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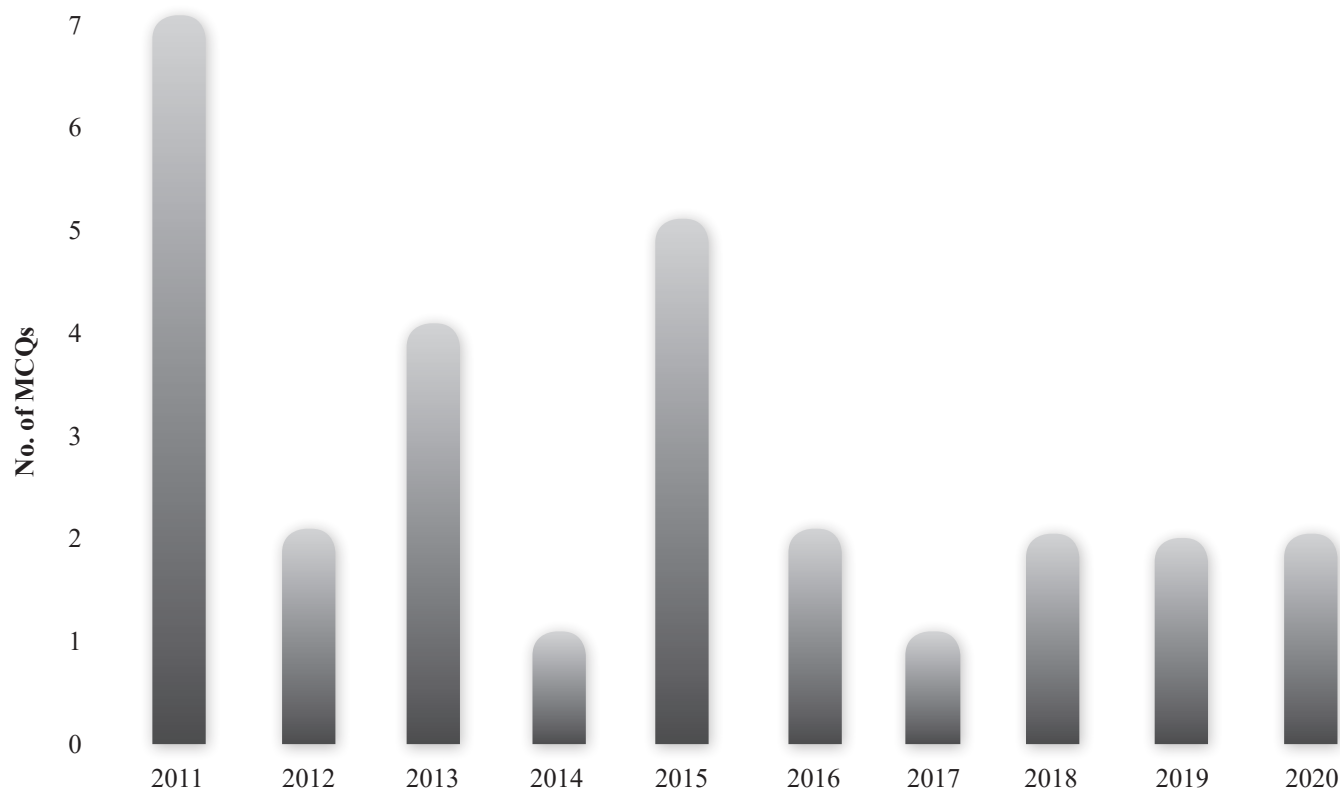
CHAPTER

Body Fluids and Circulation



Scan for Video Solution

Past Year NEET Trend



Investigation Report

TARGET EXAM	PREDICTED NO. OF MCQs	CRITICAL CONCEPTS
NEET	2-3	<ul style="list-style-type: none"> • Blood and its constituents • Human circulatory system • Electrocardiograph • Disorders of circulatory system

Perfect Practice Plan

TOPIC-WISE MCQs	NCERT BASED MCQs	MULTI-CONCEPT MCQs	NEET PAST 10 YEAR QUESTIONS	TOTAL MCQs
92	40	28	32	192

INTRODUCTION

- ☺ Every living cell needs constant supply of nutrients, oxygen and other essential substances and simultaneously the removal of wastes or harmful substances for healthy functioning of tissues. It is, therefore, essential to have efficient mechanisms for the movement of these substances to the cells and from the cells.
- ☺ Different groups of animals have evolved different methods for this transport.
- ☺ **Simple organisms** (sponges and coelenterates) circulate water from their surroundings through their body cavities to facilitate the cells to exchange these substances.
- ☺ More **complex organisms** use special fluids within their bodies (body fluids) to transport such materials.

— KEY NOTE —

Blood and lymph are the most commonly used body fluids in most of the higher organisms including humans.

TYPES OF FLUID CIRCULATION

Different animals have different types of fluid circulation for the transport of materials.

1. Intracellular circulation

- ☺ In unicellular organisms (like *Amoeba*, *Paramoecium*) as well as individual cells of multicellular organisms, cytoplasm shows regular streaming movement called cyclosis.
- ☺ It helps in distribution of materials (food and oxygen) in the cells.
- ☺ It also brings CO_2 and nitrogenous waste near the cell membrane so that these may diffuse out.

2. Extracellular Circulation

In multicellular animals, an extracellular fluid circulates outside the cells termed as extracellular circulation. It is of following types:

- (i) **Environmental Fluid Circulation (Water Circulation):** Many lower invertebrates do not have a circulatory fluid. These animals circulate the surrounding water through the cavities in their bodies with the help of flagella. E.g., Sponges and *Hydra*
- (ii) **Body Fluid Circulation:** The more active animals need a rapid supply of food and oxygen and quicker removal of waste materials. To meet this requirement, they have developed special body fluids which circulate within the body such as:
 - (a) **Body Cavity Circulation:** It occurs in roundworms (e.g., *Ascaris*), which possess a fluid filled body cavity called **pseudocoel**. The contraction of the body wall causes circulation of body fluid to transport the materials.
 - (b) **Blood Vascular System:** It occurs in higher invertebrates and all chordates. These animals possess a special circulating

fluid called **blood**. A special contractile organ, called heart causes circulation of the blood to transport the materials.

- (c) **Lymphatic System:** It occurs in all vertebrates. Lymphatic system consists of lymph and lymph vessels. Lymph also help in the transport of certain substances to and from the tissue cells.

Body fluids

- ☺ Body fluids are the medium of transport of the materials in the body.
- ☺ The body fluids can be distinguished into **two types**:
 1. **Intracellular Fluid (ICF):** The fluid which is present within the cells is called intra-cellular fluid.
 2. **Extracellular Fluid (ECF):** All the fluids outside the cells are collectively called extracellular fluid. Out of these fluids, blood and lymph are involved in the transportation of materials.

Blood

- ☺ Blood is a special connective tissue consisting of a fluid matrix, plasma and the blood corpuscles.
- ☺ About 5 litres of blood circulates in the body of an adult person. It is slightly alkaline fluid having pH 7.4.
- ☺ Blood consists of a watery fluid called **plasma** containing formed elements of blood.

Plasma

- ☺ Plasma is a straw coloured, viscous fluid constituting nearly 55 per cent of the blood.
- ☺ Factors for clotting of blood are also present in the plasma in an inactive form. Plasma without the clotting factors is called **serum**.
- ☺ 90-92 percent of plasma is water.
- ☺ Proteins are the **second largest** (i.e., 6-8 percent) constituents of plasma. Albumins, globulins and fibrinogen are the important types of proteins present in the plasma.
- ☺ Albumin and globulins retain water in blood plasma.
- ☺ Certain globulins called immunoglobulins (glycoproteins) act as antibodies. Prothrombin help in blood clotting by changing soluble fibrinogen to insoluble fibrin.
- ☺ Plasma also contain small amount of minerals like Na^+ , Ca^{2+} , Mg^{2+} , HCO_3^- , Cl^- .
- ☺ Glucose, amino acids, lipids, etc., are also present in the plasma as they are always in transit in the body

Functions of Blood Plasma

- ☺ Transport
- ☺ Prevention of blood loss
- ☺ Retention of fluid in blood due to plasma proteins.

Body Fluids and Circulation

- ☺ Uniform distribution of heat all over the body.

— KEY NOTE —

- ♦ Globulins primarily are involved in defense mechanisms of the body
- ♦ Albumins help in osmotic balance.

Formed Elements (Blood Corpuscles)

- ☺ The formed elements include blood corpuscles or blood cells and blood platelets or thrombocytes.
- ☺ The blood corpuscles are of **two types**:
 - Erythrocytes or red blood corpuscles (RBCs)
 - Leucocytes or white blood corpuscles (WBCs).
- ☺ Nearly 45 percent volume of blood consists of formed elements.

1. Erythrocytes (Red Blood Corpuscles or RBCs)

- ☺ They are the **most abundant** of all types of cells in the blood.
- ☺ Red blood corpuscles of all adult mammals are enucleated (non-nucleated) and lack cell organelles. They are biconcave and circular in shape. However, in camel, RBCs are nucleated and oval in shape.
- ☺ A healthy adult man has, on an average, 5 millions to 5.5 millions of RBCs /mm³ of blood. The total count of RBCs is more in man than in a woman. It is due to the fact that women undergo menstruation.
- ☺ An abnormal rise in RBC count is termed as **polycythemia** while decrease in the number of RBCs is called **erythrocytopenia**.
- ☺ The decrease in RBC count causes oxygen shortage in the blood, which stimulates the release of the hormone, **erythropoietin** from the kidney cells into the blood. Erythropoietin stimulates the bone marrow to increase the production of RBCs.
- ☺ The RBCs contain a red coloured, iron containing complex protein called **haemoglobin**, hence the colour and name of these cells. 100 ml of blood of a healthy individual contains about 12-16 g of haemoglobin.
- ☺ The RBCs have an average life span of 120 days after which they are destroyed in the spleen. Therefore, spleen is called the **graveyard of RBCs**.

Need to know:

- ♦ The process of erythrocyte formation is called **erythropoiesis**.
- ♦ RBCs are mainly produced in the liver and spleen.
- ♦ Iron and proteins are necessary raw materials for the synthesis of haemoglobin. However, vitamin B₁₂ and folic acid stimulate the maturation of RBCs.

Functions of RBCs

- ☺ Haemoglobin of RBCs plays a significant role in transport of respiratory gases (i.e., oxygen and carbon dioxide).

2. Leucocytes (White Blood Corpuscles or WBCs)

- ☺ The leucocytes are the **most active** and motile constituents of blood as well as lymph.
- ☺ They are **colourless** due to the lack of haemoglobin. They are nucleated and rounded or irregular in shape.
- ☺ The leucocytes are relatively lesser in number. This varies from 6000 to 8000/mm³ of blood in adult humans.
- ☺ Rise in WBC count is termed **leucocytosis**. Increased TLC shows acute bacterial infection or malignancies like leukemia (blood cancer). Fall in WBC count is called **leukopenia**.

Leucocytes are of two main types:

(i) Granulocytes

- ☺ They contain granules and irregularly lobed nucleus in the cytoplasm.
- ☺ Based on their staining property, the granulocytes are divided into **three types**:

(a) Eosinophils

- They are characterised by a bilobed nucleus.
- They contain numerous coarse granules
- The proportion of eosinophils is 2-3 per cent.
- They resist infections and are also associated with **allergic reactions**.

