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ENGLISH MEDIUM

**SAMPATH
LANKADHEERA**

B.Sc. (Hons), M.Sc.

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**UNIT
05**

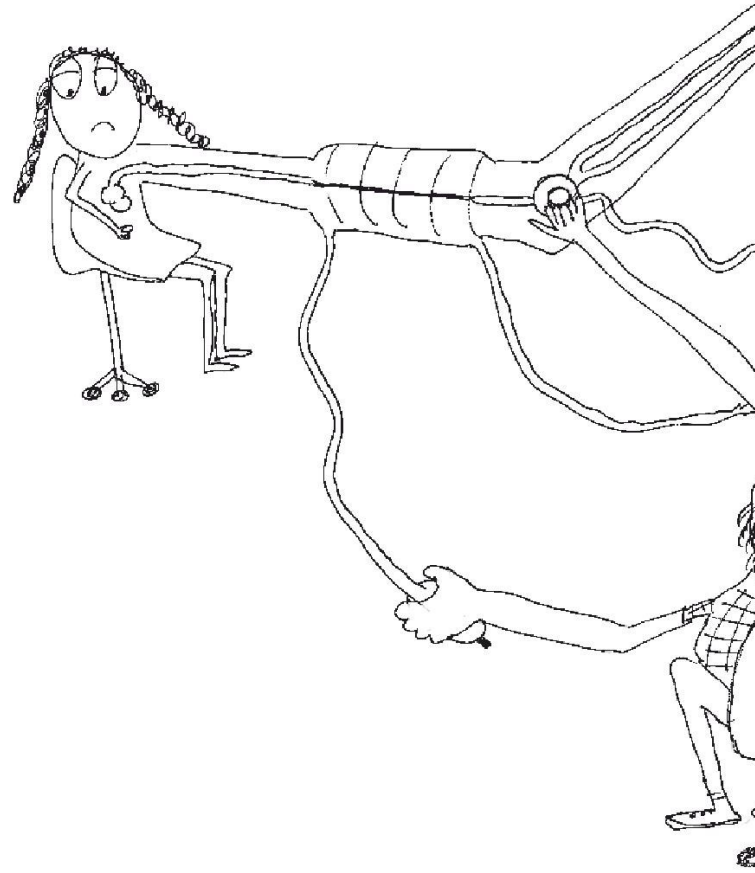
Animal Form and Function

Blood Pressure

**SAMPATH
LANKADHEERA**

B.Sc. (Hons), M.Sc.





5. Venous/ deoxygenated/ O₂ poor blood is collected into number of coronary veins
6. that join to form coronary sinus
7. which opens into the right atrium.
8. Some venous blood passes directly into heart chambers
9. through (venous) channels. Consequences of blocking
10. Lowers the efficiency of myocardium/cardiac muscle
11. causing chest pain/angina.
12. Death of cardiac muscles/ heart failure/heart attacks/ myocardial infarction (due to deprivation of oxygen supply).
13. Heart beat rhythm becomes abnormal.
14. Heart becomes unable to act as a good pump.
15. Special organs such as brain do not receive adequate oxygen (through blood/ blood supply).
16. (Can lead to) death (if not treated on time).

Any 6 pts

$$23+7+6 = 36$$

$$36 \times 4 = 144 \text{ marks}$$

Diagram = 06 marks

Total marks = 150 marks

- 07. (a) Briefly describe the structure of the wall of the heart.**
(b) Explain the coronary circulation and the consequences of the blockage of coronary arteries in man.

(a)

- 1, 2, 3. Heart wall is composed of pericardium, myocardium and endocardium.
4. Pericardium is the outermost layer which is
- 5,6. made up of (two sacs) (outer) fibrous pericardium, and (inner) serous pericardium.
7. Myocardium is the middle layer which is
8. composed of cardiac muscle.
9. Network of (specialized) conducting fibers run through the myocardium.
10. Endocardium is the inner layer which is
11. a smooth membrane
12. consisting of flattened epithelial cells.

(b)

Coronary circulation

- 1, 2. Right and left coronary arteries immediately distal to aortic valve and
- 3, 4. branch/originate from aorta
5. supply oxygen rich blood/arterial blood to the heart.
6. Coronary arteries travel/located in the heart wall
7. forming a network of capillaries.
8. (Most of) oxygen deficient blood/venous blood (from the heart) is collected into cardiac veins which

- 9, 10. (joins to) form coronary sinus that opens to the right atrium.
11. Remaining oxygen deficient blood/venous blood passes directly into heart chambers
12. through (small) venous channels.

Consequences of the blockage of coronary arteries

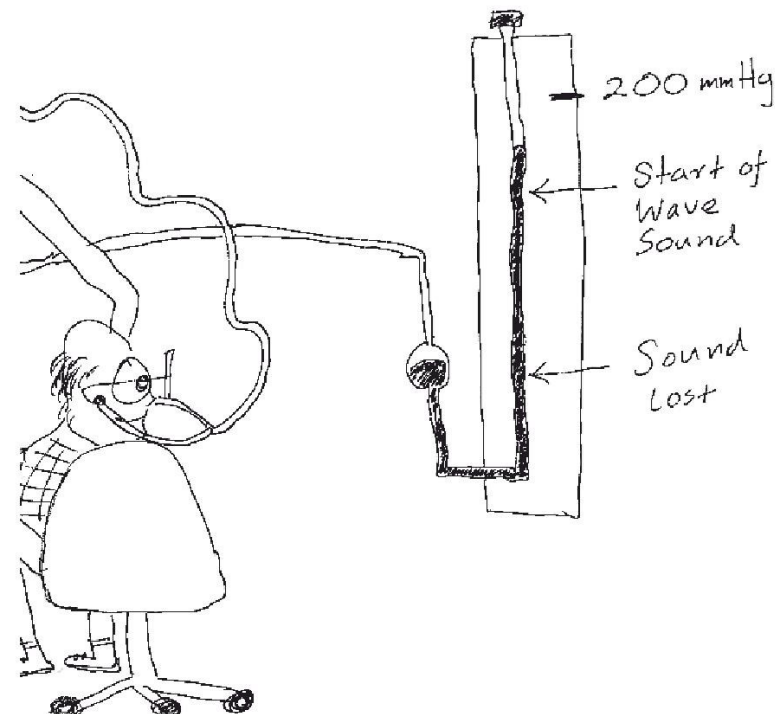
13. (One or more branches of) coronary arteries can be blocked due to atherosclerosis which is
- 14, 15. the thickening and hardening of inner lining of arteries
- 16, 17. due to fatty deposits especially cholesterol particles.
18. Blood clots/thrombus within these arteries can complicate the blockage.
- 19, 20. Depending on the place of the block and degree of blockage (in coronary arteries)
- 21, 22. (related) parts of the heart muscle will be deprived of oxygen and nutrients.
23. Narrowing of coronary arteries (due to partial blockage) causes chest pain/angina.
24. Complete blockage of (one or more branches of) coronary arteries lead to heart attacks/myocardial infarction.
25. In heart attacks, damage/ death of cardiac muscle tissue occurs
26. due to lack of adequate oxygen (and nutrients)/as adequate O₂ is not provided
27. Hence heartbeat rhythm may be abnormal and
28. heart may cease to be an effective pump.
29. Therefore, other vital organs/brain may be deprived of adequate supply of oxygen rich blood.
30. If not treated on time heart attacks can be fatal.

$$12 + 30 = 42 \text{ points}$$

$$\text{Any } 37 \text{ points } \times 4 = 148 \text{ marks}$$

If more than 37 points written add 2 marks

Maximum 150 marks



5.3.2 : Relates the structure of the human circulatory system to its functions

Blood Pressure

The that the blood exerts on the walls of blood vessels as it is referred to as blood pressure. Blood pressure in the arteries of systemic circulation maintains the essential flow of blood into and out of the organs of the body.

