

Students Learning Outcomes

After Studying this chapter, students will be able to:

- Describe how the blood is circulated inside the human body.
- Explain how blood is used to transport materials throughout the human body.
- Identify the different types of organs connected to the blood system and their roles.
- Identify the different components that make up the blood.
- Name the cell types found in blood and their roles.
- Explain the structure of the heart with a diagram.
- Explain common heart diseases (coronary heart disease, myocardial infarction, angina).
- Explain the harmful effects of smoking related to heart diseases.

Subjective Type Questions

Long Questions prepared in the light of new Examination Techniques
(Knowledge, Understanding, Application, Analytical & Conceptual)

3.1

Blood and Its Components

Q.1: What is blood? Write down its functions and composition.

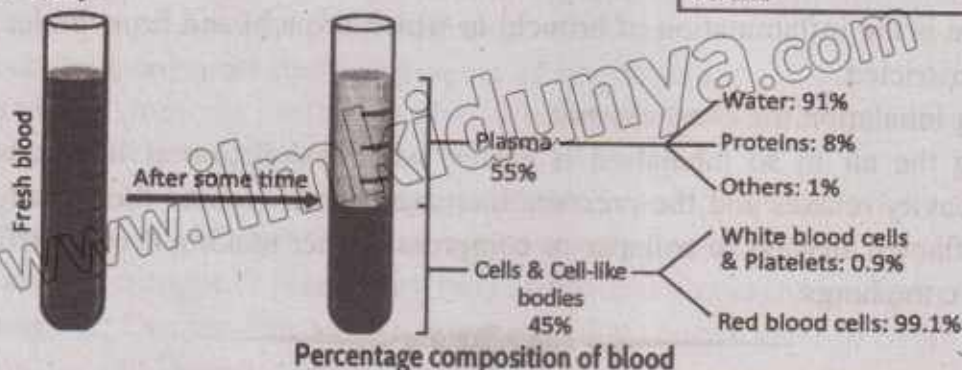
Ans. Blood: Blood is a fluid connective tissue that circulates throughout the body. Its main function is transport of substances and protection of body.

Blood is a type of connective tissue. Its main function is to transport materials through the body. It carries important materials to where they are needed. It transports oxygen from the lungs to all body cells and carries carbon dioxide back to the lungs for removal. Blood also delivers nutrients from the digestive system to the cells, hormones from glands to target organs, and waste products from the cells to kidneys for excretion.

About 55% of blood is composed of a fluid portion called plasma while 45% of blood is made up of cells or cell-like bodies. The adult human has about 5 litres blood in the body.

Q. What is serum?

Ans. If fibrinogen is removed from blood plasma, the rest is called serum.



Q.2: Write a note on Blood Plasma.

Ans. Blood Plasma: It is the liquid portion of blood. Plasma is composed 90-92% of water, 7 – 9% of proteins and 1% of other substances.

(i) Proteins: Antibodies are important plasma proteins. Antibodies defend the body against pathogens. Fibrinogen and albumin are plasma proteins.

Functions of fibrinogen and albumin:

- **Fibrinogen:** It is also a plasma protein it is responsible for blood clotting.

- **Albumin:** It is plasma protein which maintains the osmotic pressure of blood.

(ii) Salts: The important plasma salts are made of sodium, chloride and bicarbonate ions. In addition there are little amounts of calcium, magnesium, copper, potassium and zinc.

(iii) Nutrients, wastes and hormones: Plasma contains nutrients like glucose, lipids and amino acids etc. They enter blood from the digestive system. The wastes produced by cells are also present in plasma. Hormones secreted by endocrine glands are also carried by plasma.

(iv) Respiratory gases: Small amounts of carbon dioxide (about 5–7%) and oxygen (about 1.5%) are dissolved in plasma.

Q.3: Describe the structure, formation and functions of Red blood cells (Erythrocytes) in the human body.

Ans. Physical appearance and Composition: Red blood cells (RBCs) are disc-shaped cells with a depression at the centre. They contain a red portion haemoglobin. It transports oxygen and little amount of carbon dioxide. There are about 4 to 5.5 million RBCs per mm^3 of blood.

Formation and development: Before and immediately after birth, RBCs are formed in liver and spleen. In adults, they are formed in the red bone marrow of short bones (sternum, ribs and vertebrae).

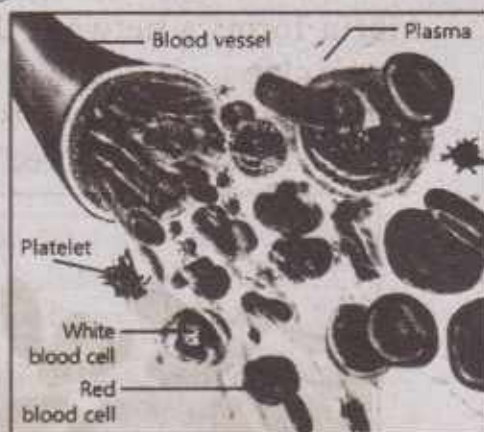
Functions: Their primary function is to transport oxygen and a small amount of carbon dioxide throughout the body. It helps in maintaining proper gas exchange in the body.

Life span: The average life span of a RBC is about 120 days.

Removal of RBCs: When RBCs complete their age, they are removed by spleen, bone marrow and liver.

Q.4: What are White Blood Cells (Leukocytes)? Discuss their role in body's immune defence mechanism and write down its types.

Ans. White Blood Cells: WBCs are colourless and have irregular shapes. They are formed in the red bone marrow. Some WBCs mature in lymph nodes, tonsils, thymus or spleen. WBCs are larger in size and less in number than RBCs. Each mm^3 of blood normally contains about 7,000 WBCs.



Blood composition

Q. How many red blood cells are present in body?

Ans. There are more than 30 trillion RBCs throughout the body. About 2 million RBCs die and are replaced every second.

Function: WBCs defend the body against diseases.

Types of White Blood Cells: There are several types of WBCs.

(i) **Granulocytes:** These WBCs have granules in cytoplasm. They include neutrophils, eosinophils and basophils.

Neutrophils: They destroy bacteria and clean up dead cells at infection sites.

Eosinophils: They fight with parasites and cause allergic reactions.

Basophils: They release histamine to cause inflammation and produce allergic reactions.

(ii) **Agranulocytes:** They have clear cytoplasm. There are two types of agranulocytes i.e. monocytes and lymphocytes.

Monocytes: Monocytes make macrophages which engulf the germs and dead cells.

Lymphocytes: Lymphocytes make antibodies against pathogens.