(b) Basophils

- They have two to three lobed nucleus. Basophils contain fewer coarse granules.
- They are the **least** (0.5-1.0 per cent) among WBCs.
- Basophils secrete histamine, serotonin and heparin and are involved in inflammatory reactions.

(c) Neutrophils

- They have two to seven lobed nucleus.
- They are the **most abundant** cells (60-65 per cent) of the total WBCs.
- Neutrophils are phagocytic cells which destroys foreign organisms entering the body.

(ii) Agranulocytes

- ☺ They lack granules in their cytoplasm.
- ☺ Agranulocytes are of two types:

(a) Lymphocytes

- They are smaller in size with large rounded nucleus.
- They have a proportion of about 20-25 per cent.
- They produce serum globulins (antibodies) to destroy microbes and their toxins, reject graft and kill tumour cells.

- Lymphocytes are of two major types-**B lymphocytes** (B-cells) and **T-lymphocytes** (T-cells). Both are responsible for immune responses of the body.

(b) Monocytes

- They are the **largest** of all types of WBCs and somewhat amoeboid in shape. They have kidney-shaped nucleus.
- Monocytes constitute 6-8 per cent of total WBC. They are motile and phagocytic in nature and engulf bacteria and cellular debris.
- Generally they change into macrophages after entering tissue spaces and the process is known as diapedesis.

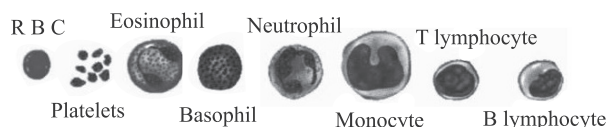


Fig.: Diagrammatic representation of formed elements in blood

Need to know:

- ♦ The process of formation of leucocytes is called **leucopoiesis**.
- ♦ The granulocytes and monocytes are formed in bone marrow.
- ♦ Lymphocytes are produced mainly in lymph nodes, spleen, thymus, tonsils, bone marrow and Peyer's patches of small intestine.

3. Thrombocytes (Blood Platelets)

- ☺ They are flat and non-nucleated fragments of the cells rather than true cells. Thrombocytes are fewer than the RBCs and more than the WBCs in number. There are about 1,50,00-3,50,00 platelets/mm³ of the blood.
- ☺ They are formed from the megakaryocytes (special cells in the bone marrow). Formation of thrombocytes is called **thrombopoiesis**. The normal life span of blood platelet is about a week.
- ☺ Platelets can release a variety of substances called platelet factors (e.g., thromboplastin) most of which are involved in the **coagulation of blood**.
- ☺ A reduction in the number of platelets (**thrombocytopenia**) can lead to clotting disorders which will lead to excessive loss of blood from the body.

BLOOD GROUPS

- ☺ Human beings have more than 30 types of antigens on the surface of blood cells. They give rise to different types of blood groups.
- ☺ Two such grouping, the ABO and Rh, are widely used all over the world.

ABO grouping

- ☺ Karl Landsteiner (1900) reported first time ABO blood groups in human beings. He discovered A, B and O blood groups while AB blood group was found out by de Castello and Steini (1902).
- ☺ ABO grouping is based on the **presence or absence of two surface antigens** (chemicals that can induce immune response) on the RBCs namely A and B. Similarly, the plasma of different individuals contain two natural antibodies (proteins produced in response to antigens).

Table: Blood groups and Donor Compatibility

Blood Group	Antigen on RBCs	Antibodies in Plasma	Donor's Group (Can get blood from)	Recipient's Group (can give blood to)
A	A	anti-B	A, O	A, AB
B	B	anti-A	B, O	B, AB
AB	A, B	Nil	A, B, AB, O	AB
O	None	anti A, B	O	A, B, AB, O

- ☺ During blood transfusion, any blood cannot be used. The blood of a donor has to be carefully matched with the blood of a recipient before any blood transfusion to avoid severe problems of clumping (production of clots that clog capillaries).

— KEY NOTE —

- ♦ The blood group O can be donated to persons with any other blood group. Therefore, the individuals with blood group O are called '**universal donors**'.
- ♦ Persons with AB blood group can accept blood from persons with any group of blood. Therefore, such persons are called '**universal recipients**'.

Rh grouping

- ☺ **Landsteiner and Weiner** (1940) discovered another protein on the surface of red blood corpuscles of rhesus monkey and many human beings. They called it as Rh factor or Rh-antigen.
- ☺ Nearly 80 per cent of humans possess this factor and are Rh positive (Rh⁺), others who do not have this factor are known as Rh negative (Rh⁻).
- ☺ The formation of Rh protein is controlled by a dominant gene, which may be designated as R. Thus, RR (homozygous dominant) and Rr (heterozygous) individuals are Rh positive, and rr (homozygous recessive) individuals are Rh negative.
- ☺ Phenotypically, Rh positive and Rh negative individuals are normal. The problem arises when an Rh -ve person, is exposed to Rh +ve blood during blood transfusion or pregnancy.

- (i) **Incompatibility during blood transfusion:** The first transfusion of Rh^+ blood to the person with Rh^- blood causes no harm. However, the recipient starts preparing antibodies (anti Rh factor) against Rh antigen in his/her blood. If the recipient person receives Rh^+ blood second time, the anti Rh factor present in his/her blood attack and destroy red blood corpuscles of the received blood.
- (ii) **Incompatibility during pregnancy**
- ☺ A special case of Rh incompatibility (mismatching) has been observed between the **Rh^- blood of a pregnant mother and Rh^+ blood of the foetus**. The Rh antigens of the foetus do not get exposed to the Rh^- blood of the mother in the first pregnancy as the two bloods are well separated by the placenta. However, during the delivery of the first child, there is a possibility of exposure of the maternal blood to the Rh^+ blood from the foetus.
 - ☺ In such cases, the mother starts preparing antibodies (anti- Rh factor) against Rh antigen in her blood. In case of her subsequent pregnancies, the Rh antibodies from the mother (Rh^-) blood can leak into the blood of foetus (Rh^+) and destroy the foetal RBCs.
 - ☺ This could be fatal to the foetus or could cause severe anaemia and jaundice to the baby, i.e., the haemolytic disease of the new born (HDN). This condition is called **erythroblastosis foetalis** (destruction of the erythrocytes of foetus).
 - ☺ This can be avoided by administering **anti- Rh antibodies** to the mother immediately after the delivery of the first child.
- (ii) In presence of calcium, the prothrombinase inactivates heparin (or antiprothrombin-anticoagulant). Prothrombinase also catalyses the conversion of prothrombin (an inactive plasma protein) into an active protein called **thrombin** and some small peptide fragments.
- (iii) Thrombin acts as enzyme and thrombin act as enzyme and convert fibrinogen (a soluble plasma protein) into long insoluble fibre like polymers called **fibrin**.
- The thin long and solid fibres of fibrin form a dense network upon the wound and trap blood corpuscles and platelets to form a clot.
 - The clot seals the wound and checks the bleeding. A clot is formed at the wound in about 2-8 minutes after injury. Soon after, the clot starts contracting (clot retraction) and a pale yellow fluid called **serum**, starts oozing out from it. This serum is blood minus the corpuscles and fibrinogens.

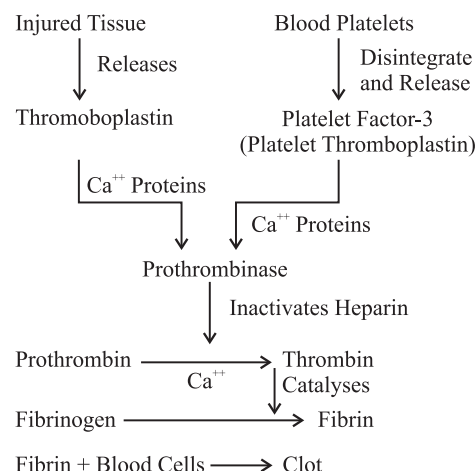


Fig.: Diagrammatic representation of blood clotting process

— KEY NOTE —

Clot or coagulum

- ♦ A dark reddish brown scum formed at the site of a cut or an injury over a period of time.
- ♦ It is mainly formed of a network of threads called fibrins in which dead and damaged formed elements of blood are trapped.

Functions of Blood

Blood serves following functions in the body:

- Blood transports O_2 from the respiratory organs to the tissues and CO_2 from the tissues to the respiratory organs.
- Blood transports the digested food from the alimentary canal to the different body cells.
- Hormones are carried by blood from the endocrine glands to the target organ.
- Blood transports excretory matter to the kidneys or other excretory organs.

Coagulation of Blood

- ☺ When an injury or trauma is caused, the wound does not continue to bleed for a long time. Usually the blood stops flowing after sometime due to blood coagulation or blood clotting. This is a mechanism to prevent excessive loss of blood from the body.
- ☺ Inside an intact blood vessel, blood does not coagulate due to the presence of active anticoagulants, heparin and antithrombins. Procoagulants also occur in the blood but are in an inactive state.
- ☺ As soon as a blood vessel is ruptured, the injured area invites formation of a clot. Procoagulants become active, overcome anticoagulants and cause blood coagulation.

Process of coagulation: It can be described in **three major steps**:

- At the site of an injury, the blood platelets disintegrate and release a phospholipid, called platelet factor-3 (platelet thromboplastin). Injured tissue also release a lipoprotein factor called thromboplastin. These two factors combine with calcium ions (Ca^{2+}) and certain proteins of blood plasma to form an enzyme called **prothrombinase**.

- (v) Blood allows the transfer of heat from the deeper tissues to surface of the body where it can be lost.
- (vi) Some leucocytes are phagocytic in nature, and certain leucocytes produce antitoxins to neutralize the toxins released by the foreign germs.
- (vii) Blood maintains the body temperature to a constant level after distributing heat within the body.
- (viii) The clotting factors present in the blood prevent loss of blood from the site of injury by the formation of clot.

Need to know:

Role of Vitamin K in Blood Clotting: Vitamin K is necessary for the synthesis of prothrombin in the liver. When vitamin K is not sufficient in the body, blood clotting becomes inefficient.

Table: Differences between blood and lymph

Blood	Lymph
It is red in colour due to the presence of haemoglobin in red cells.	It is colourless as red blood cells are absent.
It moves away from the heart and towards the heart.	It moves in one direction, i.e., from tissues to sub-clavians.
It consists of plasma, RBC, WBC, and platelets.	It consists of plasma and WBC (maximum lymphocytes).
Its plasma has more proteins, calcium and phosphorus.	Its plasma has less protein, calcium and phosphorus.
Glucose concentration is low.	Glucose concentration is higher in lymph.
Flow of blood is fast.	Lymph flows very slowly.

CIRCULATORY PATHWAYS

- ☺ The circulatory patterns are basically of two types: open and closed.
- ☺ **In open circulatory system**, the blood is pumped by the heart, which passes through large vessels into open spaces or body cavities called **sinuses**. This type of system is present in arthropods and molluscs.
- ☺ **In closed circulatory system**, the blood pumped by the heart is always circulates through a closed network of blood vessels. Closed circulatory system of circulation is more advantageous because the flow of fluid is regulated in better way.
- ☺ All vertebrates possess a muscular and chambered heart. It acts as a pumping organ of the blood vascular system. It receives blood from and pump the blood to the various organs and tissues of the body.

— KEY NOTE —

- ♦ Fishes: 2-chambered heart with an atrium and a ventricle.
- ♦ Amphibians and the reptiles (except crocodiles): 3-chambered heart with two atria and a single ventricle
- ♦ Crocodiles, birds and mammals: 4-chambered heart with two atria and two ventricles.