It is very important to keep blood pressure within limits. High blood pressure could lead to damage blood vessels resulting in formation of clots or bleeding from damaged sites. If the blood pressure falls too low, there will be inadequate blood flow through tissue capillary beds. This will adversely affects the normal functioning of vital organs such as the brain, heart and kidneys.

Blood pressure varies according to the of day, the,,, and (Emotional states) of an individual. Blood pressure falls at rest and during sleep. Blood pressure increases during excitement, fear or anxiety.

Systolic and diastolic pressure

Systolic pressure

Systolic pressure is the pressure produced within the arterial system when the ventricle contracts and pushes blood into the aorta. At rest, in a normal healthy adult systolic pressure is about 120 mmHg.

Diastolic pressure

Diastolic blood pressure is the blood pressure within the arteries following of blood at complete cardiac diastole (when the heart is at rest. In a normal healthy adult diastolic pressure is about 80 mmHg.

Arterial blood pressure is measured by a sphygmomanometer. It is expressed as

Systolic pressure (mm Hg)

Diastolic pressure (mm Hg) 120/80 mmHg

16. Blood plasma consists of inorganic ions in dissolved forms,
 17. plasma proteins such as albumin,
 18. antibodies
 19. and fibrinogen,
 20. nutrients,
 21. metabolic wastes,
 22. respiratory gases
 23. and hormones.
 24. pH of human blood is around 7.4.
 25. Protein concentration in plasma is higher than in interstitial fluid.
 26. When the clotting factors are removed from the plasma it is called as serum.
Major Functions of blood
 27. The dissolved ions in the plasma buffer and maintain the osmotic balance in the blood.
 28. Main functions of leukocytes are body defense,
 29. phagocytic engulfing
 30. and digesting microorganisms.
 31. These cells increase immune response against foreign substances.
 32. Albumin in the plasma also buffers the blood
 33. and antibodies are involved in defense.
 34. Fibrinogen in the plasma aids in blood clotting.
 35. Main function of red blood cells is the transportation of O₂ molecules.
 36. They also transport CO₂ molecules.
 37. Transport of oxygen to organs
 38. and removal of carbon dioxide from the organs and tissues
 39. Transport of soluble excretory materials to organs of excretion
 40. Transport of nutrients
 41. Transport of hormones from the glands where they are produced to target organs
 42. Defense against foreign invasions
 43. Aids in osmoregulation
7. which is composed of cardiac muscles,
 8. network of special conducting fibers
 9. and large number of capillaries (derived from coronary arteries are present in myocardium).
 10. Endocardium
 11. is the innermost layer
 12. which lines chambers and valves of heart.
 13. Heart is divided into right and left halves by the septum.
 14. (Each side is divided into upper) atrium and
 15. (lower) ventricle
 16. forming four chambers in the heart.
 17. Walls of ventricles are thicker than that of atria.
 18. Right atrio-ventricular valve/ tricuspid valve is located between right atrium and right ventricle.
 19. Left atrio-ventricular valve/ bicuspid valve/mitral valve is located between left atrium and left ventricle.
 20. Chordae tendineae
 21. extend between atrio-ventricular valves and papillary muscles (of ventricular wall)/ connect atrio-ventricular valves and papillary muscles.
 22. Superior vena cava and inferior vena cava open to right atrium/there are openings for superior and inferior vena cava in right atrium.
 23. There are four openings for pulmonary veins in left atrium/ four pulmonary veins open to left atrium.
 24. Pulmonary artery arises from right ventricle.
 25. Its opening is guarded by pulmonary/ semilunar valves.
 26. Aorta arises from left ventricle.
 27. Opening of aorta is guarded by semilunar valves/ aortic valves.
- (Diagram -06 Marks)
Fully labelled (6-8) correct diagram -06 Marks
Partially labelled (<6) diagram -03 Marks
Unlabeled diagram – 00 Marks
- (b) Explain the coronary circulation and consequences of blockage of coronary arteries in man.**
Coronary circulation
1. Heart is supplied with arterial/ oxygenated/ O₂ rich blood by the right and left coronary arteries
 2. which branch/ arise from the aorta
 3. immediately distal to the aortic valve.
 4. Coronary arteries form (vast) network of capillaries.
7. (a) Describe the structure of human heart.
 - (b) Explain the coronary circulation and consequences of blockage of coronary arteries in man.
 - (c) Describe the structure of human heart.
 1. (Roughly) cone shaped
 2. hollow muscular organ.
 3. Wall is composed of Pericardium
 4. which is the outer most layer.
 5. Myocardium
 6. is the middle layer



AL 2013

1. Write an account on Blood pressure of man
2. Describe the composition and major functions of human blood
3. (a) Describe the structure of human heart.
(b) Explain the coronary circulation and consequences of blockage of coronary arteries in man.
(c) Describe the structure of human heart.

1. Write an account on Blood pressure of man**Answer**

1. The force that the blood exerts on the walls of blood vessels
2. as it travels is referred to as blood pressure.
3. Blood pressure in the arteries of systemic circulation maintains the essential flow of blood into and out of the organs of the body.
5. It is very important to keep blood pressure within normal limits.
6. High blood pressure could lead to damage blood vessels
7. resulting in formation of clots
8. or bleeding from damaged sites.
9. If the blood pressure falls too low,
10. there will be inadequate blood flow through tissue capillary beds.
11. This will adversely affects the normal functioning of vital organs such as the brain, heart and kidneys.
12. Blood pressure varies
13. according to the time of day,
14. the posture,
15. gender,
16. age,
17. activity,
18. exercise
19. and stress (Emotional states) of an individual.
20. Blood pressure falls at rest and during sleep.
21. Blood pressure increases
22. during excitement,
23. fear or anxiety.
24. Systolic pressure is the pressure produced within the arterial system
25. when the left ventricle contracts
26. and pushes blood into the aorta.
27. At rest, systolic pressure in a normal healthy adult systolic pressure is about 120 mmHg.
28. Diastolic blood pressure is the blood pressure within the arteries
29. following ejection of blood at complete cardiac

- diastole (when the heart is at rest.
30. In a normal healthy adult diastolic pressure is about 80 mmHg.

31. Risk Factors for Hypertension

32. Obesity
33. Diabetes mellitus
34. Family history
35. Smoking
36. A sedentary life style
37. High intake of salts
38. High intake of alcohol
39. Stress
40. Deposition of low density lipoprotein (LDL) on artery walls.
41. Sustained reduction of blood pressure below normal limits is called hypotension.
42. Hypotension usually occurs as a complication of other condition
43. such as shock,
44. Dengue hemorrhage fever,
45. standing up suddenly from sitting or lying position,
46. Over bleeding/hemorrhage condition,
47. fasting, low nutrition etc.
48. Low blood pressure leads to inadequate blood supply to the brain.
49. Depending on the cause unconsciousness may be brief (fainting)
50. or prolonged possibly causing death.

