

CHAPTER 15

BODY FLUID AND CIRCULATION



CLASS 11TH

NCERT EXERCISE AND SOLUTIONS - BIOLOGY

Q. 1. Name the components of the formed elements in the blood and mention one major function of each of them.

ANSWER:-

The formed elements of blood consist of the following components:

- **Erythrocytes (Red Blood Cells):** These cells transport oxygen and contain the pigment haemoglobin. Haemoglobin binds with oxygen to form oxyhaemoglobin, which delivers oxygen to areas of the body that are low in oxygen.
- **Leukocytes (White Blood Cells):** Lymphocytes produce antibodies that neutralize or destroy pathogens. Neutrophils act as a defence mechanism against bacteria through phagocytosis.
- **Thrombocytes (Platelets):** These play a key role in blood clotting by aiding in coagulation.

Q. 2. What is the importance of plasma proteins?

ANSWER:-

Here are some plasma proteins and their functions:

- **Globulins:** These proteins are essential for the body's defence mechanisms and are also known as immunoglobulins.
- **Albumins:** They help maintain the body's osmotic balance.
- **Fibrinogens:** These proteins play a crucial role in blood clotting.

Q. 3. Match Column I with Column II :

Column I	Column II
(a) Eosinophils	(i) Coagulation
(b) RBC	(ii) Universal Recipient
(c) AB Group	(iii) Resist Infections
(d) Platelets	(iv) Contraction of Heart
(e) Systole	(v) Gas transport

ANSWER:-

(a) – (iii), (b) – (v), (c) – (ii), (d) – (i), (e) – (iv)



Q. 4. Why do we consider blood as a connective tissue?

ANSWER:-

Blood is a connective tissue as it is mesodermally derived and contains an extra-cellular matrix known as plasma. It is an abundant and widely distributed tissue in the body. Connective tissues link and bind, providing support to other organs of the body, thereby transporting oxygen and other nutrients within the body, eliminating waste products from the body and flowing throughout the body. Hence, it is considered a connective tissue.

Q. 5. What is the difference between lymph and blood?

ANSWER:-

Lymph	Blood
It is a colourless tissue fluid.	It is a red liquid connective tissue.
Lymph circulates through the lymph vessels.	Blood flows through blood vessels such as capillaries, arteries, and veins.
It contains white blood cells called lymphocytes.	Blood contains red blood cells, hemoglobin, platelets, and white blood cells.
Nutrients and gases are exchanged between the blood and cells via the lymph.	Blood transports gases and other nutrients throughout the body.

Q. 6. What is meant by double circulation? What is its significance?

ANSWER:-

Double circulation refers to the process in which blood circulates through the heart twice. This is made possible by the heart's division into four chambers—the right and left sides—separated by the atrioventricular septum.

The two types of circulation are:

Pulmonary Circulation

- Blood from the right ventricle is pumped into the pulmonary arteries.
- These arteries carry deoxygenated blood to the lungs for oxygenation.
- Oxygenated blood returns to the left atrium from the lungs through the pulmonary veins. This circulation is called pulmonary circulation, as it involves the pulmonary blood vessels.

Systemic Circulation

- Oxygenated blood is pumped from the left ventricle into the aorta.
- The blood travels through arteries, arterioles, and blood capillaries.
- Simultaneously, deoxygenated blood returns to the right atrium through the inferior and superior vena cava.
- This circulation delivers oxygen and nutrients while removing carbon dioxide and other waste products for elimination.

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Importance of Double Circulation

- It prevents the mixing of oxygenated and deoxygenated blood.
- Double circulation ensures efficient use of oxygen.

Q. 7. Write the differences between :

- Blood and Lymph**
- Open and Closed system of circulation**
- Systole and Diastole**
- P-wave and T-wave**

ANSWER:-

(a) Blood and Lymph

Blood	Lymph
It is a clear, white tissue fluid.	It is a red liquid connective tissue.
Lymph circulates in the lymphatic vessels.	Blood circulates in blood vessels such as capillaries, arteries, and veins.
It contains white blood cells, specifically lymphocytes.	Blood contains red blood cells, haemoglobin, platelets, and white blood cells.
The exchange of nutrients and gases between blood and cells occurs through the lymph.	Blood transports gases and other nutrients throughout the body.

(b) Open and Closed system of circulation

Open Circulatory System	Closed Circulatory System
Blood pumped by the heart enters large vessels and then flows into open spaces or body cavities (sinuses).	Blood pumped by the heart circulates through a closed network of blood vessels.
Blood flow is not controlled in this system.	Blood flow is regulated by valves within the closed system.
This system is slower and less efficient.	This system is faster and more efficient in comparison.
Example: Found in mollusks and arthropods.	Example: Found in chordates and annelids.