Types of circulation

(i) Single circulation

- ☺ In fishes, the heart pumps out deoxygenated blood. Such a heart is called **venous heart**.
- ☺ It pumps out deoxygenated blood which is oxygenated by the gills and supplied to the body parts from where deoxygenated blood is returned to the heart. It is called **single circulation**.

(ii) Incomplete double circulation

- ☺ In amphibians and reptiles, the heart receives both deoxygenated and oxygenated blood and is called **arteriovenous heart**.

LYMPH (TISSUE FLUID)

- ☺ **Lymph** is a colourless fluid present in the lymphatic system.
- ☺ When the blood passes through the capillaries in tissues, some water along with many small water soluble substances move out into the spaces between the cells of tissues leaving the larger proteins and most of the formed elements in the blood vessels. This fluid released out is called the **interstitial fluid or tissue fluid**.
- ☺ It has the same mineral distribution as that in plasma. An elaborate network of vessels called **lymphatic system** collects this fluid and drains it back to the major veins.
- ☺ The fluid present in the lymphatic system is called the **lymph**.
- ☺ Lymph consists of **lymph plasma** (fluid) and **lymph corpuscles** (cells).

Functions of Lymph

- (i) Lymph acts as '**middle man**' which help in exchange of nutrients and gases between the blood and the cells.
- (ii) Fats are absorbed through lymph in the lacteals present in the intestinal villi.
- (iii) When the volume of blood decreases in the blood vascular system, the lymph rushes from the lymphatic system to the blood vascular system to maintain the blood volume in the body.
- (iv) It destroys the invading microorganisms and foreign particles in the lymph nodes.
- (v) Lymph contains specialised lymphocytes which are responsible for the immune responses of the body.
- (vi) Lymph is also an important carrier for nutrients, hormones, etc.
- (vii) Exchange of nutrients, gases, etc., between the blood and the cells always occur through this fluid.

Body Fluids and Circulation

- ☺ The left atrium of the heart receives oxygenated blood from the gills/lungs/skin and the right atrium gets the deoxygenated blood from other body parts. However, they get mixed up in the single ventricle which pumps out mixed blood. It is called **incomplete double circulation**.

(iii) Double circulation

- ☺ In crocodile, birds and mammals 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 any mixing up, i.e., two separate circulatory pathways are present in these organisms. It is called **double circulation**.

Table: Differences between open and closed circulatory systems

Open System	Closed System
Blood flow through open spaces or body cavities called lacunae or sinuses.	Blood flow through blood vessels.
Body tissues are in direct contact with blood.	Body tissues are not in direct contact with blood.
Blood flows at low pressure through lacunae and sinuses.	Blood flow at high pressure through closed blood vessels.
It is slow and less efficient.	It is fast and more efficient.
Volume of blood flowing through tissues and organs is not regulated.	Volume of blood flowing through tissues and organs is well regulated by contractile arteries and other blood vessels.
Found in arthropods (prawns, crabs, lobsters, insects, spiders), and in molluscs (pila, snails, oysters and clams).	Found in annelids (earthworms, neries) and cephalopod mollusc.

HUMAN CIRCULATORY SYSTEM

- ☺ Human circulatory system also called the **blood vascular system** consists of a muscular heart, a network of closed branching blood vessels and the blood, the fluid which is circulated.

Human Heart

- ☺ Human heart consists of four chambers: two relatively small upper chambers called atria (sing.atrium) and two larger lower chambers called ventricles.
- ☺ The human heart is mesodermally derived organ located between the two in mediastinum space in thoracic cavity.
- ☺ The heart is protected by a double walled membranous sac called **pericardium**. It consists of a fibrous layer called perietal pericardium and an inner serous layer called visceral pericardium. The latter is attached to the heart.
- ☺ In between the two layers, there is a very narrow space, called the **pericardial cavity** which is filled with a **pericardial fluid**.

It protects the heart from shocks and mechanical injuries and also allow its free movements.

Structure of heart

- ☺ The right atrium is slight larger than the left atrium because interauricular groove is slightly towards left auricle.
- ☺ The right and left atria receive blood from different body parts. The right atrium receives deoxygenated blood from all parts of the body, except the lungs, through the superior and inferior vena cava.
- ☺ Pulmonary veins bring oxygenated blood to the left atrium from the lungs. The right and left atria pour their blood into the right and left ventricles, respectively.
- ☺ From the right ventricle arises a pulmonary trunk, which soon bifurcates to form right and left pulmonary arteries, which supply deoxygenated blood to the lungs of the respective side.
- ☺ The left ventricle gives rise to an ascending aorta, through which the oxygenated blood is supplied to the coronary arteries and the systemic circulation of the body. Left ventricle is large because interventricular sulcus is towards right side.

— KEY NOTE —

- ♦ **Inter-atrial septum:** A thin, muscular wall which separates the right and the left atria,
- ♦ **Inter-ventricular septum:** A thick-wall which separates the left and the right ventricles.
- ♦ **Atrio-ventricular septum:** It is a thick fibrous tissue which separates the atrium and the ventricle of the same side.

Valves of heart

- ☺ **Tricuspid valve:** The opening between the right atrium and the right ventricle is guarded by a valve formed of three muscular flaps or cusps called the **tricuspid valve**.
- ☺ A **bicuspid or mitral valve:** It guards the opening between the left atrium and the left ventricle.
- ☺ **Semilunar valves:** The openings of the right and the left ventricles into the pulmonary artery and the aorta respectively are provided with the semilunar valves.

— KEY NOTE —

The valves in the heart allows the flow of blood only in **one direction**, i.e., from the atria to the ventricles and from the ventricles to the pulmonary artery or aorta. These valves prevent any backward flow.

Nodal Tissue or Excitatory and Conductive System of the Heart.

- ☺ The entire heart is made of cardiac muscles. The walls of ventricles are much thicker than that of the atria.
- ☺ The heart rhythm is maintained by a highly specialised excitatory and conductive system, which includes sinoatrial node (SA node), inter nodal pathways, the atrio-ventricular node (AV node), the AV bundle and the bundle of Purkinje fibres.
- ☺ The sino-atrial node or SA node (SAN also called **pace maker**) is a small, flattened and ellipsoid strip of muscle fibre which is situated in the right upper corner of the right atrium.
- ☺ The atrio-ventricular node or AV node (AVN also called pace setter) is another mass of nodal tissue, lies in the wall between the right atrium and right ventricle the lower left corner of the right atrium close to the atrio-ventricular septum. A bundle of nodal fibres called **atrio-ventricular bundle** (AV bundle) arises from the AVN and passes through the atrio-ventricular septa. It emerges on the top of the interventricular septum and immediately divides into a right and left bundle.
- ☺ These bundles give rise to minute fibres throughout the ventricular musculature of the respective sides and are called **Purkinje fibres**. These fibres along with right and left bundles are known as **bundle of His**.

Working of Nodal Tissue

- ☺ The nodal musculature has the ability to generate action potentials without any external stimuli, i.e., it is **autoexcitable**. However, the number of action potentials that could be generated in a minute, vary at different parts of the nodal system.
- ☺ The SAN (SA node) can generate the maximum number of action potentials, i.e., $70-75 \text{ min}^{-1}$, and is responsible for initiating and maintaining the rhythmic contractile activity of the heart. Therefore, it is called the **pacemaker**.
- ☺ The action potential generated in the SAN spontaneously initiates a wave of contraction which spreads over both the atria more or less simultaneously. This also stimulates the AVN (AV node) through internodal pathway, which generates a fresh wave of contraction that passes over both the ventricles simultaneously along the bundle of His and Purkinje fibres.
- ☺ The ventricular contraction begins at the apex of the heart and passes quickly towards the origin of the pulmonary and systemic arches. The entire conduction of the impulse is organised in such a way that, there is a delay in transmission of impulse from SA node to the ventricle.
- ☺ Our heart normally beats **70-75 times in a minute** (average 72 beat min^{-1}).

Increase in heart beat: Tachycardia

Decrease in heart beat: Bradycardia

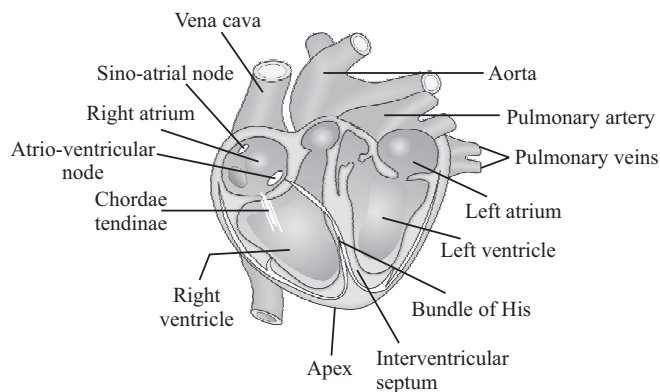


Fig.: Section of a human heart

Need to know:

The human heart is myogenic (*myo* = muscle, *genic* = originating from), as the action potential for its rhythmicity originates from a muscle, however, it is regulated by the nerves.

Table: Differences between Neurogenic heart and Myogenic heart

Neurogenic heart	Myogenic heart
The heart beat is initiated by a ganglion situated near the heart.	The heart beat is initiated by a patch of modified heart muscle.
The impulse of contraction originates from nervous system.	The impulse of contraction originates itself in the heart.
The heart normally stops beating immediately after removal from the body. Therefore, heart transplantation is not possible.	The heart removed from the body continues to beat for some time. Therefore, heart transplantation is possible.
Examples: Hearts of some annelids and most arthropods.	Examples: Hearts of molluscs and vertebrates.

CARDIAC CYCLE

- ☺ The sequence of events, which occur from the beginning of one heart beat to the beginning of the next (completion of one heart beat), is called **cardiac cycle**.
- ☺ During a heart beat, there is contraction and relaxation of atria and ventricles. The contraction phase is called the **systole** while the relaxation phase is called the **diastole**. When both the atria and ventricles are in diastolic or relaxed phase, it is referred as **joint diastole**.
- ☺ A complete heart beat consists of a systole and diastole of both the atria, plus the systole and diastole of both the ventricles.

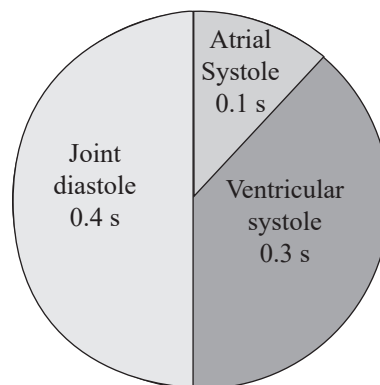
Body Fluids and Circulation

- During **joint diastole**, the blood flows from the superior and inferior vena cavae into the atria. But there is no flow of blood from the ventricles to the aorta and pulmonary trunk as the semilunar valves remain closed.

