18. Body Fluids and Circulation

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Topic-wise Questions

1. (d) Erythrocytes, leucocytes and platelets are constituents of formed elements.

2. (c) Neutrophils and monocytes (6-8%) are phagocytic cells which destroy foreign organisms entering the body.

3. (a) The most abundant and least abundant cells of the blood are RBCs and WBCs respectively.

4. (b) Most abundant and least abundant WBCs are neutrophils and basophils respectively.

5. (c) Platelets are also called thrombocytes.

6. (d) Platelets are the cell fragments produced from megakaryocytes.

7. (d) Megakaryocytes are present in bone marrow

8. (d) A reduction in number of platelets leads to clotting disorders which lead to excessive loss of blood from body.

9. (c) ABO grouping and Rh grouping are widely used all over the world.

10. (c) Neutrophils (60-65%) → Lymphocytes (20-25%) → Monocytes (6-8%) → Eosinophil (2-3%) → Acidophils → Basophils (0.5-1%)

11. (c) Basophils secrete both heparin and histamine.

12. (a) Allergic responses are regulated by eosinophils.

13. (c) Kidney-shaped nucleus occurs in monocyte.

14. (c) Mammalian RBCs are enucleated so that RBCs can carry more haemoglobin.

15. (c) Abnormal fall in total count of WBCs in the human blood is called leucopenia.

16. (d) Plasma proteins perform nutritive function, physiochemical function and transport function.

17. (a) Mast cells secretes anticoagulant heparin.

18. (c) The ratio of RBC to WBC in human is 600 : 1.

19. (b) Leucocytes can cross blood capillaries.

20. (a) Donor X and recipient Y belong to same blood group. Transfusion has led to RBC agglutination because X is Rh^+, Y is Rh^-

21. (c) Thrombocytes have a life of 3-7 days.

22. (a) pH of blood is higher in arteries and lower in veins.

23. (b) Cells formed in bone marrow include RBC and leucocytes.

24. (d) Serum is blood minus corpuscles and fibrinogen.

25. (a) **26. (c)**

27. (c) Agranulocytes are of two types– lymphocyes (about 30%) and monocytes. Lymphocytes exist in two major forms: B and T lymphocytes and produces antibodies, which are the key cells of immune respones.

28. (a) Chemicals that can induce immune responses are called antigen.

29. (b) Factors present on surface of RBC related to heredity are antigens.

30. (c) For safe blood transfusion, recipient's serum should not contain antibodies against RBC of donors.

31. (c) Blood group is due to specific antigens on the surface of RBC.

32. (b) **33. (d)**

34. (d) A dark reddish brown scum formed at the site of cut or an injury over a period of time is called clot or coagulum.

35. (c) An enzyme complex which is formed by a series of linked enzymatic reactions (cascade process) is called thrombokinase.

36. (d) Clot is formed mainly of a network of threads called fibrin.

37. (a)

$$\text{Prothrombin} \xrightarrow{\text{Thrombokinase}} \text{Thrombin}$$

$$\text{Fibrinogen} \xrightarrow{\text{Thrombin}} \text{Fibrin}$$

38. (d) Important function of lymph is to return interstitial fluid to blood.

39. (c) Lymph consist of components of blood except RBCs and some larger plasma proteins

40. (a) During blood coagulation, vitamin K helps in formation of prothrombin.

41. (a) The circulatory pattern in which blood pumped by the heart passes through large vessels into open spaces or body cavities (sinuses) is open circulatory system.

42. (c) In crocodiles, heart is four chambered.

43. (c) Circulatory system is absent in flatworms.

44. (a)

45. (b) Spleen receives only oxygenated blood.

46. (d) Typical 'lub-dub' sounds heard in heart beat are due to closure of bicuspid-tricuspid valves followed by semilunar valves.

47. (d) Systole causes exit of blood from ventricle.

48. (b) **49. (a)** **50. (c)**

51. (d) The pulse making impulse travels in the heart in the order of SA node → AV node → Bundle of his → Purkinje Fibres → heart muscles.

52. (b) Tricuspid valve is present between right auricle and right ventricle.

53. (c) The opening of the right and the left ventricles into the pulmonary artery and the aorta respectively are provided with the semilunar valves.

54. (a) Sino-atrial node (SAN) is a patch of nodal tissue present in right upper corner of right atrium.

55. (d) Another mass of nodal tissue called atrio-ventricular node (AVN) is present in left lower corner of the right atrium.

56. (a) On the top of inter-ventricular septum, AV bundle immediately divides and form right and left bundle.

