CHAPTER – 8

THE CIRCULATORY SYSTEM

Progress Check 1

Question 1

Name the two fluids that circulate in the body.

Answer

Blood and Lymph

Question 2

In a coloured diagram, why do we generally show the pulmonary artery in blue and pulmonary vein in red colour ?

Answer

Conventionally, all veins are shown in blue colour and all arteries are shown in red colour. But pulmonary vein and artery are exceptions to it. The pulmonary artery is shown in blue as it contains deoxygenated blood and pulmonary vein is shown in red colour because it contains oxygenated blood.

Question 3

Name any four substances transported by blood.

Answer

Oxygen, Carbon dioxide, Digested food and Hormones are the four substances transported by blood.

Progress Check 2

Question 1

Name the following :

(i) The yellow coloured fluid part of the blood.

(ii) The respiratory pigment contained in RBCs.

(iii) Any two organelles absent in mature RBCs.

(iv) The process of WBCs squeezing out through the walls of the blood capillaries.

Answer

(i) Plasma

(ii) Haemoglobin

(iii) Nuclei, Mitochondria

(iv) Diapedesis

Question 2

Mention the following:

(i) Average life span of RBCs.

(ii) Range of RBCs per mm^3 in a normal adult human female.

(iii) The two major categories of WBCs.

(iv) Blood cells involved in leukaemia.

Answer

(i) 120 days

(ii) 4.5 million

(iii) Granular & Non-granular

(iv) Leukocytes

Progress Check 3

Question 1

State which of the following statements are True.

(i) Process of coagulation starts with the release of a substance from RBCs.

(ii) Blood fails to clot readily in the case of deficiency of calcium.

(iii) The solid fibrin and thrombin are one and the same thing.

(iv) The clear liquid that oozes out after the formation of a clot is serum.

Answer

(i) False
Corrected Statement — Process of coagulation starts with the release of a substance from platelets.

(ii) True

(iii) False
Corrected Statement — The solid fibrin and thrombin are different. Thrombin converts fibrinogen into insoluble fibrin in presence of calcium ions.

(iv) True

Question 2

Name the following :

(i) The category of vitamin required for clotting of blood.

(ii) Any two diseases related with blood clotting.

(iii) The antibodies present in the plasma of O type blood group.

(iv) The animal for which Rh stands in the context of blood group.

Answer

(i) Vitamin K

(ii) Haemophilia, Dengue

(iii) Antibody A and B

(iv) Rhesus (common monkey)

Progress Check 4

Question 1

Fill in the blanks :

(i) Ventricles have ..... walls when compared with those of auricles.

(ii) Ventricles give rise to two large blood vessels called ..... and .....

Answer

(i) Ventricles have ***thick*** walls when compared with those of auricles.

(ii) Ventricles give rise to two large blood vessels called ***pulmonary artery*** and ***aorta***.

Question 2

Where are the following located?

(i) Tricuspid valve

(ii) Mitral valve

(iii) Pulmonary semilunar valves

Answer

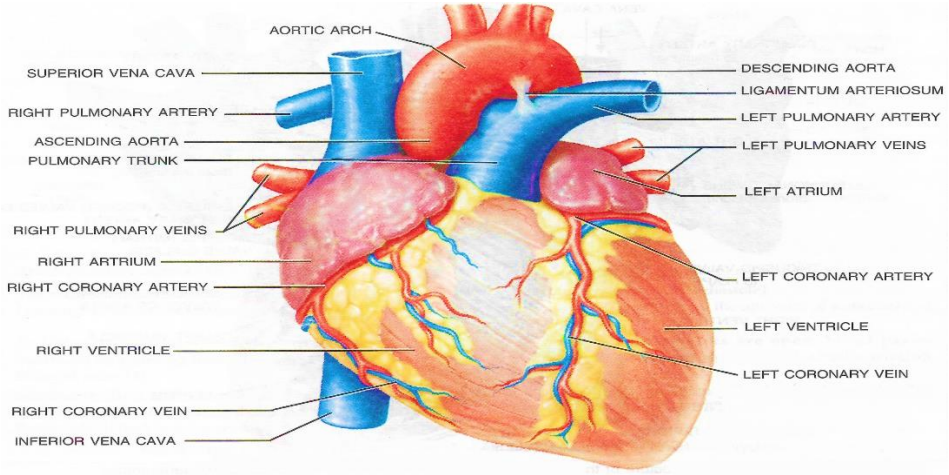
(i) Tricuspid valve — Right Ventricle

(ii) Mitral valve — Left Ventricle

(iii) Pulmonary semilunar valves — Pulmonary Artery

Question 3

Can you answer why the pulmonary artery shown in figure is blue in colour ?



Answer

The pulmonary artery carries deoxygenated blood to the lungs for oxygenation. Hence, it is shown in blue colour in the diagram.

Progress Check 5

Question 1

Name the following :

(i) Contraction phase of heart.

(ii) The structure that holds the heart valves in position.

Answer

(i) Systole

(ii) Tendinous cords (Chordae tendinae)

Question 2

Mention the phase of heart beat in which both the atrio-ventricular valves are closed.

Answer

Ventricular Systole

Progress Check 6

Question 1

Fill in the blanks

(i) The ..... have thin and less muscular ..... , and have ..... to prevent back flow of ..... .

(ii) ..... carry blood to an organ and break up into ..... ending in capillaries.

(iii) Walls of capillaries consist of a single layer of squamous ..... cells.

(iv) The substances to and from the tissues diffuse through the walls of ..... .

Answer

(i) The ***auricles*** have thin and less muscular ***walls***, and have ***Cuspid valves*** to prevent back flow of ***blood***.

(ii) ***Arteries*** carry blood to an organ and break up into ***arterioles*** ending in capillaries.

(iii) Walls of capillaries consist of a single layer of squamous ***epithelial*** cells.