The pumping action during single cardiac cycle involves following steps:

- Atrial Systole:** The two atria contract simultaneously due to wave of contraction stimulated by the SA node. The blood is pumped from the pulmonary veins and vena cava flows into the left and the right ventricle respectively through the left and right atria. as the bicuspid and tricuspid valves are open. Atrial systole takes about 0.1 second. Soon after systole, the atria enters into diastole phase for the next 0.7 second. From the atria, nearly 70% of the blood passively flows into the ventricles. The rest of the blood is pumped into the ventricles by the contraction of atria.
 - Ventricular Systole:** When the atrial systole approaches its end, the ventricles begin to contract due to a wave of contraction, stimulated by the AV node. The bicuspid and tricuspid valves close immediately producing part of the **first heart sound lub**. When the ventricles complete their contraction, the blood flows into the pulmonary trunk and aorta as the semilunar valves open. The ventricular systole takes about 0.3 seconds.
 - Ventricular Diastole:** Soon after systole, the ventricles undergo relaxation and the semilunar valves are closed. This causes **second heart sound dub**. The bicuspid and tricuspid valves open, when the pressure in the ventricles falls and blood flows from the atria into the ventricles. The period of ventricular diastole is of about 0.5 seconds.
 - Joint Diastole:** During this phase both the atria and ventricles are in diastole. As no contraction is present anywhere, the phase of joint diastole is also called general pause. The total duration of a cardiac cycle is 0.8 seconds. Thus, many cardiac cycles are performed per minute.
- The action potential is conducted to the ventricular side by the AVN and AV bundle from where the bundle of His transmits it through the entire ventricular musculature.
 - This causes the ventricular muscles to contract, (ventricular systole), the atria undergoes relaxation (diastole), coinciding with the ventricular systole.
 - Ventricular systole increases the ventricular pressure causing the closure of tricuspid and bicuspid valves due to attempted backflow of blood into the atria.
 - As the ventricular pressure increases further, the semilunar valves guarding the pulmonary artery (right side) and the aorta (left side) are forced open, allowing the blood in the ventricles to flow through these vessels into the circulatory pathways. The ventricles now relax (ventricular diastole) and the ventricular pressure falls causing the closure of semilunar valves which prevents the backflow of blood into the ventricles.

- As the ventricular pressure declines further, the tricuspid and bicuspid valves are pushed open by the pressure in the atria exerted by the blood which was being emptied into them by the veins.
- The blood now once again moves freely to the ventricles.
- The ventricles and atria are now again in a relaxed (joint diastole) state, as earlier. Soon the SAN generates a new action potential and the events described above are repeated in that sequence and the process continues.
- This sequential event in the heart which is cyclically repeated is called the cardiac cycle and it consists of systole and diastole of both the atria and ventricles.



Stroke volume and cardiac output

- During a cardiac cycle, each ventricle pumps out approximately 70 mL of blood which is called the **stroke volume**.
- The stroke volume multiplied by the heart rate (no. of beats per min.) gives the **cardiac output**.
- Therefore, the cardiac output can be defined as the volume of blood pumped out by each ventricle per minute and averages 5000 mL or 5 litres in a healthy individual.
- The body has the ability to alter the stroke volume as well as the heart rate and thereby the cardiac output.

Heart sounds

- During each cardiac cycle two prominent sounds are produced which can be easily heard through a stethoscope. These sounds are of clinical diagnostic significance.
 - Lub:** The first heart sound (lub) is associated with the closure of the tricuspid and bicuspid valves.
 - Dub:** The second heart sound (dub) is associated with the closure of the semilunar valves.

ELECTROCARDIOGRAPH (ECG)

- ECG is a graphical representation of the electrical activity of the heart during a cardiac cycle.
- Each peak in the ECG is identified with a letter from P to T that corresponds to a specific electrical activity of the heart.

- ☺ To obtain a standard ECG, a patient is connected to the machine with three electrical leads (one to each wrist and to the left ankle) that continuously monitor the heart activity.
- ☺ For a detailed evaluation of the heart's function, multiple leads are attached to the chest region.
- ☺ **P-wave:** It represents the electrical **excitation** (or **depolarisation**) of the **atria**, which leads to the contraction of both the atria.
- ☺ **QRS complex:** It represents the **depolarisation of the ventricles**, which initiates the ventricular contraction. The contraction starts shortly after Q and marks the beginning of the systole.
- ☺ **T-wave:** It represents the return of the ventricles from excited to normal state (**repolarisation**). The end of the **T-wave** marks the end of systole.

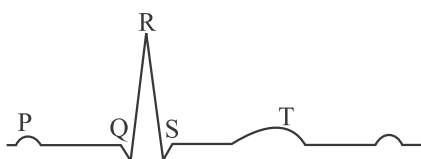


Fig.: Diagrammatic presentation of a standard ECG

— KEY NOTE —

- ♦ By counting the number of QRS complexes that occur in a given time period, one can determine the heart beat rate of an individual.
- ♦ Since the ECGs obtained from different individuals have roughly the same shape for a given lead configuration, any deviation from this shape indicates a possible abnormality or disease for example: enlarged p wave shows atrial hypertrophy, flat T shows insufficient oxygen, elevated T shows hyperkalaemia, enlarged Q, R and S-T segment shows myocardial infarction increase P-R shows atherosclerosis

DOUBLE CIRCULATION

- ☺ The movement of blood follows double circulation (systemic and pulmonary circulation) and circulation through special regions.

(i) Systemic Circulation

- ☺ It involves the **flow of oxygenated blood** from the left ventricle to all parts of the body and deoxygenated blood from various body parts to the right atrium.
- ☺ The systemic circulation starts from the left ventricle of the heart, passes to the aorta, to the arteries originating from it and to all their branches, hence to the arterioles, capillaries, venules and the veins of the whole body and finally to the two vena cava which enter the right atrium.
- ☺ As the systemic circulation supplied blood to most of the tissues of the body, it is also called the greater circulation

or **peripheral circulation**. The systemic circulation carries oxygen and provides nutrients and other essential substances to body tissues and removes carbon dioxide and other harmful substances or wastes from the tissues.

(ii) Pulmonary Circulation

- ☺ The **flow of deoxygenated blood** from the right ventricle to the lungs and the return of oxygenated blood (carried by the pulmonary veins) from the lungs to the left atrium is called the pulmonary circulation.

Hepatic portal system

- ☺ A unique vascular connection exists between the digestive tract and liver called hepatic portal system. The hepatic portal vein carries blood from intestine to the liver before it is delivered to the systemic circulation.
- ☺ A special coronary system of blood vessels is present in our body exclusively for the circulation of blood to and from the cardiac musculature.

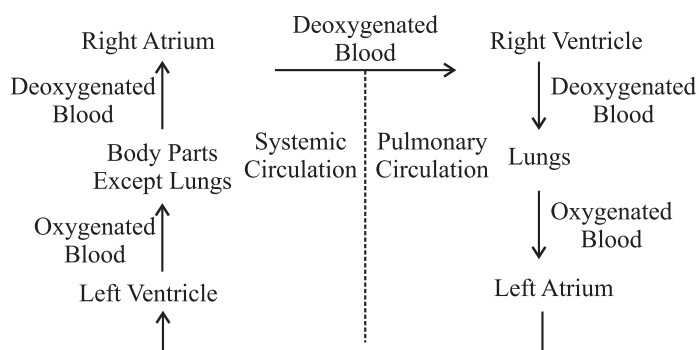


Fig.: Schematic plan of blood circulation in human

Table: Differences between systemic and pulmonary circulations

Systemic Circulation	Pulmonary Circulation
It is a larger circuit, which supplies blood to the various parts of the body and back to the heart.	It is smaller circuit which carries blood to the lungs and back to the heart.
It supplies oxygenated blood to all parts of the body.	It carries deoxygenated blood to the lungs for oxygenation.
The blood is pumped by left ventricle and received by the right atrium.	The blood is pumped by right ventricle and received by left atrium.

BLOOD VESSELS

The blood flows strictly by a fixed route through Blood Vessels—the arteries and veins. Basically, each artery and vein consists of three layers: an inner lining of squamous endothelium, the tunica intima, a middle layer of smooth muscle and elastic fibres, the tunica media, and an external layer of fibrous connective tissue with collagen fibres, the tunica externa. The tunica media is comparatively thin in the veins.

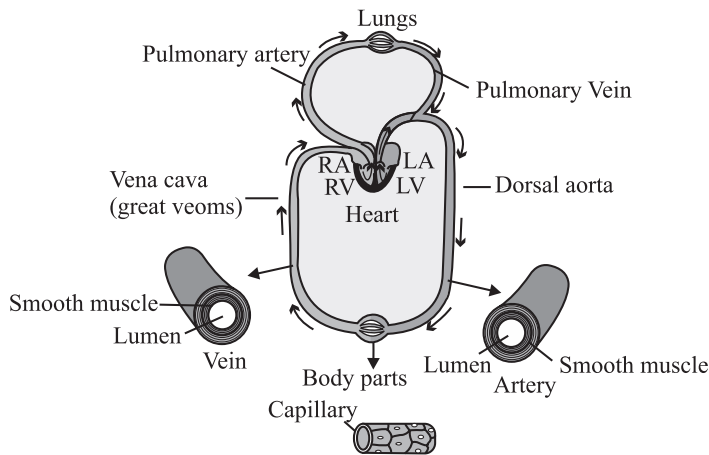


Fig.: Schematic plan of blood circulation in human

REGULATION OF CARDIAC ACTIVITY

- ☺ Normal activities of the heart are regulated intrinsically, i.e., auto-regulated by specialised muscles (nodal tissue), hence the heart is called myogenic.
- ☺ A special neural centre in the medulla oblongata can moderate the cardiac function through autonomic nervous system (ANS).
- ☺ Neural signals through the sympathetic nerves (part of ANS) can increase the rate of heart beat, the strength of ventricular contraction and thereby the cardiac output.
- ☺ Parasympathetic neural signals (another component of ANS) decrease the rate of heart beat, speed of conduction of action potential and thereby the cardiac output.
- ☺ Adrenal medullary hormones can also increase the cardiac output.

DISORDERS OF CIRCULATORY SYSTEM

High Blood Pressure (Hypertension)

- ☺ The pressure exerted by the flow of blood on the elastic walls of the arteries is called blood pressure. The blood pressure is greater during the systole than during the diastole.
- ☺ In normal young person, the systolic pressure is 120 mm Hg and diastole pressure is 80 mm Hg. It is normally expressed as 120/80. The pressure varies with age. It is also influenced by the rate of heart beat.
- ☺ It is measured w Stroke volume and cardiac output ith an instrument sphygmomanometer
- ☺ The increase in the blood pressure beyond 140 mm Hg (systolic) and 90 mm Hg (diastolic), is referred to as **high blood pressure**. A continuous or sustained rise in the arterial blood pressure is known as **hypertension**. High blood pressure is a silent killer as it can damage vital organs like heart, brain, kidneys and eyes.
- ☺ Fall in blood pressure is termed as low blood pressure or **hypotension**.

Atherosclerosis

- ☺ It is also called as Coronary artery disease (CAD).
- ☺ It is caused due to the **deposition of calcium, fat, cholesterol and fibrous tissues** on the wall lining the lumen of large and medium sized arteries. Such a deposition is called atheromatous or atherosclerotic plaque.
- ☺ In extreme circumstances, these plaques may completely block the artery. Such plaques, if formed in the coronary artery, reduce the blood supply to the heart, or may stop the supply to the heart. This may result in heart attack or stroke.
- ☺ High concentration of cholesterol in the form of low density lipoproteins (LDL) in the blood plasma is responsible for atherosclerosis.

Angina

- ☺ It is also called angina pectoris. It appears when **no enough oxygen** is reaching the heart muscle. As a result, a symptom of acute chest pain appear in the chest.
- ☺ Angina can occur in men and women of any age but it is more common among the middle aged and elderly persons. It occurs due to the conditions that affect the blood flow.

Heart Failure

- ☺ It is the state of heart when it is not pumping blood effectively enough to meet the needs of the body.
- ☺ It is sometimes called 'congestive heart failure' because congestion of the lungs is one of the main symptoms of this disease.