57. (b) Purkinje fibre along with right and left bundles are known as Bundle of His.

58. (d) The body has the ability to alter the stroke volume as well as the heart rate and thereby the cardiac output.

59. (a) 72 cardiac cycles are performed per minute.

60. (b) Number of beats per minute is called heart rate.

61. (b) The recording (ECG) of the heart activity is taken by the machine called electrocardiograph.

62. (d) Value of cardiac output is stroke volume × rate of heart beat or blood pumped in one minute.

63. (d) Open circulatory system is found in cockroach, prawn, silver fish and snail.

64. (a)

65. (b) Artificial pacemaker is usually implanted to correct the defect in SA node.

66. (a) Blood vessel carrying least CO_2 is pulmonary vein.

67. (b) Blood of cockroach is colourless as respiratory pigment is absent.

68. (b) In prawn, the heart pumps oxygenated blood.

69. (a) **70. (a)**

71. (a) The circulation which provides nutrients, O_2 and essential substances to the tissue and takes CO_2 and other harmful substances away for elimination is systemic circulation.

73. (c) The vessel that carries blood from intestine to the liver is called hepatic portal vein.

73. (c) The correct sequence of systemic circulatory pathway: Left auricle → Left ventricle → Aorta → Arteries → Tissues → Veins → Right atrium

74. (b) In incomplete double circulation, heart pumps mixed blood.

75. (b) **76. (b)**

77. (a) Pulmonary artery drains deoxygenated blood from right ventricle.

78. (d) All veins have deoxygenated blood except pulmonary veins.

79. (a) **80. (a)**

81. (d) **83. (d)**

83. (b)

84. (a) When the heart muscle is suddenly damaged by an inadequate blood supply it is called heart attack.

85. (b) Angina occurs due to conditions that affects the blood flow.

86. (c) Most probable cause of heart attack is arteriosclerosis

87. (a)

88. (b) Atherosclerosis is the hardening of the arteries due to deposition of cholesterol.

89. (d)

90. (a) Manifestation of increase in the blood pressure of a person is called hypertension.

91. (d) **92. (d)**

NCERT Based Questions

1. (a) D and E are the correct statements.

(A) Blood is a specialised connective tissue consisting of a fluid matrix, plasma and formed elements.

(B) Plasma is a straw coloured, viscous fluid constituting nearly 55 percent of the blood.

(C) 90-92 percent of plasma is water and proteins contribute 6-8 percent of it.

2. (d)

3. (c) Basophils are least common granulocyte, only composed of 0.01% to 0.3% of the circulating white blood cells. These are involved in specific kinds of inflammatory reactions, particularly those which cause allergic reactions and do not exhibit phagocytic activity.

Whereas. monocytes migrate from blood stream to tissue and differentiate into resident macrophage, e.g., kupffer

cells in liver and neutrophils target bacteria and fungi. Macrophages are also phagocytotic in nature.

4. (c) The low platelet count leads to life threatening condition and is one of the most common symptoms observed in people infected with dengue fever whereas, other options are not the symptoms of dengue fever.

5. (a) Cardiac cycle consists of one heart beat or one cycle of contraction and relaxation of the cardiac muscle. The contraction phase is called the systole while the relaxation phase is called the diastole.

The purpose of cardiac cycle is to effectively pump the blood. The right ventricle pumps the volume of deoxygenated blood to the lungs through pulmonary artery. After the oxygenation of blood, the volume of blood carried through pulmonary vein is pumped through left ventricle into the aorta and transferred to the entire body.

This pumping of blood, is about the same and any mismatch in volumes ejected by the ventricles (i.e., right ventricle pump more blood than left or vice versa) can result in the heart failure.

6. (b) Neural signals through the sympathetic nerves can increase the rate of the heartbeat, strength of ventricular contraction and thereby stimulating the cardiac volume output.

Hence, sympathetic system is involved in stimulating heart rate and stroke volume.

7. (b) Certain factors released by the tissues at the site of injury can initiate coagulation process. Calcium ions and platelet factor act in the first step of coagulation.

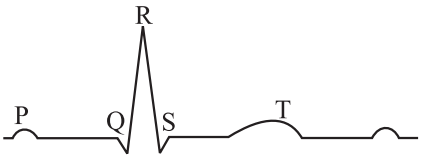
8. (a) The lymph nodes filter and destroy microorganisms that are traveling through the lymph system.

