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Body Fluids and Circulation

Multiple Choice Questions (MCQs)

Q. 1 Which of the following cells do not exhibit phagocytotic activity?

(a) Monocytes (b) Neutrophil (c) Basophil (d) Macrophage

Ans. *(c)* **Basophil** are least common of granulocyte, only composed of 0.01% to 0.3% of the circulating white blood cells. These are involved in specific kinds of inflammatory reactions, particularly those which cause allergic reactions and do not exhibit phagocytotic activity.

Whereas, **monocytes** migrate from blood stream to tissue and differentiate into resident macrophage, *e.g.*, kupffer cells in liver and neutrophils target bacteria and fungi. Mecrophages are also phagocytotic in nature.

Q. 2 One of the common symptoms observed in people infected with dengue fever is

(a) significant decrease in RBCs count (b) significant decrease in WBC count
(c) significant decrease in platelets count (d) significant increase in platelets count

Ans. *(c)* The low platelet count leads to life threatening condition and is one of the most common symptoms observed in people infected with dengue fever whereas, other options are not the symptoms of dengue fever.

Q. 3 Which among the followings is correct during each cardiac cycle?

(a) The volume of blood pumped out by the Rt and Lt ventricles is same
(b) The volume of blood pumped out by the Rt and Lt ventricles is different
(c) The volume of blood received by each atrium is different
(d) The volume of blood received by the aorta and pulmonary artery is different

Ans. *(a)* **Cardiac Cycle** consists of one heart beat or one cycle of contraction and relaxation of the cardiac muscle. The contraction phase is called the systole while the relaxation phase is called the diastole.

The purpose of cardiac cycle is to effectively pump the blood. The right ventricle pumps the volume of deoxygenated blood to the lungs through pulmonary artery. After the oxygenation of blood the volume of blood carried through pulmonary vein is pumped through left ventricle into the aorta and transferred to the entire body.

This pumping of blood, is about the same and any mismatch in volumes ejected by the ventricles (*i.e.,* right ventricle pump more blood than left or *vice versa*) can result in the heart failure. Thus, all the other option are wrong.

Q. 4 Cardiac activity could be moderated by the autonomous neural system. Tick the correct answer.

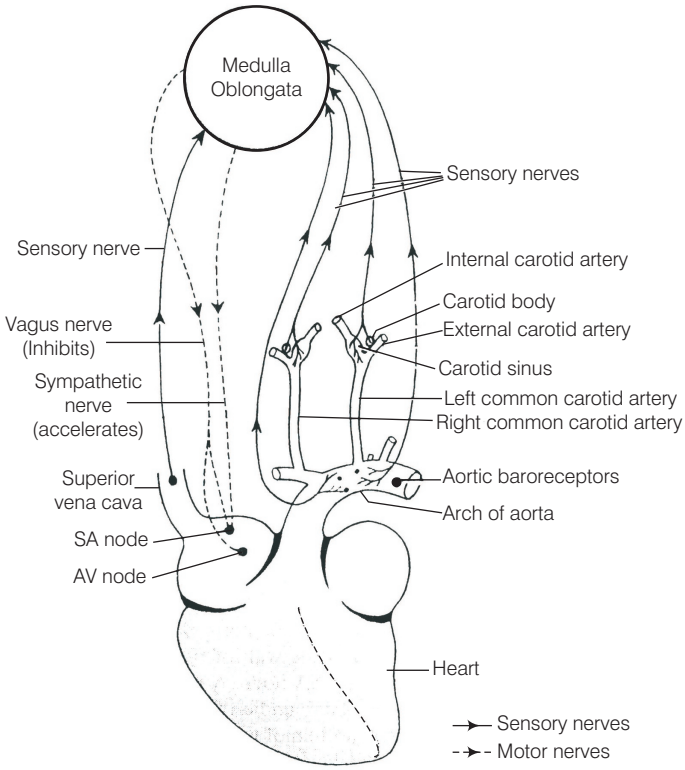
(a) The parasympathetic system stimulates heart rate and stroke volume

(b) The sympathetic system stimulates heart rate and stroke volume

(c) The parasympathetic system decreases the heart rate but increase stroke volume

(d) The sympathetic system decreases the heart rate but increase stroke volume

Ans. *(b)* Neural signals through the sympathetic nerves can increase the rate of the heart beat, the strength of ventricular contraction and thereby stimulating the cardiac output. Hence, sympathetic system is involved in stimulating heart rate and stroke volume. Therefore, other options are wrong.



Neural regulation of heart beat

Q. 5 Mark the pair of substances among the following which is essential for coagulation of blood.

(a) heparin and calcium ions

(b) calcium ions and platlet factors

(c) oxalates and citrates

(d) platelet factors and heparin

Ans. *(b)* Certain factors released by the tissues at the site of injury can initiate coagulation process.

Calcium ions and platelet factor act in the first step of coagulation which is as follows

(i) At the site of an injury, the blood platelets disintegrate and release a phospholipid, called platelet factor 3 (platelet thromboplastin)

(ii) Injured tissues also release a lipoprotein factor called thromboplastin.

(iii) These two factor combine with calcium (Ca^{2+}) ions and certain proteins of the blood plasma to form an enzyme called pro-thrombinase.

(iv) Prothrombiminase catalyzes prothrombin into active protein called thrombin.

(v) Thrombin further converts inative fibrinogens into fibrin in the blood plasma.

(vi) Then the long fibres of fibrin form a dense network upon wound and trap blood corpuscles RBCs, WBCs and platelets) to form a clot.

