

ZOOLOGY
INTERMEDIATE SECOND YEAR
UNIT – IIA
BODY FLUIDS AND CIRCULATION

SYNOPSIS

- Different groups of animals have evolved different methods for the transport of substances.
- Simple Organisms like sponges and coelenterates circulate water to facilitate the cells to exchange these substances.
- More complex organisms use special fluids, such as blood and lymph for the transport of substances.
- Blood is a special connective tissue consisting of a fluid matrix. Plasma and formed elements.
- Fibrinogen, Globulins, Albumins are the major plasma proteins.
- Fibrinogens are need for clotting or coagulation of blood
- Globulins primarily are involved in defense mechanisms of the body.
- Albumins help in osmotic balance.
- Plasma with out the clotting factors is called serum.
- Erythrocytes, Leucocytes and platelets are collectively called Formed Elements.
- RBC's are formed in the Red bone marrow in the adults.
- RBC's are devoid of nucleus in most of the mammals and are biconcave in shape.
- 12-16 gms of Hb is present in every 100 ml of blood.
- Spleen is considered as graveyard of RBC
- WBCs are nucleated and are relatively less in number.
- Neutrophils are the most abundant cells (60 – 65%) of the total WBC
- Basophiles are the least (0.5-1%) among WBC.
- Neutrophils and monocytes are phagocytes' cells.

- Basophils secrete histamine, serotonin, heparin and are involved in inflammatory reactions.
- Eosinophils are associated with allergic Reactions.
- B and T lymphocytes are responsible for immune responses of the body.
- Platelets also called thrombocytes.
- Platelets are produced from megakaryocytes in bone marrow.
- Platelets are involved in the coagulation of blood O⁻ group is considered universal donor. AB⁺ group is considered universal Recipient.
- Nearly 80% of humans have Rh antigen on the surface of their RBC. They are called Rh positive.
- Nearly 20% of humans do not have Rh antigen on the surface of their RBC. They are called Rh are satire.

CLOTTING OF BLOOD

- ❖ When a blood vessel is damaged a number of physiological mechanisms are activated that lead to **haemostasis**.
- ❖ Breakage of a blood vessel exposes collagen proteins to the blood. This initiates three separate, but over lapping haemostatic mechanisms.
 - a) Vasoconstriction** : When a blood vessel is injured, the muscles in its wall contract, which makes the lumen of the vessels narrow, sometimes so strongly that blood flow is completely stopped.
 - b) Platelet – plug formation** : When the endothelium is ruptured, platelets adhere to the collagen and release some secretions. These secretions aggregate other platelets and make them sticky, so that they adhere to those already stuck on the collagen and form a platelet –plug.
 - c) Production of web of fibrin protein** : The last mechanism for haemostasis is the formation of clot. The activator substances from the damaged vascular wall,

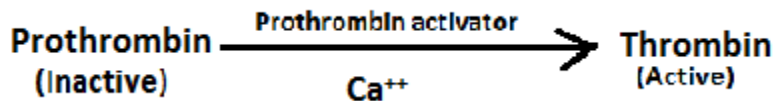
platelets and blood proteins adhering to the injured vascular wall, initiate the clotting process. **Clot** is a web of fibrin fibres with blood cells trapped in it.

Three essential steps in clotting :

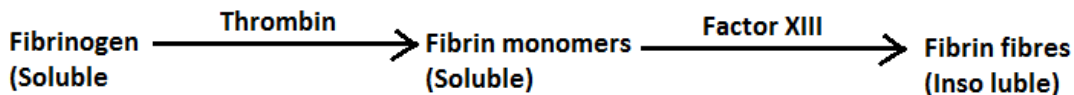
Step – 1 (Formation of Prothrombin Activator) :

- ❖ It occurs in two pathways :
 - a) Intrinsic pathway : Blood is exposed to collagen of damaged wall of blood vessel – activation of factor XII – activation of another clotting factor (Cascade fashion) – Prothombin activator.
 - b) Extrinsic pathway : Damaged vascular wall/extra vascular tissue comes into contact with blood – Release of factor III from damaged tissue – It activates factor VII (cascade fashion) – Prothombin activator.