(iv) The substances to and from the tissues diffuse through the walls of ***capillary***.

Progress Check 7

Question 1

Name the two major circulations of blood in the human body.

Answer

1. Pulmonary (lung) circulation
2. Systemic (body) circulation

Question 2

From where to where do the following blood vessels carry blood?

(i) Pulmonary artery

(ii) Renal artery

(iii) Posterior vena cava

(iv) Hepatic vein

(v) Hepatic portal vein

Answer

(i) Pulmonary artery — From right ventricle to lungs

(ii) Renal artery — from aorta into kidney

(iii) Posterior vena cava — from lower parts of body into right atrium

(iv) Hepatic vein — from liver into posterior vena cava

(v) Hepatic portal vein — from stomach and intestine to liver

Question 3

Define portal vein.

Answer

A portal vein is one which starts with capillaries and also ends in capillaries

Progress Check 8

Question 1

What is pulse ?

Answer

Pulse is the alternate expansion and elastic recoil of the wall of the artery during ventricular systole.

Question 2

What are the normal values of blood pressure in a normal human adult ?

Answer

The normal values of blood pressure in a normal human adult is 100 - 140 mm (systolic) and 60 - 80 mm (diastolic).

Question 3

Which kind of cells are mostly found in lymph?

Answer

Leukocytes

Question 4

List the three functions of lymph.

Answer

1. Supplies nutrition and oxygen to those parts where blood cannot reach.
2. It drains away excess tissue fluid and metabolites and returns proteins to the blood from tissue spaces.
3. Fats from the intestine are absorbed through lymphatics.

Question 5

Name the two main lymphatic organs in humans.

Answer

Spleen and tonsils (node) are the main lymphatic organs in humans.

Question 6

Name the following :

(i) The smallest W.B.C.

(ii) Part of lymphatic system concerned with absorption of fats from the intestine.

(iii) A special lymphatic node on the sides of the neck.

Answer

(i) Lymphocyte

(ii) Lacteals

(iii) Tonsils

Multiple Choice Type

Question 1

The corpuscles which transport the respiratory gas oxygen to the different parts of the body :

1. Leukocytes
2. Thrombocytes
3. Erythrocytes
4. Lymphocytes

Answer

Erythrocytes

Reason — Erythrocytes (RBC) contain haemoglobin which transports oxygen to different parts of the body.

Question 2

Which of following acts like a blood reservoir ?

1. Tonsils
2. Lymph
3. Spleen
4. Tissue fluid

Answer

Spleen

Reason — Spleen releases stored blood during emergency like haemorrhage and emotional stress.

Question 3

The process of engulfing bacteria by Neutrophils is called :

1. Diapedesis
2. Diuresis
3. Phagocytosis
4. Diastole

Answer

Phagocytosis

Reason — Phagocytosis is the mechanism by which neutrophils engulf particle (germs).

Question 4

The artery with the highest amount of nitrogenous wastes is :

1. Hepatic artery
2. Renal artery
3. Pulmonary artery
4. Coronary artery

Answer

Renal artery

Reason — Renal artery brings blood to kidney for purification (removal of nitrogenous waste).

Question 5

The compound formed by the combination of haemoglobin and carbon dioxide is :

1. Carbaminohaemoglobin
2. Carboxyhaemoglobin
3. Oxyhaemoglobin
4. Carbogen

Answer

Carboxyhaemoglobin

Reason — Haemoglobin combines with carbon dioxide to form Carboxyhaemoglobin. In lungs it releases carbon dioxide to combine with oxygen and forms oxyhaemoglobin.

Question 6

Which of the following chemical substances is released from Eosinophils ?

1. Histones

2. Antitoxins
3. Antibodies
4. Histamine

Answer

Antitoxins

Reason — Antitoxins are released by Eosinophils. It neutralise the toxins.

Question 7

The doubled-layered membrane which covers and protects the heart is :

1. Pericardial fluid
2. Meninges
3. Pericardium
4. Pleura

Answer

Pericardium

Reason — Pericardium forms the double layered protective covering of heart.

Question 8

The blood vessel without a muscular layer in its wall:

1. Capillary
2. Vein
3. Artery
4. Portal vein

Answer

Capillary

Reason — Capillaries are very narrow tubes with no muscles and allow diffusion of substances into and from the tissues.

Question 9

The blood vessel which carries blood from the stomach and intestine to the liver:

1. Hepatic artery
2. Carotid artery

3. Hepatic vein
4. Hepatic portal vein

Answer

Hepatic portal vein

Reason — Hepatic portal vein carry blood from the stomach and intestine to the liver.

Question 10

The kind of cells that initiate blood coagulation:

1. Monocytes
2. Lymphocytes
3. Leukocytes
4. Thrombocytes

Answer

Thrombocytes

Reason — Thrombocytes, also known as platelets form the plug at the site of injury and initiate blood coagulation.

Question 11

A human heart has four chambers and four valves to regulate the process of blood circulation in the body. What kind of phases would occur when blood is supplied to Aorta and Pulmonary Artery from the chambers of the heart ?

1. Atrial systole and ventricular diastole.
2. Ventricular systole and Atrial diastole.
3. Right ventricular systole and left ventricular diastole.
4. Left atrial systole and right atrial diastole.

Answer

Ventricular systole and Atrial diastole

Reason

When blood is supplied to aorta and pulmonary artery the ventricles contracts in order to pump blood out of the ventricles, meanwhile the atria relaxes and receives blood from vena cava and pulmonary vein.

Question 12

Pramod met with an accident while going to his office. Consequently, he lost a large volume of blood. His blood group is 'AB'. Which of the following blood groups can be donated to him ?

1. A and B only
2. AB only
3. A, B and AB only
4. A, B, AB and O

Answer

A, B, AB and O

Reason

A person with blood group AB has both A and B antigens and no antibodies, hence they can receive blood from any blood group.