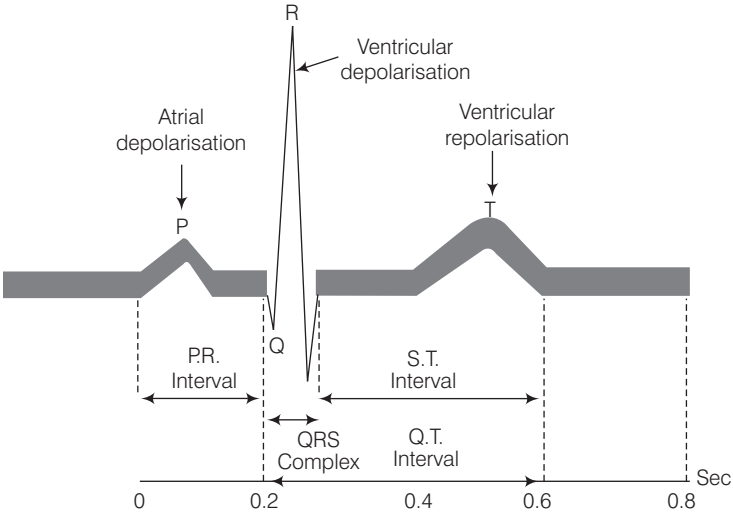
And the other options are wrong.

Q. 6 ECG depicts the depolarisation and repolarisation processes during the cardiac cycle. In the ECG of a normal healthy individual one of the following waves is not represented.

(a) Depolarisation of atria (b) Repolarisation of atria

(c) Depolarisation of ventricles (d) Repolarisation of ventricles

Ans. *(b)* A normal ECG represents P-wave atrial depolarisation QRS complex-ventricular depolarisation T-wave ventricular repolarisation. Therefore, atrial repolarisation is not represented is not represented in an electrocardiogram (ECG).



A graphic representation of a normal ECG

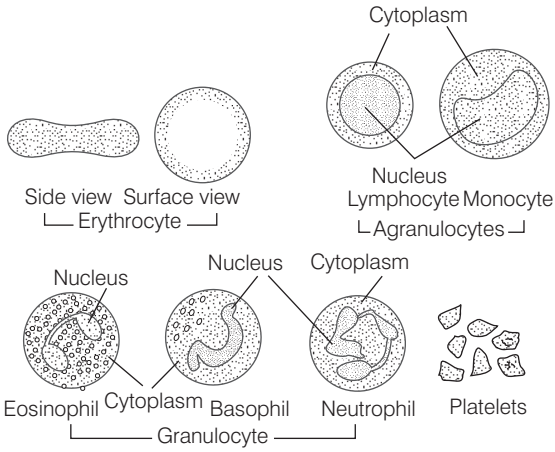
Q. 7 Which of the following type of cells lack nucleus in hormones?

(a) RBC (b) Neutrophils

(c) Eosinophils (d) Erythrocytes

Ans. *(a)* RBCs (Red Blood Corpuscles) in humans lack nucleus. Absence of nucleus in the cell reduces the O_2 consumption by the cell in various cellular activities. Therefore, the cell is able to transport maximum amount of O_2 to other cells of the body.

Other cells like neutrophils, eosinophils and monocytes possess nucleus of varied shape and size as shown below.



Human blood corpuscles

Q. 8 Which one of the following blood cells is involved in antibody production.

(a) B-lymphocytes (b) T-lymphocytes
(c) RBC (d) neutrophils

Thinking Process

Lymphocytes are of two major types, i.e., 'B and T' lymphocytes. Both B and T lymphocytes are responsible for immune responses in the body.

Ans. *(a)* **B-lymphocytes** Their principal function is to make antibodies against soluble antigens that are important in regulating humoral immunity. On the other hand RBCs transport oxygen, T-lymphocytes play central role in cell mediated immunity and neutrophils acts as phagocytes.

Q. 9 The cardiac impulse is initiated and conducted further upto ventricle. The correct sequence of conduction of impulse is

(a)	SA Node	AV Node	Purkinje fiber	AV Bundle
(b)	SA Node	Purkinje fiber	AV Node	AV Bundle
(c)	SA Node	AV Node	AV Bundle	Purkinje fiber
(d)	SA Node	Purkinje fiber	AV Bundle	AV Node

Ans. *(c)* **SA Node** It is situated in the walls of the right auricle near the opening of the superior vena cava. In myogenic heart the contraction is initiated by SA node.

AV Node The wave of contraction reaches AV node which is stimulated to emit an impulse of contraction spreading to the ventricular muscle *via* the **atrio ventricular bundle** and then to the **Purkinje fibres** stimulating heart beat.

Q. 10 Agranulocytes responsible for immune response of the body are

(a) basophils (b) neutrophils (c) eosinophils (d) lymphocytes

Thinking Process

Alteration in cells and tissue as a result of disease includes degenerative and infiltrative changes and all are involved in inflammatory reactions.

Ans. *(a)* Lymphocytes are white blood cells responsible for immune response of the body. These cells recognise and react with antigens.

Basophils contain anticoagulant heparin which pervents blood form a clotting and also contain vasodilator histamin which promotes blood flow into the tissues.

Eosinophils are white blood cells which defend the body against parasitic infections.

Q. 11 The second heart sound (dubb) is associated with the closure of

(a) tricuspid valve
(b) semilunar valve
(c) bicuspid valve
(d) tricuspid and bicuspid valve

Ans. *(b)* During each cardiac cycle two prominent sounds are produced which can be easily heard through a **stethoscope**.