9. (b)

A. Basophils - 0.5-1%, B. Eosinophils - 2-3%, E. Monocytes - 6-8%, D. Lymphocytes - 20-25%, C. Neutrophils - 60-65%.

10. (b) A sample of blood shows clumping with antiserum A but not with antiserum B. The blood group would be A.

11. (c)



12. (c)

Fishes	-	Single circulation
Amphibians and Reptiles	-	Incomplete double circulation
Birds and Mammals	-	Double circulation

13. (d) Pulmonary veins carry blood returning from the lungs to the left auricle of the heart. Hence the best place to obtain a representative sample of mixed blood from the lungs is in the left auricle where the blood of the pulmonary veins mixes.

14. (d) Cardiac output = Stroke volume × Heart beat

15. (a) A unique vascular connection between the digestive tract and liver is called hepatic portal system.

16. (a) **17. (b)**

18. (b) The correct matching is as listed below

Column I		Column II
A. Lymphatic system	3.	To drain back the tissue fluid to the circulatory system
B. Pulmonary vein	1.	Carries oxygenated blood
C. Thrombocytes	4.	Coagulation of blood
D. Lymphocytes	2.	Immune response

19. (d) The superior vena cava pours venous blood into right atria and left atria receive blood from lungs. This, then, flows into ventricles. The contraction of muscles of atria arise from SA nodes and passes to AV node and then to the Purkinje fibres.

Therefore, action mentioned in statement I and II are synchronous.

20. (d) In ventricular systole, oxygenated blood in pumped into aorta and deoxygenated into pulmonary artery.

21. (b)

22. (a) Heart valves only permit unidirectional flow of blood.

23. (d) Pathway of pulmonary circulation: Right auricle (deoxygenated blood) → Lungs (oxygenated blood) → Left auricle

24. (c) Continued consumption of diet rich in butter, red meat and eggs over long period may lead to hypercholesterolemia.

25. (a) In circulatory system, valves occur in heart and blood vessels of both vertebrates and invertebrates as well as vertebrate lymphatics.

26. (c)

27. (a) Presence of calcium will remove heparin-blood anticoagulant and promotes blood clotting. Sodium oxalate and heparin containing test tubes will not allow the blood to clot.

28. (b) QRS wave (complex) begins after a fraction of second after the P wave. It begins as a small downward deflection (0) and continuous as a large upright (R) and triangular wave, ending as downward wave (S) at its base.

This represents ventricular depolarisation (ventricular contraction).

29. (c) ABO blood grouping in human 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.

30. (d)

31. (d) Origin of heart beat and its conduction is represented by SA node → AV node → Bundle of His → Purkinje fibres.

32. (a) Raising of pH of blood shall result in inhibition of carbonic anhydrase.

33. (a) The AV node conducts the impulse from the atria to the ventricles.

34. (a) Both closed systems and open systems rely on pumping mechanisms to distribute fluid throughout the body.

35. (c) SA node is the natural pacemaker located in the right atrium. SA node initiates the cardiac impulse. So, artificial pacemaker will be grafted at the site of SA node.

36. (b) A normal ECG represents P-wave: atrial depolarisation, QRS complex-ventricular depolarization, T-wave ventricular repolarisation. Therefore, atrial repolarisation is not represented in an electrocardiogram (ECG).

37. (a) RBCs (Red Blood Corpuscles) in humans lack nucleus. Absence of nucleus in the cell reduces the O_2 consumption by the cell in various cellular activities. Therefore, the cell is able to transport maximum amount of O_2 to other cells of the body.

38. (a) B-lymphocytes: Their principal function is to make antibodies against soluble antigens that are important in regulating humoral immunity. On the other hand RBCs transport oxygen, T-lymphocytes play central role in cell mediated immunity and neutrophils acts as phagocytes.

39. (c)

40. (d) The right ventricle pumps blood to the lungs. Such backup of blood flow would force the right ventricle to work harder.

Multi-Concept Questions

1. (c) The correct proportion with respect to the distribution of blood in the body of man: 10% to heart muscles, 10% to brain, 10% to liver, 40% to kidney, 15% to other organs.

2. (a) **3. (b)**

4. (a) Haemopoeisis is the process of formation of blood corpuscles.

5. (b) Hirudin is a naturally occurring peptide present in the salivary glands of leeches. It has a blood anticoagulant property.

6. (d) Open circulatory system is present in arthropods and molluscs in which blood pumped by the heart passes through large vessels into open spaces or body cavities called sinuses.

7. (b) Capillaries are most abundant in tissues and organs that are metabolically active. Through capillaries, blood moves from arteries to veins through tiny blood vessels. Capillaries are one of the most important parts of the circulatory system because they deliver nutrients and oxygen to the cells.