Assertion Reason type

Question 13

Assertion. Human beings have an open blood vascular system.

Reason. Blood is contained in the heart and openly flows all throughout the body via three kinds of blood vessels — arteries, veins and capillaries.

1. Both A and R are True.
2. Both A and R are False.
3. A is True and R is False.
4. A is False and R is True.

Answer

A is False and R is True

Explanation
Human beings have a closed blood vascular system i.e., the blood circulates in the body through blood vessels.

Question 14

Assertion. The wall of left ventricle is thicker than the wall of right ventricle.

Reason. The left ventricle must generate enough force to pump oxygenated blood to the entire body, so it has thicker muscular walls compared to the right ventricle, which pumps blood to the lungs.

1. Both A and R are True.
2. Both A and R are False.

3. A is True and R is False.
4. A is False and R is True.

Answer

Both A and R are True.

Explanation
The left ventricle needs to generate more force during contraction because it must pump blood to distant body tissues. In contrast, the right ventricle only pumps blood to the nearby lungs.

Question 15

Assertion. The respiratory pigment haemoglobin (Hb) is formed of RBCs and albumin.

Reason. Haemoglobin contains an iron-containing part called haemin. It is richly found in erythrocytes.

1. Both A and R are True.
2. Both A and R are False.
3. A is True and R is False.
4. A is False and R is True.

Answer

A is False and R is True.

Explanation
The respiratory pigment haemoglobin (Hb) is formed of globin protein and iron containing part called haemin.

Question 16

Assertion. Lymphocytes produce antibodies and are the smallest of WBCs with a single large nucleus.

Reason. Lymphocytes contain granules in the cytoplasm. Lymphocytes release histamine.

1. Both A and R are True.
2. Both A and R are False.
3. A is True and R is False.
4. A is False and R is True.

Answer

A is True and R is False.

Explanation
Basophils contain granules in the cytoplasm and release histamine.

Question 17

Assertion Thrombin is the inactive form of prothrombin which is produced during blood coagulation.

Reason Vitamin K, a fat-soluble vitamin, is essential for the production of prothrombin.

1. Both A and R are True.
2. Both A and R are False.
3. A is True and R is False
4. A is False and R is True

Answer

A is False and R is True

Explanation
Prothrombin is the inactive form of thrombin which is produced during an injury for the purpose of blood clotting.

Question 18

Assertion. Blood group 'AB' does not contain any antibody but contains both the antigens 'A' and 'B'.

Reason. In humans, WBCs have specific proteins on their surfaces. These proteins are called antibodies.

1. Both A and R are True.
2. Both A and R are False.
3. A is True and R is False.
4. A is False and R is True.

Answer

A is True and R is False.

Explanation
In humans, RBCs have specific proteins on their surfaces. These proteins are called antigens.

Very Short Answer Type

Question 1

Given below are certain structures, write their chief functional activity.

(a) Blood platelets .....

(b) Neutrophils .....

(c) Erythrocytes .....

(d) Lymphocytes .....

(e) Bone marrow .....

Answer

(a) Blood platelets → **blood coagulation**.

(b) Neutrophils → **phagocytosis**.

(c) Erythrocytes → **transportation of gases**.

(d) Lymphocytes → **Produce antibodies**.

(e) Bone marrow → **destruction of old and weak RBC's/production of RBCs and WBCs**.

Question 2

Name these:

(a) Three components of circulatory system

(b) Three kinds of blood cells

(c) Three kinds of blood vessels

(d) Three circulating fluids in human body

(e) Three non-circulating fluids in human body

(f) Two lymphatic organs

(g) Two components of blood

(h) Two kinds of circulatory systems in different animals

(i) Two components of haemoglobin

(j) Two phases of circulation of blood in human body

Answer

(a) Heart, Blood and Blood Vessels

(b) Red blood cells, White blood cells and platelets

(c) Artery, Vein and capillary

(d) Blood, Tissue fluid and Lymph

(e) Synovial fluid, Vitreous humour and Aqueous humour

(f) Spleen and Tonsil

(g) Plasma and cellular elements

(h) Closed Blood Circulation and open blood circulation.

(i) Haemin (iron containing part) and globin protein

(j) Atrial systole and Ventricular systole

Question 3

Name the following:

(a) Any one vein which starts from an organ and ends in another organ besides the heart.

(b) The kind of blood vessels which have no muscular walls.

(c) The artery which carries deoxygenated blood.

(d) The kind of blood cells which can squeeze out through the walls of one category of blood vessels.

(e) The smallest common blood vessels formed by the union of capillaries.

(f) The blood vessels which start from capillaries and end in capillaries.

(g) The phase of the cardiac cycle in which the auricles contract.

(h) The valve present in between the chambers on the right side of the human heart.

(i) The phase of the cardiac cycle in which the ventricles get filled with blood from the atrium.

(j) The fluid found between the membranes of the heart.

Answer

(a) Hepatic portal vein

(b) Blood Capillaries

(c) Pulmonary artery

(d) White blood cells

(e) Venules

(f) Portal vein

(g) Atrial systole

(h) Tricuspid valve

(i) Atrial systole

(j) Pericardial fluid

Question 4

Complete the following statements by filling in the blanks from the choices given in the brackets.

(a) The blood vessel that begins and ends in capillaries is the ..... (hepatic artery/hepatic portal vein/hepatic vein).

(b) A blood vessel which has small lumen and thick wall is ..... (capillary/lymphatic duct/artery/venule)

(c) The valve which prevents the back flow of blood in the veins and lymph vessels ..... (mitral valve/tricuspid valve/pocket-shaped valve).

(d) An anticoagulant present in the blood is ..... (heparin/hirudin/thromboplastin/calcium).

Answer

(a) The blood vessel that begins and ends in capillaries is the ***hepatic portal vein***.