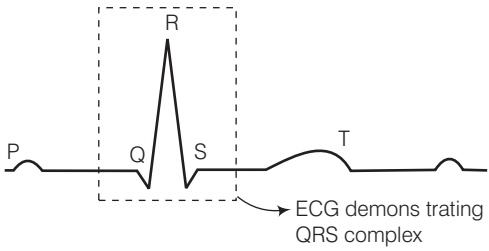
Semilunar value- The second sound of the heart is high pitched 'DUB' It is caused by vibrations associated with closure of aortic and pulmonary valves. It lasts for an about 0.12 seconds with the frequency of 50 Hz, while tricuspid value, bicuspid value and both the value together are associates with first heart (*i.e.*, lubb).

Q. 12 Which of the following correctly explains a phase/event in cardiac cycle in a standard electrocardiogram?

(a) QRS complex indicates atrial contraction.
(b) QRS complex indicates ventricular contraction.
(c) Time between S and T represents atrial systole.
(d) P-wave indicates beginning of ventricular contraction.

Ans. *(b)* **QRS Complex** QRS wave (complex) begins after a fraction of second after the P wave. It begins as a small downward deflection (Q) and continuous as a large upright (R) and triangular wave, ending as downward wave (S) at its base.

This represents ventricular depolarisation (ventricular contraction). Thus, the other options are wrong.



Q. 13 Which of the following statements is incorrect?

(a) A person of 'O' blood group has anti 'A' and anti 'B' antibodies in his blood plasma.
(b) A person of 'B' blood group can't donate blood to a person of 'A' blood group.
(c) Blood group is designated on the basis of the presence of antibodies in the blood plasma.
(d) A person of AB blood group is universal recipient.

Thinking Process

Blood Groups *It is determined by the presence of gene (isoaglutinin). There are three alleles* I^A, I^B, I^o *of this gene. Protein produced by* I^A *and* I^B *alleles are called A antigen and B antigen respectively.*

Ans. *(c)* ABO blood grouping in human is based on the presence or absence of two surface antigens on the RBCs namely A and B. Similarly, the plasma of different individuals contain two natural antibodies. *This distribution of antigens and antibodies in the four groups of blood A, B, AB and O are as follows*

Blood Groups and Donors Compatibility

Blood Group	Antigens on RBCs	Antibodies in Plasma	Donor's Group
A	A	anti-B	A, O
B	B	anti-A	B, O
AB	A, B	nil	AB, A, B, O
O	nil	anti-A, B	O

Thus, blood group in universal donar 4 blood group AB in universal recipient and the other options are correct.

Q. 14 What would be the cardiac output of a person having 72 heart beats per minute and a stroke volume of 50 mL?

(a) 360 mL (b) 3600 mL (c) 7200 mL (d) 5000 mL

Ans. *(d)* **Cardiac Output**

(i) The volume of blood pumped by each ventricle per minute is called the cardiac output. It is 500 mL or 5 litres in a healthy individual.

(ii) It is determined by multiplying the heart rate with the volume of blood ejected by each ventricle during each beat, which is called as stroke volume.

$$\text{Cardiac output} = \text{Heart rate} \times \text{Stroke volume}$$
$$= 72 \text{ beats/min} \times 0.08 \text{ litre/beat} = 5.5 \text{ litre/min}$$

(iii) *Cardiac index* is the minute volume per sq. m. of body surface area. Its normal value is 3.3 lit/min/sq.m.

Q. 15 Match the following columns.

	Column I		Column II
A.	Lymphatic system	1.	Carries oxygenated blood
B.	Pulmonary vein	2.	Immune response
C.	Thrombocytes	3.	To drain back the tissue fluid to the circulatory system
D.	Lymphocytes	4.	Coagulation of blood

Codes

	A	B	C	D		A	B	C	D
(a)	2	1	3	4	(b)	3	1	4	2
(c)	3	1	3	4	(d)	2	1	3	4

Ans. *(b)* *The correct matching is as listed below*

	Column I	Column II
A.	Lymphatic system	To drain back the tissue fluid to the circulatory system
B.	Pulmonary vein	Carries oxygenated blood
C.	Thrombocytes	Coagulation of blood
D.	Lymphocytes	Immune response

Q. 16 Read the following statements and choose the correct option.

Statement I Atria receive blood from all parts of the body which subsequently flows to ventricles.

Statement II Action potential generated at sino-atrial node passes from atria to ventricles.

(a) Action mentioned is statement I is dependent on action mentioned in Statement II
(b) Action mentioned in statement II is dependent on action mentioned in Statement I
(c) Action mentioned in statement I and II are independent of each other.
(d) Action mentioned in statement I and II are synchronous.

Ans. *(d)* The superior vena cava pours venous blood into right atria and left atria receive blood from lungs. This then flows into ventricles. The contraction of muscles of atria arise from SA nodes and passes to AV node and then to the Purkinje fibres.

Therefore, action mentioned in statement I and II are synchronous, while the other options are wrong.

Very Short Answer Type Questions

Q. 1 Name the blood component which is viscous and straw coloured fluid.

Ans. Blood is a special connective tissue consisting of a fluid matrix, plasma and cells.

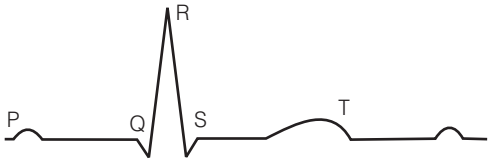
Plasma is a straw coloured, viscous fluid constituting of nearly 55 % of the blood, 90-92% of plasma is water and proteins contributes approx 6-8% . The plasma proteins contains **fibrinogen**, **globulins** and **albumins**.