2. Describe the composition and major functions of human blood**Answer**

1. Blood which is a connective tissue
2. is composed of cells
3. and plasma.
4. Cellular components of the blood are three types namely red blood cells,
5. white blood cells
6. and platelets.
7. White blood cells (Leukocytes) are five types.
8. They are Basophils,
9. Lymphocytes, T cells
10. and B cells.
11. Eosinophils,
12. Neutrophils
13. and monocytes.
14. Platelets are derived from bone marrow cells.
15. They also do not have nuclei and they play a major role in blood clotting.

Hypertension and Hypotension**Hypertension**

..... blood pressure above normal limits is called hypertension. Consequences of hypertension are kidney damage. adrenal gland disorders, heart attack (because of the increased heart rate and cardiac contraction), stroke (caused by cerebral haemorrhage), damaged blood vessels which can lead to death.

Risk Factors for Hypertension

- Obesity
- Diabetes mellitus
- Family history
- Smoking
- A sedentary life style
- High intake of salts
- High intake of alcohol
- Stress
- Deposition of low density lipoprotein (LDL) on artery walls.

Hypotension

Sustained reduction of blood pressure below normal limits is called hypotension. Hypotension usually occurs as a complication of other condition such as shock. Dengue hemorrhage fever, standing up suddenly from sitting or lying position, over bleeding/ hemorrhage condition, fasting, low nutrition etc. Low blood pressure leads to inadequate blood supply to the Depending on the causemay be brief (fainting) or prolonged possibly causing death.

Coronary circulation

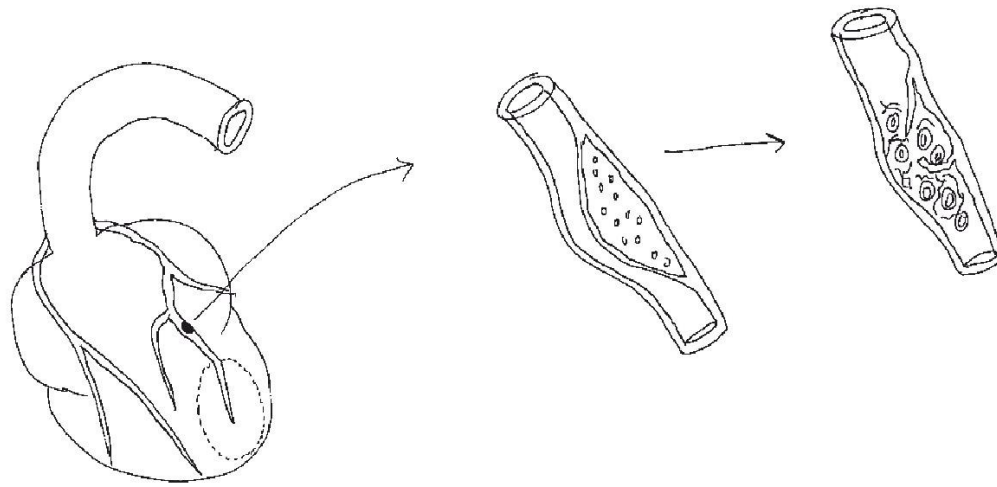
The heart is supplied with arterial blood by the right and left coronary arteries which branch from the aorta immediately distal to the aortic valve.

The coronary arteries travel the heart wall eventually forming a vast network of capillaries. Most of the venous blood is collected into a number of cardiac veins that joins to form the coronary sinus which opens into the right atrium. The remainder passes directly into the heart chambers through little venous channels.



Consequences of blockage of coronary arteries

The inner lining of the arteries can be thickened and harden leading to the condition called atherosclerosis which occurs as a result of fatty deposits especially cholesterol particles. This can affect the normal blood supply to the organs and tissues.



One or more branches of coronary arteries can be blocked due to which can be complicated by thrombosis (blood clot). Depending on the place (s) of the block in the coronary arteries and the degree of blockage related parts of the heart muscle will be deprived of oxygen and nutrients. Hence, narrowing of the arteries leads to chest pain (Angina). The complete due to the blockage of one or more coronary arteries leads to heart attacks (Myocardial infarction) which refers to the damage or death of cardiac muscle tissue due to lack of adequate oxygen and nutrients. Due to this, heart beat may be abnormal and the heart may cease to be an effective pump. The other vital organs such as brain may be deprived of adequate supply of oxygen rich blood and heart attack may be fatal if not treated on time.

18. Which of the following may be a consequence of hypotension? (AL/2019 21)
(1) Unconsciousness (2) Kidney damage (3) Internal haemorrhage (4) Increase in heart beat (5) Stroke
19. This question is based on the following.
A - Movement of lymph; contraction of cardiac muscle B - Exchange of gases in capillaries; active transport
C - Clotting of blood; formation of thrombin D - Transport of CO₂ in blood; participation of red blood cells.
In which of the above pairs, does the second contribute to the first?
(1) A and B (2) A and (3) B and C (4) B and D (5) C and D (AL2021/22)
20. Which of the following statements is/are correct regarding blood circulation of vertebrates?
(A) Animals with single circulation do not have lungs.
(B) In single circulation, blood flows from respiratory organs to other organs under a reduced pressure.
(C) Animals with single circulation have two or three chambers in the heart.
(D) In double circulation, blood flows through lungs twice during a complete circulation through the body.
(E) Myoglobin is not present in the muscles of animals having a single circulation. (AL2021/43)
21. Which of the following is most likely to happen if tricuspid valve of the human heart does not close properly?
(1) Right atrium will not completely empty during atrial systole.
(2) Left atrium will not completely empty during atrial systole.
(3) Amount of blood that flows into right atrium will be reduced.
(4) Amount of blood that flows into lungs will be reduced.
(5) Some amount of blood will flow into left atrium from left ventricle during ventricular systole. (AL21/20)
22. Which of the following statements regarding the lymphatic system of man is correct?
(1) Lymph vessels differ from arteries due to absence of valves.
(2) Lymph drains into the arteries at the base of the neck via two large ducts.
(3) Composition of lymph is the same as blood plasma.
(4) Lymphatic system is involved in the absorption of vitamin C in the small intestine.
(5) Lymph nodes are mainly composed of connective tissues and white blood cells. (AL2022/22)
23. Select the correct statement/statements regarding clotting of blood in man.
(A) Fibrinogen is converted to fibrin by thrombin.
(B) Prothrombin present in platelets is converted to thrombin.
(C) Heparin prevents conversion of prothrombin to thrombin.
(D) Vitamin K is a clotting factor present in blood plasma
(E) Platelets become sticky due to agglutininogen present on their surface. (AL/2022/43)
24. Select the correct route of blood through the human heart front systemic circulation to pulmonary circulation and back to systemic circulation via aortic valve.
(1) Left atrium, bicuspid valve, left ventricle, pulmonary valve, right atrium, tricuspid valve, right ventricle
(2) Right atrium, tricuspid valve, right ventricle, pulmonary valve, left atrium, bicuspid valve, left ventricle
(3) Left atrium, tricuspid valve, left ventricle, pulmonary valve, right atrium, bicuspid valve, right ventricle
(4) Left ventricle, bicuspid valve, left atrium, pulmonary valve, right atrium, tricuspid valve, right ventricle
(5) Right atrium, bicuspid valve, pulmonary valve, left atrium, tricuspid valve, left ventricle
25. Which of the following indicates the forms that transport the lowest and highest percentages of carbon dioxide in the human blood?

