DAY TWENTY ONE

Body Fluids and Circulation

Learning & Revision for the Day

- Blood
- Lymph
- Circulatory System
- Human Circulatory System
- Double Circulation
- Disorders of Circulatory System

Blood

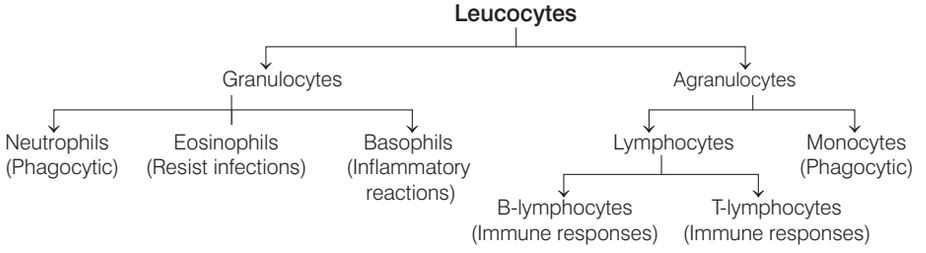
Blood is the most common body fluid connective tissue, which transports nutrients, oxygen, essential substances and collects harmful substances for excretion from tissues. Blood is a special connective tissue containing a fluid matrix, plasma and the formed elements.

(i) **Plasma** is a straw coloured, viscous fluid constituting about 55% of blood. It contains fibrinogen, globulins, albumins, small amount of minerals like Na^+, Ca^{2+}, Mg^{2+}, HCO_3^-, Cl^-, glucose, amino acids, lipids, etc., and factors for coagulation.

(ii) **Formed elements** in blood are erythrocytes, leucocytes and platelets, which are about 45% of blood.

- **Erythrocytes** or **Red Blood Cells** (RBCs) are the most abundant elements. RBCs are devoid of nucleus (nucleated in animals like frog) and biconcave in shape. RBCs are formed in red bone marrow. A healthy person has 12-16 g of haemoglobin in every 100 mL of blood. RBCs have an average life span of 120 days, after which they are destroyed in the spleen.
- **Leucocytes** or **White Blood Cells** (WBCs) are nucleated and less in number of (average 6000-8000/mm^3 of blood).

Leucocytes are mainly of two types :



Platelets or thrombocytes are cell fragments produced by megakaryocytes (special cells in bone marrow). Blood contains about 1,500,00-3,500,00 platelets mm^{-3}. Platelets are involved in clotting of blood.

Blood Groups

Two types of blood grouping are widely used all over the world in humans. A **ABO blood** group is based on the presence or absence of two surface antigens on the RBCs, i.e. A and B. The plasma also contains two natural antibodies.

Blood Groups and Donor Compatibility

Blood	Antigen 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

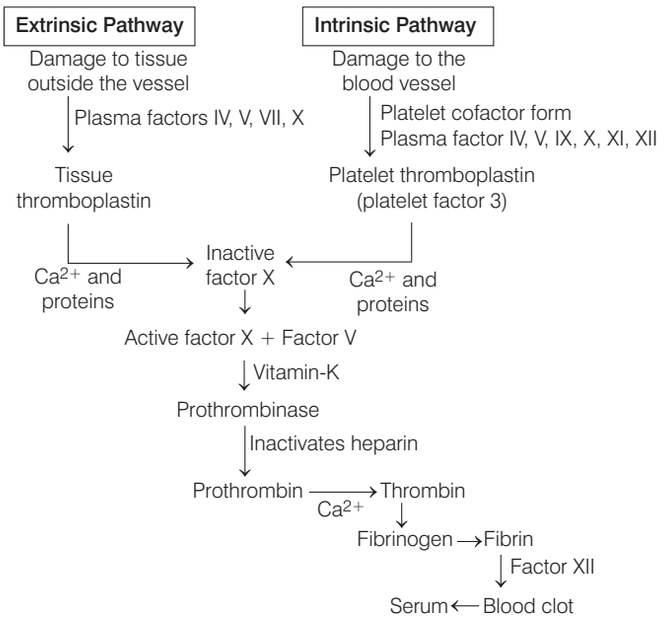
Person with blood group AB is called, **universal recipient** while person with blood group O is called **universal donor**.

Rh Group

- Rh group is based on Rh-antigen similar to that present in rhesus monkey, it is also observed on the surface of RBCs of about 80% of humans. Such persons are called **Rh positive** (Rh^+) and those, in whom antigen is lacking are called **Rh negative** (Rh^-).
- Rh group should be matched before transfusion. An Rh^- person, if exposed to Rh^+ blood, will form specific antibodies against the Rh antigens.
- The Rh^- blood of a pregnant mother does not mix with Rh^+ antigens of the foetus in the first pregnancy as two bloods will be separated by the placenta. However, during delivery of the first child maternal blood may be exposed with the Rh^+ blood of the foetus. In such cases, the mother starts preparing antibodies against Rh antigen in her blood.
- In case of further pregnancies, the Rh antibodies of mother (Rh^-) can leak into the blood of the foetus (Rh^+) and destroy the foetal RBCs.
- This could be fatal to the foetus and the condition is called **erythroblastosis foetalis**. This can be avoided by administering anti-Rh antibodies to the mother immediately after the delivery of first child.