(b) A blood vessel which has small lumen and thick wall is ***artery***.

(c) The valve which prevents the back flow of blood in the veins and lymph vessels is ***pocket-shaped valve***.

(d) An anticoagulant present in the blood is ***heparin***.

Question 5

Note the relationship between the first two words and suggest the suitable word/words for the fourth place:

(a) Lub : Atrio-ventricular valve :: Dup : .....

(b) Coronary artery : Heart :: Hepatic artery : .....

(c) RBCs : Polycethemia :: WBCs : .....

(d) WBCs : ..... :: RBCs : Erythropenia

(e) Chest pain : Angina pectoris :: Heart attack: .....

Answer

(a) Lub : Atrio-ventricular valve :: Dup : ***Semilunar valves***

(b) Coronary artery : Heart :: Hepatic artery : ***Liver***

(c) RBCs : Polycethemia :: WBCs : ***Leukemia***

(d) WBCs : ***Leukopenia*** :: RBCs : Erythropenia

(e) Chest pain : Angina pectoris :: Heart attack: ***Myocardial infarction***

Short Answer Type

Question 1

Enumerate the structural differences between white blood cells and red blood cells.

Answer

Structural Differences between White Blood Cells and Red Blood Cells:

White Blood Cells	Red Blood Cells
White blood cells are irregularly shaped with lots of extensions.	Red blood cells are minute biconcave disc-like structures.
White blood cells have a nucleus.	Red blood cells do not contain a nucleus.
Haemoglobin is absent in white blood cells.	Haemoglobin is present in red blood cells.

Question 2

When are the sounds "LUBB" and "DUP" produced respectively during heart beat?

Answer

The first sound "LUBB" is produced when the atrio-ventricular (tricuspid and bicuspid) valves get closed sharply at the start of ventricular systole. The second sound "DUP" is produced when at the beginning of ventricular diastole, the **semilunar valves** at the **roots of aorta and pulmonary artery** get closed.

Question 3

Match the items in column A with those in column B. Rewrite the correct matching pairs.

Column A	Column B
(a) SA node	Plasma
(b) Defective haemoglobin in RBC	Serum
(c) Muscle fibres located in the heart	Pacemaker
(d) The liquid squeezed out of blood during clotting	Sickle cell anemia
(e) Never tires, keep on contracting and relaxing	Purkinje fibres
(f) Cardiac cycle	Cardiac muscles
(g) Liquid part of the blood without corpuscles	0.85 sec

Answer

Column A	Column B
(a) SA node	Pacemaker
(b) Defective hemoglobin in RBC	Sickle cell anemia
(c) Muscle fibres located in the heart	Purkinje fibres
(d) The liquid squeezed out of blood during clotting	Serum
(e) Never tires, keep on contracting and relaxing	Cardiac muscles
(f) Cardiac cycle	0.85 sec
(g) Liquid part of the blood without corpuscles	Plasma

Question 4

The table below is designed to indicate the transport of certain substances in our body. Fill in the blanks with suitable answers.

Substance	From	To
.....	Lungs	Whole body
Carbon dioxide	.....	.....
Urea	.....	.....
Digested carbohydrates	Intestine	.....
.....	.....	Target organs

Answer

Substance	From	To
Oxygen	Lungs	Whole body
Carbon dioxide	***Whole body***	***Lungs***

Substance	From	To
Urea	***Whole body***	***Kidneys***
Digested carbohydrates	Intestine	***Whole body***
Hormones	***Endocrine glands***	Target organs

Question 1

Define the following terms:

(a) Circulatory system

(b) Blood

(c) Heart

(d) Diapedesis

(e) Phagocytosis

(f) Rh factor

Answer

(a) **Circulatory system** — The circulatory system is a network consisting of blood, blood vessels and the heart. This network supplies tissues in the body with oxygen and other nutrients, transports hormones and removes unnecessary waste products.

(b) **Blood** — Blood is the circulating fluid contained in the heart and in the blood vessels such as arteries, veins and capillaries of the circulatory system. Blood from the heart is pumped throughout the body using blood vessels.

(c) **Heart** — The heart is made of specialized cardiac muscle tissue that allows it to act as a pump within the circulatory system. Heart pushes the blood around the body and has different chambers such as right atrium, left atrium, right ventricle, left ventricle to prevent the mixing of oxygenated blood and carbon dioxide rich blood.

(d) **Diapedesis** — Diapedesis is the squeezing of leucocytes through the wall of capillaries into the tissues.

(e) **Phagocytosis** — Phagocytosis is the process in which most WBCs and particularly the neutrophils engulf particle-like solid substances, especially bacteria.

(f) **Rh factor** — Rh factor is an inherited antigen often found on the blood cells. Some individuals have these antigens and are thus Rh positive (Rh+) while others who do not have this antigen are Rh negative (Rh-)

Question 2

Distinguish between the following pairs on the basis of words indicated in the brackets

(a) Erythrocytes and Leukocytes (Nucleus)

(b) Leukocytes and Thrombocytes (Life-span)

(c) Arteries and Veins (Wall and lumen)

(d) Pulmonary and Systemic circulation (Kind of blood)

(e) Mitral valve and Tricuspid valve (Location)

Answer

(a) Difference between Erythrocytes and Leukocytes (Nucleus):

Character	Erythrocytes	Leukocytes
Nucleus	Absent	Present

(b) Difference between Leukocytes and Thrombocytes (Life-span):

Character	Leukocytes	Thrombocytes
Life span	Two weeks	3-5 days

(c) Difference between Arteries and Veins (Wall and lumen):

Character	Arteries	Veins
Wall	Thick and muscular	Thin and less muscular
Lumen	Narrow	Wider

(d) Difference between Pulmonary and Systemic circulation (Kind of blood):

Character	Pulmonary circulation	Systemic circulation
Kind of blood	Pulmonary artery brings deoxygenated blood to lungs and pulmonary vein takes oxygenated blood from lungs to heart.	Oxygenated blood is transported to body parts from heart and deoxygenated blood is transported back to heart.