Q. 2 Complete the missing word in the statement given below

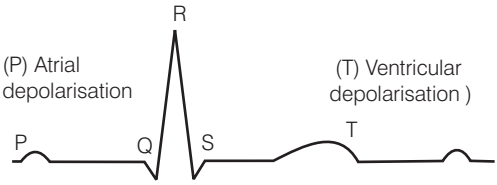
(a) Plasma without ..... factors is called serum.
(b) ..... and monocytes are phagocytic cells.
(c) Eosinophils are associated with ..... reactions.
(d) ..... ions play a significant role in clotting.
(e) One can determine the heart beat rate by counting the number of ..... in an ECG.

Ans. (a) Plasma without **clotting factors** is called serum.
(b) **Neutrophils** and monocytes are phagocytic cells.
(c) Eosinophils are associated with **allergic** reactions.
(d) **Calcium** ions play a significant role in clotting.
(e) One can determine the heart beat rate by counting the number of QRS **complex** in an ECG.

Q. 3 Given below is the diagrammatic representation of a standard ECG. Label its different peaks.



Ans. *The representation of a standard ECG diagram*



Ventricular depolarisation

Q. 4 Name the vascular connection that exists between the digestive tract and liver.

Ans. The unique vascular connection that, exists between the digestive tract and liver is called **hepatic portal system**.

Q. 5 Given below are the abnormal conditions related to blood circulation. Name the disorders

(a) Acute chest pain due to failure of O_2 supply to heart muscles

(b) Increased systolic pressure

Ans. (a) **Angina** also called as 'angina pectoris'. It a symptom of acute chest pain that appears when there is no enough oxygen is reaching to the heart muscle. Angina can occur in men and women of any age but it is more common among the middle aged and elder people. It occurs due to condition that affect the blood flow (hypertension etc.)

(b) **High Blood Pressure** (hypertension) is the term for blood pressure that is higher than normal (120/80). In this measurement 120 mm Hg is the systolic, or pumping pressure and 80 mm Hg is the diastolic or resting pressure.

Increased systolic pressure, *i.e.,* 140/80 or 150/80, shows hypertension. High blood pressure leads to heart diseases and also affects vital body organs like brain and kidney.

Q. 6 Which coronary artery diseases is caused due to narrowing of the lumen of arteries?

Ans. **Atherosclerosis** is the coronary artery disease caused due to the narrowing of the lumen of arteries. The narrowing of arteries occurs due to deposition of calcium, fat, cholesterol and fibrous tissue affecting vessels that supply blood to the heart muscles.

Q. 7 Define the following terms and give their location?

(a) Purkinje fibre (b) Bundle of His

Ans. (a) **Purkinje fibres** are the impulse conducting fibres which relay the contraction impulses from AV node into the walls of ventricles.

(b) **Bundle of His** are mass of specialised fibres that originates from the AV node.

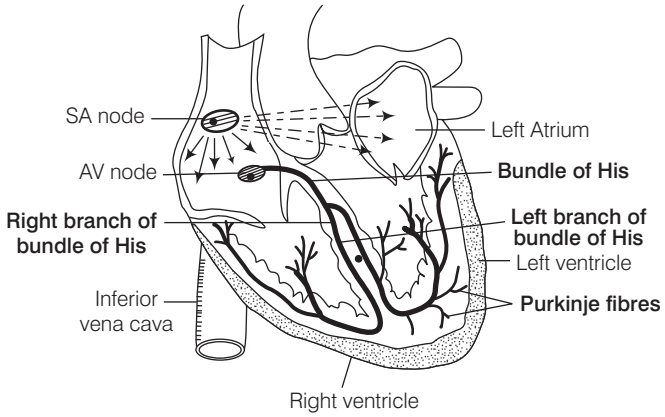


Diagram depicting Purkinje fibre and bundle of His in heart

Q. 8 State the functions of the following in blood

(a) fibrinogen (b) globulin

(c) neutrophils (d) lymphocytes

Ans. (a) **Fibrinogens** are inactive components of blood plasma. Under the action of enzyme thrombin they form a clot or coagulum of a network of threads called fibrin in which dead and damaged elements of blood are trapped.

(b) **Globulins** are primarily involved in immunity, *i.e.,* defence mechanisms of the body.

(c) **Neutrophils** are phagocytic cells which destroy foreign organisms entering the body.

(d) **Lymphocytes** are specialised cells which are responsible for the immune responses in the body. Two major types of lymphocytes, that are involved in this process are B and T-lymphocytes.

Q. 9 What physiological circumstances lead to erythroblastosis foetalis?

Ans. A protein named as **rhesus antigen**, is present on the surface of red blood corpuscles. The population having this protein are called **Rh positive** (Rh^+) while others who do not have this protein are known as Rh negative (Rh^-) (dominant).

Erythroblastosis Foetalis occurs due to Rh incompatibility between the foetus and mother during pregnancy. Rh antigen of the foetus do not get exposed to the Rh^- blood of the mother in the first pregnancy. However, during the delivery of the first child, there is a possibility of exposure of the maternal blood to small amounts of the Rh^+ blood from the foetus.

In such cases, the mother starts preparing antibodies against Rh antigen in her blood and during her subsequent pregnancies the Rh antibodies from the mother (Rh – ve) leak into the blood of the foetus (Rh + ve) resulting in the destruction of foetal RBCs. This could be fatal to the foetus or could cause severe anaemia and jaundice , even may lead to the death of the foetus.

Q. 10 Explain the consequences of a situation in which blood does not coagulate.

Ans. Blood exhibits coagulation or clotting in response to an injury or trauma.