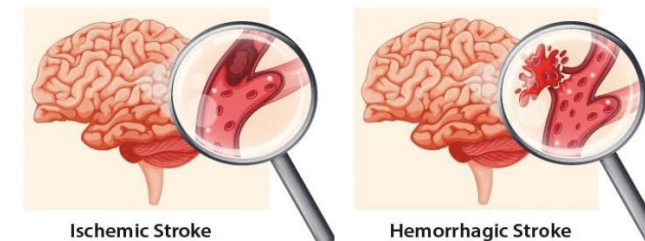
Lowest percentage	Highest percentage
(1) Dissolved CO ₂	Carbaminohemoglobin
(2) HCO ₃ ⁻	Carbaminohemoglobin
(3) Carbaminohemoglobin	Dissolved CO ₂
(4) HCO ₃ ⁻	Dissolved CO ₂
(5) Dissolved CO ₂	HCO ₃ ⁻



6. Which one of the following statements is **incorrect** regarding human blood pressure?
 (1) The blood pressure of a normal healthy adult person at rest is 120/80 mmHg.
 (2) Systolic blood pressure is higher than diastolic blood pressure.
 (3) Activity of the parasympathetic nervous system increases blood pressure.
 (4) Deposition of fat in the walls of arteries can cause hypertension.
 (5) Blood pressure is dependent on the elasticity of arterial walls. (AL/2006)
7. Which of the following indicates the blood vessels in correct sequence that a molecule of urea passes from its site of production to site of excretion in man?
 (1) Hepatic vein → inferior vena cava → pulmonary vein → pulmonary artery → aorta → renal artery
 (2) Capillaries → venules → veins → inferior vena cava → renal vein
 (3) Hepatic vein → inferior vena cava → pulmonary artery → pulmonary vein → aorta → renal artery
 (4) Capillaries → venules → veins → pulmonary vein → pulmonary artery → aorta → renal artery
 (5) Capillaries → arterioles → arteries → aorta → dermal arteries → arterioles → capillaries. (AL/2010)
8. Which one of the following does not contribute to increase the rate beat in man?
 (1) Adrenalin (2) Thyroxine (3) Sex hormones (4) Reduction of blood pH
 (5) Stimulation of parasympathetic nervous system. (AL/2010)
9. Which one of the following statements is correct regarding human blood?
 (1) It is slightly acidic. (2) Most of the leukocytes are agranulocytes.
 (3) Haemoglobin has a higher affinity to oxygen than carbon monoxide. (4) It helps to maintain homeostasis.
 (5) A person with O blood group has both A and B agglutinogens.
10. Which one of the following statements regarding human heart is correct?
 (1) It is made up of long and cylindrical fibres. (2) The right atrioventricular valve is bicuspid.
 (3) The rate of heart beat is increased by stimulation of the parasympathetic nervous system.
 (4) Duration of atrial systole is 0.1 seconds.
 (5) Ventricular depolarization is represented by T wave in the electrocardiogram (ECG).
11. Which of the following is not a part of the conducting system of human heart?
 (1) Chordae tendineae (2) Atrioventricular (AV) node (3) Bundle of His (4) Sino-auricular (SA) node
 (5) Purkinje fibres (AL/2016)
12. Which one of the following does not play a part in the regulation of heart in man?
 (1) Hormones. (2) Sympathetic (3) S.A. node. (4) A.V. node. (5) Medulla oblongata. (AL/1991Z)
13. The abnormal rise in blood pressure is called
 (1) Angiotensin (2) Hypertension (3) Hypotension (4) Atherosclerosis (5) None
14. Average cardiac output is,
 (1) 4 liters per min (2) 6.3 liters per min (3) 5.3 liters per min (4) 7.3 liters per min (5) 3 liters per min
15. A person with blood group **A**, willing to give blood, what should be the blood group of the recipient/recipients?
 (1) O, AB, A, B (2) A, B (3) B, AB (4) AB (5) O
16. If the blood group of a person is B⁺ he cannot be transfused with blood from a donor whose blood type is
 (1) O⁻ (2) O⁺ (3) B⁻ (4) B⁺ (5) A⁻ (AL/2007)
17. Select the **incorrect** statement regarding human blood.
 (1) It is a specialized connective tissue. (2) A mature erythrocyte lacks both nucleus and mitochondria.
 (3) Neutrophils and monocytes are leucocytes showing phagocytosis.
 (4) Most of the carbon dioxide is transported in combination with haemoglobin.
 (5) It helps to regulate body temperature. (AL2016/13)

Stroke

Similarly blockage due to atherosclerosis or rupture of arteries supplying blood to the brain may cause the death of nervous tissue due to lack of oxygen and nutrients. This is referred to as stroke.



Respiratory pigments

.....

Since oxygen is less soluble in watery medium including blood, transportation of oxygen from respiratory surface to the tissues/organs is a problem for complex animals.

To overcome this problem animals have evolved the respiratory pigments. Different respiratory pigments can be seen in the animal kingdom:

1. Haemoglobin - present in blood of human, other vertebrate and annelids
2. Haemocyanin - present in hemolymph of arthropods and molluscs.
3. Chlorocruorin - present in the blood of many annelids
4. Haemoerythrin - present in the blood of marine invertebrates (some annelids)
5. Myoglobin- present in vertebrate muscles

All these respiratory pigments except transport oxygen from respiratory surfaces to the tissues and organs and while transporting carbon dioxide from tissue/ organs to the respiratory surface for elimination. Myoglobin present in the muscle tissue has an oxygen storage function.



Transport of respiratory gases in human blood

Transport of oxygen

It is the hemoglobin molecule found in the erythrocytes which is responsible for the transport of oxygen around the body. Hemoglobin is composed of four subunits. Each subunit is composed of a globin protein and the heme group. Heme groups are responsible for the characteristic red colour of the blood. A ferrous (iron) atom is located within each heme group and each of these can combine reversibly with one molecule of oxygen. Therefore each hemoglobin molecule can carry up to four oxygen molecules.



Combination of oxygen with hemoglobin to form oxyhemoglobin

Transport of Carbon dioxide

Carbon dioxide is carried by the blood in different ways.

- AS HCO_3^- ions in the plasma (about 70%): When CO_2 diffuses into the red blood cells the enzyme carbonic anhydrase catalyze the combination of CO_2 with water to form bicarbonate (HCO_3^-) and H^+ ions. The HCO_3^- moves out of the erythrocytes into the plasma.
- As carbaminohemoglobin (about 23%): CO_2 combined with protein group of hemoglobin and form carbaminohemoglobin. Therefore CO_2 does not compete with oxygen binding sites in hemoglobin.
- Dissolved in plasma (about 7%): as free gas.

(iii) How is carbon dioxide transported in the blood of man?

(iv) Why is carbon monoxide considered as a strong respiratory inhibitor?

(v) What are the two respiratory pigments found in annelids?

(AL/2020 B)

(ii) State the functions of the SA node and AV node of the human heart.

SA node :

SV node :

(iii) Draw the normal ECG tracing of a healthy person and label its waves.

(iv) State what are represented by the first and last waves of the ECG tracing.