Coagulation of Blood

- In an injured or cut site, a clot or coagulation is formed mainly of a network of threads called **fibrins.** Dead and damaged formed elements of blood are trapped in fibrins.
- Fibrins are formed by the conversion of inactive fibrinogens in the plasma by the enzyme thrombin.
- Thrombins are formed from prothrombin. An enzyme, thrombokinase is required for this reaction.
- Coagulation of blood occurs by a series of linked enzyme reactions (cascade process) involving a number of factors present in plasma. Calcium ions also play an important role in clotting.
- The pathways or mechanisms of blood clotting are of two types, i.e. extrinsic pathway and intrinsic pathway. It can be summarised as follows :



Lymph

- The fluid collected in the spaces between the cells of tissues is called **lymph** or **interstitial fluid** or **tissue fluid**.
- Lymph contains water and same mineral contents as in plasma. The network of vessels called **lymphatic system** collects this fluid and drains it back to the major veins.
- Lymph is a colourless fluid containing special lymphocytes responsible for the immune responses of the body.
- Functions of lymph are as follows
  - Exchange of nutrients, gases, hormones, etc., occur through it.
  - It is responsible for the immune responses of the body.
  - Fats are absorbed through lymph in the lacteals present in the intestinal villi.

Circulatory System

In higher and multicellular organisms, there is no direct supply of useful materials and removal of wastes from the body cells so, they need a transport system called **circulatory system**. The circulatory system are generally of two types

1. In **open circulatory system**, blood pumped by the heart passes through the large vessels into open spaces or body cavities called **sinuses**.
   - This system is found in leeches among the annelids, cockroach, prawns, insects, spiders, starfish, etc.
   - Blood flows with very slow velocity and at low pressure. In cockroach, blood circulation is completed in 5-6 min.
2. In **closed circulatory system**, the blood pumped by the heart is always circulated through a closed network of blood vessels.
   - It is found in earthworm, *Nereis*, molluscs and all vertebrates. Blood flows with high speed and at high pressure.
   - Exchange of materials occurs through the tissue fluids.

Human Circulatory System

- The blood vascular system transports nutrients like glucose, fatty acids, vitamins, etc., from the site of absorption to different parts of the body.
- It transports nitrogenous wastes like ammonia, urea, uric acid, etc., from different parts of the body to the organ of excretion.
- It transports hormone from the endocrine glands to target organs. It transports water and other chemical substances all over the body. It transports oxygen to different cells and tissues of the body from lungs.
  Blood vascular system consists of three components, i.e. heart, blood vessels and blood.

Blood Vessels

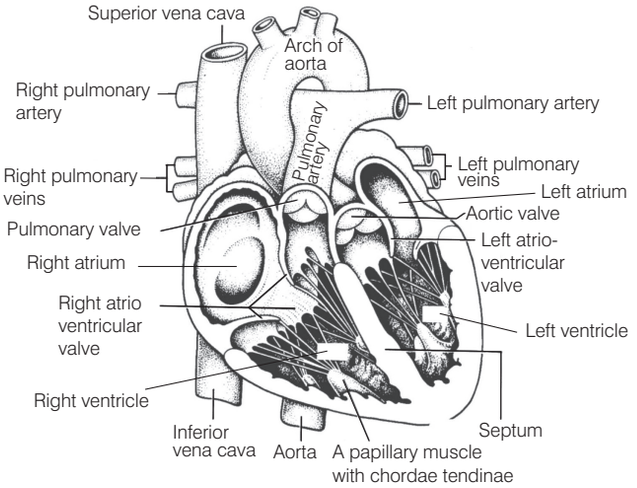
Blood vessels are generally of three types

1. **Arteries** are thick-walled blood vessels which carry the blood away from the heart to various body parts.
   - They are deep seated in body and have no valves in them.
   - Carry oxygenated blood in them, except the pulmonary artery, which carries deoxygenated blood to the lungs. Blood flows at high pressure with high speed.
2. **Veins** are thin-walled blood vessels.
   - Carry blood away from various body parts to the heart.
   - Superficial in position and have valves in them to prevent back flow of blood in them, blood flows at low pressure with slow speed.
   - Carry deoxygenated blood in them except the pulmonary vein, which carries oxygenated blood to the heart.
3. **Capillaries** are thinnest blood vessel. These connect arteries to the veins.
   - Each capillary is lined by a single layer of flat cells.
   - These help in exchange of materials like nutrients, gases, waste products, etc., between blood and cells.

Structure of Human Heart

Heart is a thick, muscular, automatic pulsating and contractile organ.

- A fish has only two-chambered heart (one auricle and one ventricle).
- In amphibians, heart is three-chambered.



Internal structure of human heart

- Reptilian heart is structurally three-chambered but functionally four-chambered (i.e. incomplete four-chambered) except in crocodile.
- In crocodiles, birds and mammals, the heart is divided into four chambers (two auricles and two ventricles).
- The human heart is four-chambered, i.e. two auricles and two ventricles.