Q. What do you know about pus?

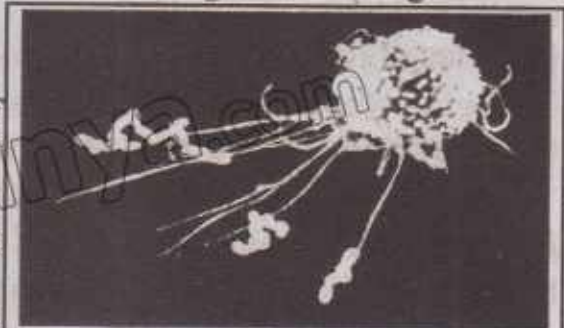
Ans. Macrophages die in the process of killing the germs. The dead cells accumulate and make the white substance called pus, seen at infection sites.

Q.5: What are platelets? Write down their functions.

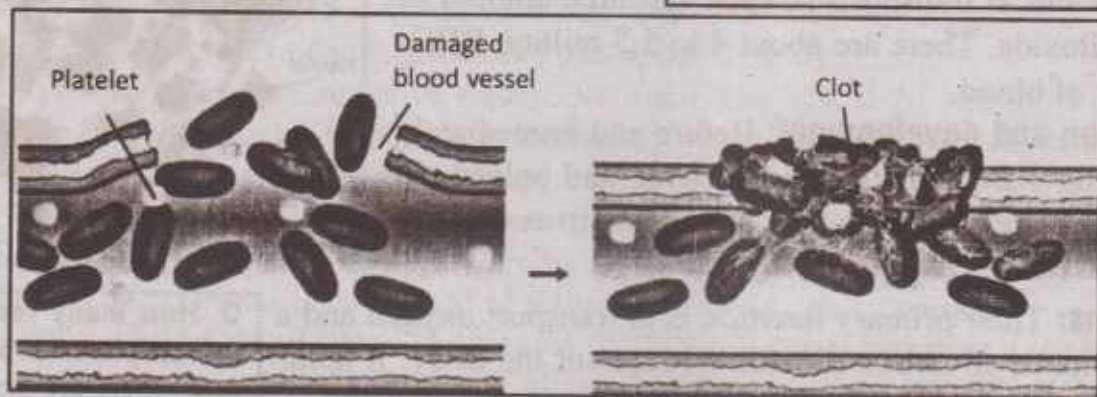
Ans. Platelets: Platelets are not whole cells. They are small fragments of large cells of bone marrow. Platelets lack a nucleus.

Functions:

- Platelets help in blood clotting at the site of injury.
- Platelets convert fibrinogen into fibrin.
- Fibrin forms a network that traps RBCs to form a clot.
- It prevents excessive bleeding until the damaged vessel is repaired.



A macrophage engulfing the bacteria



Formation of clot by platelets

Q.6: Explain how blood transports materials throughout the human body?

Ans. Blood acts as a comprehensive transport system using both its liquid component (plasma) and specialized cells to move essential materials.

Oxygen transport: Red blood cells contain haemoglobin which transports oxygen.

Carbon dioxide: Blood carries carbon dioxide produced in body cells and transports it back to lungs.

Nutrients transport: Glucose, lipids, amino acids and vitamins are transported by plasma from intestine to all body tissues.

Waste Removal: Metabolic wastes are carried by blood to excretory organs for elimination.

Hormone transport: Blood carries hormones from endocrine glands to target organs to regulate body functions.

3.2

Human Heart

Q.7: Explain the structure of the heart with a diagram.

Ans. Heart: The heart is a muscular organ that pumps blood through a network of blood vessels. The heart lies within the chest cavity, beneath the breast bone (sternum) between the two lungs.

Structure of Heart: Red blood cells contain haemoglobin which transports oxygen.

Pericardium: In human heart, a tough, sac-like membrane is called pericardium.

Function of pericardium: Pericardium secretes a fluid around heart. This fluid reduces friction between the pericardium and heart.

Septum: Human heart has two sides. The wall between the left and right sides is called septum.

Chambers of the heart: The upper and lower sides of the heart is divided into two chambers. The upper chambers are called atria and lower chambers are called ventricles. The atria have thinner walls as compared to ventricles.

Valves of the heart: Special flaps called valves are present between the chambers of both sides. The valves open in only one direction.

Tricuspid valve: The valve between right atrium and right ventricle is called tricuspid valve (made of 3 flaps).

Bicuspid valve: The valve between left atrium and left ventricle is called bicuspid valve (made of 2 flaps).

Semilunar valve: A valve present between each ventricle and large vessels is called semilunar valve.

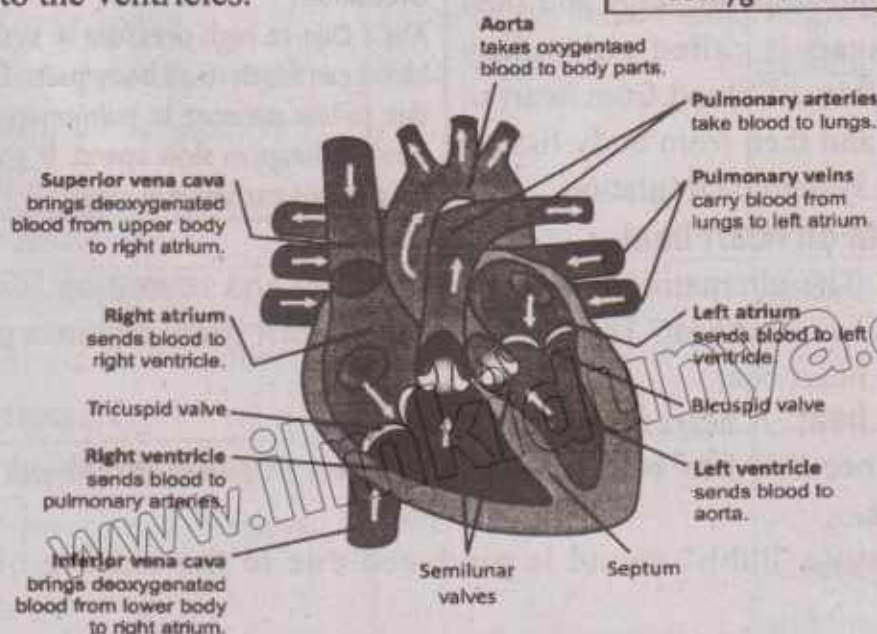
Function of valves: The valves prevent blood from flowing back into the ventricles.

Q. Which is the largest chamber in the heart?

Ans. The left ventricle is the largest and strongest chamber in the heart.

Q. What is the color of oxygenated and deoxygenated blood?

Ans. Oxygenated blood is bright red and deoxygenated blood is dark red.