First wave :

Last wave :

(AL/2022 B)

(iv) What is the normal value of each of the following in a healthy adult person?

(a) Blood pH :

(b) Life span of erythrocytes :

(c) Blood pressure at rest :

(v) What is known by each of the following?

(a) Cardiac cycle :

MCQ

1. Blood and lymph is similar because they contain
(1) Leucocytes (2) Hemoglobin (3) Nutrients (4) waste materials (5) ions (AL/1988 Z)
2. When blood pressure is recorded by a doctor its given n 2 parameters as 120/80. These values exist in,
(1) Wall of ventricle (2) In atria during systole and diastole (3) In ventricle during systole and diastole
(4) In artery in systole and diastole. (5) In veins in systole and diastole. (AL/1978 Z)
3. Which one of the following is **unlikely** to cause hypertension in man?
(1) High level of low density lipoproteins in blood (2) Heavy consumption of alcohol (3) Sleep disturbances
(4) Mental relaxation (5) Ageing (AL/2003)
4. Which of the following statements is correct regarding human blood cells?
(1) All leucocytes are granulated. (2) Monocytes are involved in the production of antibodies.
(3) Usually the highest percentage of leucocytes are the neutrophils.
(4) Erythrocytes store haemoerythrin. (5) Basophills are important in blood clotting. (AL/2005)
5. Which one of the following statements is false regarding the blood circulatory systems of animals ?
(1) Open circulatory systems are characteristic of all arthropods.
(2) In closed circulatory systems, mixing of oxygenated and deoxygenated blood may take place.
(3) In man, plasma proteins transport **oxygen**.
(4) In vertebrates, exchange of materials between blood and tissues takes place through capillaries.
(5) SA node is the pace maker of the mammalian heart. (AL/1997 Z)



Structured Essay

(AL/2014 B)

1. (A) (i) Name the two iron containing respiratory pigments found among animals other than hemoglobin.

- (ii) Name four vitamins required for the formation of blood components in man.

- (B) (i) What is lymph?

- (ii) Name the two main vessels in the lymphatic system of man.

- (iii) At which location does the lymphatic system join with the blood circulatory system in man?

- (iv) (a) State the prominent structural similarity between lymph vessels and veins in man.

- (b) State two main structural dissimilarities between the blood circulatory system and lymphatic system in man.

- (v) How is lymph transported in lymph vessels in man?

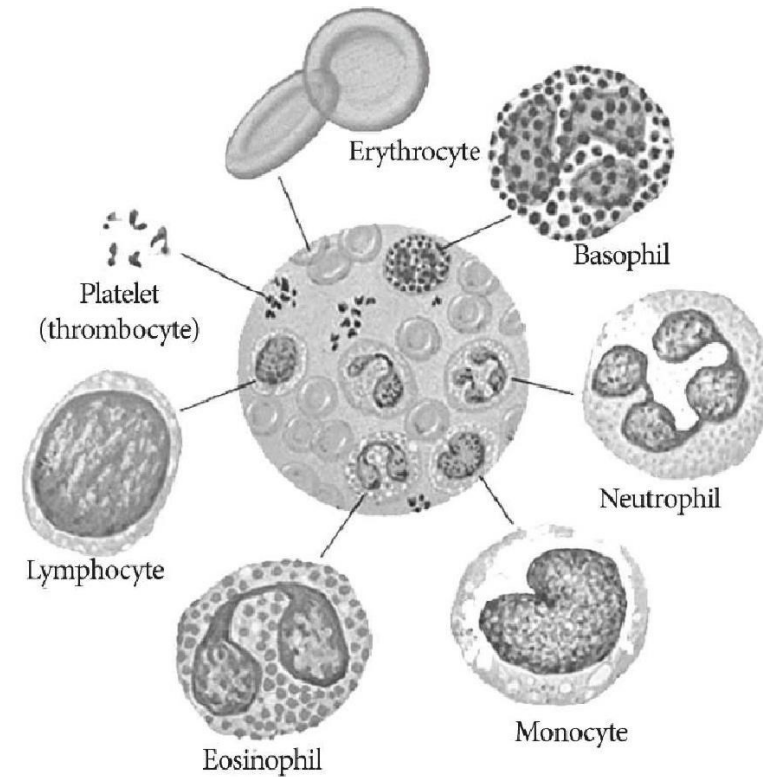
(AL/2004 B)

- (C) (i) What is blood plasma?

- (ii) What is the main component of blood plasma?

Composition and major functions of human blood

Blood which is a connective tissue is composed of cells and plasma. Cellular components of the blood are three types namely red blood cells, white blood cells and platelets. Leukocytes and platelets are developed from the bone marrow in the bones such as ribs, vertebrae, sternum and pelvis. Erythropoietin hormone (from kidneys) stimulates the generation of red blood cells.



Red blood cells (erythrocytes)

They are small biconcave disk-like cells. Mature erythrocytes lack nuclei. This character helps to carry more hemoglobin molecules within the cell. They also lack thus they produce ATP via anaerobic respiration. If they produce ATP by aerobic respiration that will reduce the O₂ transport efficiency. They have about days of life span. Generally a micro liter of blood contains million red blood cells. This figure can be varied depending on the gender and health status. Main function of red blood cells is the transportation of O₂ molecules. They also transport CO₂ molecules.

White blood cells (Leukocytes)

There are five types of leukocytes. They are Basophils, Lymphocytes, Eosinophils, Neutrophils and monocytes. Main functions of leukocytes are body defense, phagocytic engulfing and digesting microorganisms. Lymphocytes develop into T cells and B cells. These cells increase immune response against foreign substances.

Platelets

Platelets are derived from bone marrow cells. They also do not have nuclei and they play a major role in blood clotting.

Blood plasma

Blood plasma consists of water, inorganic ions in dissolved forms, plasma proteins such as albumin, antibodies and fibrinogen, nutrients, metabolic wastes, respiratory gases and hormones pH of human blood is around 7.4. Protein concentration in plasma is higher than in interstitial fluid. The dissolved ions in the plasma buffer and maintain the osmotic balance in the blood. Albumin in the plasma also buffers the blood and antibodies are involved in defense. Fibrinogen in the plasma aids in blood clotting. When the clotting factors are removed from the plasma it is called as serum.

Major Functions of blood

-
-
-
-
-
-
-

Blood clotting

When a tissue is damaged. blood flows from it and coagulates to form a blood clot. This prevents further blood loss and entry of pathogenic micro organisms which is of clear survival value. In general the blood in undamaged vessels does not clot. A highly complex series of reactions takes place in order to occur coagulation. When the blood vessel is damaged the connective tissues of the vessel wall is exposed. Therefore platelets in the blood adhere to the collagen fibers in the connective tissue and release substance that makes close by platelets sticky. This

11. Briefly describes blood clotting process by using a flow chart

12. Briefly describes the A, B, O grouping of blood, based on agglutinin and agglutinin

.....
.....
.....
.....
.....