(c) Systole and Diastole

Systole	Diastole
Systole refers to the contraction of the heart chambers.	Diastole refers to the relaxation of the heart chambers.
It results in an increase in blood pressure within the heart.	It leads to a decrease in blood pressure within the heart.
Blood is expelled from the chambers.	Blood enters the chambers.



(d) P-wave and T-wave

P-wave	T-wave
The P-wave represents the depolarization or electrical activation of the atria.	The T-wave represents the repolarization of the ventricles.
It triggers the pumping of blood into the ventricles.	It indicates the reception of blood by the atria.

Q. 8. Describe the evolutionary change in the pattern of heart among the vertebrates.

ANSWER:-

An evolutionary progression in the heart structure among vertebrates has been noted through detailed analysis. Vertebrates have a muscular, chambered heart, which has evolved from a two-chambered heart in fish to a four-chambered heart in mammals.

Fish have a two-chambered heart that pumps deoxygenated blood to the gills for oxygenation, which is then sent to the body. The oxygenated blood is subsequently returned to the heart.

Amphibians possess a three-chambered heart, consisting of one ventricle and two atria (left and right). The left atrium receives oxygenated blood from the respiratory organs, while the right atrium receives deoxygenated blood from the body. However, both blood types mix in the ventricle, resulting in mixed blood being pumped to the body.

In reptiles, the ventricle is partially divided by a half septum, while in birds, crocodiles, and mammals, the heart is fully separated into two halves, ensuring complete separation of oxygenated and deoxygenated blood.

This structural evolution in the heart, from fish to mammals, ensures that oxygen-rich blood is efficiently delivered to the body. The presence of a four-chambered heart facilitates synchronized blood flow. The heart's structure also determines the type of circulation—whether it is single or double circulation.

Q. 9. Why do we call our heart myogenic?

ANSWER:-

The term 'myo' refers to muscle, while 'genic' means originating from. The specialized cardiac muscles or nodal tissues in the heart, such as the sino-atrial (SA) node, have the ability to generate an electrical impulse that spreads across the heart wall, leading to the heartbeat. Since the cardiac impulse originates in the cardiac muscles, this process is termed myogenic.

Q. 10. Sino-atrial node is called the pacemaker of our heart. Why?

ANSWER:-

The sino-atrial (SA) node, also known as the sinus node, is a specialized bundle of neurons that generates an action potential, producing a cardiac impulse without external stimuli, meaning it is auto-excitabile. The SA node can generate around 70 to 75 action potentials per minute. It is responsible for initiating and regulating the heart's rhythmic contraction. Because of its role, the SA node is often called the pacemaker.



Q. 11. What is the significance of atrio-ventricular node and atrio-ventricular bundle in the functioning of heart?

ANSWER:-

The atrioventricular bundle (AV bundle), which originates from the AV node, transmits the cardiac impulse to the walls of the ventricles. Meanwhile, the atrioventricular node (AVN) carries the impulse from the SA node. Both the AVN and AV bundle are activated by the action potential generated by the sino-atrial node, conducting the electrical stimulus to different parts of the heart. This results in the heartbeat being propagated throughout the heart.

Q. 12. Define a cardiac cycle and the cardiac output.

ANSWER:-

Cardiac Cycle: The rhythmic contraction and relaxation of the heart chambers drive blood circulation within the heart. The relaxation phase is known as diastole, while the contraction phase is called systole. Each systole is followed by a diastole. The cardiac cycle refers to the sequence of events occurring during one full heartbeat, lasting approximately 0.8 seconds.

Cardiac Output: Cardiac output is the volume of blood pumped by each ventricle per minute. It is calculated as:

$$\text{Cardiac output} = \text{Stroke volume} \times \text{Heart rate (number of beats per minute)}$$

Q. 13. Explain heart sounds.

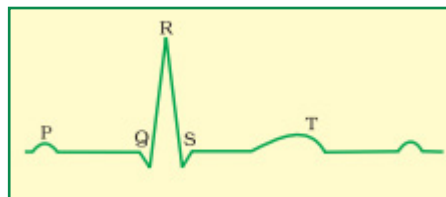
ANSWER:-

A heartbeat produces two distinct sounds – “lub” and “dub” – during each cardiac cycle. These sounds occur in sequence with every heartbeat. The “lub” sound is the first, low-pitched sound, generated when the bicuspid and tricuspid valves close. The “dub” sound is the second, high-pitched sound, produced when the semilunar valves close. Both sounds are important for diagnosing heart disorders.

Q. 14. Draw a standard ECG and explain the different segments in it.

ANSWER:-

The electrocardiogram (ECG) is a graphical representation of the cardiac cycle produced by an electrograph. The diagram below illustrates a typical ECG.



In the ECG, each peak labeled from ‘P’ to ‘T’ corresponds to specific electrical events in the heart. The initial peak, ‘P’, represents atrial contraction or atrial depolarization. The following QRS complex signifies ventricular depolarization or ventricular contraction. Lastly, the T-wave reflects ventricular relaxation or ventricular repolarization.

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