutrophils d. Lymphocytes

Ans: a. Fibrinogen—Fibrinogens are needed for clotting or coagulation of blood. ■

b. Globulin—Globulins primarily are involved in immunity, i.e., defense mechanisms of the body.

- c. Neutrophils—Phagocytosis
- d. Lymphocytes—Immunity

Q9. What physiological circumstances lead to erythroblastosis foetalis?

Ans: A special case of Rh incompatibility (mismatching) has been observed between the Rh-negative blood of a pregnant mother with Rh-positive blood of the foetus.

Q10. Explain the consequences of a situation in which blood does not coagulate.

Ans: This situation leads to excessive loss of blood from body due to injury which can be fatal.

Q11. What is the significance of time gap in the passage of action potential from sino-atrial node to the ventricle?

Ans: This time gap is significant for ventricular systole.

Q12. How will you interpret an electrocardiogram (ECG) in which time taken in QRS complex is higher.

Ans: Period of ventricular systole increases

Short Answer Type Questions

Q1. The walls of ventricles are much thicker than atria. Explain.

Ans: The walls of ventricles are much thicker than atria because they pump blood more strongly than the atria.

Q2. Differentiate between:

a. Blood and Lymph

b. Basophils and Eosinophils

c. Tricuspid and Bicuspid valves

Ans: a. Blood and Lymph: Blood is a connective tissue consisting of a fluid matrix, plasma and formed elements (RBCs, WBCs and Platelets). Blood flows in blood vascular system comprising heart, arteries and veins.

Lymph is a colourless fluid containing specialised lymphocytes (imparting immunity to the body), but devoid of RBCs. Lymph flows in the lymphatic system and it absorbs fats.

a.	Blood		Lymph
1.	It contains plasma, RBCs, WBCs and platelets	1.	It contains plasma and lymphocytes
2.	It is red in colour	2.	It is colourless
3.	Haemoglobin is present	3.	Haemoglobin is absent
4.	It transports nutrients and gases from heart to tissues and vice-versa	4.	It transports infection fighting white blood cells from tissues to lymph nodes
b.	Basophils		Eosinophils

1.	They constitute about 0.5-1% of WBCs	1.	They constitute about 2-3% of WBCs
2.	They secrete heparin, histamine and serotonin	2.	They resist infection
3.	They are involved in inflammatory reaction	3.	These are associated with allergic reactions
c.	Tricuspid valve		Bicuspid valve
1.	It has three cusps.	1.	It have two cusps.
2.	It is present between right atrium and right ventricle	2.	It is present between left atrium and left ventricle.

Q3. Briefly describe the following:

a. Anaemia

b. Angina Pectoris

c. Atherosclerosis

d. Hypertension

e. Heart failure

f. Erythroblastosis foetalis

Ans: a. Anaemia: Decrease in oxygen carrying capacity of blood either due to reduced RBCs production or low haemoglobin content is called anaemia.

b. Angina Pectoris: A symptom of acute chest pain appears when not enough oxygen is reaching the heart muscle. Angina can occur in men and women of any age but it is more common among the middle-aged and elderly. It occurs due to conditions that affect the blood flow.

c. Atherosclerosis: Sometimes deposition of calcium, fat, cholesterol and fibrous tissues occurs in the blood vessel (e.g., coronary artery) supplying blood to the heart muscles. This condition makes the lumen of arteries narrower affecting blood supply to heart; which leads to Coronary Artery Disease (CAD) also referred to as atherosclerosis.

d. Hypertension: If repeated checks of blood pressure of an individual is 140/90 (140 over 90) or higher, it shows hypertension. High blood pressure leads to heart diseases and also affects vital organs like brain and kidney.

e. Heart failure: Heart failure means the state of heart when it is not pumping blood effectively enough to meet the needs of the body. It is sometimes called congestive heart failure because congestion of the lungs is one of the main symptoms of this disease.

f. Erythroblastosis foetalis: A special case of Rh incompatibility (mismatching) has been observed between the Rh-negative blood of a pregnant mother with Rh-positive blood of the foetus! Rh antigens of the foetus do not get exposed to the Rh-negative blood of the mother in the first pregnancy as the two bloods are well separated by the placenta. However, during the delivery of the first child, there is a possibility of exposure of the maternal blood to small amounts of the Rh-positive blood from the foetus. In such cases, the mother starts preparing antibodies against Rh antigen in her blood. In case of her

subsequent pregnancies, the Rh antibodies from the mother (Rh-negative) can leak into the blood of the foetus (Rh-positive) and destroy the foetal RBCs. This could be fatal to the foetus or could cause severe anaemia and jaundice to the baby. This condition is called erythroblastosis foetalis. This can be avoided by administering anti-Rh antibodies to the mother immediately after the delivery of the first child.