13. Briefly explains the significance of blood grouping in blood transfusion

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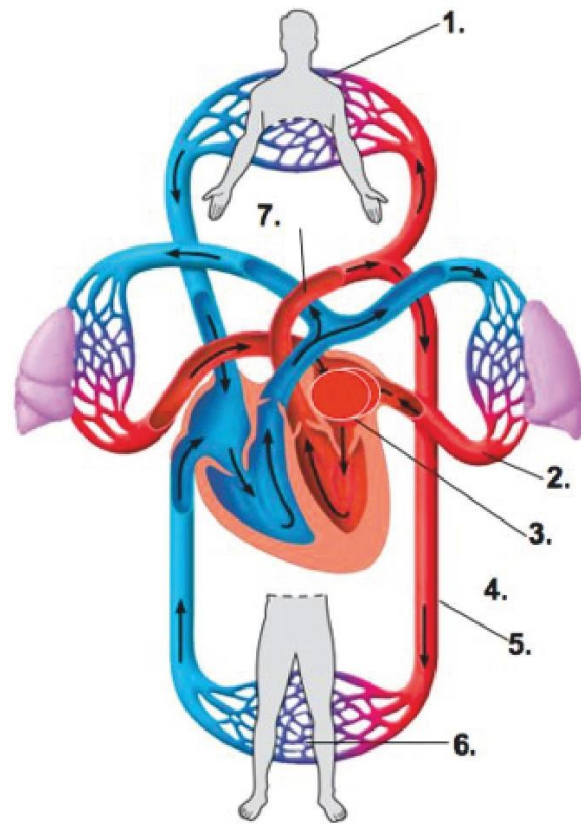
14. States what "Rh" factor is

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15. Appreciates the importance of "Rh" factor in pregnancy and blood transfusion

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7. Identifies the organization of human circulatory system shown in the diagram.



8. Names the respiratory pigments and states their roles in human and other animals.

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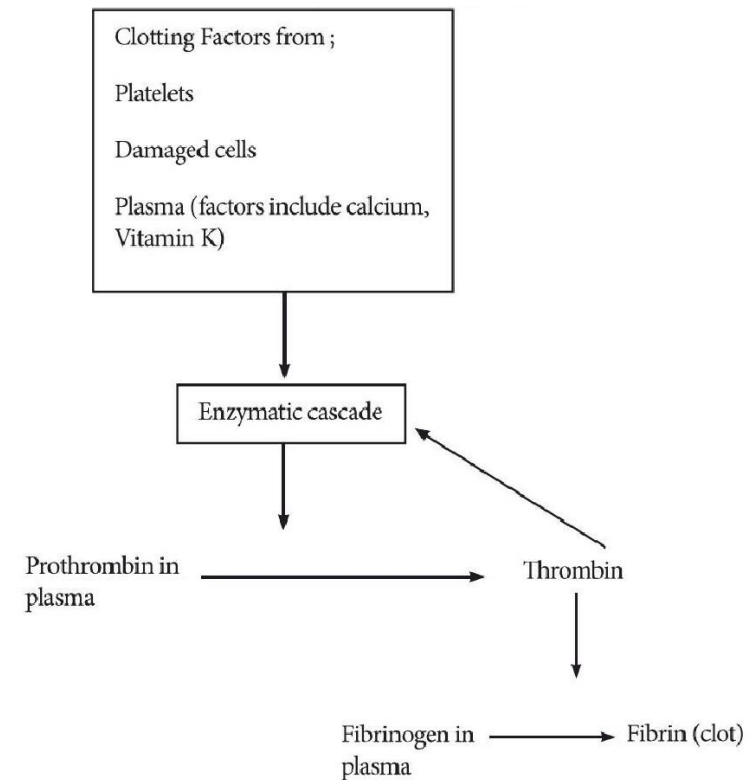
9. Briefly describes the transport of respiratory gases and other substances within the human body

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10. States the composition and major functions of human blood

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platelet plug provides instant protection against blood loss. Then platelets release clotting factors. They trigger the formation of thrombin. Then converts into Next this fibrin aggregates into threads that form a network of the clot. The activated thrombin is also involved in formation of more thrombin which completes the formation of blood clot. The cascade of reaction of blood clotting is given below



Clotting does not occur in blood vessels because the lining of the vessels is very smooth and does not promote platelet aggregation or cell rupture. Also some substances such as prevent clotting. Heparin prevent the conversion of prothrombin into thrombin and fibrinogen to fibrin and is widely used clinically as an anticoagulant.

Grouping of blood

The surface of the red blood cells carries antigens called agglutigen (antigen A and antigen B). In addition individuals have antibodies in plasma (anti—A and anti-B). According to ABO blood grouping system there are four blood groups namely A, B, AB and O. A person with a specific antigen in red cells does not possess the corresponding antibody in the plasma. e.g. Anyone with antigen A on the red blood cell membrane has no anti—A antibody in the plasma.

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If red blood cells have antigen B and plasma with antibodies a (anti—A) that person's blood group is B

If red blood cells have both antigen 'A' and 'B' and plasma has no anti-A or anti- B antibodies that person's blood group is 'AB'

If red blood cells have no antigen A or B but plasma has both antibodies (anti—A and anti-B) that person's blood group is 'O'

When a patient receives a blood transfusion it is vital that they receive blood that is compatible with their own. If it is incompatible a type of immune response occurs. This is because the donor's red cell membranes possess glycoprotein which act as antigens and react with antibodies (agglutinin) in the recipient's plasma. The result is that the donor's cells are agglutinated.

Therefore when transfusion occurs it is important to know blood group of donor and recipient.

People with blood group AB make neither anti—A nor— Anti-B antibodies. Transfusion of type A, B, AB and O blood into these individuals is likely to be safe since there are no antibodies to react with them Person with AB blood group is known as a universal recipient.