Human heart; structure and blood circulation

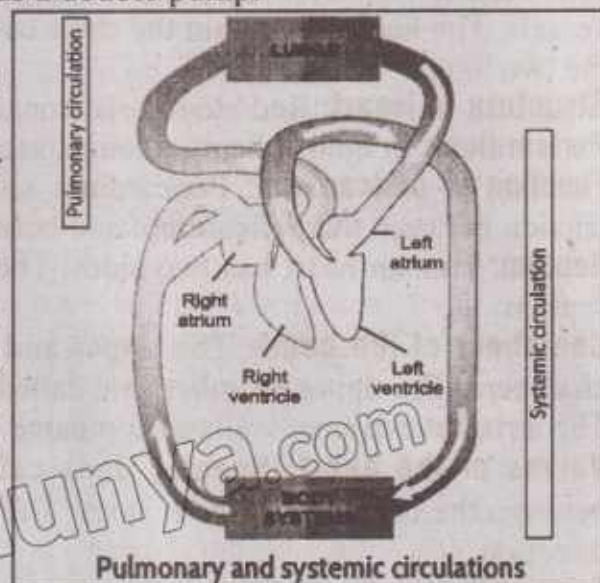
Q.8: Describe the pathway of blood through the human heart and explain its importance.

Ans. Heart: Heart is a muscular organ that pumps blood through a network of blood vessels. The heart lies within the chest cavity.

Circulation of blood as a double pump: The right side of the heart collects blood from body and sends it to the lungs while the left side collects blood from the lungs and sends it to the body. It means that human heart works as a double pump.

The deoxygenated Pathway (to the lungs):

Two veins i.e., superior and inferior vena cava bring deoxygenated blood (with high concentration of CO_2 and low concentration of O_2) from parts of the body (other than lungs). These veins open in the right atrium. The right atrium contracts and sends this blood into the right ventricle. The right ventricle contracts and pumps this blood into pulmonary arteries. The pulmonary arteries take this blood to lungs. In lungs CO_2 diffuses out of the blood and O_2 diffuses into the blood.



The oxygenated Pathway (to the body): From lungs pulmonary veins carry the oxygenated blood (low concentration of CO_2 and high concentration of O_2) back. These veins open in the left atrium of heart. This blood is pumped into left ventricle. When left ventricle contracts it pumps the blood into a large blood vessel called aorta. From aorta, this blood is transported to all parts of the body.

Pulmonary and systemic circulation: The flow of blood from heart to lungs and then from lungs to heart is called pulmonary circulation. The flow of blood from heart to the body tissues and then from body tissues to heart is called systemic circulation.

Q. How blood flows during systemic and pulmonary circulation?

Ans. Due to high pressure in systemic circulation, blood can reach to all body parts. On the other hand, due to low pressure in pulmonary circulation, blood flows in lungs in slow speed. It gives sufficient time for gaseous exchange in lungs.

Q.9: Write a note on heart beat.

Ans. Heartbeat: The alternating contraction (systole) and relaxation (diastole) of heart chambers makes one heartbeat. The average human heart beats 70 times per minute. This is also called the heart beat.

Phases of heart beat: A heart beat has two phases:

Systole: Systole occurs when both ventricles contract to pump the blood into pulmonary arteries and aorta.

- During systole "lubb" sound is produced due to the closing of tricuspid and bicuspid valves.

Diastole: Diastole occurs immediately after systole when both atria relax so that blood

enters the atria. Contraction of the atria fills the ventricles.

- During diastole "dubb" sound is produced due to the closing of semilunar valves.



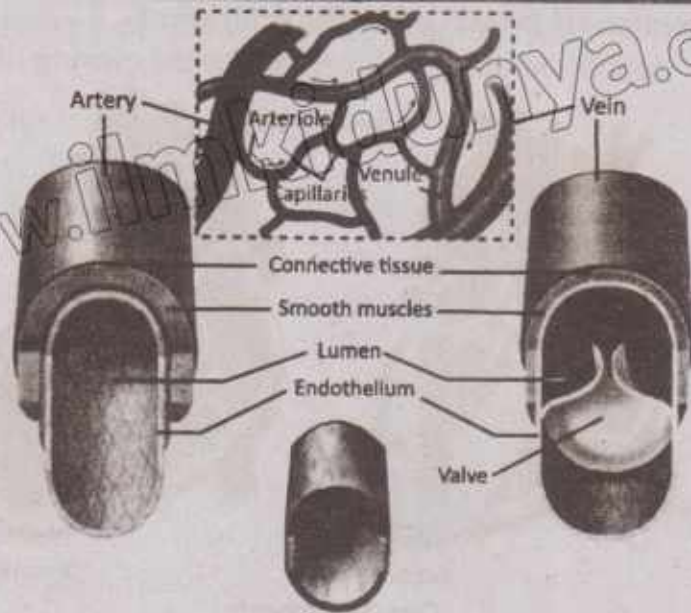
3.3

Blood Vessels

Q.10: Compare the structure and function of artery, a vein and a capillary.

Ans.

Feature	Artery	Vein	Capillary
Direction of blood flow	Carry blood away from the heart.	Carry blood towards the heart.	Connect arterioles with venules.
Type of blood	Carry oxygenated blood	Carry deoxygenated blood	Blood exchanges gases and nutrients.
Wall thickness	Thick, strong and elastic	Thin walls as compared to arteries	Extremely thin walls.
Layers of wall	Three layers Endothelium smooth muscles connective tissue	Three layers but middle layer is thinner	Single layer of endothelium only
Lumen	Narrow lumen	Broad lumen	Very narrow lumen
Valves	Absent	Present	Absent
Blood Pressure	Blood flows under high pressure.	Blood flows under low pressure	Blood flows slowly.
Function	Transport blood from heart to body organs.	Return blood from body to heart.	Allow exchange of oxygen, nutrients and wastes between blood and tissues.



Blood vessels

3.4

Arterial and Venous System

Q.11: Differentiate between arterial and venous system.

OR Explain arterial and venous system and compare their roles in blood circulation.

Ans. Arterial system:

Arteries of Pulmonary circulation: A large artery called pulmonary trunk carries deoxygenated blood from right ventricle. It branches into two smaller pulmonary arteries, each artery supplying blood to each lung.

- **Arteries of Systemic circulation:** Oxygenated blood is pumped from left ventricle into aorta. It forms arteries which supply blood to head, shoulders and arms. Aorta passes through the thorax and becomes dorsal aorta. It makes many arteries that supply blood to all parts of the lower region. For example, hepatic artery supplies blood to the liver and renal arteries supply blood to kidneys. Aorta divides and makes two femoral arteries which supply blood to legs.

Venous System:

- **Veins of Pulmonary circulation:** Two pulmonary veins carry oxygenated blood from lungs to the left atrium of heart.

- **Veins of Systemic circulation:** Two major veins i.e., superior vena cava and the inferior vena cava carry deoxygenated blood from body to right atrium. The superior vena cava is made by joining of veins from head, shoulders and arms. The inferior vena cava is made of many veins from parts of the lower region. For example, two femoral veins from legs empty into inferior vena cava. Renal veins carry blood from the kidneys. The hepatic portal vein carries blood from alimentary canal to the liver. From liver, a hepatic vein carries blood to the inferior vena cava.