Q4. Explain the advantage of the complete partition of ventricle among birds and mammals and hence leading to double circulation.

Ans: Complete partition of ventricle among birds and mammals is advantageous because there is no mixing of oxygenated and deoxygenated blood in the ventricle, so tissues of the body receive more oxygenated blood.

Q5. What is the significance of hepatic portal system in the circulatory system?

Ans: The hepatic portal vein carries blood from intestine to liver before it is delivered to systemic circulation. This is significant because excess of nutrients like glucose is converted into glycogen in liver and stored there.

Q6. Explain the functional significance of lymphatic system?

Ans: As the blood passes through the capillaries in tissues, some water along with many small water soluble substances move out into the spaces between the cells of tissues leaving the larger proteins and most of the formed elements in the blood vessels. This fluid released out is called the interstitial fluid or tissue fluid. It has the same mineral distribution as that in plasma. Exchange of nutrients, gases, etc., between the blood and the cells always occur through this, fluid. An elaborate network of vessels called the lymphatic system collects this fluid and drains it back to the major veins. The fluid present in the lymphatic system is called the lymph. Lymph is a colourless fluid containing specialised lymphocytes which are responsible for the immune responses of the body. Lymph is also an important carrier for nutrients, hormones, etc. Fats are absorbed through lymph in the lacteals present in the intestinal villi.

Q7. Write the features that distinguish between the two

a. Plasma and Serum

b. Open and Closed circulatory system

c. Sino-atrial node and Atrio-ventricular node

a.	Plasma		Serum
i.	Blood without formed elements is called plasma	1.	Plasma without clotting factor is called serum
2.	Plasma has clotting factors	2.	Serum does not have clotting factors
3.	Plasma involved in blood coagulation	3.	Serum does not involve in blood coagulation
b.	Open circulatory system		Closed circulatory system

1.	Blood pumped by heart passes through large vessels into open spaces or body cavities called sinuses	1.	Blood pumped by the heart is always circulated through a closed network of blood vessels
2.	Less advantageous	2.	More advantageous
3.	Flow of fluid cannot be more precisely regulated	3.	Flow of fluid can be more precisely regulated
4.	It is present in arthropods molluscs, and hemichordates	4.	It is found in annelids and chordates
c.	Sino-atrial node		Atrio-ventricular node
1.	SA node is present in the right upper corner of the right atrium	1.	AV node is present in the lower left corner of the right atrium
2.	It initiates and maintains the rhythmic contractile activity of the heart	2.	It passes the electrical impulses from SA node to AV bundle
3.	It is also called pace-maker	3.	It is also called pace-setter

Q9. Answer the following:

a. Name the major site where RBCs are formed.

b. Which part of heart is responsible for initiating and maintaining its rhythmic activity?

c. What is specific in the heart of crocodiles among reptilians?

Ans: a. Bone marrow

b. Sino-Atrial Node (SA Node)

c. Reptiles have 3-chambered heart but crocodiles have 4-chambered heart.

Long Answer Type Questions

Q1. Explain Rh-incompatibility in humans.

Ans: A special case of Rh-incompatibility (mismatching) has been observed between the Rh-negative blood of a pregnant mother with Rh-positive blood of the foetus. Rh antigens of the foetus do not get exposed to the Rh-negative blood of the mother in the first pregnancy as the two bloods are well separated by the placenta. However, during the delivery of the first child, there is a possibility of exposure of the maternal blood to small amounts of the Rh – positive blood from the foetus. In such cases, the mother starts preparing antibodies against Rh antigen in her blood. In case of her subsequent pregnancies, the Rh antibodies from the mother (Rh-negative) can leak into the blood of the foetus (Rh-positive) and destroy the foetal RBCs. This could be fatal to the foetus or could cause severe anaemia and jaundice to the baby. This condition is called erythroblastosis foetalis. This can be avoided by administering anti-Rh antibodies to the mother immediately after the delivery of the first child.

Q2. Describe the events in cardiac cycle. Explain “double circulation”.