Step – 2 (Activation of prothrombin) :



Step – 3 (Formation of fibrin) :



- ❖ Fibrin monomers are held together by weak hydrogen bonds.
- ❖ The Factor XIII released from platelets replaces hydrogen bonds with covalent bonds and cross links the fibres to form a 'mesh work'.
- ❖ The insoluble mesh work of fibrin fibres spreading in all directions adhere to the damaged surfaces and trap the blood cells and platelets.
- ❖ Within a few minutes after the clot is formed, it begins to contract so that the fluid is expelled out. This is called clot retraction and the fluid thus formed is the serum (plasma without fibrinogen) and some other proteins.

- ❖ Platelets are necessary for clot retraction.
- ❖ Failure of clot retraction is an indication that the number of platelets in the blood might be low.
- ❖ In the case of diseases such as 'dengue' the platelet count falls low and the patient may require transfusion of blood platelets.

❖ **Clotting factors :**

Factor	Name
I	Fibrinogen (In plasma)
II	Prothrombin (In plasma)
III	Thromboplastin
IV	Calcium ions (Ca ⁺⁺)
V	Proaccelerin (Labile factor)
VI	Proconvertin (Stable factor)
VII	Antihaemophilic Factor – A
VIII	Plasmathromboplastin component (PTC) or Christmas Factor or Antihaemophilic factor – B
IX	Stuart – Prower Factor
X	Plasmathromboplastin antecedent (PTA)
XI	Hageman's Factor
XII	Fibrin Stabilizing Factor

Anticoagulants :

- ❖ Heparin is an anticoagulant synthesized by mast cells and basophils.
- ❖ Heparin activates antithrombin, a plasma protein, which combines with thrombin and inactivates it.
- ❖ Coumarins of plant origin are the precursors of anticoagulants such as warfrin, which are antagonistic to Vit – K and thus prevent the synthesis of the blood clotting factors – II, VII, IX and X, formed in the liver.
- ❖ Clotting of blood in test tubes in clinical laboratories and blood banks can be prevented by the addition of citrates or oxalates of sodium or Ethylene diamine tetra

acetic acid (EDTA). They bind to calcium ions and thus make Ca^{++} unavailable for the action in clotting.

CIRCULATING PATHWAYS

- ❖ Two types – open and closed.

Open type :

- ❖ In this type, blood flows from the heart into the vessels. The vessels open into large spaces called sinuses. From sinuses blood is collected into heart and distributed to body parts.

Ex : leeches, arthropods, mollusks, echinoderms and ascidians.

Closed type :

- ❖ In this type, blood flows through blood vessels.
- ❖ Fishes have a 2- chambered heart with an atrium and a ventricle. It pumps out deoxygenated blood to gills for oxygenation, hence the name 'branchial heart'. Blood passes through the heart only once in a complete circuit, hence called single circulation.
- ❖ Amphibians have a 3 – chambered heart with two atria and one ventricle. Reptiles have two atria and an incompletely divided ventricle (except in the crocodiles in which the ventricle is divided into two chambers). The left atrium receives oxygenated blood, from the gills/ lungs / receives oxygenated blood, from the gills / lungs/ skin and the right atrium receives deoxygenated blood from the other parts of the body through the vena cavae.
- ❖ The two types of blood get mixed up in the single ventricle, which pumps out mixed type of blood. Thus these animals (amphibians and reptiles) show an incomplete double circulation.
- ❖ Birds and mammals possess a 4 – chambered heart with two atria and two ventricles. These animals are said to be showing double circulation.