8. (c) 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.

9. (d) Thrombokinase is an enzyme complex required for coagulation of blood.

10. (c) Closure of auriculo-ventricular valve makes louder sound of heart beat. The second heart sound (dub) is produced by the closure of the atrioventricular valves and semilunar valves,

11. (d) **12. (d)**

13. (a) The ventricular contraction starts shortly after Q wave and marks the beginning of the systole.

14. (a) **15. (b)**

16. (b) RBCs have an average life span of 120 days after which they are destroyed in the spleen.

17. (d) Purkinje fibres arise from apex of ventricles. The right and left bundle of ventricles branches to give rise to minute fibres throughout the ventricular musculature of the respective sides and are called purkinje fibres.

18. (c) Lymph, spleen and blood are some important carriers for nutrients, hormones, etc.

19. (b) Calcium ions play a very important role in clotting. Prothrombin is secreted by prothrombinase.

20. (d)

21. (a) Statement A, C are incorrect. The nodal musculature has the ability to generate action potentials without any external stimuli. The duration of cardiac cycle is 0.8 seconds.

22. (d)

23. (d) Lymph has the same mineral distribution as that in plasma.

24. (b) RBCs have an average life span of 120 days after which they are destroyed in the spleen. Leucocytes are nucleated. Neutrophils are the most abundant granulocytes.

25. (b) Heart failure is not the same as cardiac arrest (when the heart stops beating) or a heart attack (when the heart

muscle is suddenly damaged by an inadequate blood supply).

26. (a) If person had two-chambered heart (one atrium and one ventricle), the oxygenated blood and deoxygenated blood get mixed, then blood would circulate through the body without being fully oxygenated and the tissues will receive less or no oxygen.

27. (b) Atrioventricular septum is a fibrous tissue of the membranous septum of the heart just above the septal cusp of the tricuspid valve. It separates the atrium and the ventricle of the same side.

28. (b) The Na^+ level in the blood is controlled by aldosterone, antidiuretic hormone (ADH), and atrial natriuretic peptide (ANP). Aldosterone increases renal reabsorption of Na^+.

NEET Past 10 Year Questions

1. (b) ***NCERT (XI) Ch - 18, Pg. 266***

The QRS complex in a standard ECG represents the depolarisation of the ventricles, which initiates the ventricular contraction.

2. (d) ***NCERT (XI) Ch - 18, Pg. 279***

Eosinophils- Release histamines, destructive enzymes

Basophils- Release granules containing histamine

Neutrophils- Phagocytosis

Lymphocytes- Immune response

3. (a) ***NCERT (XI), Ch - 18, Pg. 287***

Parasympathetic neural signals (another component of ANS) decrease the rate of heart beat, speed of conduction of action potential and thereby the cardiac output.

4. (a) ***NCERT (XI), Ch - 18, Pg. 281***

During subsequent pregnancies, the Rh antibodies from the mother (Rh^{-ve}) can leak into the blood of the foetus (Rh^{+ve}) 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.

5. (c) Cardiac output = Stroke volume × Heart rate

Given, Cardiac output = 5L or 5000 ml

Blood volume in ventricles at the end of diastole = 100 ml

Blood volume in ventricles at the end of systole = 50 ml

Therefore, Stroke volume = 100 – 50 = 50 ml.

So,

$\Rightarrow$ 5000 ml = 50 ml × Heart rate

Heart rate = 100 beats per minute.

6. (a) ***NCERT (XI) Ch - 18, Pg. 286***

In ECG, P-wave represents depolarisation of atria. QRS complex represents depolarisation of ventricles. T-wave represents repolarisation of ventricle, i.e., return from excited to normal state. Reduction in the size of T-wave represents insufficient supply of oxygen, i.e., coronary ischemia.

7. (a) ***NCERT (XI) Ch - 18, Pg. 283***

Tricuspid valve is a muscular flap of three cusps present betwen right atrium and right ventricle.

Bicuspid valve is bimuscular flap prevents the backflow from left ventricle to left atrium.

Semilunar valve guards the flow of blood between right ventricle and pulmonary artery.

8. (d) ***NCERT (XI) Ch - 18, Pg. 279 & 281***

Fibrinogen is converted into fibrin by the action of thrombin, a clotting enzyme. These fibrin makes a fibrous network to clot the blood. Globulin forms a large fraction of blood serum proteins. Albumin contributes to colloid osmotic pressure of plasma.