(e) Difference between Mitral valve and Tricuspid valve (Location):

Character	Mitral valve	Tricuspid valve
Location	Present between left atrium and left ventricle.	Present between right atrium and right ventricle.

Question 3

Give reasons/explain:

(a) The left ventricle has thicker walls than the right ventricle.

(b) The walls of right ventricle are thicker than those of the right auricle.

(c) Vitamin K is essential for the process of blood clotting.

(d) A mature mammalian Erythrocyte lacks nucleus, mitochondria and endoplasmic reticulum.

(e) People have a common belief that the heart is located on the left side of the chest.

Answer

(a) The left ventricle pumps blood to the farthest points in the body such as the feet, the toes and the brain against the gravity while the right ventricle pumps the blood only up to the lungs. Therefore, the left ventricle has thicker walls than the right ventricle.

(b) The right ventricle pumps blood to the lungs for oxygenation whereas the right auricle receives the blood from venae cavae and passes it to the right ventricle. Therefore, walls of the right ventricle are thicker than those of the right auricle.

(c) Vitamin K acts as a catalyst that transforms some anti-clotting proteins, which are always present, into clotting proteins when there is a cut or wound to the body. The mechanism of blood clotting involves the presence of calcium and other clotting factors. Thrombokinase activates an enzyme called prothrombin activator. The enzyme prothrombin activator then converts plasma protein prothrombin into thrombin. Thrombin is the enzyme which in turn converts fibrinogen into fibrin. Polymerized fibrin together with platelets forms a clot at the wound site. The prothrombin is a plasma protein synthesized in the liver. Vitamin K is essential for the synthesis of prothrombin. Hence, Vitamin K is essential for the process of blood clotting.

(d) Lack of nucleus, mitochondria and endoplasmic reticulum helps erythrocytes in the following way:

1. Loss of nucleus makes the red cells biconcave, thus increasing their surface area to absorb more oxygen.
2. Loss of mitochondria means that they cannot use the absorbed oxygen themselves.
3. Absence of endoplasmic reticulum makes it flexible so that they can move through fine capillaries.

(e) The heart is right in the center between the two lungs and above the diaphragm. The narrow end of the roughly triangular heart is pointed to the left side and during working, the contraction of the heart is most powerful at this end giving a feeling that the heart is on the left side.

Question 4

Write important role/roles of the following:

(a) Tonsils

(b) Spleen

(c) Hepatic portal vein

(d) Basophils

(e) S.A.N.

Answer

(a) **Tonsils** — Tonsils are lymph glands located on the sides of the neck. They tend to localize the infection and prevent it from spreading it in the body as a whole.

(b) **Spleen** — The spleen is a large lymphatic organ. The spleen acts as a blood reservoir in case of emergency such as haemorrhage, stress or poisoning. It produces lymphocytes and destroys worn out RBCs.

(c) **Hepatic portal vein** — The hepatic portal vein is a blood vessel that carries blood from the gastrointestinal tract, gallbladder, pancreas and spleen to the liver. This blood contains nutrients and toxins extracted from digested contents.

(d) **Basophils** — Basophils are a type of white blood cells. They are the least common type of granulocyte which release chemicals called histamine for inflammation which dilate blood vessels.

(e) **S.A.N.** — The sinoatrial node (SAN) is a region of cardiac fibres located in the right atrium. The electrical wave of stimulation is initiated here and extends over the two atria, causing them to contract. It is often referred to as the pacemaker of the heart.

Question 5

What is meant by the term 'Double circulation'? Distinguish between the two types of circulation in our body.

Answer

Double circulation is a process during which blood passes twice through the heart during one complete cycle. The flow of blood in the heart consists of two phases —

1. **The short pulmonary (lung) circulation**
2. **The long systemic (general body) circulation**

Difference between pulmonary and systemic circulation —

Pulmonary circulation	Systemic circulation
It involves circulation of blood between the heart and the lungs.	It involves circulation of blood between the heart and the body organs (except lungs).
It carries deoxygenated blood to the lungs to receive oxygen.	It carries oxygenated blood to the body organs.
It returns oxygenated blood back to the heart.	It returns deoxygenated blood back to the heart.

Question 6

Write the main steps in coagulation of blood in their correct sequence?

Answer

Coagulation of blood (or clotting) occurs in a series of steps as follows:

1. The injured tissue cells and the platelets which disintegrate at the site of the wound release a substance thrombokinase (also called thromboplastin).
2. The thrombokinase acts as an enzyme and with the help of calcium ions present in the plasma, it converts a substance prothombin (inactive) of the plasma, into thrombin (active). Vitamin K, a fat-soluble vitamin is essential for the production of prothombin.
3. Thrombin in the presence of calcium ions reacts with the soluble fibrinogen of the plasma to convert it into insoluble fibrin. Fibrin is a solid substance that forms threads. These microscopic threads of fibrin are sticky and form a mesh or network at the site of wound.
4. Blood cells are trapped in the network of the fibrin; the network then shrinks and squeezes out the rest of the plasma which is in the form of a clear liquid, the serum. The solid mass which is left behind is called clot (or thrombus).

Question 7

Write the exact location of the following:

(a) Pulmonary semilunar valve

(b) Tonsils

(c) Heart

(d) Pacemaker

(e) Hepatic portal vein

Answer

(a) Pulmonary artery

(b) Sides of neck

(c) Centre of chest, between the lungs and above diaphragm

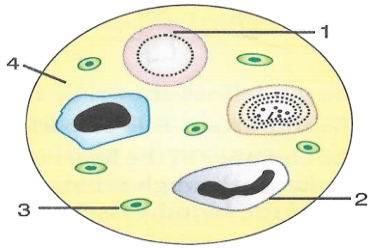
(d) Upper right corner of the walls of the right atrium

(e) Between liver and stomach, intestine

Structured / Application / Skill Type

Question 1

Given below is a diagram of a smear of human blood. Study the same and answer the questions that follow:



(a) Name the parts 1, 2, 3 and 4 indicated by guidelines.