Coagulation prevents excessive loss of blood from the body. In its absence their could be huge loss of blood, which can be fatal.

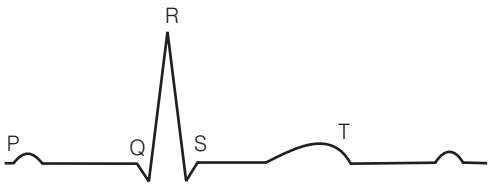
Q. 11 What is the significance of time gap in the passage of action potential from sino-atrial node to the ventricle?

Ans. The time gap in the passage of action potential from sino-atrial node to the ventricles allows ventricles to relax. Thus, ventricular pressure falls, causing the closing of semilunar valves, and prevents the back flow of blood into ventricles.

Q. 12 How will you interpret an electrocardiogram (ECG) in which time taken in QRS complex is higher?

Ans. **Electrocardiograph** (ECG) is a graphical representation of the electrical activity of the heart during a cardiac cycle. A patient is connected to the machine with three electrical leads (one to each wrist and one to the left ankle) that continuously monitor the heart activity. For a detailed evaluation of the heart functions multiple leads are attached to the chest region.

The **QRS complex** represents the depolarisation of the ventricles, which initiates the ventricular contraction. The contraction starts shortly after Q and marks the beginning of the systole. The time taken in QRS complex is 0.12 second in normal ECG.



Electrocardiograph

The larger Q and R wave indicate a myocardial infarction (heart attack). The S-T segment is elevated in acute myocardial infarction and depressed when the heart muscle receives insufficient oxygen.

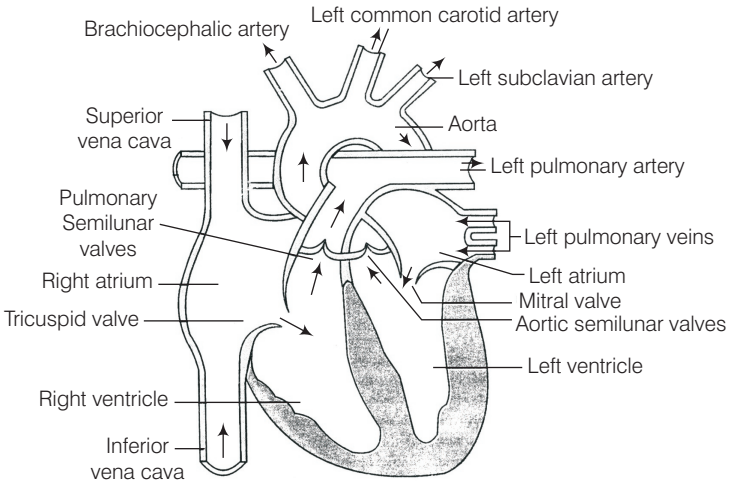
Short Answer Type Questions

Q. 1 The walls of ventricles are much thicker than atria. Explain.

Ans. The structure of heart of fishes, reptiles, birds and mammals show many structures of evolutionary significance. Thicker walls of **ventricles** is one of them.

Ventricles have thick walls because these are mainly involved in pumping the blood to the body parts with certain pressure.

The walls of the left ventricle is about 3 times thicker from the right ventricle, while the atria acts as a collecting chambers for the blood which is starting to the heart thus have thin walled. Also they have to force the blood into the ventricles that lies just below there thus atria have thin walls.



Human heart showing the flow of blood

Q. 2 Differentiate between

(a) blood and lymph (b) basophils and eosinophils

(c) tricuspid and bicuspid valve

Ans. (a) *Difference between blood and lymph are as follows*

Blood	Lymph
Blood is a connective tissue which have erythrocytes leucocytes and platelet present in fluid called plasma.	Lymph is also a connective tissue which, is devoid of RBC but has large number of WBC (leucocytes) in plasma.
It flows in all blood vessels.	It flows only in lymphatic system and is also found extracelluarly inside the tissue.

(b) *Difference between basophils and eosinophils are as follows*

Basophils	Eosinophils
These possess 3 lobed nucleus, with less number of coarse granules.	These possess bilobed nucleus and coarse granules in cytoplasm
These take basic stain.	These take acidic stain
These are normally 0-1% is the blood.	These are 1-6% is the blood.

(c) *Difference between tricuspid valve and bicuspid valve are as follows*

Tricuspid Valve	Bicuspid Valve
This valve separate the right atria from right ventricle.	This valve separates the left atria from left ventricle.
It is made of 3 cusps or flaps.	It has 2 cusps or flaps.
This is also known as right atrio ventricular valve.	This is also called mitral valve or left atrio ventricular valve.

Q. 3 Briefly describe the followings

(a) anaemia
(b) angina pectoris
(c) atherosclerosis
(d) hypertension
(e) heart failure
(f) erythroblastosis foetalis

Ans. (a) **Anaemia** is the decrease in the number of RBC than the normal amount and also due to less quantity of haemoglobin than the normal value in blood This is the most common disorder of the blood.

(b) **Angina Pectoris** Ocurs when there is blockage in coronary artery, thus in sufficient supply of blood reaches to heart muscles. This results in chest pain, fear, anxiety, pale skin, profuse sweating and vomitting. The anginal pain usually starts in the centre of the chest spreads down to the left arm which last for only few second.

(c) **Atherosclerosis** is the deposition of cholesterol in the inner lining of arteries called atherosclerotic plaque. Sometimes arteries are completely blocked, this result in stroke or heart attack.