Heart Attack

- ☺ It is the condition, when the heart muscles are suddenly damaged by an inadequate blood supply. It is also called **myocardial infarction**.

Cardiac Arrest

- ☺ It is a condition of complete stoppage of the heart beat, i.e., sudden and complete loss of cardiac function.

Need to know:

- ♦ **Blue Baby Syndrome:** A baby with a blue tinge to the skin due to insufficient oxygenation of the blood.
- ♦ **Angioplasty:** It is a technique for unblocking coronary arteries that have atherosclerotic plaque.
- ♦ **Example of anticoagulants** (substances which prevent blood clotting):
 - **Natural** - Heparin
 - **Artificial** - EDTA (Ethylene Diamine Tetra acetic Acid), Na citrate, oxalate

Topic-wise Questions



Scan for Video Solution

Blood

1. Which of the following is not a constituent of formed elements?

- a. Erythrocytes b. Leucocytes
- c. Platelets d. Plasma

2. Which of the following leucocytes destroy foreign organisms entering the body?

- A. Eosinophils B. Basophils
- C. Neutrophils D. Monocytes
- a. A and B b. B and C
- c. C and D d. D and E

3. The most abundant and least abundant cells of the blood are

- a. RBCs and WBCs respectively
- b. WBCs and RBCs respectively
- c. RBCs and platelets respectively
- d. Platelets and RBCs respectively

4. Most abundant and least abundant WBCs are

- a. Lymphocytes and monocytes respectively
- b. Neutrophils and basophils respectively
- c. Eosinophils and monocytes respectively
- d. Neutrophils and eosinophils respectively

5. Platelets are also called

- a. Thromboplasts b. Thromboplasts
- c. Thrombocytes d. Megakaryocytes

6. Platelets are the cell fragments produced from

- a. Thromboplasts b. Thromboplasts
- c. Thrombocytes d. Megakaryocytes

7. Megakaryocytes are present in

- a. Blood b. Liver
- c. Bone d. Bone marrow

8. A reduction in the number of platelets can lead to

- a. Blood coagulation inside vessels
- b. Clotting disorders
- c. Excessive loss of blood from the body
- d. Both (b) and (c)

9. Blood grouping which is/are widely used all over the world are

- a. ABO grouping b. Rh grouping
- c. Both (a) and (b) d. None of the above

10. The correct descending order of percentage proportion of leucocytes in human blood is

- a. Neutrophils → Basophils → Lymphocytes → Acidophils → Monocytes
- b. Neutrophils → Monocytes → Lymphocytes → Acidophils → Basophils
- c. Neutrophils → Lymphocytes → Monocytes → Eosinophil → Basophils
- d. Neutrophils → Acidophils → Basophils → Lymphocytes → Monocytes

11. Which leucocyte secretes both heparin and histamine?

- a. Acidophil b. Monocyte
- c. Basophil d. Neutrophil

12. Allergic responses are regulated by

- a. Eosinophils b. Neutrophils
- c. Basophils d. Monocytes

13. Kidney-shaped nucleus occurs in

- a. Neutrophil b. Eosinophil
- c. Monocyte d. Lymphocyte

14. Mammalian RBCs are enucleated so that

- a. Nucleus is non-essential for RBC
- b. RBCs cannot divide
- c. RBCs can carry more Hb
- d. Nucleus does not show lethal effect

15. Abnormal fall in total count of WBCs in the human blood is called

- a. Anaemia b. Polycythemia
- c. Leucopenia d. Leukemia

16. Plasma proteins perform

- a. Nutritive function
- b. Physiochemical function
- c. Transport function
- d. All of the above

17. Which one secretes anticoagulant?

- a. Mast cells b. Nerve cells
- c. Adipose cells d. Plasma cells

18. The ratio of RBC to WBC in human is

- a. 6:1 b. 60:1
- c. 600:1 d. 6000:1

19. Which is correct about leucocytes?
- They are red coloured
 - They can cross blood capillaries
 - They are enucleate
 - Decrease in their number causes leukemia
20. Donor X and recipient Y belong to same blood group. Transfusion has led to RBC agglutination because
- X is Rh⁺, Y is Rh⁻
 - X is Rh⁻, Y is Rh⁺
 - Both are Rh⁺
 - Both are Rh⁻
21. Thrombocytes have a life of
- 3-4 weeks
 - 4-5 weeks
 - 3-7 days
 - None of the above
22. pH of blood in arteries and veins is
- Higher in arteries and lower in veins
 - Higher in veins and lower in arteries
 - Same in both
 - Variable in both
23. Cells formed in bone marrow include
- RBCs only
 - RBC and leucocytes
 - Leucocytes only
 - Lymphocytes only
24. Serum is
- Blood minus fibrinogen
 - Lymph minus corpuscles
 - Lymph only
 - Blood minus corpuscles and fibrinogen
25. Number of RBC/mm³ in healthy female is
- 5.0 - 5.5 million
 - 5.5 - 6.0 million
 - 3.5 - 4.0 million
 - 6.5 - 7.0 million
26. Which of the following organ is considered as graveyard of RBCs?
- Tonsils
 - Liver
 - Spleen
 - Pancreas
27. There are two major type of lymphocytes (20-25%), B and T forms. Identify their function.
- Blood coagulation
 - Thickness of blood
 - Immune responses
 - All of these
29. Factors present on surface of RBC related to heredity are
- Blood groups
 - Antigens
 - Antibodies
 - Haemoglobin
30. For safe blood transfusion
- Donor's RBC should not contain antibodies against recipient's serum
 - Recipient's serum should not contain antigens against donor's antibodies
 - Recipient's serum should not contain antibodies against RBC of donors
 - Recipient's RBC should not contain antibodies against donor's antigens
31. Blood group is due to
- Specific antigens on the surface of WBC
 - Specific antibodies on the surface of RBC
 - Specific antigens on the surface of RBC
 - Type of haemoglobin
32. Which of the following blood groups will be having antigen A on RBC surface?
- A
 - A, AB
 - A, O
 - AB
33. Universal acceptor is having following antibodies:
- Anti-A
 - Anti-B
 - Anti-A and Anti-B
 - No antibodies

Coagulation of Blood and Lymph

34. A dark reddish brown scum formed at the site of cut or an injury over a period of time is called
- Clot
 - Scar
 - Coagulum
 - Both (a) and (c)
35. An enzyme complex which is formed by a series of linked enzymatic reactions (cascade process) is called
- Thrombin
 - Prothrombin
 - Thrombokinase
 - Fibrinogen
36. Clot is formed mainly of an network of threads called
- Fibrinogen
 - Prothrombin
 - Thrombin
 - Fibrin
37. Prothrombin \xrightarrow{A} Thrombin
Fibrinogen \xrightarrow{B} Fibrin
Recognise A and B
- A—thrombokinase, B—thrombin
 - A—fibrin, B—thrombokinase
 - A—thrombikinese, B—thrombinase
 - A—thrombinase, B—thrombokinase

Blood Groups

28. Chemicals that can induce immune response are called
- Antigen
 - Antibody
 - Antiserum
 - Antitoxin

38. Important function of lymph is to:
- Transport oxygen to the brain
 - Transport CO_2 to the lungs
 - Return WBC' and RBCs to lymph nodes
 - Return interstitial fluid to blood
39. Lymph consists of
- RBCs, WBCs and plasma
 - RBCs, proteins and platelets
 - All components of blood except RBCs and some larger plasma proteins
 - WBCs and serum
40. During blood coagulation, vitamin K helps in
- Formation of prothrombin
 - Formation of thromboplastin
 - Conversion of fibrinogen into fibrin
 - Conversion of prothrombin to thrombin
- ### Circulatory Pathways
41. The circulatory pattern in which blood pumped by the heart passes through large vessels into open spaces or body cavities (sinuses) is
- Open circulatory system
 - Closed circulatory system
 - Incomplete circulatory system
 - Mixed circulatory system
42. In crocodiles, heart is
- Two-chambered
 - Three-chambered
 - Four-chambered
 - Thirteen-chambered
43. Circulatory system is absent in
- Annelids
 - Arthropods
 - Flatworms
 - Cephalopods
44. Which one of the following is a correct matching pair?
- Lub–Sharp closure of AV valves at the beginning of ventricular systole.
 - Dub–Sudden opening of semilunar valves at the beginning of ventricular diastole.
 - Pulse–Pulsation of the radial artery valves in the blood vessels.
 - Purkinje fibers–Initiation of the heart beat.
45. Which organ receives only oxygenated blood?
- Gill
 - Spleen
 - Lung
 - Liver
46. Typical 'lub-dub' sounds in heart beat are due to
- Closing of bicuspid and tricuspid valves
 - Closing of semilunar valves
 - Blood under pressure through aorta
 - Closure of bicuspid-tricuspid valves followed by semilunar valves
47. Systole causes
- Entry of blood into lungs
 - Entry of blood into heart
 - Exit of blood from brain
 - Exit of blood from ventricle
48. The heartbeat of a person increases at the time of an interview due to secretion of
- Renin
 - Adrenaline
 - ADH
 - ACTH
49. Mitral valve in mammals guards the opening between
- Left auricle and left ventricle
 - Pulmonary vein and left auricle
 - Stomach and intestine
 - Liver and spleen
50. 'P' wave of ECG occurs before the
- Onset of ventricular contraction
 - End of arterial contraction
 - Beginning of atrial contraction
 - None of the above
51. The correct route through which pulse-making impulse travels in the heart is
- AV node → bundle of His → SA node → purkinje fibres → heart muscles
 - AV node → SA node → Purkinje fibres → bundle of His → heart muscles
 - SA node → Purkinje fibre → bundle of His → AV node → heart muscles
 - SA node → AV node → bundle of His → purkinje fibre → heart muscles
52. Tricuspid valve is found in between
- Sinus venosus and right auricle
 - Right auricle and right ventricle
 - Left ventricle and left auricle
 - Ventricle and aorta
53. The opening of the right and the left ventricles into the pulmonary artery and the aorta respectively are provided with the
- Bicuspid valves
 - Tricuspid valves
 - Semilunar valves
 - Both (a) and (b)
54. Sino-atrial node (SAN) is a patch of nodal tissue present in
- Right upper corner of right atrium
 - Left upper corner of right atrium
 - Right lower corner of left atrium
 - Left lower corner of left atrium
55. Another mass of nodal tissue called atrio-ventricular node (AVN) is present in
- Right upper corner of right atrium
 - Left upper corner of right atrium
 - Right lower corner of left atrium
 - Left lower corner of right atrium

Body Fluids and Circulation

56. On the top of inter-ventricular septum, AV bundle immediately divides and form
- Right and left bundle
 - Purkinje fibres
 - Bundle of His
 - Both (a) and (b)
57. Purkinje fibre along with right and left bundles are known as
- Bundle branches
 - Bundle of His
 - Purkinje bundle
 - Both (a) and (c)
58. The body has ability to alter the
- Stroke volume
 - Heart rate
 - Cardiac output
 - All of the above
59. How many cardiac cycles are performed per minute?
- 72
 - 12-16
 - 80-120
 - 30
60. Number of beats per minute is called
- Beat number
 - Heart rate
 - Stroke rate
 - All of the above
61. The recording of the heart activity is taken by the machine called:
- Electrocardiogram
 - Electrocardiograph
 - Electroencephalograph
 - Both (a) and (b)
62. Value of cardiac output is
- Auricular volume \times ventricular volume
 - Stroke volume \times rate of heart beat
 - Blood pumped in one minute
 - Both (b) and (c)
63. Which ones have open circulatory system?
1. Ascidia 2. Cockroach 3. Earthworm 4. Prawn 5. Silver Fish
6. Snail 7. Squid
- 2,4,6
 - 1,2,4,6
 - 3,4,5,7
 - 1,2,4,5,6
64. Heart of heart is
- SA node
 - AV node
 - Cardiac muscles
 - Purkinje fibres
65. Artificial pacemaker is usually implanted to correct the defect in
- AV node
 - SA node
 - Purkinje fibres
 - Atrial valve
66. Blood vessel carrying least CO_2 is
- Pulmonary vein
 - Pulmonary artery
 - Vena cava
 - Hepatic vein

