**Chapter 2 - Blood Circulatory System**

**All Lectures Uploaded on YouTube:**

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**MCQS:**

1. B
2. A
3. Left atrium with left ventricle
4. C
5. B
6. D
7. B
8. B
9. B
10. A
11. B
12. B
13. C
14. A
15. A

**Short Question answers:**

### **Q1. Functions of:**

**a. Pericardium**:  
 A muscular sac that protects the heart, anchors it in place, and prevents overfilling with blood.

**b. Left atrium**:  
A chamber of the heart that receives oxygenated blood from the lungs via pulmonary veins.

**c. Right atrium**:  
 Receives deoxygenated blood from the body via the superior and inferior vena cava.

**d. Left ventricle**:  
 Pumps oxygenated blood to the whole body through the aorta.

**e. Right ventricle**:  
 Pumps deoxygenated blood to the lungs via the pulmonary artery.

**f. Bicuspid (mitral) valve**:  
 Prevents backflow of blood from the left ventricle to the left atrium.

**g. Tricuspid valve**:  
 Prevents backflow of blood from the right ventricle to the right atrium.

**h. Semilunar valve**:  
 Prevents backflow of blood from the ventricles and blood vessels. Also present between the right ventricle and the pulmonary artery, and between the left ventricle and the aorta.

**i. Septum**:  
 Divides the left and right sides of the heart, preventing oxygen-rich and oxygen-poor blood from mixing.

**j. Aorta**:  
The largest artery of the body. Carries oxygenated blood from left ventricle to the body.

**k. Pulmonary artery**:  
 Carries deoxygenated blood from the right ventricle to the lungs.

**l.. Pulmonary vein**:  
Carries oxygenated blood from the lungs to the left atrium.

**m. Plasma**:  
 Transports nutrients, hormones, and waste; it is the fluid part of blood.

**n. Red blood cells**:  
 Carry oxygen from the lungs to the body and bring carbon dioxide back to the lungs.

**o. White blood cells**:  
 Defend the body against infections and foreign substances. Forms the first line of defence in bodies

**p. Platelets**:  
 It helps with blood clotting and prevents excessive bleeding.

### **Q2. Differentiate Between:**

**a. Serum and Blood**:

Serum is the blood plasma without cells and clotting factors. Whereas, blood refers to the whole fluid containing RBCs, WBCs, platelets, and plasma.

**b. Artery and Vein**:

An artery carries blood away from the heart (usually oxygenated, except for: pulmonary artery). Veins carry blood toward the heart (usually deoxygenated, except for the pulmonary vein).

**c. Tricuspid and Bicuspid Valve**:

**The tricuspid** valve is between the right atrium and ventricle (3 flaps). **The bicuspid** valve is between the left atrium and ventricle (2 flaps).

**d. Systole and Diastole**:

**Systole**: Contraction phase; blood is pumped out, whereas **diastole**: Relaxation phase; chambers fill with blood.

**e. Red blood cells and White blood cells**:

**RBCs** carry oxygen and CO₂; they have no nucleus, therefore have a large surface area. On the other hand, **WBCs** fight infections and have a nucleus.

**f. Pulmonary artery and Pulmonary vein**:

**The pulmonary artery** carries deoxygenated blood from the heart to the lungs. **Pulmonary vein**, however, carries oxygenated blood from the lungs to the heart (left atrium).

**3. Why is a circulatory system necessary?**To transport oxygen, nutrients, hormones, and waste materials throughout the body. It makes sure that all the organs of the human body receive oxygenated blood

**4. Name the three circuits of the circulatory system.**

* Pulmonary circuit
* Systemic circuit
* Coronary circuit

**5. Describe the coronary circuit.** Supplies blood to the heart muscle itself through coronary arteries and removes deoxygenated blood via cardiac veins.