Q. What is the main function of aorta?

Ans. Aorta makes right and left coronary arteries which supply oxygenated blood to the heart muscles. From heart muscle deoxygenated blood returns to left atrium through coronary veins.

Q. Describe the appearance of veins.

Ans. Veins are blue-looking, but the blood inside is actually dark red.

Q.12: What are cardiovascular disorders? Describe the causes, symptoms and prevention of coronary heart disease (CHD)?

Ans. Cardiovascular disorders:

The diseases that involve the heart or blood vessels are collectively called cardiovascular disorders or cardiovascular diseases (CVDs).

Coronary Heart Disease (CHD): It is the narrowing or blockage of the coronary arteries, which supply blood to the heart muscle. This condition is primarily caused by atherosclerosis i.e., accumulation of fatty deposits (plaques) inside arteries.

Causes: High levels of low-density lipoproteins (e.g., cholesterol) in blood, high blood pressure, smoking, diabetes, sedentary lifestyle.

Causes: High levels of low-density lipoproteins (e.g., cholesterol) in blood, high blood pressure, smoking, diabetes, sedentary lifestyle.

Symptoms: Asymptomatic in early stages; may lead to chest pain or discomfort as the condition progresses.

Risk Factors: Family history, obesity, high blood pressure, high cholesterol levels, and lifestyle factors.

Prevention: Healthy diet, regular exercise, smoking cessation and management of blood pressure and cholesterol levels.

Complications: If left untreated, CHD can lead to more severe conditions, including myocardial infarction and heart failure.

Q. Differentiate between arteriosclerosis and atherosclerosis.

Ans. Arteriosclerosis is the general hardening and thickening of arterial walls.

Atherosclerosis is a specific type of arteriosclerosis, caused by the build-up of fats, cholesterol, and other substances (plaque) inside the arteries.

Q.13: Enlist the causes, symptoms, complications and prevention of myocardial infarction.

Ans. Myocardial Infarction: "Myocardium" means heart muscle. "Infarction" means tissue death. The death of heart muscles is called myocardial infarction. It is commonly known as a "heart attack". It occurs when blood flow to a part of the heart muscle is blocked for prolonged a period leading to death of the heart muscle.

Causes: A blockage in one or more coronary arteries often caused by a blood clot that forms over atherosclerotic plaques.

Symptoms: Chest pain, tightness, and pressure; shortness of breath; sweating; pain radiating to the arm, neck or jaw.

Treatment: Emergency treatment (medicines to dissolve clots), angioplasty to open blocked arteries, and stenting to keep arteries open.

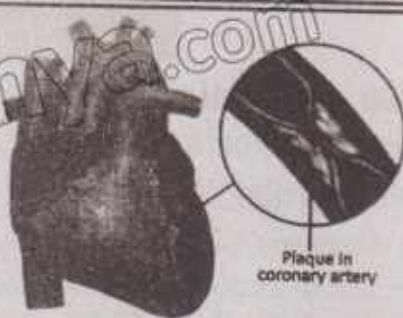
Q. According to WHO. What percentage of deaths are caused by cardiovascular diseases?

Ans. According to the World Health organization (WHO), cardiovascular disorders are responsible for about 32% of all global deaths.

In Pakistan, CVDs contribute to nearly 29% of all fatalities

Complications: Heart failure, arrhythmias (irregular heartbeats), and sudden cardiac arrest.

Prevention: Maintaining weight with a healthy diet; avoiding smoking; exercise regularly; control blood pressure, cholesterol and diabetes.



Artherosclerosis and resulting Myocardial infraction

Q.14: Write a note on Angina Pectoris as a cardiovascular disorder.

Ans. Angina Pectoris:

Angina Pectoris (commonly called Angina) is chest pain or discomfort caused by reduced blood flow to the heart muscle, typically due to coronary artery disease. Angina is a symptom of CHD and often indicates that the heart is not getting enough oxygen.

Symptoms:

Chest pain or discomfort, chest pressure, squeezing or heaviness. Pain can radiate to the shoulders, neck or arms.

Treatment: Lifestyle changes, medications, procedures like angioplasty or stent placement.

Complications: If untreated, can progress to myocardial infarction and increase the risk of heart failure.

Q. What is silent heart attack?

Ans. Sometime heart attack occurs without symptoms. It is called silent heart attack. It is more common in the elderly and in patients with diabetes

Q.15: Explain the harmful effects of smoking related to heart diseases.

Ans. Harmful Effects of Smoking Related to Heart Diseases:

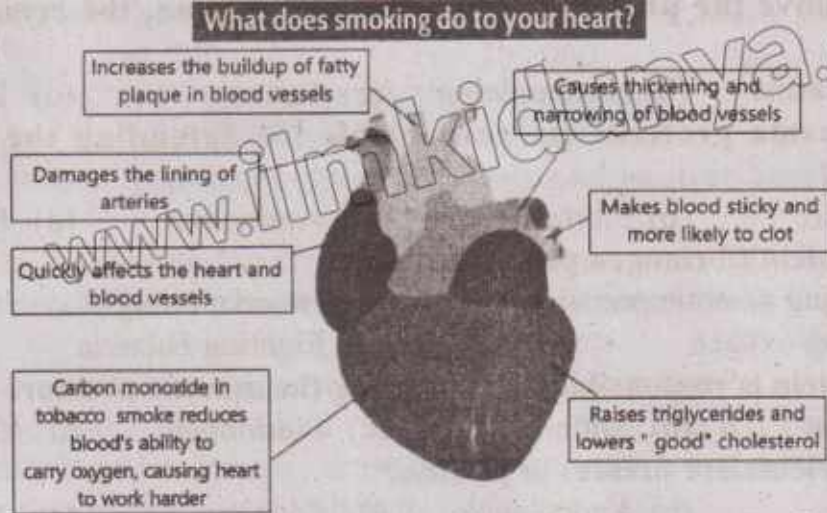
Smoking is the major risk factor for the development of heart diseases. Here's an overview of how smoking adversely impacts heart health:

- (i) **Increased Risk of Atherosclerosis:** Smoking accelerates atherosclerosis by damaging the endothelium of arteries.
- (ii) **Increased Risk of Blood clot Formation:** Smoking increases the chances for blood to clot by promoting platelet aggregation. The clots that can block coronary arteries and lead to myocardial infarction.
- (iii) **Elevated Blood Pressure:** Smoking contributes to elevated blood pressure by causing vasoconstriction.
- (iv) **Heart Rate and Rhythm Abnormalities:** Arrhythmias are irregular heartbeats that can be dangerous. Smoking affects heart rhythm by increasing heart rate.
- (v) **Reduced Oxygen Delivery:**

Carbon monoxide from cigarette smoke binds to haemoglobin in RBCs more effectively than oxygen, reducing the blood's oxygen-carrying capacity.

Q. What do you know about world Heart day?

Ans. World Heart Day is held on 29 September every year. Its objective is to give awareness to common people about the risks of cardiovascular disorders.