HUMAN CARDIO-VASCULAR SYSTEM

- ❖ Heart is present in mediastinum
- ❖ Heart is mesodermal in origin and it is of the size of a clenched fist.
- ❖ Heart is covered by a double layered **pericardium** (outer fibrous pericardium and inner serous pericardium).
- ❖ **Serous pericardium** is double layered – outer parietal layer and inner visceral layer (**epicardium**).
- ❖ Parietal and visceral layers of serous pericardium are separated by **pericardial cavity**, which is filled with pericardial fluid. It protects the heart from shocks and friction.
- ❖ The wall of heart is formed by an outer **epicardium** (i.e., visceral layer), middle **myocardium** and inner **endocardium**.
- ❖ Heart is four chambered with two atria and two ventricles.
- ❖ Atria and ventricles are externally separated by a deep groove called **coronary sulcus**.
- ❖ Muscular pouch like projection of each atrium is called **auricular appendix**.
- ❖ Ventricles are separated by two inter ventricular grooves (Anterior & posterior grooves).
- ❖ Right atrium is larger than left one and both atria are separated from each other by an **interatrial septum**.
- ❖ In embryonic stage, inter atrial septum has a small pore called **foramen ovale**.
- ❖ At birth, when lungs become functional foramen ovale is closed leaving a fossa ovalis.
- ❖ If the foramen ovale does not close properly, it is called a **patent foramen ovale**.
- ❖ Left atrium receives oxygenated blood from lungs through **two pairs** of pulmonary veins.
- ❖ Right atrium receives deoxygenated blood from different parts of the body through **a precaval vein** (anterior vena cava) and a **postcaval vein** (Posterior vena cava)
- ❖ In the opening of post caval vein, **a valve of Eustachian** is present.

- ❖ In embryo, it directs the blood into left atrium through foramen ovale from post caval vein.
- ❖ In adult, valve of Eustachian is vestigial.
- ❖ The **coronary circulation** in humans includes the left and right coronary arteries and four coronary / cardiac veins.
- ❖ Coronary veins open into the **coronary sinus**.
- ❖ Right atrium receives blood from myocardium through the coronary sinus, whose opening is guarded by the **valve of Thebesius**.
- ❖ There are two ventricles (left and right) and are separated from each other by an inter ventricular septum.
- ❖ Atria and ventricles are separated by an **atrio ventricular septum**.
- ❖ Left ventricle is larger than right ventricle.
- ❖ The wall of left ventricle is thicker than that of right ventricle.
- ❖ The inner surface of ventricle is raised into muscular ridges called columnae corneae.
- ❖ Some of the columnae corneae are large and conical, and are called papillary muscles.
- ❖ Right atrium opens into right ventricle through a right atrio – ventricular aperture, which is guarded by a tricuspid valve. It allows the blood to flow into right ventricle only.
- ❖ Left atrium opens into left ventricle through a left atrio – ventricular aperture, which is guarded by a bicuspid valve (Mitral valve). It allows the blood to flow into left ventricle only.
- ❖ Extending between atrio ventricular valves (tricuspid and bicuspid valves) and papillary muscles, tendon like cords are present, known as chordate tendinae (heart strings). They prevent the over bulging of cusps of atrio ventricular valves into the atria.

Aortic arches :

- ❖ Left systemic arch arises from left ventricle. It supplies oxygenated blood to all parts through different arteries.
- ❖ At the base of left systemic arch, an aortic valve is present. It allows the blood to flow into systemic arch only.
- ❖ Pulmonary arch arises from left anterior angle of right ventricle.
- ❖ It supplies deoxygenated blood to lungs through a pair of pulmonary arteries.
- ❖ At the base of pulmonary arch, pulmonary valve is present. It allows the blood to flow into pulmonary arch only.
- ❖ At the point of contact, systemic arch and pulmonary arch are connected by a fibrous strand called ligamentum arteriosum.
- ❖ Ligamentum arteriosum is the remnant of ductus arteriosus.
- ❖ Human embryonic heart begins beating at around a month of embryonic development.
- ❖ The heart rhythmically contract (systole) and relax (diastole).
- ❖ A systole and its following diastole constitutes a heart beat.
- ❖ Pace maker (sinu atrial node; SA node) is formed by a modified cardiac muscle (myogenic pace maker)
- ❖ SA node lies in the right upper corner of right atrium near the opening of the superior vena cava.
- ❖ Atrio ventricular node (AV node) is present in lower left corner of right atrium postero-inferior region of the inter atrial septum close to the opening of coronary sinus.
- ❖ When atria are filled with blood, wave of atrial depolarization originates in SA node.
- ❖ SAN can generate action potentials every 0.6 sec., which means it can initiate 100 beats per minute.
- ❖ Human heart normally beats 70 – 80 times / min (Average 72 beats min⁻¹)

Conduction of impulses :

SAN – Atrial wall – AVN – AV – bundle (Bundle of His) – Bundle branches – Purkinje fibres – Ventricular walls.