Ans:

• Cardiac cycle: To begin with, all the four chambers of heart are in a relaxed state, i.e., they are in joint diastole. As the tricuspid and bicuspid valves are open, blood from the pulmonary veins and vena cava flows into the left and the right ventricle respectively through the left and right atria. The semilunar valves are closed at this stage. The SAN now generates an action potential which stimulates both the atria to undergo a simultaneous contraction—the atrial systole. This increases the flow of blood into the ventricles by about 30%. The action potential is conducted to the ventricular side by the AVN and AV bundle from where the bundle of His transmits it through the entire ventricular musculature. This causes the ventricular muscles to contract (ventricular systole), the atria undergoes relaxation (diastole), coinciding with the ventricular systole. Ventricular systole increases the ventricular pressure causing the closure of tricuspid and bicuspid valves due to attempted backflow of blood into the atria. As the ventricular pressure increases further, the semilunar valves guarding the pulmonary artery (right side) and the aorta (left side) are forced open, allowing the blood in the ventricles to flow through these vessels into the circulatory pathways.

The ventricles now relax (ventricular diastole) and the ventricular pressure falls causing the closure of semilunar valves which prevents the backflow of blood into the ventricles. As the ventricular pressure declines further, the tricuspid and bicuspid valves are pushed open by the pressure in the atria exerted by the blood which was being emptied into them by the veins. The blood now once again moves freely to the ventricles. The ventricles and atria are now again in a relaxed (joint diastole) state, as earlier. Soon the SAN generates a new action potential and the events described above are repeated in that sequence and the process continues.

• Double circulation: The blood pumped by the right ventricle enters the pulmonary artery, whereas the left ventricle pumps blood into the aorta. The deoxygenated blood pumped into the pulmonary artery is passed on to the lungs from where the oxygenated blood is carried by the pulmonary veins into the left atrium. This pathway constitutes the pulmonary circulation. The oxygenated blood entering the aorta is carried by a network of arteries, arterioles and capillaries to the tissues from where the deoxygenated blood is collected by a system of venules, veins and vena cava and emptied into the right atrium. This is the systemic circulation. The systemic circulation provides nutrients, O₂ and other essential substances to the tissues and takes CO₂ and other harmful substances away for elimination.

Q3. Explain different types of blood groups and donor compatibility by making a table.

Ans: ABO blood grouping is based* on the presence or absence of two surface antigens on the RBCs namely A and B. Similarly, the plasma of different individuals contain two natural antibodies anti-A and anti-B. Blood group 'A' carries antigen-A and antibodies-B. The donor's group for blood group A are A and O. Blood group B carries antigen-B and antibodies-A. The donor's group for blood group B are B and O. Blood group AB carries antigens A and B but no corresponding antibodies so, the compatible donor's group for blood group AB are A, B, AB and O hence, blood group 'AB' is also called as “universal acceptor”. Blood group 'O' carries no antigens but carries antibodies both A and B hence its compatible donor's group is only 'O' but it is a compatible donor group for all the blood groups. A, B, AB and O hence, blood group 'O' is called as ‘universal donor’.

Blood groups and donor compatibility

Blood Group	. Antigen on RBCs	Antibodies in Plasma	Donor's Compatibility

A	A	Anti-B	A, O
B	B	Anti-A	B, O
AB	A, B	Nil	AB, A, B, O
O	Nil	Anti – A, B	O

Q4. Write a short note on the following:

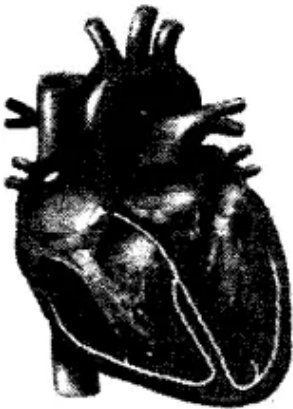
a. Hypertension

b. Coronary Artery Disease

Ans: a. Hypertension: If repeated checks of blood pressure of an individual is 140/90 (140 over 90) or higher, it shows hypertension. High blood pressure leads to heart diseases and also affects vital organs like brain and kidney.

b. Coronary Artery Disease: Coronary Artery Disease, often referred to as atherosclerosis, affects the vessels that supply blood to the heart muscle. It is caused by deposits of calcium, fat, cholesterol and fibrous tissues, which makes the lumen of arteries narrower.

Q5. In the diagrammatic presentation of heart given below, mark and label, SAN, AVN, AV bundles, bundle of His and Purkinje fibres.



Ans.