(b) Mention two structural differences between the parts labelled 1 and 2.

(c) What is the main function of the parts labelled 1, 2 and 3 respectively?

(d) What is the life span of the part labeled "1"?

(e) Name a soluble protein found in "4" which helps in clotting of blood.

Answer

(a) The parts indicated are as follows —

- 1 → Red Blood Cell (RBC)
- 2 → White Blood Cell (WBC)
- 3 → Blood Platelet
- 4 → Blood Plasma

(b) Two structural differences between red blood cells and white blood cells are:

Red Blood Cells	White Blood Cells
Red blood cells are minute biconcave disc-like structures.	White blood cells are amoeboid and can produce pseudopodia with which they can squeeze through the walls of the capillaries into the tissues.

Red Blood Cells	White Blood Cells
Red blood cells lack nucleus.	White blood cells have a nucleus.

(c) The main functions of the parts labelled 1, 2 and 3 are as follows:

1. **Part 1 (Red Blood Cell)** — Transport of respiratory gases to the tissues and from the tissues, transport of nutrients from the alimentary canal to the tissues.
2. **Part 2 (White Blood Cell)** — WBCs play major role in defense mechanism and immunity of the body.
3. **Part 3 (Blood Platelet)** — Blood platelets are the initiators of blood clotting.

(d) The average life span of a red blood cell (RBC) is about 120 days.

(e) Fibrinogen.

Question 2

Robin was suffering from blood cancer. Due to his reduced immunity, he has become prone to various kinds of infectious diseases. Answer the questions that follow:

(a) Write the technical term for the above mentioned disease.

(b) Mention the specific structure/cell of the blood whose number increases manifold in this disease.

(c) Write two main functions of the above mentioned structure/cell of the blood.

Answer

(a) Leukemia

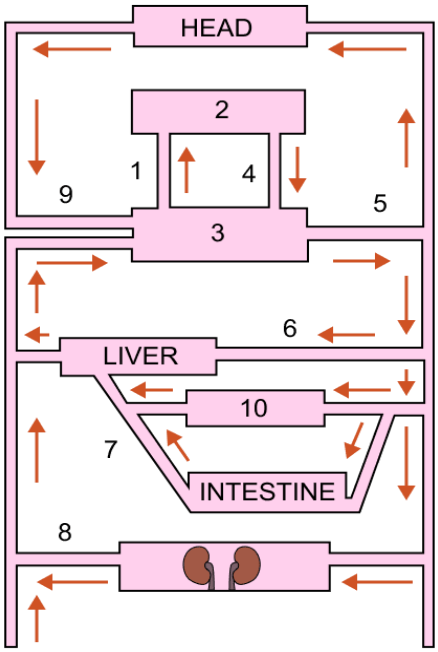
(b) White Blood cells (WBC)

(c) Two functions of WBC

1. Helps in fighting with infections.
2. Helps in removing damaged tissues and in cleaning up cellular waste.

Question 3

Given below is a highly schematic diagram of the human blood circulatory system.



(a) Which part (state the number) represents the heart? Give reason in support of your answer.

(b) Which numbers represent the following respectively?

Aorta

Hepatic portal vein

Pulmonary artery

Superior vena cava

Renal vein

Stomach

Answer

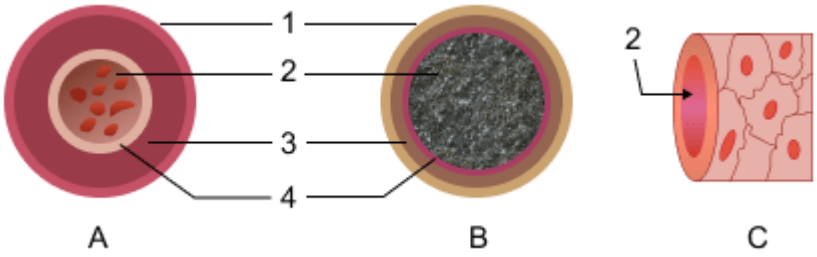
(a) The structure 3 represents the heart. It forms the centre of double circulation and is located between the liver and the head. Also the blood circulation (indicated by 1) begins from heart to lungs.

(b) The numbers of the structures are mentioned below:

- Aorta → 5
- Hepatic portal vein → 7
- Pulmonary artery → 1
- Superior vena cava → 9
- Renal vein → 8
- Stomach → 10

Question 4

The figures given below show diagrammatic cross-sections of three kinds of blood vessels.



(a) Identify the blood vessels A, B and C.

(b) Name the parts labeled 1-4.

(c) Mention two structural differences between A and B.

(d) Name the kinds of blood that flow through A and through B respectively.

(e) In which one of the vessels referred to in (a) above does the exchange of gases actually take place?

Answer

(a) The blood vessels A, B and C are:

- A → Artery
- B → Vein
- C → Capillary

(b) The parts labeled 1-4 are:

- 1 → External layer made of connective tissue
- 2 → Lumen
- 3 → Middle layer of smooth muscles and elastic fibres
- 4 → Endothelium

(c) Two structural differences between Artery and Vein are:

Artery	**Vein**
Have thick and more muscular walls.	Have thin and less muscular walls.
Have narrower lumen.	Have wider lumen.