Cardiac cycle :

- ❖ The sequence of events that take place during single heart beat constitutes a **cardiac cycle.**
- ❖ Cardiac cycle lasts for about 0.8 sec. (60/72 – 0.8 sec)
- ❖ Cardiac cycle includes 3 phases :
 - (1) Atrial Systole increases the flow of blood into the ventricles by about 30%
 - (2) Ventricular systole (0.3 sec) : Ventricles contract. Thus blood flows into aortic arches. Due to high pressure, atrio ventricular valve are closed causing first sound of heart beat lubb.
 - (3) Cardiac diastole (0.4 sec) : Pressure in ventricles reduces and thus semi lunar valves are closed causing second heart sound dupp. As the pressure in ventricles decreases further, AV valves open and ventricular filling begins.

Stroke volume and Cardiac output :

- ❖ The volume of blood pumped out by each ventricle for each beat is called stroke volume (70 mL).
- ❖ Volume of blood pumped out by the heart from each ventricle per minute is termed as cardiac output.

$$\begin{aligned} \text{Cardiac output} &= \text{Stroke volume} \times \text{Heart rate} \\ &= 70\text{mL} \times 72 = 5040 \text{ mL} \end{aligned}$$

Double Circulation :

- ❖ Pulmonary circulation (Lesser Circulation) :
- ❖ Right ventricle – Pulmonary arch Lungs – Pulmonary veins – Left atrium
- ❖ Systemic circulation (greater circulation) :

Left ventricle – Systemic aorta, arteries / arterioles and capillaries – Tissues – Systemic venules/veins and vena cavae – Right atrium

REGULATION OF CARDIAC ACTIVITY

- ❖ Normal activities of the heart are regulated intrinsically, i.e., auto regulated by nodal tissue.
- ❖ A special neural centre in the medulla oblongata can moderate the cardiac function through the ANS.
- ❖ Neural signals through the sympathetic nerves can increase the rate of heart beat, the strength of ventricular contraction and thereby the cardiac output.
- ❖ Parasympathetic neural signals decrease the rate of heart beat, speed of conduction of action potential and thereby the cardiac output.
- ❖ Adrenal medullary hormones, the epinephrine and norepinephrine can also increase the cardiac output. Thyroxine also increases the heart rate and cardiac output.

PORTAL CIRCULATION

- ❖ A blood vessel that starts in capillaries and ends in capillaries is called a portal vessel.
- ❖ A system of portal vessel is named after the name of the organ in which it ends in capillaries.
- ❖ In man there is a portal system between the digestive tract and the liver. It is called hepatic portal system.
- ❖ The hepatic portal vein carries blood from the gut to the liver before it is delivered to the systemic circulation via the heart.
- ❖ The absorbed food such as sugars, when present in excess, are converted into glycogen and stored in the liver cells (glycogenesis).

BLOOD VESSELS

- ❖ Blood leaving the heart passes through vessels of progressively smaller diameter, referred to as arteries, arterioles, and capillaries.
- ❖ Blood returning to the heart from the capillaries passes through vessels of progressively larger diameter, called venules and veins.
- ❖ The wall of arteries is formed by an outer tunica externa (fibrous connective tissue), tunica media (smooth muscles) and tunica interna or endothelium (simple epithelium). On either side of tunica media, elastic laminae are present.
- ❖ In veins, only one elastic lamina is present inner to the tunica media.
- ❖ The smallest vessels present in the walls of large blood vessels like aortic arches are called vasa vasorum.

Capillaries :

- ❖ These are the smallest blood vessels of the body, which connect arterioles and venules.
- ❖ The walls of capillaries are composed of just one cell thick layer a simple squamous epithelium, or endothelium.
- ❖ The absence of smooth muscles and connective tissue layers permits more rapid exchange of materials between the blood and the tissues.