67. Blood of which of the following is colourless?

- Earthworm
- Cockroach
- Leech
- Frog

68. In prawn, the heart pumps

- Deoxygenated blood
- Oxygenated blood
- Both (a) and (b)
- Mixed blood

Double Circulation and Regulation of Cardiac Activity

69. Pulmonary artery carries

- Deoxygenated blood from heart to lungs
- Deoxygenated blood from lungs to heart
- Oxygenated blood from heart to lungs
- Oxygenated blood from lungs to heart

70. Blood circulation that starts in capillaries and ends in capillaries is called

- Portal circulation
- Hepatic circulation
- Lymphatic circulation
- Renal circulation

71. The circulation which provides nutrients, O_2 and essential substances to the tissue and takes CO_2 and other harmful substances away for elimination is

- Systemic circulation
- Pulmonary circulation
- Double circulation
- Systematic circulation

72. The vessel that carries blood from intestine to the liver is called

- Hepatic vein
- Hepatic artery
- Hepatic portal vein
- Hepatic portal artery

73. A correct systemic circulation pathway is

- Right auricle \rightarrow Left ventricle \rightarrow Aorta \rightarrow Tissues \rightarrow Veins
- Right ventricle \rightarrow Pulmonary aorta \rightarrow Tissues \rightarrow Pulmonary veins \rightarrow Left auricle
- Left auricle \rightarrow Left ventricle \rightarrow Aorta \rightarrow Arteries \rightarrow Tissues \rightarrow Veins \rightarrow Right atrium
- Left auricle \rightarrow Left ventricle \rightarrow Pulmonary aorta \rightarrow Tissues \rightarrow Right auricle.

74. In which of the following, heart pumps mixed blood?

- Single circulation
- Incomplete double circulation
- Double circulation
- Both (a) and (b)

75. The artery can be distinguished from the vein in having

- Thicker walls
- Thinner walls
- More plasma
- Larger cavity

76. How many times a red blood corpuscle will have to pass through the heart in its journey from hepatic artery?
- Once
 - Two times
 - Four times
 - Several times
77. Pulmonary artery drains deoxygenated blood from
- Right ventricle
 - Right atrium
 - Left atrium
 - Left ventricle
78. All veins have deoxygenated blood except
- Renal artery
 - Hepatic vein
 - Hepatic portal vein
 - Pulmonary veins
79. What are the functions of double circulation?
- Systemic circulation of nutrients and gases.
 - Absorption of harmful substances
 - Carries blood from intestine to the kidney
 - All of these
80. A special neural centre that regulates the cardiac function through ANS is located in
- Medulla oblongata
 - Pons
 - Hypothalamus
 - Adrenal gland
81. Parasympathetic neural signals can
- Decrease the rate of heart beat
 - Increase the speed of conductance of action potential
 - Decrease the cardiac output
 - Both (a) and (c)
82. Sympathetic nerves can
- Decrease the rate of heart beat
 - Increase the strength of ventricular contraction
 - Increase the cardiac output
 - Both (b) and (c)
- Disorders of Circulatory System**
83. When the heart beat increases, the condition is called as
- Bradycardia
 - Tachycardia
 - Leucopenia
 - Cardiac arrest
84. When the heart muscle is suddenly damaged by an inadequate blood supply, it is called as
- Heart attack
 - Heart failure
 - Cardiac arrest
 - CAD
85. Angina occurs due to conditions that affects the
- Blood clotting
 - Blood flow
 - Closure of bicuspid and tricuspid valves
 - Opening of the semilunar valves
86. Most probable cause of heart attack is
- Vasomotion
 - Systolic pressure of 120 mm Hg
 - Atherosclerosis
 - High level of HDL
87. Thickening of arteries due to cholesterol deposition is
- Atherosclerosis
 - Rheumatic heart
 - Blood pressure
 - Cardiac arrest
88. Hardening of the arteries due to deposition of cholesterol is called
- Thrombosis
 - Atherosclerosis
 - Rhinitis
 - Stenosis
89. Myocardial infarction is caused by
- Hardening of arteries
 - Lumpy thickness development in the inner walls of arteries
 - Clot occurring in the lumen of a coronary artery
 - Sudden interruption in blood flow towards a portion of heart
90. Manifestation of increase in the blood pressure of a person is called
- Hypertension
 - Atherosclerosis
 - Arteriosclerosis
 - None of these
91. Rhythmic stretching of the arteries caused by heart contractions is called
- Hypertension
 - A heart murmur
 - Arteriosclerosis
 - Pulsation
92. If the PQ interval in a patients ECG is prolonged the possible cause can be
- Angina
 - Myocardial infarction
 - Ventricular hypertrophy
 - Inflammation of AV node

NCERT Based Questions



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1. Read the following statements and find out the incorrect statements.

- A. Blood is a loose connective tissue consisting of a fluid matrix, plasma and formed elements.
- B. Plasma is a straw coloured, viscous fluid constituting nearly 90-92 percent of the blood.
- C. 55 percent of plasma is water and proteins and contribute 6-8 percent of it
- D. Fibrinogen are needed for clotting or coagulation of blood.
- E. Factors for clotting of blood are present in the plasma in an inactive form.

- a. A, B and C
- b. B, C and D
- c. C, D and E
- d. A, B and E

2. Blood clotting can be prevented by the use of potassium oxalate. It is due to

- a. Checking of conversion of fibrinogen into fibrin
- b. Inactivation of all factors for blood coagulation
- c. Neutralisation of acidic medium
- d. Removal of free Ca^{2+} ions

3. Which of the following cells do not exhibit phagocytic activity?

- a. Monocytes
- b. Neutrophil
- c. Basophil
- d. Macrophage

4. One of the common symptoms observed in people infected with dengue fever is:

- a. Significant decrease in RBC count
- b. Significant decrease in WBC count
- c. Significant decrease in platelets count
- d. Significant increase in platelets count

5. Which among the following is correct during each cardiac cycle?

- a. The volume of blood pumped out by the right and left ventricles is same.
- b. The volume of blood pumped out by the right and left 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.

6. 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.

7. Mark the pair of substances among the following which is essential for coagulation of blood?

- a. Heparin and calcium ions
- b. Calcium ions and platelet factors
- c. Oxalates and citrates
- d. Platelet factors and heparin

8. Which of the following structures of the lymphatic system acts primarily as a filter for detecting and destroying microorganisms in lymph traveling through major lymph vessels?

- a. Lymph nodes
- b. Thymus
- c. Lymph capillaries
- d. Tonsil

9. Match the columns I and II, and choose the correct combination for, the options given.

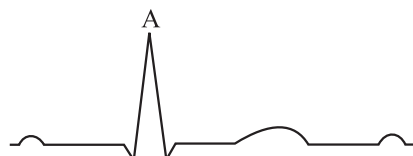
	Column I		Column II
A.	Eosinophils	1.	0.5—1%
B.	Basophils	2.	2—3%
C.	Neutrophils	3.	6—8%
D.	Lymphocytes	4.	20—25%
E.	Monocytes	5.	60—65%

- a. A-1, B-2, C-4, D-5, E-3
- b. A-2, B-1, C-5, D-4, E-3
- c. A-2, B-3, C-1, D-4, E-5
- d. A-2, B-1, C-4, D-3, E-5

10. A sample of blood shows clumping with antiserum A but not with antiserum B. The blood group would be

- a. O
- b. A
- c. B
- d. AB

11. In this figure, peak point (A) is represented by letter



- a. P
- b. Q
- c. R
- d. S

12. Match the columns I and II, and choose the correct combination from the options given.

	Column I (Organisms)		Column II (Circulation)
A.	Fishes	1.	Single circulation
B.	Amphibians	2.	Incomplete double circulation
C.	Reptiles	3.	Double circulation
D.	Birds		
E.	Mammals		

- a. A-1, B-1, C-2, D-2, E-3
- b. A-1, B-1, C-2, D-3, E-3
- c. A-1, B-2, C-2, D-3, E-3
- d. A-1, B-2, C-3, D-2, E-2

13. If oxygen saturation in mixed pulmonary blood is to be measured in blood drawn from a single place in the body, blood from which location will give the best results?
- Pulmonary artery
 - Pulmonary vein
 - Superior vena cava
 - Left ventricle
14. Which one of the following will be the cardiac output (in litres per minute) of a heart that has a stroke volume of 0.07 litres and is beating at a rate of 90 per minute?
- 63.30
 - 63.00
 - 00.63
 - 6.30
15. A unique vascular connection between the digestive tract and liver is called
- Hepatic portal system
 - Renal portal system
 - Hypophyseal portal system
 - Coronary system
16. During recording electrocardiogram, patient is connected to 3 electrical leads. These position are:
- Both wrists and left ankle
 - Left wrist and both ankles
 - 1 on chest, 1 on wrist and 1 on ankle
 - Both wrists and right ankle
17. What would be the cardiac output of a person having 72 heart beats per minute and a stroke volume of 50 mL?
- 360 mL
 - 3600 mL
 - 7200 mL
 - 5000 mL
18. Match the following columns.
- | | |
|---------------------|---|
| 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 |
- A-2 B-1 C-3 D-4
 - A-3 B-1 C-4 D-2
 - A-2 B-1 C-3 D-4
 - A-1 B-3 C-2 D-4
19. 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.
- Action mentioned in statement I is dependent on action mentioned in statement II.
 - Action mentioned in statement II is dependent on action mentioned in statement I.
 - Action mentioned in statement I and II are independent of each other.
 - Action mentioned in statement I and II are synchronous.
20. In ventricular systole, oxygenated blood is pumped into
- Pulmonary artery and deoxygenated into aorta
 - Aorta and deoxygenated into pulmonary vein
 - Pulmonary vein and deoxygenated into pulmonary artery
 - Aorta and deoxygenated into pulmonary artery
21. What happens when the pacemaker is non functional?
- Only the auricles will contract rhythmically
 - The cardiac muscles do not contract in a coordinated manner rhythmically
 - Only ventricles will contract rhythmically
 - Auricles and ventricles contract rhythmically
22. Heart valves function to
- Keep blood moving forward through the heart.
 - Mix blood thoroughly as it passes through the heart.
 - Control the amount of blood pumped by the heart
 - Slow blood down as it passes through the heart.
23. Which one represents pulmonary circulation?
- Left auricle (oxygenated blood) → Lungs (deoxygenated blood) → Right auricle
 - Left auricle (deoxygenated blood) → Lungs (oxygenated blood) → Right auricle
 - Left auricle (oxygenated blood) → Lungs (deoxygenated blood) → Left auricle
 - Right auricle (deoxygenated blood) → Lungs (oxygenated blood) → Left auricle
24. Continued consumption of diet rich in butter, red meat and eggs over long period may lead to
- Vitamin A toxicity
 - Kidney stones
 - Hypercholesterolemia
 - Urine laden with ketone bodies
25. In circulatory system, valves occur in
- Heart and blood vessels of both vertebrates and invertebrates as well as vertebrate lymphatics
 - Both vertebrate and invertebrate hearts
 - Vertebrate heart only
 - Both vertebrate and invertebrate hearts and their blood vessels
26. An artificial pacemaker is implanted subcutaneously and connected to the heart in patients
- Having 90% blockage of the three main coronary arteries
 - Having a very high blood pressure
 - With irregularity in the heart rhythm
 - Suffering from arteriosclerosis
27. You are required to draw blood from a patient and to keep it in a test tube for analysis of blood corpuscles and plasma. You are also provided with the following four types of test tubes. Which of them you will not use for the purpose?
- Test tube containing calcium bicarbonate
 - Chilled test tube
 - Test tube containing heparin
 - Test tube containing sodium oxalate