  (i) **Right auricle** receives deoxygenated blood from superior vena cava and inferior vena cava. Right auricle opens in right ventricle through a wide circular right auriculoventricular aperture guarded by tricuspid valve. Tricuspid valve regulates unidirectional flow of blood from right auricle to right ventricle.

Differences between Tricuspid Valve and Bicuspid (Mitral) **Valve**

Character	Tricuspid Valve	Bicuspid (Mitral) Valve
Location	Guards the right atrioventricular aperture.	Guards the left atrioventricular aperture.
Structure	Formed of three flaps of different sizes.	Formed of two flaps of equal size.
Function	Prevents back flow of blood from right ventricle to right auricle.	Prevents backflow of blood from left ventricle to left auricle.

(ii) **Right ventricle** gives off blood into a large blood vessel called pulmonary artery leading to the lungs, which carries deoxygenated blood to the lungs.

(iii) **Left auricle** receives oxygenated blood from lungs through pulmonary vein. They have no valve. Left auricle opens in left ventricle by an aperture called left auriculoventricular aperture.

- This aperture is guarded by bicuspid valve (mitral valve). Bicuspid valve prevents back flow of blood from left auricle to left ventricle.

(iv) **Left ventricle** gives off blood into a large blood vessel called the **aorta**. It carries oxygenated blood to various body parts. The thickest part of the human heart is the wall of the left ventricle.

- Heart is made up of cardiac muscles. A nodal tissue (specialised cardiac musculature) is also distributed in heart. A patch of nodal tissue is present in the right upper corner of the right atrium called the Sino-Atrial Node (SAN). Another mass of this tissue is present in lower left corner of the right atrium close to the atrio-ventricular septum called Atrio-Ventricular Node (AVN).
- A bundle of nodal fibres, atrioventricular bundle (AV node) continues from the AVN and divides into a right and left bundle. These branches give rise to minute fibres called Purkinje fibres. These fibres alongwith right and left bundles are known as bundle of His. The nodal musculature is autoexcitable.
- The SAN can generate the maximum number of action potentials, i.e. 70-75 min^{-1} and is responsible for rhythmic contractile activity of the heart. Therefore, it is called **pacemaker**. The human heart beats about 70-75 times per minute.

NOTE

- The pressure created by the blood on the walls of the blood vessels due to the repeated pumping of heart is called **blood pressure.** It can be felt at certain places in our body *viz.*, wrist of the hands, etc. The rate of pulsation increases during excitement.
- Blood pressure is recorded as systolic/diastolic. Blood pressure in a normal person = 120 / 80 mm Hg. Factors affecting blood pressure are age, cardiac output, total peripheral resistance, etc.

Cardiac Cycle

- It refers to the repeating pattern of systole and diastole of the heart. Each cycle of atrial and ventricular systole and diastole is of 0.8 second.
- In the beginning, all the four chambers of heart are in a relaxed state, i.e. joint diastole.
- The bicuspid and tricuspid valves open and blood from pulmonary veins and vena cava flows into the left and right ventricle respectively through the left and right atria.
- SAN now generates action potential leading to atrial systole. The action potential is conducted to the ventricular side by the AVN and AV bundle from where, the bundle of His transmits through the entire ventricular musculature.
- This leads to ventricular systole, which increases the ventricular pressure causing the closure of tricuspid and bicuspid valves.
- As the ventricular pressure increases further the semilunar valves are forced open, allowing the blood in the ventricles to flow into pulmonary artery (right ventricle) and aorta (left ventricle).
- 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. The ventricles and atria are now again in a relaxed (joint diastole) state as earlier.
- The SA node again generates a new action potential and the events above are repeated in sequence and the process continues.
- This sequential event in heart is called cardiac cycle and it consists of systole and diastole of both atria and ventricles. Many such cardiac cycles are performed per minute.

Cardiac Output

- During a cardiac cycle, each ventricle pumps out about 70 mL of blood called the **stroke volume**. Cardiac output is the volume of blood pumped out of each ventricle per minute and averages 5000 mL or 5 L in a healthy individual.
- Cardiac output = Stroke volume × Heart rate
- The cardiac output of an athlete is much higher than that of an ordinary man.

Heartbeat

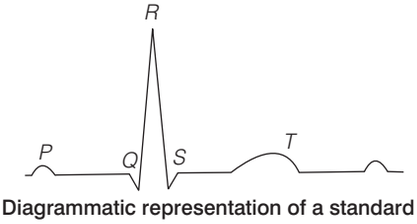
- Heartbeat is the rhythmic contraction and expansion movement of heart. The movements of heartbeat are similar to the contraction and dilation of ventricles.
- The rate of heartbeat is 72 per min in adult male and little higher in women, children, infants, during exercise, fever and excitement.
- A heartbeat has two components, systole and diastole. These components produce sounds like lub and dubb.
- Stethoscope is used to listen heartbeat on the left side of the chest.
- **Pacemaker** is a medical support instrument implanted artificially to stimulate a heart to beat. Its used when there is disturbance in natural pacemaking as in case of ventricular escape.