Public awareness poster on "Effects of Smoking on Heart"

(vi) Impact on Overall Cardiovascular Health: Smoking contributes to the narrowing of arteries in the legs, which can further strain the heart.

Objective Type Questions

Additional MCQ's

Multiple Choice Questions prepared in the light of new Examination Techniques
(Knowledge, Understanding, Application, Analytical & Conceptual)

3.1

Blood and its Components

- The human transport system is composed of which two key parts?
(a) nervous system and circulatory system (b) Blood circulatory
(c) Lymphatic system (d) Both b and c
- Which of the following is not one of the three main components of the blood circulatory system?
(a) Heart (b) Blood vessels (c) Lungs (d) Blood
- Blood is considered as a type of:
(a) Epithelial tissue (b) connective tissue (c) Muscular tissue (d) Nervous tissue
- What is the primary overall function of blood?
(a) To produce energy (b) To transport material
(c) To digest food (d) To filter toxins
- How much blood does an average adult human have in their body?
(a) About 2 litres (b) About 10 litres (c) About 5 litres (d) About 8 litres
- The fluid portion of blood called:
(a) Cytoplasm (b) Serum (c) Plasma (d) Lymph
- How much portion of blood is composed of plasma?
(a) 45% (b) 91% (c) 55% (d) 8%

8. If you remove the protein fibrinogen from plasma, the remaining fluid is called:
- (a) Pure plasma (b) Haemoglobin (c) Serum (d) Lymph
9. Which plasma proteins are responsible for defending the body against pathogens?
- (a) Albumin (b) Fibrinogen (c) Antibodies (d) Platelets
10. Plasma protein fibrinogen play its role in:
- (a) Maintaining osmotic pressure (b) Blood clotting
(c) Carrying oxygen (d) Fighting bacteria
11. Which protein is responsible for maintaining the osmotic pressure of blood?
- (a) Albumin (b) Antibody (c) Fibrinogen (d) Globulin
12. Which nutrients are present in plasma?
- (a) Lipids (b) Amino acids (c) Glucose (d) All of these
13. Disc-shaped cells are:
- (a) Red blood cells (b) White blood cells
(c) Platelets (d) Plasma
14. Which protein helps RBCs to transport oxygen?
- (a) Albumin (b) Fibrinogen (c) Haemoglobin (d) Globulin
15. Normal range of RBCs per mm^3 of blood:
- (a) 7,000 (b) 2 million (c) 4 to 5.5 million (d) 7 million
16. In adults, RBCs are primarily formed in:
- (a) Liver and spleen (b) Red bone marrow
(c) Lymph nodes (d) Thymus
17. What is the average life span of a Red Blood cell?
- (a) 7 days (b) 120 days (c) 1 year (d) Two years
18. The characteristic property of white blood cells is:
- (a) Contain haemoglobin (b) disc-shaped
(c) colourless (d) smaller than RBCs
19. Approximately how many WBCs are typically found in each mm^3 of blood?
- (a) 4 million (b) 3 million (c) 7,000 (d) 70,000
20. What is the primary function of white blood cells?
- (a) To transport oxygen (b) To defend body against diseases
(c) To help blood clotting (d) To remove carbon dioxide
21. Primary function of Basophils:
- (a) Engulfing dead cells (b) Producing antibodies
(c) Releasing histamine (d) Carrying oxygen
22. What is the specific role of Lymphocytes?
- (a) Making antibodies (b) Releasing histamine
(c) Forming a fibrin (d) Cleaning up dead cells
23. Average life span of a platelet is:
- (a) 120 days (b) 1 to 2 days (c) 7 to 12 days (d) 24 hours
24. During the clotting process, which plasma protein is converted into fibrin?
- (a) Histamine (b) Haemoglobin (c) Fibrinogen (d) Antibody

25. In a 1mm³ sample of blood, there are approximately how many platelets?
(a) 100,000 (b) 250,000 (c) 500,000 (d) 1,000,000

3.2

Human Heart

26. The tough, sac-like membrane that surrounds and protect heart is known as the:
(a) Pleura (b) Pericardium (c) Septum (d) Epicardium
27. The muscular wall that separates the left and right sides of the heart is called:
(a) Valve (b) Pericardium (c) Septum (d) Venacava
28. The bicuspid valve is located between which two chambers?
(a) Right atrium and right ventricle (b) Left atrium and left ventricle
(c) Right ventricle and pulmonary artery (d) Left ventricle and aorta
29. Primary function of semilunar valves is:
(a) To allow blood to flow (b) To prevent blood from back flow
(c) To separate oxygenated and deoxygenated blood
(d) To pump blood to lungs
30. How many flaps make up the tricuspid valve?
(a) 1 (b) 2 (c) 3 (d) 4
31. Which blood vessels bring deoxygenated blood from the body to the right atrium?
(a) Pulmonary veins (b) Pulmonary arteries
(c) Superior and inferior vena cava (d) Aorta
32. The pulmonary veins are unique because they carry:
(a) Deoxygenated blood to lungs (b) Oxygenated blood back to left atrium
(c) Deoxygenated blood to the right atrium
(d) Oxygenated blood to the rest of the body
33. Deoxygenated blood is:
(a) Bright red (b) Dark red (c) Pale red (d) Pale yellow
34. When the left ventricle contracts, it pumps blood directly into the:
(a) Pulmonary vein (b) Right ventricle (c) Aorta (d) Vena cava
35. The flow of blood from heart to the lungs and then back to the heart is called:
(a) Systemic circulation (b) Pulmonary circulation
(c) Coronary circulation (d) Double circulation
36. The flow of blood from heart to body tissues and then from body tissues to heart is called:
(a) Pulmonary circulation (b) Coronary circulation
(c) Systemic circulation (d) Diastole
37. The alternating contraction and relaxation of heart chambers is called:
(a) Heart failure (b) Heart beat (c) Systole (d) Diastole
38. The "dubb" sound of the heart beat is produced by the closing of the:
(a) Tricuspid valves (b) Bicuspid valves
(c) Semilunar valves (d) Closed valves
39. What is the average heart rate of a healthy adult human?
(a) 60 times per minute (b) 70 times per minute

- (c) 80 times per minute (d) 100 times per minute
40. "Lubb" sound is produced during:
(a) Diastole (b) Systole
(c) Systemic circulation (d) Pulmonary circulation