Differences between arteries and veins

Arteries	Veins
1. Carry oxygenated blood, away from the heart (except the pulmonary artery)	Carry deoxygenated blood, towards, the heart (except the pulmonary veins)
2. Bright red in colour	Dark red in colour
3. Mostly deep seated in the body	Generally superficial
4. Thick – walled as the tunica media is relatively thick, with elastin fibres and smooth muscles.	Thin walled (tunica media relatively thin with few elastin fibres) and slightly muscular
5. Lumen is narrow	Lumen is wide

6. Non-valvular	Valvular
7. Blood in the arteries flows with more pressure and by jerks.	Blood in the veins flows steadily with relatively low pressure
8. Arteries end in capillaries	Veins start with capillaries

DISORDERS

Hypertension :

- ❖ Blood pressure is measured in the brachial artery of the arm by using a sphygmomanometer.
- ❖ Pressure 120/80 mm Hg is considered normal blood pressure in human beings. The upper reading pertains to systolic pressure and the lower one, the diastolic pressure.
- ❖ Blood pressure above 140/90 is considered hypertension.

Coronary Artery Disease (CAD) :

- ❖ Often referred to as atherosclerotic heart disease.
- ❖ CAD is the result of the accumulation of calcium, fat, cholesterol and fibrous tissue along the wall of coronary arteries which makes their lumen narrow.
- ❖ Narrow blood vessel reduces the blood flow to the heart, causes ischemia (restriction of blood supply to muscle tissue, causing shortage of oxygen).
- ❖ Myocardial infarction : Myocardial cells die due to lack of oxygen. It leads to heart muscle damage.
- ❖ CAD is associated with smoking, diabetes and hypertension.

Angina Pectoris :

- ❖ It is marked by chest pain' caused by narrowing of blood vessels to the heart (ischemia).
- ❖ Angina pectoris is a 'warning signal' of deprivation of blood supply to the heart muscles. However there is no necrosis
- ❖ The major risk factors for angina include smoking, diabetes, high cholesterol, high blood pressure etc.

Heart Failure :

- ❖ Heart failure is a condition in which the heart is unable to provide sufficient pumping action to distribute blood flow to meet the needs of the body.
- ❖ It is also called congestive heart failure because congestion of the lungs is one of the main symptoms of this disease.
- ❖

Causes :

1. Myocardial infarction / heart attack (localized death of heart tissue – necrosis)
2. Other forms of ischemic heart diseases
3. Hypertension

EXERCISE – I**(MULTIPLE CHOICE QUESTIONS)**

1. Find out the organ that serves as reservoir of blood
 - 1) Liver
 - 2) MALT
 - 3) Thymus
 - 4) Spleen
2. An emulsion of lymph and triglyceride fat, characteristically present in lacteals is called
 - 1) Chyme
 - 2) Bolus
 - 3) Chyle
 - 4) MALT
3. Which of these has a closed type of circulatory system
 - 1) Cockroach
 - 2) Fish
 - 3) Snail
 - 4) Scorpion
4. One of the following event does not occur at the venular end of the capillaries
 - 1) Increasing colloidal osmotic pressure
 - 2) Movement of ECF in to the capillaries
 - 3) High filtration pressure
 - 4) Increased concentration of plasma proteins
5. Identify the extrinsic pathway
 - 1) Blood is exposed to collagen of injured wall of blood vessel – Activation of factor XII – Activation of another factor – Prothrombin activator
 - 2) Damaged vascular wall comes into contact with blood – Release of tissue thromboplastin – Activation of factor VII – Activation of another factor in the cascade fashion – prothrombin activator

- 3) Damaged vascular wall – Release of factor XII – Activation of factor VII – Prothrombin activator
- 4) Blood is exposed to collagen of injured wall – Activation of factor VII – Activation of factor XIII – Prothrombin activator
6. Which of the following is not a part of lymphatic system ?
- 1) Adenoid 2) Spleen 3) Thymus 4) Auricular appendix
7. Choose the third mechanism
- 1) Platelet – plug formation 2) Vasoconstriction
- 3) Vasoconstriction or platelet – plug formation
- 4) Production of web of fibrin protein
8. Chordates with open blood circulation are
- 1) lancelets 2) lampreys 3) squids 4) ascidians
9. In the mechanism of blood clotting, hydrogen bonds among soluble fibrin monomers are replaced with covalent bonds by
- 1) Factor – XII 2) Factor – XIII 3) Factor – IX 4) Factor – XI
10. Clot retraction begins
- 1) Before Vasoconstriction 2) After clot formation
- 3) Before clot formation 4) Before platelet – plug formation
11. In the formation of Prothrombinase in two pathways during blood clotting, the clotting factors that are involved are
- 1) IV & XII 2) I & XIII 3) VI & XII 4) I,III,IV,XII & XIII
12. Intrinsic pathway is initiated by
- 1) Factor XI 2) Factor XII 3) Factor XIII 4) Factor X