(d) **Hypertension** Ps sometimes also called as arterial hypertension. The blood pressure in the arteries getselevated. It could be primary hypertension which has no obvious medical reason but secondary hypertension are caused by various conditions which affect kidneys, arteries heart or endocrine system.

(e) **Heart Failure** is the state of heart when it does not pump blood effectively enough to meet the needs of the body.

(f) **Erythroblastosis foetalis** is a haemolytic disease of new borns which is an allo-immune condition that develops in foetus when IgG molecules produced by mother pass through placenta and attack RBC causing reticulocytosis and anaemia. It develops due to Rh incompatibility between the couples.

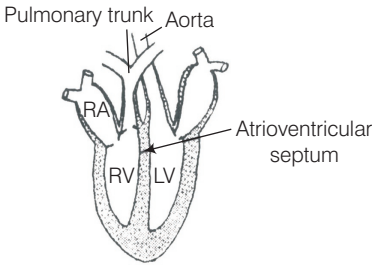
In a man with RH^+ blood and women with Rh^-, blood the second pregnancy foetus may have this problem due to IgG accumulation in women during first child development and delivery.

Q. 4 Explain the advantage of the complete partition of ventricle among birds and mammals and hence leading to double circulation.

Ans. The birds and mammals have evolutionary advancement as far as structure of heart is concerned. They need more oxygen to live in terrestrial habitat.

In these animals, the blood received by left and right auricles is oxygenated and deoxygenated respectively. It passes towards the left and right ventricles and thus no oxygenated and deoxygenated blood is mixed. The ventricles pump oxygenated deoxygenated blood without mixing.

Thus, two separate circulatory pathways are found thus this type of blood circulation is called as double circulation, which include **systemic** and **pulmonary circulation**.



Heart of Bird / Mammal

Q. 5 What is the significance of hepatic portal system in the circulatory system?

Ans. **Hepatic Portal System**

There is special vascular connection that exists between the digestive tract and liver in all chordates and is called as hepatic portal system. This system carries blood from intestine to the liver before it is delivered to the systemic circulation.

Significance of hepatic portal system in circulatory system

(i) Blood that comes from alimentary canal contain glucose, amino acids and other nutrients. The liver absorbs excess of fats and glucose to be used at the time of starvation when blood passess through given.

(ii) Harmful nitrogenous wastes like ammonia is converted into urea which is later removed by kidney.

(iii) Liver produces proteins which are transported through blood circulation *(e.g.,* fibrinogen for blood clotting).

Q. 6 Explain the functional significance of lymphatic system?

Ans. **Human Lymphatic System** comprises of lymph, lymphatic capillaries, lymphatic vessels, lymphatic ducts and lymphatic nodes.

Functional significance of lymphatic system

(i) It removes CO_2 and other metabolic waste from the tissue where blood vessels can not reach.

(ii) Lymphatic blood capillaries of intestine are called lacteals, which help in absorption of fats.

(iii) Lymph filters through out lymph nodes where phagocytotic WBC and macrophages are present in a good number which eats harmful microorganisms and remove foreign particles from the body fluid.

Q. 7 Write the features that distinguish between the two

(a) plasma and serum

(b) open and closed circulatory system

(c) sino-atrial node and atrio-ventricular node

Ans. (a) *Difference between plasma and serum are as follows*

Blood Plasma	Blood Serum
It is the fluid without blood corpuscles.	It is liquid without clotting elements.
It is faint yellow in colour.	It is pale yellow.
It has fibrinogen and other clotting materials.	It does not have fibrinogen and other clotting materials.
It takes part in blood clotting.	It does not take part in blood clotting.

(b) *Difference between open and closed circulatory system are as follows*

Open Circulatory System	Closed Circulatory System
Open circulation occurs in arthropods and molluscs.	It occurs in annelids (earthworms), some molluscs and all vertebrates.
The blood is not completely enclosed within vessels, the heart pumps blood through arteries into large cavities or sinuses, where it mixes with the interstitial fluid and bathes the cells of the body.	In closed circulatory system, materials move between the blood and interstitial fluid through thin walls capillaries.
Circulation is **slower** in an open system, because some of the blood pooled in sinuses and, the heart is unable to build up enough pressure to make the blood flow rapidly.	Blood flows at a **high pressure** in a closed circulatory system.
Respiratory pigment, if present, is dissolved in the plasma, no red corpuscles are present.	Respiratory pigment is present which may be dissolved in the plasma but is usually contained red blood corpuscles.

(c) *Difference between sino atriol node and artrio-ventricular node are as follow*

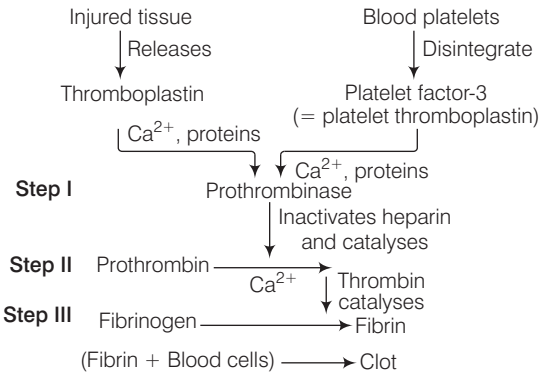
SA Node	AV Node
It is the small mass of specialised muscle cells in the wall of right atrium near the opening of vena cava.	It is situated in the fibrous ring between the right atrium and ventricle of the heart.
It initiates and maintains the heart beat.	It is the pathway through, which electrical impulses can pass.

Q. 8 Thrombocytes are essential for coagulation of blood. Comment.

Ans. Blood is a connective tissue. It has many cellular components. Thrombocytes or platelets are one of them.