3.3

Blood Vessels

41. The middle layer of an arterial wall is primarily composed of:
(a) Endothelium (b) Connective tissue
(c) Smooth muscles and elastic tissues (d) Skeletal muscle
42. The hollow internal cavity of a blood vessel through which blood flows is called:
(a) Septum (b) Lumen (c) Valve (d) Pericardium
43. Small blood vessels are:
(a) Arteries (b) Veins (c) Capillaries (d) Aorta
44. The walls of the capillaries are composed of only a single layer of cells called:
(a) smooth muscles (b) connective tissue (c) Endothelium (d) Epithelium
45. Capillaries unite to form small veins called:
(a) Endothelium (b) Epithelium (c) Vena cava (d) Venules
46. Most veins carry deoxygenated blood towards the heart. Which of the following is exception?
(a) Renal veins (b) Hepatic veins (c) Pulmonary veins (d) Vena cava
47. Oxygenated blood is pumped from the left ventricle into the:
(a) Superior vena cava (b) Aorta
(c) Pulmonary artery (d) Hepatic vein
48. Which artery supplies blood to the head, shoulders and arms?
(a) Renal artery (b) Femoral artery (c) Aorta (d) Hepatic artery
49. Which artery supplies blood to the kidneys?
(a) Hepatic artery (b) Renal artery (c) Femoral artery (d) Coronary artery
50. The hepatic artery supplies blood to the:
(a) Liver (b) Kidneys (c) Legs (d) Heart
51. Which arteries supply blood to the legs?
(a) Renal arteries (b) Hepatic arteries (c) Pulmonary arteries (d) Femoral arteries
52. Renal veins carry blood away from the:
(a) Liver (b) Lungs (c) Kidneys (d) Heart
53. Which vein carries blood from the liver to the inferior vena cava?
(a) Hepatic vein (b) Renal vein
(c) Hepatic portal vein (d) Femoral vein
54. Veins are:
(a) Red-looking (b) Green-looking
(c) Blue-looking (d) Bright blue-looking

3.5

Cardiovascular Disorders

55. Diseases involving the heart or blood vessels are called:
(a) Respiratory disorders (b) Cardiovascular disorders
(c) Digestive disorders (d) Renal disorders

56. **Coronary Heart Disease (CHD) is the narrowing or blockage of:**
 (a) Renal arteries (b) Coronary arteries
 (c) Pulmonary arteries (d) Hepatic portal vein
57. **What is the primary cause of Coronary Heart disease?**
 (a) Exercise (b) Atherosclerosis
 (c) Low blood pressure (d) Drinking water
58. **The death of heart muscles is called:**
 (a) Angina Pectoris (b) Emphysema
 (c) Myocardial infarction (d) Coronary heart disease
59. **Which of the following is an emergency treatment used to physically open blocked coronary arteries?**
 (a) Dialysis (b) Vaccination (c) Angioplasty (d) Antibiotic therapy
60. **The chest pain or discomfort caused by reduced blood flow to the heart muscle is called.**
 (a) Myocardial Infarction (b) Coronary Heart Disease
 (c) Angina Pectoris (d) Asthma

Answers

- | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|
| 1. (d) | 2. (c) | 3. (b) | 4. (b) | 5. (c) | 6. (c) | 7. (c) |
| 8. (c) | 9. (c) | 10. (b) | 11. (a) | 12. (d) | 13. (a) | 14. (c) |
| 15. (c) | 16. (b) | 17. (b) | 18. (c) | 19. (c) | 20. (b) | 21. (c) |
| 22. (a) | 23. (c) | 24. (c) | 25. (b) | 26. (b) | 27. (c) | 28. (b) |
| 29. (b) | 30. (c) | 31. (c) | 32. (b) | 33. (b) | 34. (c) | 35. (b) |
| 36. (c) | 37. (b) | 38. (c) | 39. (b) | 40. (b) | 41. (c) | 42. (b) |
| 43. (c) | 44. (c) | 45. (d) | 46. (c) | 47. (b) | 48. (c) | 49. (b) |
| 50. (a) | 51. (d) | 52. (c) | 53. (a) | 54. (c) | 55. (b) | 56. (b) |
| 57. (b) | 58. (c) | 59. (c) | 60. (c) | | | |

Additional Short Questions

Short Answer Questions prepared in the light of new Examination Techniques
 (Knowledge, Understanding, Application, Analytical & Conceptual)

3.1

Blood and its components

1. **The human transport system is consist of which two parts?**

Ans. The human transport system consists of two key parts:

- (i) Blood circulatory system (ii) Lymphatic system

2. **What is blood? Name its main components.**

Ans. Blood: Blood is a type of connective tissue. Its main function is to transport materials throughout the body.

Main components: Its main components are plasma, red blood cells (RBCs), white blood cells (WBCs) and platelets.

3. **State two functions of blood in the human body.**

Ans. Functions of blood:

- (i) Blood transports oxygen from lungs to all body cells and carries carbon dioxide

back to lungs for removal.

(ii) Blood delivers nutrients, hormones and waste products.

4. **What do you know about plasma?**

Ans. **Blood plasma:** Plasma is the liquid portion of blood. Plasma is composed of 90-92% of water, 7-9% of proteins and 1% of other substances.

5. **Write down the role of proteins in blood plasma.**

Ans. Antibodies are important plasma proteins.

- Antibodies defend the body against pathogens.
- Fibrinogen (a plasma protein) responsible for blood clotting.
- Albumin (a plasma protein) maintains the osmotic pressure of blood

6. **Which salts are present in blood plasma?**

Ans. The important plasma salts are made of sodium, chloride and bicarbonate ions.

7. **State the role of respiratory gases in plasma.**

Ans. Small amount of carbon dioxide and oxygen are dissolved in plasma. About 1.5% of oxygen and about 5-7% of carbon dioxide is carried as dissolved in plasma.

8. **What is the function of red blood cells?**

- Ans. • Red blood cells transport oxygen from lungs to body tissues.
• Red blood cells carries small amount of carbon dioxide back to lungs.

9. **Write two functions of white blood cells.**

Ans. **White blood cells (Leucocytes):**

- White blood cells defend the body against diseases.
- It destroy pathogens and produce immunity.

10. **Write two functions of platelets.**

Ans. **Platelets (Thrombocytes)**

- Helps in blood clotting.
- Prevent excessive blood loss during injury

11. **Write a short note on erythrocytes.**

Ans. **Erythrocytes:** Red blood cells (erythrocytes) are disc-shaped cells. They contain haemoglobin. Before and after birth RBCs are formed in liver and spleen. In adults they are formed in red bone marrow. The average life span of an RBC is about 120 days.

12. **Differentiate between granulocytes and agranulocytes.**

Ans. **Granulocytes:** These WBCs have granules in cytoplasm. They include neutrophils, eosinophils and basophils.

Agranulocytes: They have clear cytoplasm. There are two types of agranulocytes. i.e. monocytes and lymphocytes.

13. **Write down the functions of monocytes and lymphocytes.**

Ans. **Monocytes:** Monocytes make macrophages which engulf the germs and dead cells.

Lymphocytes: Lymphocytes make antibodies against pathogens.

14. **What are cell-like bodies? Discuss them.**

Ans. The cell like bodies are platelets. Platelets are not whole cells. They are small

fragments of large cells of bone marrow. Platelets lack a nucleus. Their life span is 7-12 days.