Heart Sounds

- The beating of heart produces **sounds**, heard by stethoscope. There are four heart sounds designated as S_1, S_2, S_3 and S_4.
- **First sound** (lubb – S_1) is a long and louder sound created by the closure of atrioventricular valves (tricuspid and bicuspid) at the beginning of ventricular systole.
- **Second sound** (dubb – S_2) is a short and sharper sound created by the closure of semilunar valves towards the end of ventricular systole (beginning of ventricular diastole).
- The S_3 and S_4 may not be audible but are usually faint. These sounds are associated with the rapid ventricular filling (S_3) and atrial systole (S_4).

Regulation of Cardiac Activity and ECG

- The activities of heart are auto regulated by nodal tissues, hence, the heart is called **myogenic**.
- A special neural cell in the medulla oblongata regulates the cardiac function through Autonomic Nervous Systems (ANSs).
- Neural signals through the sympathetic nerves can increase the rate of heartbeat, the strength of ventricular contraction and thereby cardiac output.
- The parasympathetic neural signals decrease the rate of heartbeat, speed of conduction of action potential and thereby the cardiac output. Adrenal medullary hormones also increase the cardiac output.
- **Electrocardiogram** is a graphical representation of the electrical activity of the heart during a cardiac cycle. The machine used to obtain this graph is called **electrocardiograph**.
- The P-wave in ECG represents the electrical excitation or depolarisation of the atria, which leads to the contraction of both the atria. The QRS complex represents the depolarisation of the ventricles, which initiate the ventricular contraction. The contraction starts shortly after Q and marks the beginning of the systole.
- The T-wave represents the return of the ventricles from excited to normal state (repolarisation). The end of the T-wave marks the end of systole. By counting the QRS complex, the idea of number of heartbeat per minute can be obtained. Any deviation from the usual shape, indicates an abnormality.



Diagrammatic representation of a standard ECG

- ECG gives accurate analysis about the functioning of heart and its chambers.
- It indicates the functioning of heart valves.
- It helps in identification of any damage or injury of heart.

Double Circulation

- The blood pumped by the right ventricle enters the pulmonary artery, whereas the left ventricle pumps blood into the aorta.
- The deoxygenated blood pumped into the pulmonary artery is passed on to the lungs from, where the oxygenated blood is carried by the pulmonary veins into left atrium. This pathway is called **pulmonary circulation**.
- The oxygenated blood entering the aorta is carried by a network of arteries, arterioles and capillaries to the tissues from, where the deoxygenated blood is collected by a system of venules, veins and vena cava and emptied into the right atrium.
- This is **systemic circulation**, which provides nutrients, O_2 and other essential substances to the tissues and takes CO_2 and other harmful substances for elimination.
- A connection between digestive tract and liver is called **hepatic portal system**. The hepatic portal vein carries blood from intestine to the liver before it is delivered to systemic circulation.

Disorders of Circulatory System

Some disorders of circulatory system are as follows

1. If a person has persistent high blood pressure, then it is called **hypertension**. It is 150/90 mmHg. The factors responsible are over eating, fear, worry, anxiety, sorrow, etc. **Hypotension** is a condition of low blood pressure, i.e. persistent 100/50 mmHg.
2. **Coronary Artery Disease** (CAD) It is also called as artherosclerosis. It affects blood vessels, caused by the deposition of calcium, fat, cholesterol and fibrous tissues, which makes the lumen of arteries narrower.
3. **Angina pectoris** is a symptom of acute chest pain, where no oxygen reaches the heart muscles. It is more common in middle-aged and elderly and affects blood flow.
4. **Heart failure** is the state, when heart is not pumping enough blood to meet the body demands. It is also called **congestive heart failure** because of congestion of lungs (main symptom).
   - Heart failure is different than cardiac arrest, where heart stops beating or a heart attack, when the heart muscle is suddenly damaged by an inadequate blood supply.
   - Blood flow is lowest in blood capillaries.
   - A thrombosis in the blood vessels of brain is called a **stroke**.
   - Cardiomegaly-Heart enlargement.

DAY PRACTICE SESSION 1

FOUNDATION QUESTIONS EXERCISE

1 Blood is a specialised connective tissue consisting of
(a) fluid matrix (b) plasma
(c) formed elements (d) All of these

2 Granules are not visible in
(a) neutrophils (b) lymphocytes
(c) eosinophils (d) basophils

3 Which of the following options describes all the components of human blood?
(a) A and B blood groups
(b) AB and O blood groups
(c) Rh and ABO blood groups
(d) Rh and AB blood groups

4 Individuals having Rh antigen are called
(a) Rh negative (Rh–ve) (b) Rh positive (Rh + ve)
(c) Rh (±) (d) Rhesus positive

5 Lymph is a colourless fluid containing specialised
(a) RBCs (b) lymphocytes
(c) cells (d) long lined cells

6 The chief function of the serum albumin in the blood is to
(a) produce antibodies
(b) form fibrinogen
(c) maintain colloidal osmotic pressure
(d) remove waste products

7 What is correct regarding leucocytes?
(a) These can squeeze out through (can cross) the capillary walls
(b) These are enucleate
(c) Sudden fall in their number indicates cancer
(d) These are produced in thymus