Thrombocytes or platelets are found in blood. There number in the blood is 250,000/cubic mL of blood. They are formed in bone marrow and their life span is one week.

When an injury is caused in the blood vessel, bleeding starts, and the platelets are disintegrated to release the clotting factor 3 called thromboplastin. This in presence of Ca^{2+} ions activate prothrombokinase. A series of reactions ultimately occurs which causes blood to clot and plugg the injured blood vessel thus preventing further loss of blood.



Role of thrombocytes in blood coagulation

Q. 9 Answer the following

(a) name the major site where RBCs are formed.

(b) which part of heart is responsible for initating and maintaining its rhythmic activity?

(c) what is specific in the heart of crocodiles among reptilians?

Ans. **(a)** Bone marrow **(b)** SA Node (Sino Atrial Node)

(c) Reptile have 3 chambered heart with an exception of crocodile which possess 4 chambered heart, due to the partial division of ventricle through a septum.

Long Answer Type Questions

Q. 1 Explain Rh-incompatibility in humans.

Ans. Rh antigen is observed on the surface of RBCs of majority (nearly 80%) of humans. Such individuals are called Rh positive (Rh^+) and those individuals where this antigen is absent are called Rh negative (Rh^-).

Both Rh^+ and Rh^- individuals are phenotypically normal. The problem in them arises during blood **transfusion** and **pregnancy**.

(i) **Incompatibility During Blood Transfusion** The first blood transfusion of Rh^+ blood to the person with Rh^- blood causes no harm because the Rh^- person develops **anti** Rh **factors** or **antibodies** in his/her blood.

In second blood transfusion of Rh^+ blood to the Rh^- person, the already formed anti Rh factors attack and destroy the red blood corpuscles of the donor.

(ii) **Incompatibility During Pregnancy** If father's blood is Rh^+, mother blood is Rh^- and the foetus blood is Rh^+. it will lead to a serious problem. Rh antigens of the foetus do not get exposed to the Rh^- ve blood of the mother in the first pregnancy as the two bloods are well separated by the **placenta**.

But in the subsequent Rh^+ foetus, the anti Rh factors (antibodies) of the mother destroy the foetal red blood corpuscles due to mixing of blood.

This result in the **Haemolytic Disease of the New Born** (HDN), called as **erythroblastosis foetalis**. In some cases new born may survive but will be anaemic and may also suffer with jaundice.

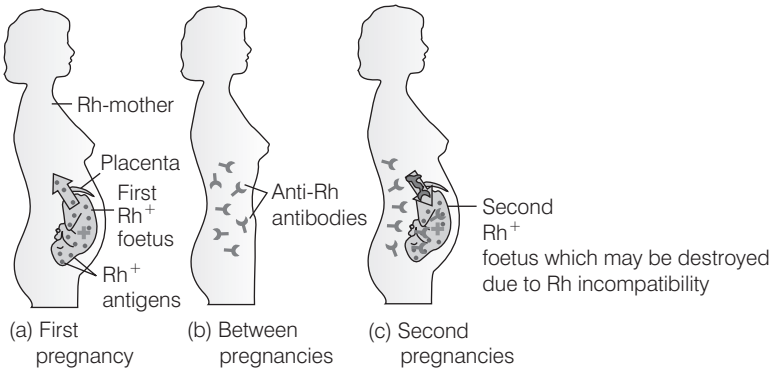


Diagram depicting Rh incompatibility during pregnancy

This condition can be avoided by administering anit-Rh antibodies to the mother immediately after the delivery of the first child.

Q. 2 Describe the events in cardiac cycle. Explain 'double circulation'.

Ans. The cardiac cycle consist of one heart beat or one cycle of contraction and relaxation *i.e.*, takes place in the cardiac muscles. During the heart beat there is a contraction and relaxation of atria and ventricles. The contraction phase is referred as systole while the relaxation phase is called as diastole.

The successive events of the cardiac cycle are briefly described as below

(i) **Atrial Systole** The atria contract due to the wave of contraction, stimulated by the SA node. The blood is forced into the ventricles as the bicuspid and tricuspid valves are open.

(ii) **Beginning of Ventricular Systole** The contraction of ventricles begin due to the wave of contraction stimulated by AV node. This led to the closing of bicuspid and tricuspid valve producing part of first heart sound, *i.e.,* lub.

(iii) **Complete Ventricular Systole** After ventricular contraction, the blood flows into the pulmonary trunk and aorta as the semilunar valves open.