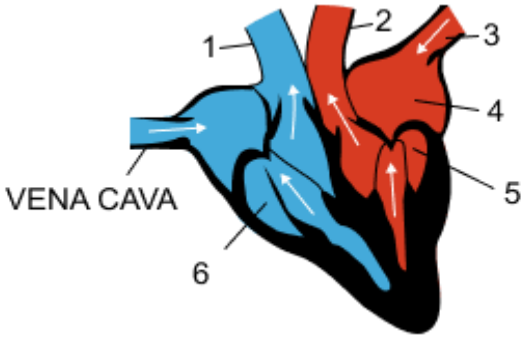
(d) The kinds of blood that flow through A and through B are:

- A (Artery) → Oxygenated blood
- B (Vein) → Deoxygenated blood

(e) At the capillary level the actual exchange of gases takes place.

Question 5

The diagram given below represents the human heart in one phase of its activity. Study the same and then answer the questions that follow:



(a) Name the phase.

(b) Which part of the heart is contracting in this phase? Give a reason to support your answer.

(c) Name the parts numbered 1 to 6.

(d) What type of blood flows through the parts marked '1' and '2' respectively?

(e) How many valves are closed in this phase?

Answer

(a) The phase is Ventricular Systole and Atrial Diastole.

(b) Ventricular muscles are contracting during this phase because the valves between the two ventricles and pulmonary artery and aorta are open while the atrio-ventricular valves are closed.

(c) The parts numbered 1 to 6 are:

- 1 → Pulmonary Artery
- 2 → Aorta
- 3 → Pulmonary Vein
- 4 → Left Atrium
- 5 → Bicuspid Valve
- 6 → Right Ventricle

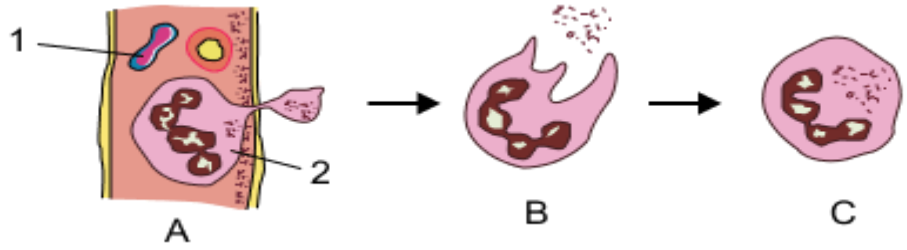
(d) Types of blood flowing through parts '1' and '2' are mentioned below:

- Part 1 (Pulmonary artery) → Deoxygenated blood
- Part 2 (Aorta) → Oxygenated blood

(e) Two valves — Bicuspid and Tricuspid valves are closed in this phase.

Question 6

Study the following diagram carefully and then answer the questions that follow:



(a) Name the cell labelled 1.

(b) Identify the phenomenon occurring in A.

(c) Mention two structural differences between 1 and 2.

(d) Name the process occurring in B and C and state the importance of this process in the human body.

Answer

(a) The cell labelled 1 is a Red blood cell.

(b) Phenomenon occurring in A is **Diapedesis**.

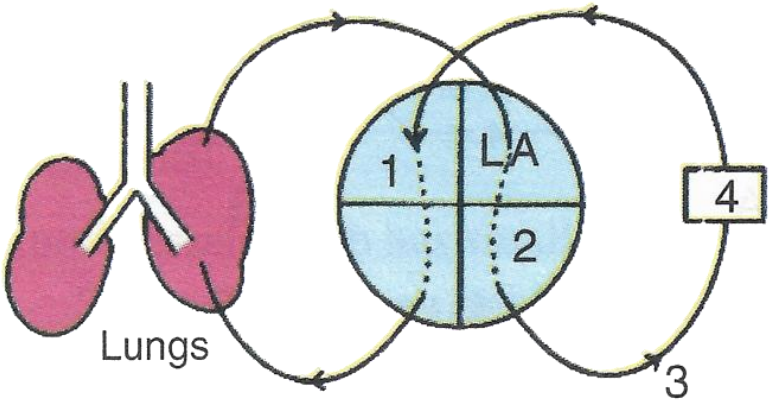
(c) Two structural differences between red blood cells and white blood cells are:

Red Blood Cells	**White Blood Cells**
Red blood cells are minute biconcave disc-like structures.	White blood cells are amoeboid and can produce pseudopodia with which they can squeeze through the walls of the capillaries into the tissues.
Red blood cells lack nucleus.	White blood cells have a nucleus.

(d) The process which occurs in B and C is phagocytosis. In this process, the WBCs engulf the foreign particles and destroy them, thus preventing the occurrence of disease.

Question 7

Given diagram is a schematic representation of the circulatory system in humans. Study the same and answer the questions that follow :



(a) Label the parts 1 and 4 indicated in the diagram.

(b) Which of the above mentioned number is the thickest artery? Also write its name.

(c) Mention the number and chamber of the heart which has the thickest muscular wall.

(d) Which of the above numbers/structures has the maximum number of blood capillaries?

(e) Draw neat and labelled diagrams of the transverse section of vena cava and the part numbered as 3. Make sure to show the structural differences between these two in the diagram.

Answer

(a) Parts 1 and 4 are:

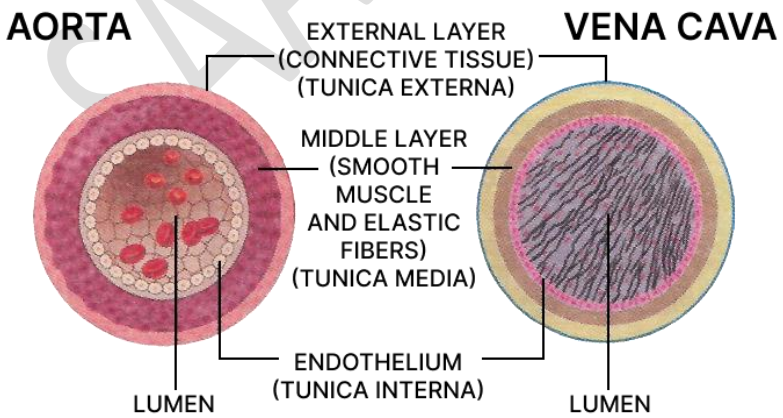
1 → Right Auricle
4 → body parts

(b) 3, Aorta

(c) 2, Left ventricle

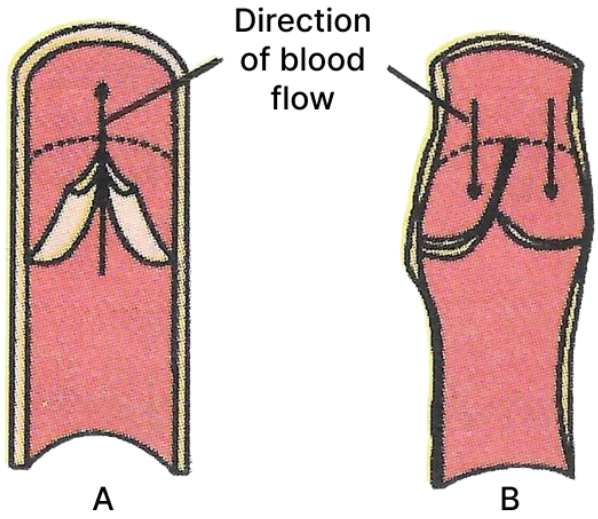
(d) Lungs

(e) Labelled diagrams of the transverse section of vena cava and aorta showing their structural differences are given below:



Question 8

Given alongside are diagrams of a certain category of blood vessels showing the role of a special structure in their walls. Study the figure and answer the questions that follow.



(a) Name the kind of blood vessels shown in the figure. What are its branches termed as ?

(b) Name the structure shown inside the blood vessels. Write its important role.

(c) What kind of blood flows through these blood vessels normally? Name the blood vessel which carries blood from the heart to the lungs.

(d) Name a similar kind of blood vessel which is related to the liver and kidney.

(e) Draw a neat and labelled diagram of the transverse section of the blood vessel shown above showing the three layers of its wall and lumen.

Answer

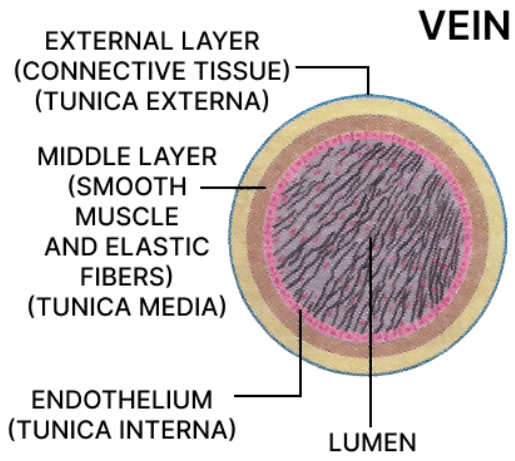
(a) The kind of blood vessels shown in the figure is vein. Its branches are termed as venule.

(b) The structure shown inside the blood vessels are valve. Its role is to prevent the backflow of blood.

(c) Deoxygenated blood flows through these blood vessels normally. The blood vessel which carries blood from the heart to the lungs is the pulmonary artery.

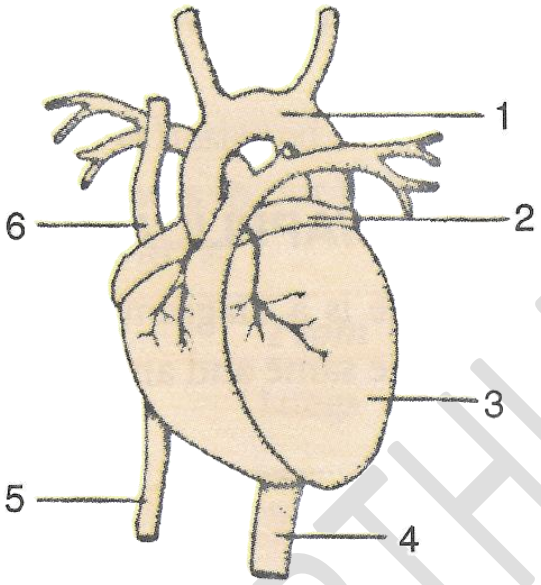
(d) Hepatic vein and renal vein are related to Liver and Kidney respectively.

(e) Below diagram shows the transverse section of a vein with the three layers of its wall and lumen labelled:



Question 9

Given below is a diagram of the external features of the human heart. Study the figure and answer the questions that follows :



(a) Label the guidelines shown as 1 to 6 in the figure.

(b) Write the important role of parts 5 and 6.

(c) Name the chamber of the heart which collects blood from the lungs through a blood vessel. Also write the name of the blood vessel.

(d) Write one structural and one functional difference between the blood vessels 4 and 5.

(e) What happens when there is a blockage in any coronary artery or any of their branches?

Answer

(a) Labelled guidelines are:

1 → Aortic Arch

2 → Left atrium

3 → Left ventricle

4 → Aorta

5 → Inferior vena cava

6 → Superior vena cava

(b) Inferior vena cava transports deoxygenated blood from the posterior or the lower region of the body (including abdomen and legs) to heart and superior vena cava transports deoxygenated blood from the anterior or upper regions of the body (including head, chest and arms) to the heart.

(c) Left Atrium collects blood from Lungs. The blood vessel involved is Pulmonary vein.

(d) One structural and one functional difference between Inferior vena cava and Aorta is:

Inferior vena cava	**Aorta**
Thin wall and wide lumen.	Thick wall and narrow lumen.
Transports deoxygenated blood to heart.	Transports oxygenated blood from heart to body parts.

(e) When there is a blockage in any coronary artery or in any one or more of their branches, there is deadening of the corresponding area of heart muscles leading to myocardial infarction (i.e., heart attack).