8 Which of the following is not correct?
(a) Neutrophils are most abundant RBCs
(b) Rh^- person, if exposed to Rh^+ blood will form specific antibodies against the Rh antigens
(c) Fishes have 2-chambered heart
(d) Calcium ions play a very important role in clotting

9 A haemoglobin measurement of 15 g /100 mL (or 1 dL) of blood is
(a) within the normal limits
(b) subnormal
(c) above normal
(d) low, but satisfactory

10 Which one of the following is correct?
(a) Plasma= Blood – Lymphocytes → CBSE-AIPMT 2015
(b) Serum = Blood + Fibrinogen
(c) Lymph = Plasma +RBC + WBC
(d) Blood = Plasma + RBC + WBC + Platelets

11 Grouping of ABO blood is based on the
(a) surface antigens present on RBCs
(b) surface lipids present on the cell membrane
(c) nature of all constituents
(d) nature of RBC and WBC

12 Person with blood group AB is considered as universal recipient because he has → CBSE-AIPMT 2014
(a) both A and B antigens on RBC but no antibodies in the plasma
(b) both A and B antibodies in the plasma
(c) no antigen on RBC and no antibody in the plasma
(d) both A and B antigens in the plasma but no antibodies

13 What will happen if an Rh –ve person is exposed to the Rh + ve person?
(a) Antigen formation takes place
(b) –ve and + ve Rh antigen cancel out each other
(c) Nothing will happen
(d) Antibody will form

14 Haemolytic disease in the newborns occurs due to passage of ..... in foetus through mother's blood.
(a) anti Rh antibodies (b) Rh antigens
(c) ABO antibodies (d) None of these

15 Factor II a glycoprotein synthesised in liver by vitamin-K is
(a) fibrin
(b) accelerin
(c) thrombin
(d) prothrombin

16 If you suspect major deficiency of antibodies in a person. Which of the following would you look for as confirmatory evidence? → CBSE-AIPMT 2015
(a) Fibrinogen in plasma (b) Serum albumin
(c) Haemocytes (d) Serum globulins

17 The formed elements are
(a) proteins, leucocytes and mineral ions
(b) erythrocytes, leucocytes and thrombocyte
(c) erythrocytes and thrombocytes
(d) None of the above

18 Adult human RBCs are enucleate. Which of the following statement(s) is/are most appropriate explanation for this feature? → NEET 2017
I. They do no need to reproduced
II. They are somatic cells
III. They do not metabolise
IV. All their internal spaces are available for oxygen transport.

Codes
(a) Only IV (b) Only I
(c) I, III and IV (d) II and III

19 A differential blood count
(a) gives the number of red blood cells per cubic millimetre
(b) determines the percentage of erythrocytes per cubic millimetre
(c) gives the number and variety of leucocytes in each 200 counted
(d) determines the platelet count

20 One of the common symptoms observed in people infected with dengue fever is
(a) significant decrease in RBCs count
(b) significant decrease in WBCs count
(c) significant decrease in platelets count
(d) significant increase in platelets count

21 Which one 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

22 Which of the following four components of the blood are necessary for clotting?
(a) Calcium, vitamin-K, albumin and globulin
(b) Calcium, prothrombin, fibrinogen and platelets
(c) Calcium, heparin, prothrombin and fibrinogen
(d) Calcium, prothrombin, platelets and vitamin-A

23 Haemophilia-A is caused by the absence of which clotting factors?
(a) Factor VIII
(b) Platelet
(c) Both (a) and (b)
(d) Serum prothrombin accelerator

24 Which of the following statement (s) is/are incorrect about the lymph?
I. Lymph is colourful as it has haemoglobin but no RBC.
II. The fluid present in the lymphatic system is called lymph.
III. It contains specialised lymphocytes which are responsible for the immunity of the body.
IV. Lymph is an important carrier for nutrients and hormones.
V. Fats are absorbed through the lymph in the lacteals present in the intestinal villi.

Choose the correct option.
(a) Only I (b) III and IV
(c) II and III (d) Only IV

25 Which one of the following has an open circulatory system?
(a) *Pheretima* (b) *Periplaneta*
(c) *Hirudinaria* (d) *Octopus*

26 Which is not an important function of vertebrate circulatory system?
(a) Transport of nutrients and respiratory gases
(b) Regulation of body by circulating antibodies
(c) Protection of body by circulatinhg antibodies
(d) Removal of waste products for excretion from the body

27 Which of the following blood vessels in the circulatory system of frog has more oxygenated blood?
(a) Pulmocutaneous artery (b) Pulmocutaneous vein
(c) Pulmonary artery (d) Precaval veins

28 Which one of the following animals has two separate circulatory pathways? → CBSE-AIPMT 2015
(a) Frog (b) Lizard
(c) Whale (d) Shark

29 In mammals, which blood vessel would normally carry largest amount of urea? → NEET-I 2016
(a) Dorsal aorta (b) Hepatic vein
(c) Hepatic portal vein (d) Renal vein

30 The site of exchange of wastes, nutrients, gases and hormones between the blood and body is
(a) arteries (b) arterioles (c) capillary (d) veins