15. What happens if the number of platelets in blood decreases?

Ans. If number of platelets decreases blood clotting becomes slow, leading to excessive bleeding even from minor wounds.

3.2

Human Heart

16. What is human heart and describe its location in the body?

Ans. Heart: The heart is a muscular organ that pumps blood through a network of blood vessels.

Location: The heart lies within the chest cavity, behind the breast bone (sternum), between the two lungs.

17. Name four chambers of human heart and state one function of each.

Ans. The four chambers of human heart are:

(i) **Right atrium:** Receives deoxygenated blood from the body.

(ii) **Left atrium:** Receives oxygenated blood from the lungs.

(iii) **Right ventricle:** Pumps deoxygenated blood to the lungs.

(iv) **Left ventricle:** Pumps oxygenated blood to the whole body.

18. Why are valves present in the heart? Name two heart valves.

Ans. Valves prevent blood from flowing back into the ventricles.

Two heart valves are tricuspid valve and bicuspid valves.

19. Define septum.

Ans. Septum: The wall present between the left and right sides of the heart is called septum.

20. Why heart works as a double pump?

Ans. Human heart works as a double pump because:

- The right side of the heart collects blood from body and send it to the lungs.
- The left side collect blood from the lungs and sends it to the whole body.

21. Why does oxygenated and deoxygenated blood not mix in the human heart?

Ans. The oxygenated and deoxygenated blood not mix in heart because the heart is divided into right and left sides by a septum, which prevents mixing.

22. Differentiate between pulmonary and systemic circulation.

Ans. Pulmonary circulation: The flow of blood from heart to lungs and then from lungs to heart is called pulmonary circulation.

Systemic circulation: The flow of blood from heart to body tissues and then from body tissues to heart is called systemic circulation.

23. Define heart beat and mention its normal rate in a healthy adult.

Ans. Heartbeat: The alternating contractions (systole) and relaxation (diastole) of heart chambers makes one heartbeat. The average human heart beats 70 times per minute.

24. What are the phases of heartbeat?

Ans. Phases of heartbeat: A heartbeat has two phases:

- (i) Systole occurs when both ventricles contract to pump the blood into pulmonary arteries and aorta.
- (ii) Diastole occurs immediately after systole when both atria relax so that blood enters the atria. Contraction of the atria fills the ventricles.

3.3

Blood Vessels

25. Name the three main types of blood vessels and give one function of each.

Ans. The blood vessels are:

- (i) **Arteries:** Carries blood away from the heart.
- (ii) **Veins:** Carries blood towards the heart.
- (iii) **Capillaries:** Connects arteries and veins.

26. What is the structural difference between arteries and veins?

- Ans. • Arteries are thick, elastic walls to withstand high pressure.
• Veins have thin walls and valves to prevent backflow.

27. Define lumen.

Ans. **Lumen:** The hollow internal cavity of arteries in which blood flows in called lumen.

28. What are capillaries and why are they important for the body?

Ans. Capillaries are the smallest blood vessels. They are thin-walled, tiny vessels connecting arteries and veins.

They allow exchange of oxygen, nutrients and wastes with body tissues.

29. Which layers are present in veins?

Ans. The walls of veins are composed of three layers an inner layer of endothelium, a middle layer of smooth muscles and elastic tissues and an outer layer of connective tissue.

3.4

Arterial and Venous System

30. Trace the path of aorta as it supplies blood to the lower body.

Ans.

- Oxygenated blood leaves the left ventricle via the aorta.
- It passes through the thorax to become the dorsal aorta.
- It branches into specific arteries i.e. the hepatic artery (liver), renal arteries (kidneys) and finally divides into femoral arteries (legs).

31. Differentiate between Pulmonary and Systemic circulation in terms of veins.

Ans. **Pulmonary veins:** Two veins carry oxygenated blood from the lungs back to the left atrium of the heart.

Systemic veins: Major veins (Superior and Inferior Vena Cava) carry deoxygenated blood from the body tissues to the right atrium.

32. Differentiate between superior and inferior vena cava.

Ans. **Superior Vena Cava:** The superior vena cava formed by joining the veins from the upper body, it collects blood from the head, shoulders and arms.

Inferior Vena Cava: Inferior vena cava formed by veins from the lower body. It collects blood from legs and lower trunk.

3.5

Cardiovascular Disorders

33. Define Cardiovascular diseases.

Ans. Cardiovascular diseases: The diseases that involve the heart or blood vessels are collectively called cardiovascular diseases.

34. What happens in coronary heart diseases (CHD)? Write down its causes.

Ans. CHD: It is the narrowing or blockage of the coronary arteries, which supply blood to the heart muscles.

Causes of CHD: High level of low-density lipoproteins in blood, high blood pressure, smoking, diabetes and sedentary lifestyles are the causes of CHD.

35. What are the risk factors and complications of coronary heart diseases?

Ans. Risk factors: Family history, high blood pressure, high cholesterol levels and lifestyle factors are the risk factors of CHD.

Complications: If left untreated, CHD can lead to more severe conditions, including myocardial infarction and heart failure.

36. What do you know about myocardial infarction?

Ans. "Myocardium" means heart muscles".

"Infraction" means tissue death. The death of heart muscles is called myocardial infarction. It is commonly known as heart attack. It occurs when blood flow to a part of the heart muscle is blocked for a prolonged period, leading to death of heart muscles.

37. What is Angina Pectoris?

Ans. Angina Pectoris: Angina pectoris is chest pain or discomfort caused by reduced blood flow to the heart muscles, typically due to coronary artery disease.

38. Write down any two harmful effects of smoking related to heart diseases.

Ans. Smoking adversely impacts heart healths:

- (i) **Increased risk of blood clot formation:** Smoking increases the chances for blood to clot by promoting platelet aggregation.
- (ii) **Elevated blood pressure:** Smoking contributes to elevated blood pressure by causing vasoconstriction.

Exercise Questions (Solved)

A. Select the correct answers for the following questions.

- 1. Which component of blood is mainly responsible for carrying oxygen?
(a) White blood cells (b) Platelets (c) Red blood cells (d) Plasma
- 2. A person with low platelet count is likely to face difficulty in:
(a) Fighting infections (b) Breathing
(c) Clotting blood (d) Transporting oxygen
- 3. Which of the following layer is found in all blood vessels?
(a) Smooth muscle (b) Endothelium

- (c) Skeletal muscle (d) Connective tissue
- Which of the following contains deoxygenated blood in an adult human?
(a) Left atrium (b) Pulmonary artery (c) Pulmonary vein (d) Aorta
 - When fibrinogen makes blood clot it separates from blood and the rest is;
(a) Plasma (b) Lymph (c) Serum (d) Pus
 - Which heart chamber has the thickest walls?
(a) Right atrium (b) Left atrium (c) Left ventricle (d) Right ventricle
 - The exchange of materials between the blood and tissues occurs in;
(a) Arteries (b) Veins
(c) Capillaries (d) Arteries and veins
 - All veins carry deoxygenated blood except the _____ vein.
(a) Vena cava (b) Hepatic portal (c) Pulmonary (d) Renal
 - Myocardial infarction is due to blockage of blood flow in;
(a) Aorta (b) Pulmonary artery
(c) Coronary artery (d) Hepatic artery
 - If the bicuspid valve is damaged, which flow of blood will be affected?
(a) From left atrium to left ventricle (b) From right atrium to right ventricle
(c) From left ventricle to aorta (d) From lungs to left atrium

Answers

- | | | | | |
|--------|--------|--------|--------|---------|
| 1. (c) | 2. (c) | 3. (b) | 4. (b) | 5. (c) |
| 6. (c) | 7. (c) | 8. (c) | 9. (c) | 10. (a) |

B. Write short answers.

- List the types of cells present in blood along with their functions.