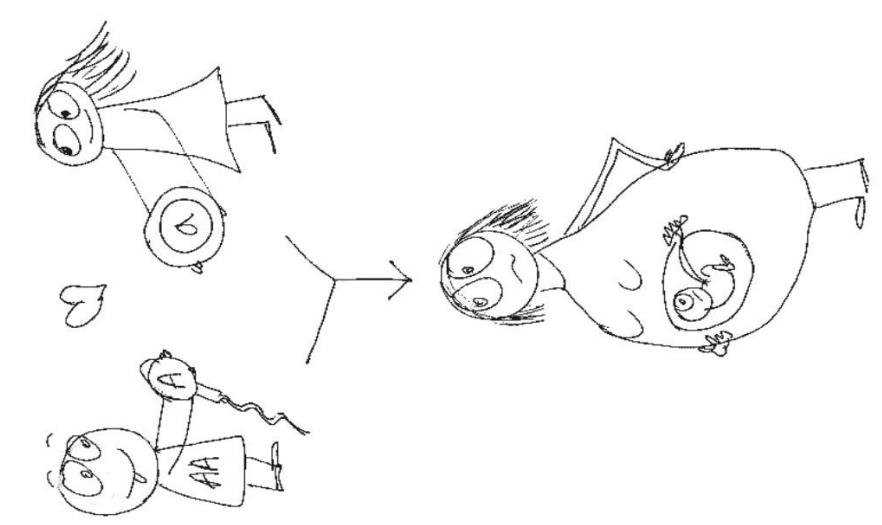
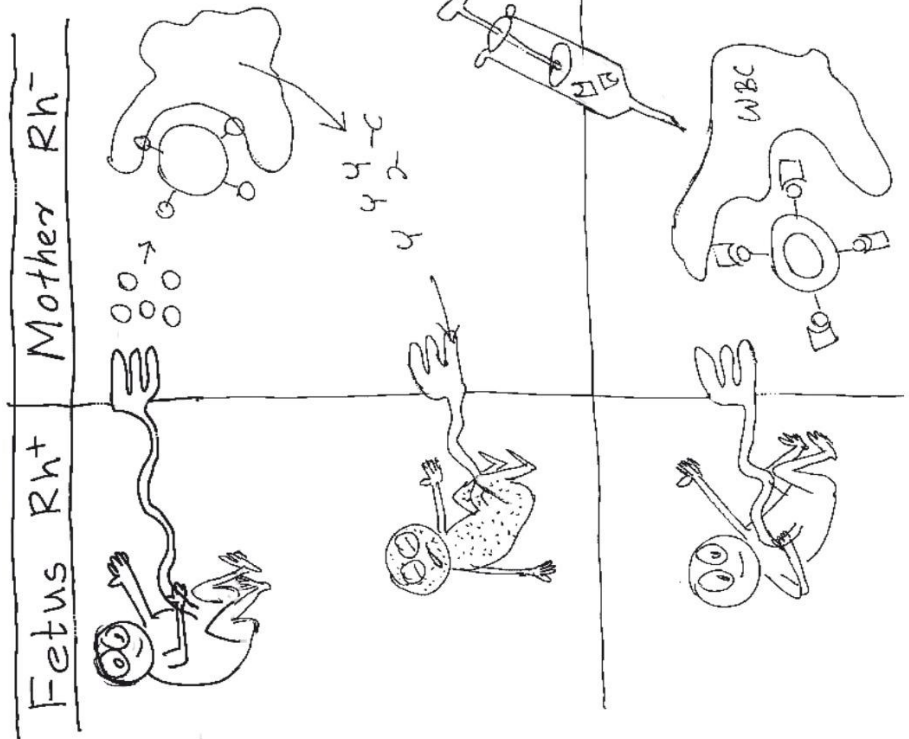
Individual with blood group O has neither antigen A nor antigen B on their plasma membrane of red blood cells but they do have antibodies (anti—A and anti-B) in their plasma.

So these individuals having blood group O can donate blood to the persons with any blood group. A person with the blood group O is known as a universal donor.

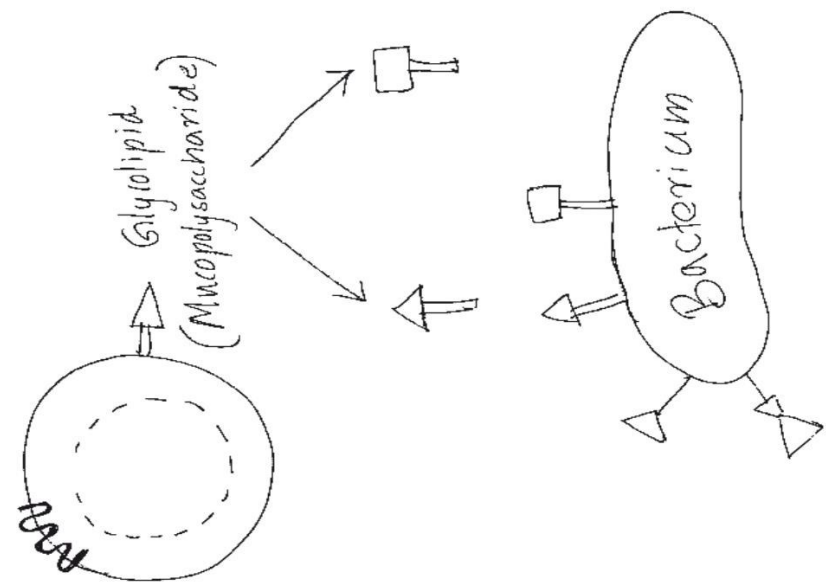
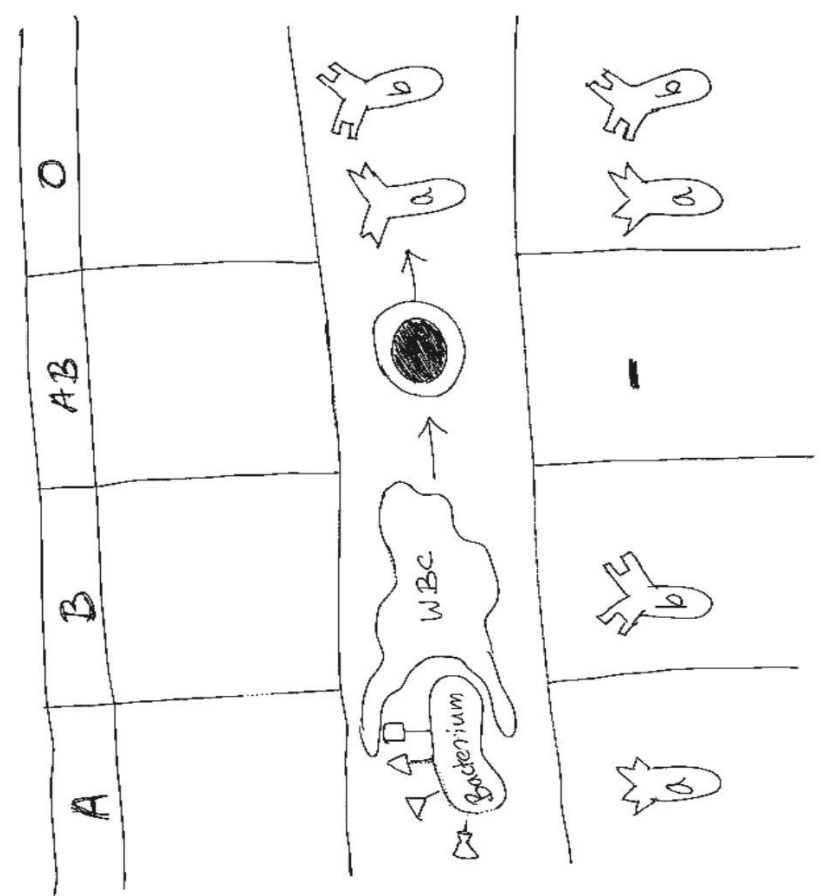
Therefore prior to transfusion cross-matching is still required to ensure that there is no reaction between donor and recipient blood.