28. Which of the following correctly explains a phase/event in cardiac cycle in a standard electrocardiogram?
- QRS complex indicates atrial contraction.
 - QRS complex indicates ventricular contraction.
 - Time between S and T represents atrial systole.
 - P-wave indicates beginning of ventricular contraction.
29. Which of the following statements is incorrect?
- A person of 'O' blood group has anti 'A' and anti 'B' antibodies in his blood plasma
 - A person of 'B' blood group can't donate blood to a person of 'A' blood group
 - Blood group is designated on the basis of the presence of antibodies in the blood plasma
 - A person of AB blood group is universal recipient
30. A portal vessel is one in which
- A vein starts from an organ as capillaries & pours blood to vessel carrying blood to heart
 - An artery arises as capillaries in one organ and terminates as capillaries in the other organ
 - A vessel supplies oxygenated blood and collects deoxygenated blood
 - None of these
31. Origin of heart beat and its conduction is represented by
- AV node → Bundle of His → SA node → Purkinje fibres
 - SA node → Purkinje fibres → AV node → Bundle of His
 - Purkinje fibres → AV node → SA node → Bundle of His
 - SA node → AV node → Bundle of His → Purkinje fibres
32. Raising of pH of blood shall result in
- Inhibition of carbonic anhydrase
 - Production of carbon monoxide, causing carbon monoxide poisoning
 - Non-release of carbon dioxide from carbonic acid and carbonates
 - Non-dissociation of oxygen from oxyhaemoglobin
33. A recording of the electrical activity of a patient's heart shows that the atria are contracting regularly and normally, but every few beats the ventricles fail to contract. Which of the following is probably not functioning properly?
- AV node
 - Semilunar valve
 - Coronary artery
 - Pacemaker
34. Which of the following is not one of the reasons that closed circulatory systems are more efficient than open circulatory systems?
- Closed systems rely exclusively on simple diffusion for transport, whereas open systems rely on pumping mechanisms.
 - Transport within closed systems is more rapid than in open systems.
 - Blood can easily be directed to specific areas in closed systems, but not in open systems.
 - Closed systems operate better under higher pressure than open systems.
35. The cardiac pacemaker in a patient fails to function normally. The doctors find that an artificial pacemaker is to be grafted in him. It is likely that it will be grafted at the site of
- Atrioventricular bundle
 - Purkinje system
 - Sinoatrial node
 - Atrioventricular node
36. 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?
- Depolarisation of atria
 - Repolarisation of atria
 - Depolarisation of ventricles
 - Repolarisation of ventricles
37. Which of the following type of cells lack nucleus in humans?
- RBCs
 - Neutrophils
 - Eosinophils
 - Lymphocytes
38. Which one of the following blood cells is involved in antibody production?
- B-lymphocytes
 - T-lymphocytes
 - RBC
 - Neutrophils
39. Special body fluids for circulation and exchange of nutrients and waste between cells and surroundings, are found in
- Simple unicellular organisms
 - Simple multicellular organisms
 - Complex multicellular organisms
 - All living organisms
40. Emphysema damages the tissues of the lungs and slows pulmonary blood flow. This causes blood to back up, stretching and weakening the walls of the heart and blood vessels. Which of the following do you think would be most affected by this backup of blood from the lungs?
- Aorta
 - Right atrium
 - Left atrium
 - Right ventricle

Multi-Concept Questions

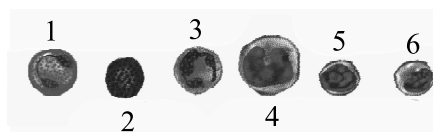


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- Choose the correct proportion with respect to the distribution of blood in the body of man:
 - 5% to heart muscles, 15% to brain, 25% to liver, 25% to kidney, 15% to bones, 15% to other organs.
 - 20% to heart muscles, 10% to brain, 10% to liver, 25% to kidney, 10% to bones, 25% to other organs
 - 10% to heart muscles, 10% to brain, 10% to liver, 40% to kidney, 15% to other organs
 - 10% to heart muscles, 20% to brain, 20% to liver, 15% to kidney, 5% to bones, 35% to other organs
- 2 and 4 chambered hearts are respectively found in:
 - Fishes and crocodiles
 - Reptiles and birds
 - Reptiles and mammals
 - Fishes and amphibians
- In SAN, when an action potential is initiated, which of the following do not occur?
 - Both atria contract simultaneously.
 - Blood flow from atria to ventricles increases by 60%
 - Blood from atria to ventricle passes through atrioventricular valves.
 - Volume of atria decreases.
- The process of formation of blood corpuscles is called:
 - Haemopoiesis
 - Hirudin
 - Haemozoin
 - None of these
- Leech secretes which of the following anticoagulant?
 - Heparin
 - Hirudin
 - Serotonin
 - Histamine
- Open circulatory system is present in
 - Arthropods
 - Annelids
 - Chordates
 - Molluscs
 - 2 and 3
 - 1 and 2
 - 2 and 4
 - 1 and 4
- Find out the incorrect statement from the following:
 - Veins have larger lumen than arteries.
 - Because of their small size, capillaries contain blood that is moving more quickly than in other parts of the circulatory system.
 - The walls of arteries are elastic, enabling them to stretch and shrink during changes in blood pressure
 - Veins contain more blood than any other part of the circulatory system.
- Thrombokinase is associated with
 - Production of erythrocytes from the bone marrow
 - Pulmonary and systemic circulation
 - Cardiac cycle and its regulation
 - Enzymatic reactions in coagulations of blood

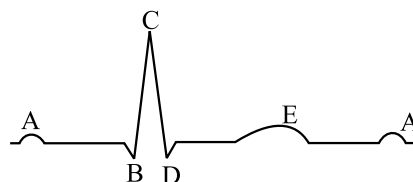
- Closure of which of the following makes louder sound of heart beat?
 - Mitral valve
 - Semilunar valve
 - Auriculo-ventricular valve
 - Tricuspid valve

- Identify the correct option with respect to WBC:



	Least abundant	Most abundant	Phagocytic WBC
a.	1	3	3, 6
b.	1	4	2, 3
c.	2	5	1, 3
d.	2	3	3, 4

- Select the correct option w.r.t E.C.G?



a.	A	P-Wave	End of atrial systole
b.	A-A	P-P interval	72 heart beats
c.	BCD	QRS Complex	Depolarisation of ventricles
d.	E	T - Wave	End of ventricular systole

- Read the following statement and find out incorrect statement.
 - In ECG, the contraction of ventricles starts immediately after the Q wave and marks the beginning of the diastole.
 - Adrenal medullary hormones can also increase the cardiac output.
 - High blood pressure leads to heart diseases and also affect vital organs like brain & kidney.
 - Ventricular systole increases the ventricular pressure causing the closure of tricuspid and bicuspid valves due to attempted back flow of blood into the atria.

13. Match the columns and find out the correct combination:

A.	Tunica externa	1.	Mesothelial cells
B.	Tunica media	2.	Single layer of epithelial cells
C.	Tunica intima	3.	Smooth, circular muscles
D.	Epicardium	4.	Elastic, collagen fibres

- A-4 B-3 C-2 D-1
- A-4 B-2 C-3 D-1
- A-3 B-4 C-2 D-1
- A-3 B-2 C-1 D-4

14. Match the columns and find out the correct combination:

A.	Chordae tendineae	1.	Closure of aortic valves
B.	AV node	2.	Right atrium
C.	Second heart sound	3.	Interatrial septum
D.	SA node	4.	Heart string

- A-3 B-1 C-2 D-4
- A-4 B-3 C-1 D-2
- A-2 B-1 C-4 D-3
- A-4 B-2 C-3 D-1

15. Read the following statements and choose incorrect one.

- Neural signal through sympathetic nerves can increase the strength of ventricular contraction
- RBCs have a fixed life span of 120 days after which they are destroyed in the thymus
- Basophils are least in number among all WBCs
- During a cardiac cycle each ventricle pumps approximately 70 ml blood which is called stroke volume

16. Choose correct statement for apex of ventricles.

- Normally it remains tilted towards the right side.
- Apex is present in right ventricle.
- From apex SVC enters inside the heart.
- From apex purkinje fibres arises.

17. Read the following statements carefully and choose incorrect one.

- Lymph is a colourless fluid containing special lymphocytes
- Interventricular septum is thick walled and it separates left and right ventricles
- Lymph is the only carrier for nutrients, hormones etc.
- All the nodal musculature of heart is autoexcitable.

18. Consider the following steps and choose option which have all correct statement.

- Formation of fibrins by the conversion of inactive fibrinogens in the plasma by the enzyme thrombin
- Prothrombin is the precursor of thrombin which is secreted by thrombocytes
- Thrombocytes releases certain factors which activates the mechanism of coagulation
- Blood exhibits coagulation or clotting in response to an injury or trauma
- Role of calcium ions in clotting is insignificant.

- A, B, C and D
- A, C and D
- A, B, C and E
- B, D and E

19. Choose the correct statement

- The T-wave in an ECG represents excitation of ventricles
- The sum of P and T waves in a given time period can determine the heart beat rate of an individual
- The end of the P-wave marks the end of the systole
- In a standard ECG, a person is connected to the machine with three electrical leads.

20. Read the following statements carefully and choose how many statement are wrong.

- Nodal musculature has the ability to generate action potential due to external stimuli.
- SAN is responsible for initiating and maintaining the rhythmic contractile activity of heart.
- The duration of cardiac cycle is 0.7 seconds
- During joint diastole tricuspid and bicuspid valves are open.

- Two
- Three
- One
- Four

21. Read the following statements carefully and choose correct statements.

- During the joint diastole, bicuspid and tricuspid valve remains closed.
- The valves in the heart allows the flow of blood only in one direction, i.e., from the ventricles to the atria.
- Each peak in the ECG is identified with a letter from P to T that corresponds to a specific neural activity of the heart.
- During atrial systole, left atria pumps blood with more pressure than the right atria.