31 As compared to arteries, veins
(a) contain more muscles
(b) appear more rounded
(c) stretch more
(d) are under a greater pressure

32 The Sino-Atrial Node (SA Node) is situated in the wall of the
(a) right atrium (b) interventricular septum
(c) pulmonary trunk (d) superior vena cava

33 Which is pace setter of the human heart?
(a) SA node (b) AV node
(c) Purkinje fibres (d) Bundle of His

34 Which of the following has the thickest walls?
(a) Right ventricle (b) Left ventricle
(c) Right auricle (d) Left auricle

35 In adult man, normal BP is
(a) 100/80 mm Hg (b) 120/80 mm Hg
(c) 100/120 mm Hg (d) 100/120 mm Hg

36 Blood pressure in the pulmonary artery is → NEET 2016
(a) more than that in the carotid
(b) more than that in the pulmonary vein
(c) less than that in the vena cava
(d) same as that in the aorta

37 An increase in cardiac output follows all of the following except
(a) fever
(b) physical exercise
(c) digestion
(d) parasympathetic stimulation through the vagus (X cranial) nerves

38 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

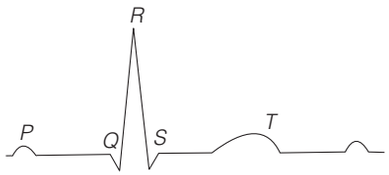
39 Doctors use stethoscope to hear the sounds produced during each cardiac cycle. The second sound is heard when → CBSE-AIPMT 2015

(a) AV valves open up
(b) ventricular walls vibrate due to gushing in of blood from atria
(c) semilunar valves close down after the blood flows into vessels from ventricles
(d) AV node receives signals from SA node

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

(a)	SA node	AV node	Purkinje fibre	AV bundle
(b)	SA node	Purkinje fibre	AV node	AV bundle
(c)	SA node	AV node	AV bundle	Purkinje fibre
(d)	SA node	Purkinje fibre	AV bundle	AV node

41 The diagram given here is the standard ECG of a normal person. The P-wave represents the → NEET 2013



(a) initiation of the ventricular contraction
(b) beginning of the systole
(c) end of systole
(d) contraction of both the atria

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

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

43 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

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

(a) ORS 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

45 It is given that the end diastolic volume and end systolic volume of blood are 130 mL and 60 mL respectively in normal resting person. Calculate the following

I. Stroke volume II. Cardiac output

	I	II		I	II
(a)	5.25 L	180 mL	(b)	3.1 L	20 mL
(c)	70 mL	5.25 L	(d)	180 mL	4.4 L

46 Double circulation is the characteristic feature of which of the following?

(a) Human (b) Fishes (c) Arthropods (c) Annelids

47 Hepatic portal system is a connection between digestive tract and

(a) pancreas (b) lungs (c) stomach (c) liver

48 Which one of the following circulations is not a type of systemic circulation?

(a) Coronary circulation (b) Hepatic portal circulation
(c) Pulmonary circulation (d) Renal circulation

49 Artherosclerosis is also called as

(a) hypotension (b) angina pectoris
(c) coronary artery disease (d) cardiomegaly

50 Hypertension is

(a) without any symptoms
(b) when blood vessels lumen gets constricted
(c) when blood pressure is above 140 mm of Hg (systolic) and 90 mm of Hg (diastolic)
(d) All of the above

51 What is most likely to happen when the heart is unable to pump blood sufficiently in order to meet the body's needs?

(a) Heart failure (b) Hypotension
(c) Stress (d) Thrombosis

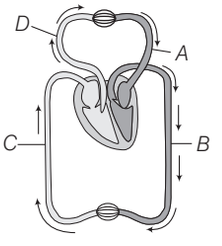
52 An artificial pacemaker is implanted subcutaneously and connected to the heart in patients

(a) having 90% blockage of the three main coronary arteries
(b) having a high blood pressure
(c) with irregularity in the heart rhythm
(d) suffering from arteriosclerosis

53 Choose the incorrect match.

(a) Angina pectoris — Pain in the chest
(b) Hypertension — High blood pressure
(c) Myocardial infarction — Heart failure
(d) Coronary artery disease — Ischemic heart disease

54 Figure shows schematic plan of blood circulation in humans with labels *A* to *D*. Identify the label and give its function. → NEET 2013



(a) *B*–Pulmonary artery-Takes blood from heart to lungs, pO_2 = 90 mmHg

(b) *C*–Vena cava-Takes blood from body parts to right auricle, pCO_2 = 45 mmHg

(c) *D*–Dorsal aorta-Takes blood from heart to body parts, pO_2 = 95 mmHg

(d) *A*–Pulmonary vein-Takes impure blood from body parts, pO_2 = 60 mmHg

55 Match the following columns. → NEET 2018

	Column I		Column II
A.	Fibrinogen	1.	Osmotic balance
B.	Globulin	2.	Blood clotting
C.	Albumin	3.	Defence mechanism

Codes

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

56 Choose the correct option for *X*, *Y* and *Z*.

Blood Group	Antigen on RBCs	Antibody in Plasma	Donor's Group
A	A	Anti b	A, O
B	B	Anti a	B, O
AB	*X*	Nil	*Z*
O	Nil	*Y*	O

