

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

Solution:

The components of the formed elements in blood are as follows:

- Erythrocytes or red blood cells – They carry oxygen and contain the pigment called haemoglobin. Haemoglobin reacts with oxygen to form Oxyhaemoglobin that carries oxygen to areas that are deprived of oxygen in the body.
- Leucocytes or white blood cells – Lymphocytes are known to synthesise antibodies that neutralise or kill germs. Neutrophils act as a defence mechanism against bacteria, known as phagocytosis.
- Thrombocytes or blood platelets – They aid in the coagulation of blood.

2. What is the importance of plasma proteins?

Solution:

Some of the plasma proteins and their significance are given below.

- Globulins – They are involved in the defence mechanism of the body and are also referred to as immunoglobulins.
- Albumins – They aid in maintaining the osmotic balance of the body.
- Fibrinogens – It plays a significant role in blood coagulation.

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

Solution:

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

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

Solution:

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.

5. What is the difference between lymph and blood?

Solution:

The difference between lymph and blood is as follows:

Lymph	Blood
It is a white tissue fluid.	It is a red liquid connective tissue.
Lymph flows in the lymph vessels.	Blood flows in the blood vessels such as capillaries, arteries and veins.
It contains white blood cells known as lymphocytes.	Blood contains red blood cells, haemoglobin, platelets and white

	blood cells.
The exchange of nutrients and gases between the blood and cells takes place through the lymph.	Blood transports gases and other nutrients to the body.

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

Solution:

Double circulation, as the name suggests, is where the blood circulates twice in the heart. Double circulation is possible, as the heart is divided into four chambers – the right and the left halves – by the atrioventricular septum.

The two circulations are

1. Pulmonary circulation

- Blood in the right ventricle is pumped into the pulmonary arteries.
- For oxygenation, these pulmonary arteries transport deoxygenated blood to the lungs.
- The oxygenated blood is then sent to the left atrium from the lungs through the pulmonary veins.
- This type of circulation of blood is referred to as pulmonary circulation, where blood is pumped via pulmonary blood vessels.

2. Systemic circulation

- It is a term used to refer to the major circulation of the body.
- Oxygenated blood is pumped from the left ventricle into the aorta.
- Furthermore, it is carried by the arteries, arterioles and the linkage of blood capillaries.
- Simultaneously, deoxygenated blood is accumulated in the right atrium through the inferior and superior vena cava.
- This circulation supplies nutrients and oxygen and carries away carbon dioxide and other toxic substances for elimination.

Importance of double circulation

- This type of circulation checks and prevents the mixing of oxygenated and deoxygenated blood.
- In double circulation, oxygen is utilised efficiently.

7. Write the differences between:

(a) Blood and Lymph

(b) Open and Closed system of circulation

(c) Systole and Diastole

(d) P-wave and T-wave

Solution:

The differences are as follows:

(a) Blood and Lymph

Lymph	Blood
It is a white tissue fluid.	It is a red liquid connective tissue.
Lymph flows in the lymph vessels.	Blood flows in the blood vessels such as capillaries, arteries and veins.
It contains white blood cells known as lymphocytes.	Blood contains red blood cells, haemoglobin, platelets and white blood cells.
The exchange of nutrients and gases between the blood and cells takes place through the lymph	Blood transports gases and other nutrients to the body.

(b) Open and Closed system of circulation

Open system of circulation	Closed system of circulation
Blood that is pumped by the heart passes through the large vessels into the open spaces or body cavities (sinuses).	Blood pumped by the heart flows via the closed network of the blood vessels.
Blood flow is not regulated in this type of circulation.	Blood flow is regulated by the valves in the closed system of circulation.
This circulation is slower and less efficient.	This circulation is more rapid and efficient comparatively.
Example: It is found in molluscs and	Example: It is found in chordates

arthropods.	and annelids.
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(c) Systole and Diastole

Systole	Diastole
Systole is the contraction of the chambers of the heart.	Diastole is the relaxation of the chambers of the heart.
It causes an increase in blood pressure within the heart.	It causes blood pressure to decline in the heart.
Blood is pumped out of the chambers.	Blood is received by the chambers.

(d) P-wave and T-wave

P-wave	T-wave
P-wave depicts the depolarisation or electrical excitation of the atria.	T-wave depicts the repolarisation of the ventricles.
Blood is pumped into the ventricles.	Blood is received by the atria.

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

Solution:

An evolutionary change in the pattern of heart among the vertebrates has been observed through careful analysis. Vertebrates possess a muscular heart, it is chambered. They have evolved from having a two-chambered heart (fish) to possessing a four-chambered heart (mammals).

A fish has a two-chambered heart. It pumps deoxygenated blood to the gills, where it is oxygenated and sent to the body. The blood that is oxygenated is then carried to the heart.

Three-chambered hearts are found in amphibians – a ventricle and 2 atria (left atrium and right atrium). The left atrium receives oxygenated blood from the respiratory organs, while deoxygenated blood is received by the right atrium from the organs of the body. But, both types of blood are eventually mixed in the ventricle; hence, the body receives mixed blood.

Half septum in reptiles divides the ventricle partially. But in birds, crocodiles and mammals, the heart is completely segregated into halves hence deoxygenated, and oxygenated blood is separated.

A structural modification in the hearts of fish up to mammals is observed, checking that oxygen-rich blood is supplied to the body while the four-chambered heart ensures that the blood flow is synchronised. As the structure of the heart has evolved, the type of circulation also depends on it, if it is single or double circulation.