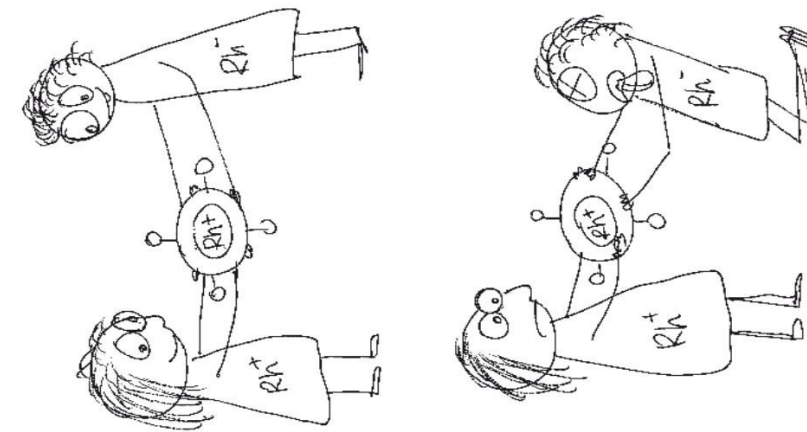
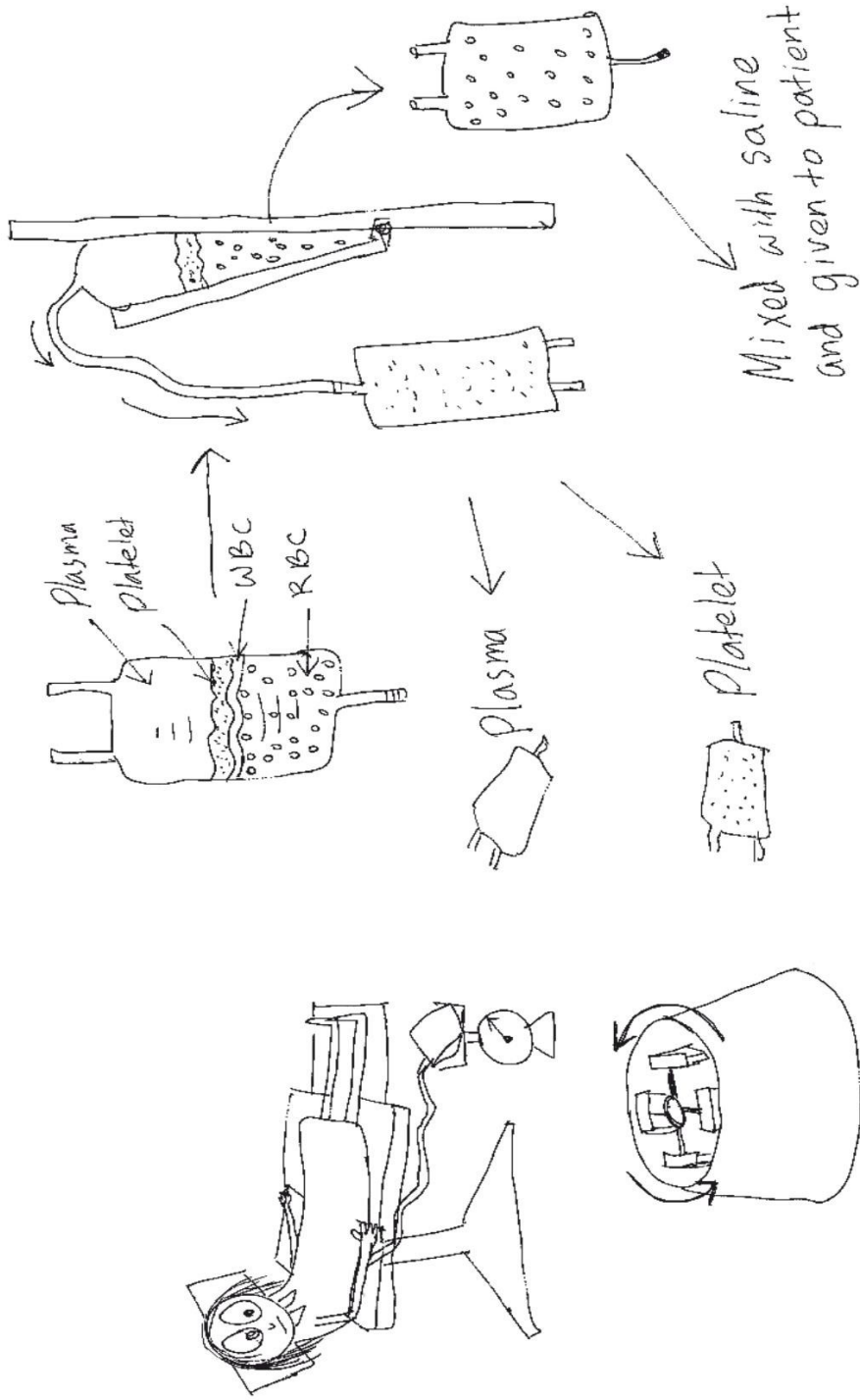
Learning Outcomes:

1. Briefly describes the blood pressure, diastolic pressure and systolic pressure.
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2. States what are hypotension and hyper tension and name the factors which effects on hypertension and hypotension.
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3. States the harmful effects of hypertension and hypotension regarding the human body.
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4. Briefly describes the coronary circulation related to the human heart.
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5. Briefly describes the effects of coronary arterial blockages and thickening leading to heart attacks and strokes
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6. States the major functions of the lymphatic system
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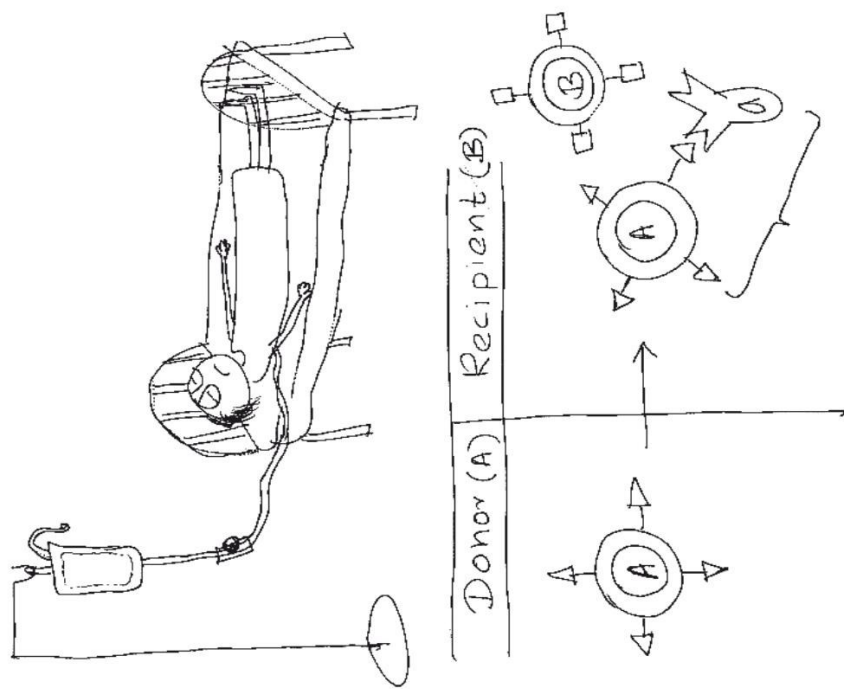
Blood Groups





A (b)	B (a)	AB (-)	O (a and b)
A	B	AB	O

A B
O AB



The Rhesus system

- Some individuals have antigen called Rhesus factor on the of red blood cells.
- Individuals having this factor on the red blood cells are called Rh+ and those who do not have this factor are called Rh-.
- Rh+ individuals do not have anti Rhesus antibodies in the plasma while individuals who are Rh- have anti-Rhesus antibodies in their plasma in certain situation.
- If Rh+ blood enters a Rh- negative individual the recipient responds by manufacturing anti-bodies in blood plasma.

Rh antibodies in the blood plasma.

- When a Rh - mother bears a Rhesus positive (Rh+) child during delivery few Rh+ red blood cells of the fetus may enter the mother's circulation and cause the mother to produce anti Rh antibodies in her plasma.
- If the mother is pregnant for the second time with a Rhesus positive fetus, the anti Rh antibodies developed in her plasma in response to the first child's red blood cells can pass across the placenta to the fetus and destroy fetal red cells.
- Therefore, subsequent Rh+ children can suffer destruction of their red blood cells.