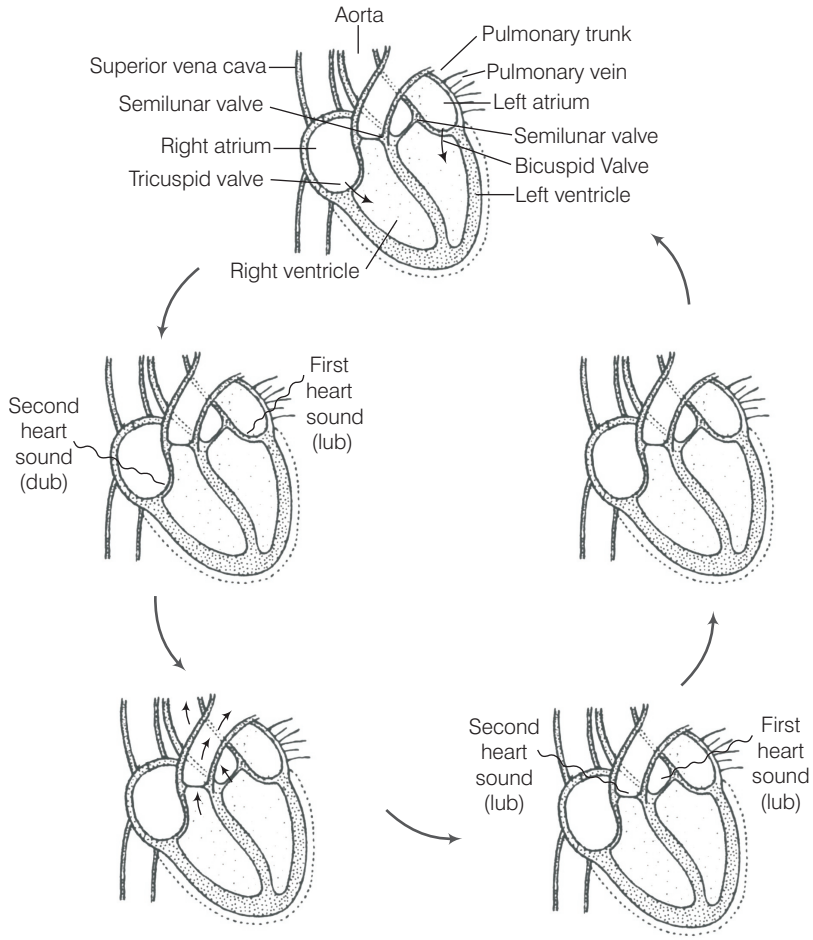


Diagram representing the cardiac cycle and arrow representing the direction of the flow of blood. Dotted line representing change in contraction size

(d) **Beginning of the Ventricular Diastole** The ventricles relax and the semilunar valves are closed. This cause the second heart sound, *i.e.,* dub.

(e) **Complete Ventricular Diastole** The opening of tricuspid and bicuspid valves due to fall in pressure of ventricles and blood flows from the atria into the ventricles. Contraction of the heart does not cause this blood to flow, backward direction, due to the fact that the pressure within the relaxed ventricles is less than that of the atria and veins.

The duration of **cardiac cycle** last for 0.8 sec.

In double circulation, the blood passes twice through the heart during one complete cycle. *Double circulation is carried out by two ways*

(i) Pulmonary circulation

(ii) Systemic circulation

Significance of Double Circulation In birds and mammals, two separate circulatory pathways are present. Oxygenated and deoxygenated blood received by the left and right atria respectively passes on to the ventricles of the same sides. The ventricles pump it out without mixing the oxygenated and deoxygenated blood in the heart.

Q. 3 Explain different types of blood groups and donor compatibility by making a table.

Ans. There are more than 30 antigens on the surface of blood cells that give rise to different blood groups.

ABO Grouping ABO grouping is based on the presence or absence of two surface antigens on the RBCs namely. A and B. The plasma of different individuals contain two natural antibodies. The distribution of antigen and antibody in the four groups of blood, A, AB, B and O are explained above in the table.

Human ABO Blood Groups and their Compatibility

Blood Group	Genotype	Antigens on Red Blood Corpuscles	Antibodies in Blood Plasma	Donor	Recipient
A	I^AI^A or I^AI^O	A	b	A, AB	A, O
B	I^BI^B or I^BI^O	B	a	B, AB	B, O
AB	I^AI^B	AB	None	AB	AB, A, B, O
O	I^OI^O	None	a, b	AB, A, B, O	O

From the above table it is evident that group 'O' blood can be donated to persons with any other blood group and hence 'O' group individuals are called '**Universal donors**'. Person with 'AB' blood can accept blood from persons with AB, as well as the other groups of blood. Therefore, such persons are called '**Universal recipients**'.

Q. 4 Write short note on the following.

(a) Hypertension (b) Coronary Artery Disease

Ans. (a) **Hypertension** The high blood pressure can harm heart, brain kidneys and eyes. High blood pressure is most common disease affecting the heart and blood vessels, Blood pressure is considered normal at 120/80. When it goes beyond 140 mm Hg and 90 mm Hg it is called hypertension or high blood pressure.

Causes of Hypertension

(i) Blockage in the coronary heart vessels.

(ii) Tobacco smoking speeds up heart rate. It constrict blood vessels and raises blood pressure.

(b) **Coronary Artery Disease** (CAD) It is caused due to the deposition of fatty substances on the arterial wall causing **atherosclerotic plaques**. The lumen of artery decreases, thus obstructing the blood flow and sometimes completely blocks the artery resulting into thus, heart attack.

Q. 5 In the diagrammatic presentation of heart given below, mark and label. SAN, AVN, AV bundles, bundle of his and Purkinje fibres.

Ans. The diagrammatic presentation of heart with labelled SAN, AVN, AV bundles bundle of His and purkinje fibres in heart is show as follows

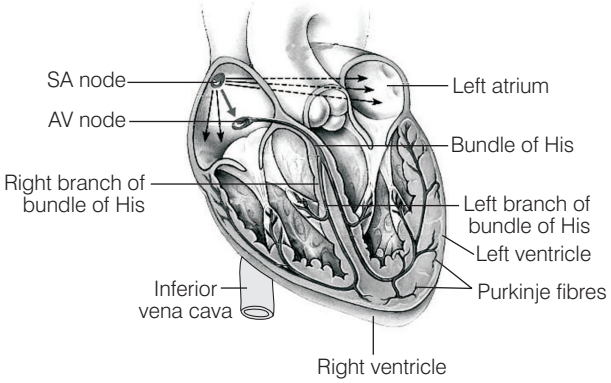


Diagram depicting purking fibre and bundle of HIS, SAN, AVN and AV bundles in heart