Ans. The cells present in blood are:

(i) **Red blood cells (Erythrocytes):**

- Red blood cells transport oxygen from lungs to body tissues.
- Red blood cells carries small amount of carbon dioxide back to lungs.

(ii) **White blood cells (Leucocytes):**

- White blood cells defend the body against diseases.
- It destroy pathogens and produce immunity.

(iii) **Platelets(Thrombocytes):**

- Helps in blood clotting.
- Prevent excessive blood loss during injury

- Differentiate between atria and ventricles.

Ans. **Atria:** The upper chambers of the heart are called atria (singular:atrium)

- Atria receive blood and are thin-walled.

Ventricles: The lower chambers of heart are called ventricles.

- Ventricles pump blood out from the heart and are thick-walled.

- Trace the flow of blood from the vena cava to various body parts.

Ans. • Deoxygenated blood from body parts enter the right atrium through vena

cava.

- Blood passes from right atrium to right ventricle.
- Right ventricle pumps blood to the lungs.
- In lungs blood becomes oxygenated.
- Oxygenated blood returns to left atrium.
- Blood moves from left atrium to left ventricle.
- Left ventricle pump blood into aorta.
- The aorta distributes blood to various body parts.

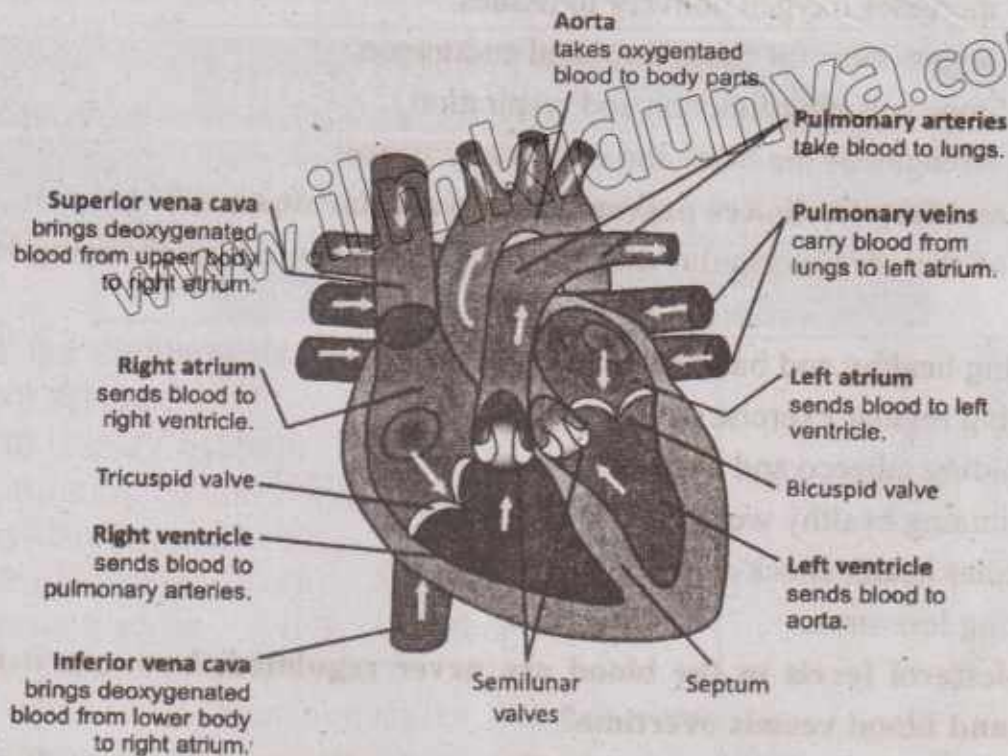
4. Identify the causes and treatments of myocardial infarction.

Ans. Causes of myocardial infarction: A blockage in one or more coronary arteries that forms over atherosclerotic plaques.

Treatment: Emergency treatment (medicines to dissolve clots), angioplasty to open blocked arteries and stenting to keep arteries open.

5. Colour the following diagram of heart to show oxygenated and deoxygenated blood. Label the different structures as marked.

Ans.



Human heart; structure and blood circulation

C. Write answers in detail.

1. Describe the functions of the components of blood.

Ans. For answer See Question. No. 1

2. Explain how blood transports materials throughout the human body.

Ans. For answer See Question. No. 6

3. Explain the structure of the heart with a diagram.

Ans. For answer See Question. No. 7

4. Explain the harmful effects of smoking related to heart diseases.

Ans. For answer See Question. No. 15

5. Compare the structure and function of an artery, a vein and a capillary.

Ans. For answer See Question. No. 10

D. Inquisitive questions

1. Why is oxygenated blood separated from deoxygenated blood in heart?

Ans. Oxygenated blood is separated from deoxygenated blood in the heart by septum because it allows the heart to function efficiently as a double pump. The oxygen should be efficiently supply to body tissues and while oxygen poor blood should be sent to the lungs for purification.

2. How does regular exercise strengthen the circulatory system?

Ans. Regular exercise improve the strength and efficiency of body in multiple ways:

- (i) It boosts immunity and mental health
- (ii) It increases oxygen delivery to tissues.
- (iii) It lowers harmful cholesterol and endurance.
- (v) It improves lung function and respiration.
- (vi) It strengthens the heart and circulatory system.

3. How can lifestyle choices prevent cardiovascular diseases?

Ans. Many of the cardiovascular diseases can be prevented by choosing healthy life style.

- (i) By eating healthy and balanced diet.
- (ii) By taking regular exercise
- (iii) By avoiding tobacco and alcohol
- (iv) By maintaing healthy weight
- (v) By regular health check-ups
- (vi) By taking less stress.

4. If cholesterol levels in the blood are never regulated, how can it impact the heart and blood vessels overtime?

Ans. High cholesterol can have serious effects on cardiovascular system. It can leads to atherosclerosis (formation of plaque in arteries). Over time this narrow the ateries, increases blood pressure and can lead to a complete blockage causing a myocardial infarction or stroke.