22. Read the following statements and choose incorrect one.
- Heart is autoexcitable and its functions can be moderated by neural and hormonal mechanism.
 - The systole forces the blood to move from the atria to the ventricles and to the pulmonary artery and the aorta.
 - All vertebrates and a few invertebrates have a closed circulatory system.
 - Lymph is almost similar to blood except for the formed elements.
23. Read the following statement and choose correct one.
- RBC have an average life span of 120 days after which all these are destroyed in liver.
 - Basophils secrete histamine, serotonin, heparin, etc. and are involved in inflammatory reactions.
 - Leucocytes are non-nucleated cells and are relatively lesser in number.
 - Eosinophils are maximum among granulocytes.
24. Read the following statements and choose incorrect one.
- In the case of angina, a symptom of acute chest pain appears.
 - Heart failure is not the same as cardiac arrest but similar to a heart attack.
 - Heart is auto excitable and its functions can be moderated by neural and hormonal mechanisms.
 - Blood comprises of a fluid matrix plasma and formed elements.
25. If a person had two-chambered heart (one atrium, and one ventricle) with the vena cava entering the atrium and the aorta leaving the ventricle then which of the following statement would be correct?
- No oxygen would reach the cells
 - No blood would reach the head and neck
 - The blood would be unable to carry food to the cells
 - There would be no blood to the cells
26. "X" is a fibrous tissue of the membranous septum of the heart just above the septal cusp of the tricuspid valve. It separates the atrium and the ventricle of the same side. Identify "X"?
- Sino atrial node
 - Atrioventricular septum
 - Atrioventricular node
 - Interventricular septum
27. A person suffers from slow, i.e., delayed blood clotting leading to excessive loss of blood from the body. Which of the following can be a probable reason for this?
- Thrombocytosis
 - Thrombocytopenia
 - Defect in the synthesis of Castle's intrinsic factor
 - Defective absorption and storage of folic acid
28. What will happen if the neuromuscular conduction pathway in heart is broken between SA node and AV node?
- Auricles will contract due to impulse generated by SA node, while ventricles will not show any activity
 - No contraction or heart beat will be seen in heart
 - Auricles will contract at the rate set by the SA node while ventricles will contract at the rate of impulse generated by the AV node
 - There will be no effect on the activity of heart

NEET Past 10 Year Questions



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- The QRS complex in a standard ECG represents: (2020)
 - Depolarisation of auricles
 - Depolarisation of ventricles
 - Repolarisation of ventricles
 - Repolarisation of auricles
- Match the following columns and select the correct option (2020)

	Column - I		Column - II
1.	Eosinophils	(i)	Immune response
2.	Basophils	(ii)	Phagocytosis
3.	Neutrophils	(iii)	Release histaminase, destructive enzymes
4.	Lymphocytes	(iv)	Release granules containing histamine

- (1) (2) (3) (4)
 - (iv) (i) (ii) (iii)
 - (i) (ii) (iv) (iii)
 - (ii) (i) (iii) (iv)
 - (iii) (iv) (ii) (i)
- Which of the following is associated with decrease in cardiac output? (2020 Covid Re-NEET)
 - Parasympathetic neural signals
 - Pneumotaxic centre
 - Adrenal medullary hormones
 - Sympathetic nerves
 - Which of the following conditions cause erythroblastosis foetalis? (2020 Covid Re-NEET)
 - Mother Rh^{-ve} and foetus Rh^{+ve}
 - Both mother and foetus Rh^{-ve}
 - Both mother and foetus Rh^{+ve}
 - Mother Rh^{+ve} and foetus Rh
 - What would be the heart rate of a person if the cardiac output is 5 L, blood volume in the ventricles at the end of diastole is 100 mL and at the end of ventricular systole is 50 mL? (2019)
 - 50 beats per minute
 - 75 beats per minute
 - 100 beats per minute
 - 125 beats per minute

- Match the Column-I with Column-II (2019)

	Column I		Column II
A.	P - wave	i.	Depolarisation of ventricles
B.	QRS complex	ii.	Repolarisation of ventricle
C.	T - wave	iii.	Coronary ischemia

D.	Reduction in the size of T-wave	iv.	Depolarisation of atria
		v.	Repolarisation of atria

Select the correct option.

- A-iv B-i C-ii D-iii
 - A-iv B-i C-ii D-v
 - A-ii B-i C-v D-iii
 - A-ii B-iii C-v D-iv
- Match the items given in Column I with those in Column II and select the correct option given below: (2018)

	Column I		Column II
A.	Tricuspid valve	i.	Between left atrium and left ventricle
B.	Bicuspid valve	ii.	Between right ventricle and pulmonary artery
C.	Semilunar valve	iii.	Between right atrium and right ventricle

- A-iii B-i C-ii
 - A-i B-iii C-ii
 - A-i B-ii C-iii
 - A-ii B-i C-iii
- Match the items given in Column I with those in Column II and select the correct option given below (2018)

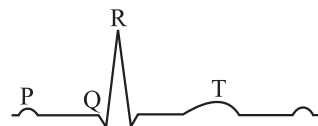
	Column I		Column II
A.	Fibrinogen	i.	Osmotic balance
B.	Globulin	ii.	Blood clotting
C.	Albumin	iii.	Defence mechanism

- A-iii B-ii C-i
 - A-i B-ii C-iii
 - A-i B-iii C-ii
 - A-ii B-iii C-i
- Frog's heart when taken out of the body continues to beat for some time (2017-Delhi)

Select the best option from the following statements

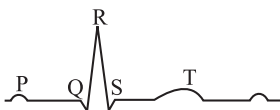
 - Frog is a poikilotherm
 - Frog does not have any coronary circulation
 - Heart is "myogenic" in nature
 - Heart is autoexcitable
 - Only (A)
 - Only (D)
 - (A) & (B)
 - (C) & (D)

10. Adult human RBCs are enucleate. Which of the following statement(s) is/are most appropriate explanation for this feature? (2017-Delhi)
- They do not need to reproduce
 - They are somatic cells
 - They do not metabolise
 - All their internal space is available for oxygen transport
- Only (D)
 - Only (A)
 - (A), (C) and (D)
 - (B) and (C)
11. The hepatic portal vein drains blood to liver from (2017-Delhi)
- Heart
 - Stomach
 - Kidneys
 - Intestine
12. All the components of the conducting system can generate an action potential for the contraction of heart muscle, but the sino-atrial node acts as the pacemaker because: (2017-Gujarat)
- The sino-atrial node has a lower inherent rate of depolarisation
 - All the other components in heart cannot conduct the action potential
 - Only the sino-atrial node is auto-excitabile and auto-rhythmic
 - The sino-atrial node has a higher inherent rate of depolarisation
13. In the heart, as the action potential reaches the AV node from the SA node, there is a delay of the action potential. This delay is important because: (2017-Gujarat)
- It allows right atria to receive the blood from vena cava
 - It allows atria to rest
 - It allows a stronger right atrial contraction
 - It allows ventricles to receive all the blood from the atria
14. Serum differs from blood in: (2016 - II)
- Lacking clotting factors
 - Lacking antibodies
 - Lacking globulins
 - Lacking albumins
15. Name the blood cells, whose reduction in number can cause clotting disorder, leading to excessive loss of blood from the body. (2016 - II)
- Neutrophils
 - Thrombocytes
 - Erythrocytes
 - Leukocytes
16. Blood pressure in the pulmonary artery is: (2016 - I)
- Same as that in the aorta
 - More than that in the carotid
 - More than that in the pulmonary vein
 - Less than that in the vena cava
17. Blood pressure in the mammalian aorta is maximum during: (2015)
- Systole of the left ventricle
 - Diastole of the right atrium
 - Systole of the left atrium
 - Diastole of the right ventricle
18. Which one of the following is correct? (2015)
- Lymph = Plasma + RBC + WBC
 - Blood = Plasma + RBC + WBC + Platelets
 - Plasma = Blood – Lymphocytes
 - Serum = Blood + Fibrinogen
19. Erythropoiesis starts in: (2015)
- Spleen
 - Red bone marrow
 - Kidney
 - Liver
20. Which one of the following animals has two separate circulatory pathways? (2015 Re)
- Lizard
 - Whale
 - Shark
 - Frog
21. If you suspect major deficiency of antibodies in a person, to which of the following would you look for confirmatory evidences? (2015 Re)
- Serum albumins
 - Haemocytes
 - Serum globulins
 - Fibrinogen in plasma
22. Doctors use stethoscope to hear the sounds produced during each cardiac cycle. The second sound is heard when: (2015 Re)
- Ventricular walls vibrate due to pushing in of blood from atria
 - Semilunar valves close down after the blood flows into vessels from ventricles
 - AV node receives signal from SA Node
 - AV valves open up
23. Person with blood group AB is considered as universal recipient because he has: (2014)
- Both A and B antigens in the plasma but no antibodies
 - Both A and B antigens on RBC but no antibodies in the plasma
 - Both A and B antibodies in the plasma
 - No antigen on RBC and no antibody in the plasma
24. The diagram given here is the standard ECG of a normal person. The P-wave represents the: (2013)



- End of systole
- Contraction of both the atria
- Initiation of the ventricular contraction
- Beginning of the systole

25. The most abundant intracellular cation is: (2013)
a. K^+ b. Na^+
c. Ca^{++} d. H^+
26. A certain road accident patient with unknown blood group needs immediate blood transfusion. His one doctor friend at once offers his blood. What was the blood group of the donor? (2012 Pre)
a. Blood group A b. Blood group B
c. Blood group AB d. Blood group O
27. A person with unknown blood group under ABO system has suffered much blood loss in an accident and needs immediate blood transfusion. His one friend, who has a valid certificate of his own blood type, offers for blood donation without delay. What would have been the type of blood group of the donor friend? (2011 Pre)
a. Type A b. Type B
c. Type AB d. Type O
28. Given below is the ECG of a normal human. Which one of its components is correctly interpreted below? (2011 Mains)



- a. Peak P and Peak R together – Systolic and Diastolic blood pressures
b. Peak P – Initiation of left atrial contraction only

- c. Complex QRS – One complete pulse
d. Peak T – Initiation of total cardiac contraction
29. Which one of the following statements is correct regarding blood pressure? (2011 Pre)
a. 190/110 mmHg may harm vital organs like brain and kidney
b. 130/90 mmHg is considered high and requires treatment
c. 100/55 mmHg is considered an ideal blood pressure
d. 105/50 mmHg makes one very active
30. Which one of the following plasma proteins is involved in the coagulation of blood? (2011 Pre)
a. Fibrinogen b. An albumin
c. Serum amylase d. A globulin
31. 'Bundle of His' is a part of which one of the following organs in humans? (2011 Pre)
a. Pancreas b. Brain
c. Heart d. Kidney
32. Arteries are best defined as the vessels which: (2011 Pre)
a. Carry blood from one visceral organ to another visceral organ
b. Supply oxygenated blood to the different organs
c. Carry blood away from the heart to different organs
d. Break up into capillaries which reunite to form a vein

Answer Key

Topic-wise Questions

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
d	c	a	b	c	d	d	d	c	c	c	a	c	c	c	d	a	c
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
b	a	c	a	b	d	a	c	c	a	b	c	c	b	d	d	c	d
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
a	d	c	a	a	c	c	a	b	d	d	b	a	c	d	b	c	a
55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
d	a	b	d	a	b	b	d	d	a	b	a	b	b	a	a	a	c
73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
c	b	b	b	a	d	a	a	d	d	b	a	b	c	a	b	d	a
91	92																
d	d																

NCERT Based Questions

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
a	d	c	c	a	b	b	a	b	b	c	c	d	d	a	a	b	b
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
d	d	b	a	d	c	a	c	a	b	c	d	d	a	a	a	c	b
37	38	39	40														
a	a	c	d														

Multi-Concept Questions

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
c	a	b	a	b	d	b	d	c	d	d	a	a	b	b	d	c	b
19	20	21	22	23	24	25	26	27	28								
d	a	d	d	b	b	a	b	b	c								

NEET Past 10 Year Questions

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
b	d	a	a	c	a	a	d	d	a	d	d	d	a	b	c	a	b
19	20	21	22	23	24	25	26	27	28	29	30	31	32				
b	b	c	b	b	b	a	d	d	c	a	a	c	c				