9. Why do we call our heart myogenic?**Solution:**

The term ‘myo’ refers to muscle, and ‘genic’ refers to originating from. The altered cardiac muscles or the nodal tissues of the heart – the sino-atrial or the sinus node (SA node) – is capable of generating an impulse that extends over the heart wall, which results in the heartbeat. As the cardiac impulse initiates in the cardiac muscles, it is referred to as myogenic.

10. Sino-atrial node is called the pacemaker of our heart. Why?**Solution:**

The sino-atrial, or the sinus node (SAN), is a specialised bundle of neurons generating action potential which produces a cardiac impulse without any exterior stimuli, i.e., it is auto-excitabile. SAN can generate a maximum action potential of approximately 70 to 75 in a minute. It is responsible for initiating and maintaining the rhythmic contractile activity of the heart. Due to these capabilities, SAN is referred to as the pacemaker.

11. What is the significance of the atrioventricular node and the atrioventricular bundle in the functioning of the heart?**Solution:**

The atrioventricular bundle (AV), originating from the AV node, passes the cardiac impulse to the walls of the ventricles, whereas the atrioventricular node (AVN) conveys the impulse from the SA node. Both AVN and AV are triggered by the action potential that is originated by the sino-atrial node, thereby conducting the stimulus to the other parts of the heart. This causes the heartbeat, which is conducted to various other parts of the heart.

12. Define the cardiac cycle and the cardiac output.**Solution:****Cardiac cycle**

- The alternate contraction and relaxation of the chambers of the heart cause the blood to circulate in the heart.
- The relaxation or expansion phase is also referred to as diastole, whereas contraction is also referred to as systole.
- Every systole is followed by a diastole.
- The cardiac cycle is the series of events that take place in one complete heartbeat. It lasts for about 0.8 seconds.

Cardiac output

- It is the amount of blood that is pumped by each of the ventricles in a minute.
- It is given by

Cardiac output = Stroke volume x Number of heartbeats per minute

13. Explain heart sounds.

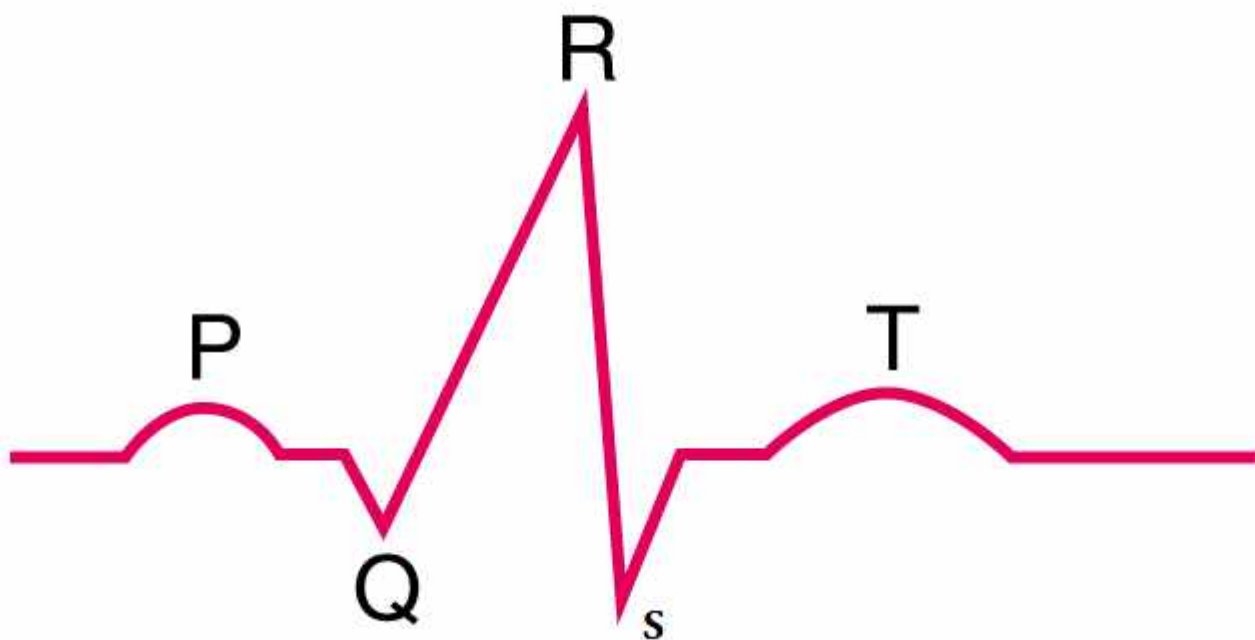
Solution:

A heartbeat generates two sounds – lub and dub, produced in every cardiac cycle. The sound is produced in a sequence, in sync with every heartbeat. ‘Lub’ is the first sound and is low-pitched. It is caused when the bicuspid valve and the tricuspid valve close. ‘Dub’ is the second sound which arises when the semi-lunar valve closes. This sound is high-pitched. Both sounds are significant in the diagnosis of any disorder of the heart.

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

Solution:

The graphical representation of the cardiac cycle that is generated by the electrograph is known as the electrocardiogram or ECG. The diagram below depicts a standard ECG.



In the ECG, each peak indicated by the letters ‘P’ to ‘T’ relates to a particular electrical activity of the heart. The first peak, ‘P’, represents the atrial contraction or the atrial depolarisation. The subsequent QRS complex indicates the depolarisation of the ventricles or the ventricular contraction. Finally, the T-wave indicates ventricular relaxation or ventricular repolarisation.