9. (d) Frog or the vertebrates have myogenic heart having self contractile system or are autoexcitable; because of this condition, it will keep on working outside the body for some time.

10. (a) ***NCERT (XI) Ch - 18, Pg. 279***

Haemoglobin of RBC play a significant role in transport of respiratory gases.

11. (d) ***NCERT (XI) Ch - 18, Pg. 286***

Hepatic portal system: It is a system which includes the hepatic portal vein that carries blood from intestine to the liver before it is delivered to the systemic circulation.

12. (d) ***NCERT (XI) Ch - 18, Pg. 284***

The SAN can generate the maximum number of action potentials, i.e., 70-75 min^{-1}, and is responsible for initiating and maintaining the rhythmic contractile activity of the heart. Therefore, it is called the pacemaker.

13. (d) The delay is important because it allows ventricles to receive all the blood from the atria.

14. (a) ***NCERT (XI) Ch - 18, Pg. 279***

Plasma without the clotting factors is called serum.

15. (b) ***NCERT (XI) Ch - 18, Pg. 280***

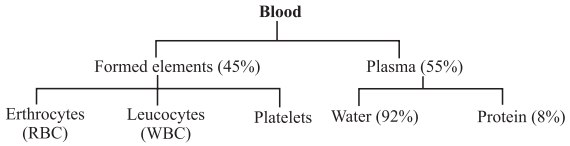
Blood normally contains 1,500,00-3,500,00 platelets mm^{-3}. Platelets can release a variety of substances most of which are involved in the coagulation or clotting of blood. A reduction in their number can lead to clotting disorders which will lead to excessive loss of blood from the body.

16. (c) Blood pressure in the pulmonary artery is more than that in the pulmonary vein

17. (a) ***NCERT (XI) Ch - 18, Pg. 285***

Ventricular systole increases the pressure causing the closure of tricuspid and bicuspid valves due to attempted blood backflow. As the ventricular pressure increases further, the semilunar valves guarding the pulmonary artery and aorta are forced to open, allowing the blood in the ventricles to flow.

18. (b) ***NCERT (XI) Ch - 18 Pg. 279***



19. (d)

20. (b) ***NCERT (XI) Ch - 18, Pg. 282***

Mammals has two different pathway for blood circulation, pulmonary and systemic.

21. (c) ***NCERT (XI) Ch - 18, Pg. 279***

Globulins primarily are involved in defense mechanisms of the body.

22. (b) ***NCERT (XI) Ch - 18, Pg. 285***

During each cardiac cycle, two prominent sounds are produced which can be heard by stethoscope. 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 a closure of the semilunar valves.

23. (b) ***NCERT (XI) Ch - 18, Pg. 280***

Blood group is attributed to presence of antigen on RBC. AB blood group person have A and B antigen on his RBCs while no antibodies in the plasma.

24. (b) ***NCERT (XI) Ch - 18, Pg. 286***

In ECG, P wave represent depolarisation of atria which leads to the contraction of both the atria.

25. (a) K^+ is most abundant intracellular cation.

26. (d) ***NCERT (XI) Ch - 18, Pg. 280***

Person having 'O' blood Group can be donated to persons with any other blood group and hence 'O' group individuals are called 'universal donors'. Persons with 'AB' group can accept blood from persons with AB as well as the other groups of blood. Therefore, such persons are called 'universal recipients'.

27. (d) ***NCERT (XI) Ch - 18, Pg. 280***

'O' is the universal donor blood group, because there is no antigen on RBC. They can donate blood to persons with any other blood group.

28. (c) ***NCERT (XI) Ch - 18, Pg. 286***

The P-wave represents the electrical excitation (or depolarisation) of the atria, which leads to the contraction of both the atria. The QRS complex represents the depolarisation of the ventricles, which initiates the ventricular contraction. The T-wave represents the return of the ventricles from excited to normal state (repolarisation). The end of the T-wave marks the end of systole.

Number of QRS complexes that occur in a given time period, helps to determine the heart beat rate of a an individual, i.e., one complete cycle.

29. (a) ***NCERT (XI) Ch - 18, Pg. 287***

Hypertension can harm kidneys and brain.

30. (a) ***NCERT (XI) Ch - 18, Pg. 281***

Fibrinogen → fibrin → clotting of blood

31. (c) ***NCERT (XI) Ch - 18, Pg. 284***

It is a part of conducting system of heart.

Purkinje fibers along with right and left bundles are known as bundle of His.

32. (c) ***NCERT (XI) Ch - 18, Pg. 286***

Arteries carry oxygenated blood away from the heart.