(a) *X*–B; *Y*–A; *Z*–AB

(b) *X*–AB; *Y*–Nil; *Z*–AB, A,B,O

(c) *X*–AB; *Y*–anti-AB; *Z*–AB, A,B,O

(d) *X*–AB; *Y*–anti AB; *Z*–AB, AB

57 Match the following columns.

	Column I		Column II
A.	Atrial systole	1.	0.7 sec
B.	Atrial diastole	2.	0.5 sec
C.	Ventricular systole	3.	0.1 sec
D.	Ventricular diastole	4.	0.3 sec

Codes

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

Directions (Q. Nos. 58-60) *In each of the following questions a statement of Assertion is given followed by a corresponding statement of Reason just below it. Of the statements, mark the correct answer as*

(a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion

(b) If both Assertion and Reason are true, but Reason is not the correct explanation of Assertion

(c) If Assertion is true but Reason is false

(d) If both Assertion and Reason are false

58 **Assertion** Larger animals have a higher heart rate than smaller animals.
Reason Metabolic rate of smaller animals is higher than larger animals.

59 **Assertion** Pulmonary circulation includes flow of deoxygenated blood from right ventricles to the lungs.
Reason The main purpose of this circulation is purification of blood.

60 **Assertion** Systemic blood circulation occurs in human beings.
Reason The main purpose of this circulation is to carry oxygen and nutrients to the body tissues and to remove CO_2 and other wastes from the tissues.

DAY PRACTICE SESSION 2

PROGRESSIVE QUESTIONS EXERCISE

1 Vitamin-K (phylloquinone) is required for the synthesis of prothrombin necessary for

(a) blood clotting (b) anticoagulation
(c) muscle contriction (d) muscle relaxation

2 The intrinsic factor necessary for the complete maturation of red blood cells is derived from

(a) bone marrow (b) vitamin-B_6
(c) liver (d) mucosa of the stomach

3 The innermost coat of the wall of artery is called

(a) tunica interna (b) tunica media
(c) tunica adventitia (d) endothelium

4 Cerebro Vascular Accident (CVA) is commonly called

(a) coronary artery disease (b) arteriosclerosis
(c) hypotension (d) stroke

5 Identify the mineral required for conversion of prothrombin and thrombin.

(a) Mn^{2+} (b) Ca^{2+} (c) K (d) Na^{2+}

6 Blue baby syndrome is a condition related to

(a) decrease in elasticity of blood vessels
(b) non-closure of tricuspid valves during blood circulation
(c) non-closure of foramen ovale at birth
(d) None of the above

7 Animals having single circulation possess ... in their heart.

(a) sinus venosus (b) foramen to panizzae
(c) conus arteriosus (d) Both (a) and (c)

8 The valve, located on the same side of the heart as the pulmonary semilunar valve is the

(a) tricuspid valve (b) mitral valve
(c) bicuspid valve (d) aortic semilunar valve

9 Select the lymphoid organs from the given choices.

I. Lymph node II. Thymus gland
III. Red bone marrow IV. Liver
V. Spleen VI. Osteocytes
VII. Peyer's patches

The correct option with correct choices is

(a) I, II, III and IV (c) III, IV, V and VI
(b) IV, V, VI and VII (d) I, II, IV, V and VI

10 Which artery supplies blood to diaphragm?

(a) Gonadial artery (b) Anterior mesenteric artery
(c) Phrenic artery (d) Bronchial artery

11 Since it is the sino-auricular node, which initiates the impulses in the heart of mammal is called

(a) cholinergic (b) adrenergic
(c) neurogenic (d) myogenic

12 What will be the number of heartbeats per minute, if the stroke volume of heart increases, whith total volume of heart increases, with total volume of blood remains same?

(a) Remains constant (b) Decreases
(c) Increases (d) Becomes erratic

13 Tunica media of an elastic artery is mainly made up of

(a) smooth muscle fibres (b) loose alveolar tissue
(c) elastic fibres (d) collagen fibres

14 Starling's law is related to

(a) venous return to heart (b) force of heartbeat
(c) frequency of heartbeat (d) peripheral resistance

15 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

16 Resistive vessels of the circulatory system are

(a) large arteries
(b) large veins
(c) small arteries and arterioles
(d) small veins and venules

17 Match the following columns. → NEET 2018

	Column I		Column II
A.	Tricuspid valve	1.	Between left atrium and left ventricle
B.	Bicuspid valve	2.	Between right ventricle and pulmonary artery
C.	Semilunar valve	3.	Between right atrium and right ventricle

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

18 Erythropoietin is a hormone secreted by kidney cells. It stimulates the

(a) native immunity
(b) blood clotting
(c) RBCs production in bone marrow
(d) acquired immunity

19 Which of the following vein is paired one?

(a) Thyroid (b) Tibial vein
(c) Facial vein (d) Occipital vein

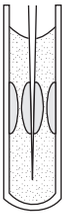
20 Which of the following is not a condition of late diastole?