**6. Write the six functions of blood.**

1. Transport of oxygen and nutrients
2. Removal of waste
3. Regulation of body temperature
4. Defence against infection
5. Clotting
6. Transport of hormones

**7. What are the organs that are connected to the circulatory system?**The ***heart*** is the central pumping organ, circulating blood throughout the body. The ***lungs*** are responsible for gas exchange, oxygenating the blood and removing carbon dioxide. The ***kidneys*** filter the blood, removing waste products and excess substances. The ***liver*** processes nutrients, detoxifies harmful substances, and helps in the production of blood proteins. The ***spleen*** helps filter old and damaged blood cells and supports the immune system. Finally, ***blood vessels***—arteries, veins, and capillaries—form a network connecting all these organs, allowing the transport of blood, nutrients, gases, and waste materials.

**8. Name the types of blood vessels.**Arteries, veins, capillaries, venules, and arterioles. **Arteries** are thick-walled vessels that carry oxygen-rich blood away from the heart to the body tissues (except the pulmonary artery). **Veins** return deoxygenated blood back to the heart and have valves to prevent backflow. **Capillaries** are tiny, thin-walled vessels where exchange of gases, nutrients, and waste occurs between blood and tissues. **Arterioles** are small branches of arteries that lead into capillaries, while **venules** are small vessels that collect blood from capillaries and channel it into veins.

**9. What are the types of white blood cells? Why are these called white blood cells?**

The main types include neutrophils, lymphocytes, monocytes, eosinophils, and basophils. Each type has a unique role—for instance, **neutrophils** are the first responders to infection, while **lymphocytes** (B-cells and T-cells) are responsible for specific immune responses. WBCs are called "white" blood cells because they lack the red pigment haemoglobin and appear *colourless* or white under a microscope when stained and observed.

**10. In what ways does the pulmonary artery differ from all other arteries?**It carries **deoxygenated** blood, unlike other arteries, which carry oxygenated blood. This is part of the pulmonary circulation, where the blood is oxygenated in the lungs before being returned to the heart.

**11. How are the valves of the human heart important?**Heart valves are crucial for maintaining the **unidirectional flow** of blood and preventing backflow. There are four main valves in the heart: the tricuspid, pulmonary, mitral (bicuspid), and aortic valves. These valves open and close in response to pressure changes within the heart chambers, ensuring that blood moves forward efficiently from the atria to the ventricles and then to the major arteries. They also help maintain proper blood pressure and circulation throughout the body.

**12. Suggest why an injury that cuts open an artery is much more dangerous than an injury to a vein.** An injury to an artery is typically more dangerous than to a vein because arteries carry blood under high pressure, directly from the heart. When an artery is cut, the blood spurts out forcefully and rapidly, which can result in severe and quick blood loss. In contrast, veins carry blood at a much lower pressure, so bleeding is usually slower and less forceful. Without immediate medical attention, arterial bleeding can lead to shock and death.

**13. Why are valves present in veins but not in arteries?**Valves are present in veins to prevent the backflow of blood, especially in the limbs where blood must travel against gravity to return to the heart. Since veins carry blood under low pressure and do not have muscular walls like arteries, these one-way valves help ensure smooth blood flow in the correct direction.

**14. Why are the walls of the atria thinner than the walls of the ventricles?**The walls of the atria are thinner because they only need to pump blood a short distance into the adjacent ventricles. This task requires less force, so the atrial walls don’t need to be very muscular.

**15. Why is the muscle of the left ventricle thicker than that of the right ventricle?**

The left ventricle has to pump blood to the entire body through the aorta, which requires a large amount of force. To generate this high pressure, the left ventricular wall is significantly thicker and more muscular than the right ventricle.

## **Extensive Answer Questions**

**1. Describe the pulmonary and systemic circuits of the circulatory system.**

The ***pulmonary circuit*** begins when deoxygenated blood is pumped from the right ventricle of the heart through the pulmonary artery to the lungs. In the lungs, carbon dioxide is exchanged for oxygen. The now oxygen-rich blood returns to the left atrium of the heart via the pulmonary veins. The ***systemic circuit*** starts as the oxygenated blood is pumped from the left ventricle through the aorta to the rest of the body. It supplies organs and tissues with oxygen and nutrients. The deoxygenated blood from the body returns to the right atrium via veins like the superior and inferior vena cava, completing the cycle.

**2. How are materials transported through the blood?**

Blood acts as a transport medium in the body, moving essential materials to and from cells. **Oxygen** from the lungs binds to haemoglobin in red blood cells and is transported to body tissues. **Nutrients** absorbed from the digestive tract are carried in the plasma to different parts of the body. **Hormones** released by glands are also transported via blood to target organs. **Waste products** like carbon dioxide and urea are carried away to the lungs and kidneys for excretion. Platelets and white blood cells are transported to sites of injury or infection, aiding in clotting and immunity. Thus, blood ensures the distribution and regulation of materials necessary for survival.

**3. What are the organs connected to the blood circulatory system? Explain.**

Several key organs are directly connected to and dependent on the circulatory system. The **heart** pumps blood throughout the body, maintaining circulation. The **lungs** are involved in the exchange of gases—oxygen enters the blood, and carbon dioxide is expelled. The **kidneys** filter waste products from the blood and help regulate fluid balance and blood pressure. The **liver** processes and detoxifies chemicals, produces clotting proteins, and regulates nutrients. The **spleen** filters out old or damaged red blood cells and contributes to immune defence. All of these organs rely on a steady supply of blood to function properly.

**4. What are the components of blood?**

Blood is made up of two main components: plasma and formed elements. **Plasma** is the liquid portion, comprising about 55% of blood. It contains water, dissolved salts, proteins (like albumin and fibrinogen), nutrients, hormones, and waste products. The **formed elements**, which make up about 45%, include **red blood cells (erythrocytes)** that transport oxygen and carbon dioxide, **white blood cells (leukocytes)** that defend against infections, and **platelets (thrombocytes)** that are essential for blood clotting. Each component plays a vital role in maintaining bodily functions.

**5. Describe the cell types found in blood.**

Blood contains three major types of cells. **Red blood cells** (RBCs) are biconcave cells that contain haemoglobin, which binds oxygen and carries it from the lungs to tissues while transporting carbon dioxide back to the lungs. **White blood cells** (WBCs) are involved in the body’s immune response and include different types, such as neutrophils, lymphocytes, and monocytes, each fighting pathogens in different ways. **Platelets** are small, irregularly shaped cell fragments that help form clots at injury sites, preventing excessive bleeding.

**7. Explain the circulation of blood through the human heart.**

Blood circulation in the heart follows a precise pathway. Deoxygenated blood from the body enters the right atrium via the superior and inferior vena cava. It then flows into the right ventricle, which pumps it through the pulmonary artery to the lungs for oxygenation. Oxygen-rich blood returns from the lungs to the left atrium via the pulmonary veins. From there, it moves into the left ventricle, which pumps it into the aorta. The aorta distributes oxygenated blood to the rest of the body. This cycle ensures that tissues continuously receive oxygen and nutrients while removing waste products.

**8. Discuss the following heart diseases in humans:**

a. **Coronary heart disease** occurs when the coronary arteries become narrowed or blocked due to plaque buildup (atherosclerosis), reducing blood flow to the heart muscles. This can lead to chest pain, heart attacks, or other serious complications.  
 b. **Myocardial infarction (heart attack)** happens when a coronary artery becomes completely blocked, stopping blood flow to part of the heart muscle. This causes the affected tissue to die due to a lack of oxygen, and immediate treatment is essential to prevent fatal outcomes.  
 c. **Angina** is a symptom of reduced blood flow to the heart muscles, often due to narrowed coronary arteries. It causes chest pain or discomfort, usually triggered by physical exertion or stress, and can signal an increased risk of a heart attack.

**9. Explain the harmful effects of smoking related to heart disease.**

* Increases heart rate and blood pressure
* Damages blood vessels
* Promotes plaque formation
* Raises the risk of stroke, heart attack, and coronary artery disease