(a) The atria and ventricles are relaxed
(b) The AV valves are open
(c) The aortic semilunar valve is open
(d) Both (a) and (c)

21 Return of blood to the heart is not facilitated by

(a) venous valves (b) the skeletal muscle pump
(c) skeletal muscle groups (d) venous pressure

22 Angiogram of a procedure in coronary blood vessel depicts



(a) removal of cancerous growth
(b) opening of defective valves
(c) cracking of a plaque blocking coronary artery
(d) removal of parasite blocking coronary vein

23 Wenckebach phenomenon is seen in

(a) complete heart block (b) partial heart block
(c) ventricular fibrillation (d) myocardial infarction

24 Vasa vasorum supplies blood to

(a) pericardium
(b) blood vessels
(c) tunica adventitia and external part of tunica media
(d) vas deferens

25 After birth ... *A* ... gets blocked by the deposition of ... *B* ... fibres forming ligamentum arteriosum. Identify *A* and *B*

	A	*B*
(a)	ductus arteriosus	connective
(b)	eustachian valve	elastin
(c)	traberculae valve	connective
(d)	ductus arteriosus	elastin

26 To clearly hear the sound of the bicuspid valve, a stethoscope should be placed to the

(a) right of the sternum at the second intercostal space
(b) left of the sternum at the second intercostal space
(c) left of the sternum at the fifth intercostal space inferior to the nipple
(d) right of the sternum at the fifth intercostal space

27 When the atrioventricular bundle is completely interrupted then the

(a) atria beat at an irregular rate
(b) ventricles typically contract at 30-40 beats/min
(c) PR intervals in the ECG are longer than normal but remain constant from beat to beat
(d) QRS complex varies in shape from beat to beat

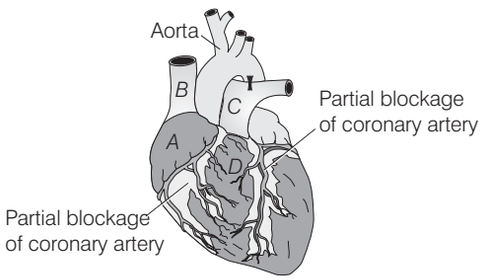
28 Which of the following is first to receive lymphatic duct from legs?

(a) Left subclavian vein (b) Right subclavian vein
(c) Right lymphatic duct (d) Thoracic lymphatic duct

29 Identify the correct match with respect to clotting factors and their specific characters.

(a)	Prothrombin	—	Lipoprotein synthesised in liver
(b)	Fibrinogen	—	Glycoprotein deficiency causes haemophilia-A
(c)	Hageman factor	—	Glycoprotein deficiency causes delayed blood clotting
(d)	Fibrin stabilising factor	—	Lipoprotein deficiency causes haemophilia-B

30 Which tube in the given figure of a heart correctly represents the result of a successful coronary bypass operation?



(a) *C* (b) *B* (c) *D* (d) A

31 A clotting factor required for the formation of prothrombin activator complex, whose deficiency leads delayed blood clotting is

(a) Hageman factor (b) Stuart-Prower factor
(c) Christmas factor (d) PTA

32 Which one of the following, matches is correct?

(a) Inferior vena cava – Receives deoxygenated blood from the head and body
(b) Superior vena cava–Receives deoxygenated blood from the lower body and organs
(c) Pulmonary artery – Carries deoxygenated blood to the lungs
(d) Hepatic artery – Carries deoxygenated blood to the gut

Directions (Q. Nos. 33-34) *In each of the following questions a statement of Assertion is given followed by a corresponding statement of Reason just below it. Of the statements, mark the correct answer as*

(a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion
(b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion
(c) If Assertion is true but Reason is false
(d)If both Assertion and Reason are false

33 **Assertion** Left ventricle of heart has a thinner wall than that of right ventricle.

Reason Left ventricle needs to pump blood to nearly lungs only.

34 **Assertion** Heat pacemaker is a life-saving device when the normal, heart rate of 72-80 drops to 30-40 due to disease or some other cause.

Reason The pacemaker electrically stimulates the contractile heart walls.

ANSWERS

SESSION 1

1 (d)	**2** (b)	**3** (c)	**4** (b)	**5** (b)	**6** (c)	**7** (a)	**8** (a)	**9** (a)	**10** (d)
11 (a)	**12** (a)	**13** (d)	**14** (a)	**15** (d)	**16** (d)	**17** (b)	**18** (a)	**19** (c)	**20** (c)
21 (c)	**22** (b)	**23** (c)	**24** (a)	**25** (b)	**26** (d)	**27** (b)	**28** (c)	**29** (b)	**30** (c)
31 (b)	**32** (a)	**33** (b)	**34** (b)	**35** (b)	**36** (b)	**37** (d)	**38** (b)	**39** (c)	**40** (c)
41 (d)	**42** (c)	**43** (b)	**44** (b)	**45** (c)	**46** (a)	**47** (d)	**48** (c)	**49** (c)	**50** (d)
51 (a)	**52** (c)	**53** (c)	**54** (b)	**55** (d)	**56** (c)	**57.** (a)	**58.** (d)	**59.** (a)	**60** (a)

SESSION 2

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