13. One of the following is a calcium ion remover
- 1) EDTA 2) Citrates 3) Oxalates 4) All the above
14. The immediate response to an injury is
- 1) Conversion of prothrombin into thrombin 2) Formation of prothrombinase
- 3) Conversion of fibrinogen into fibrin 4) Contraction of vascular muscles
15. In blood clotting, fibrins are formed from inactive fibrinogen by the enzyme
- 1) Thrombin 2) Thrombokinase 3) Creatine kinase 4) Heparin
16. Which of the following ions play important role in blood clotting
- 1) Mg 2) Na 3) K 4) Ca
17. Process of prevention of loss of blood from the body by blood clotting is known as
- 1) Haemostasis 2) Haemorrhage 3) Homeostasis 4) Haemolysis
18. The final step in the coagulation of blood is catalysed by
- 1) Thrombin 2) Factor XIII 3) Factor XII 4) Heparin
19. These do not play any part in coagulation
- 1) RBC &WBC 2) RBC & Platelets 3) WBC & Platelets 4) Plasma& Platelets
20. Blood coagulation is a change in
- 1) RBC 2) WBC 3) Plasma 4) Serum
21. Vit – K is required for the synthesis of factors like
- 1) II, VII, IX, X 2) II, VIII, IX, X 3) II, VII, XI, XIII 4) III, VII, IX, X
22. Select the antihaemophilic factors
- 1) III, V, VII 2) VIII, IX, XI 3) IX, XI, XII 4) VIII, IX, X

23. The network of thread like fibres found in the clot are
1) Collagen fibres 2) Elastic fibres 3) Fibrin fibres 4) Muscle fibres
24. Prothrombin is present in
1) Liver 2) Pancreas 3) Platelets 4) Spleen
25. Prothrombin is present in
1) RBC 2) WBC 3) Platelets 4) Plasma
26. Substance necessary for the conversion of prothrombin to thrombin is
1) Fibrinogen 2) Prothrombinase 3) Coumadin 4) Factor – XIII
27. Heparin helps to
1) Increase the activity of antithrombin and prevents the action of thrombin
2) Promote the action of thrombin and antithrombin
3) Increase the activity of thrombin
4) Prevent the action of anti thrombin and increase the activity of thrombin
28. Anti – coagulant that is produced by mast cells
1) Heparin 2) Haemolysin 3) EDTA 4) Coumadin
29. The final step in the coagulation of blood is catalysed by
1) Thrombin 2) Factor XIII 3) Factor XII 4) Heparin
30. Atria and ventricles are separated by a deep groove called
1) Auricular appendi 2) Coronary sulcus
3) Atrio ventricular septum 4) Coronary sinus
31. Which of the following is not a hemostatic mechanism of human ?
1) Constriction of blood vessels 2) Inflammation of blood vessels
3) Platelet plug formation 4) Clotting of blood
32. The right atrium receives deoxygenated blood from different parts of the body except
1) Liver 2) Lungs 3) Limbs 4) Tail

33. The valve that directs the flow of blood from post caval vein into left atrium through foramen ovale in embryonic stage is
- 1) Valve of The besius
 - 2) Valve of Eustachian
 - 3) Tricuspid valve
 - 4) Bicuspid valve
34. The inner surface of ventricles is raised into muscular ridges called
- 1) Chordae tendineae
 - 2) Papillary muscles
 - 3) Columnae corneae
 - 4) Inter ventricular septum
35. Large and conical ridges in the ventricles of heart are
- 1) Columnae corneae
 - 2) Papillary muscles
 - 3) Chordae tendineae
 - 4) Auricular appendix
36. Mitral valve is present in between
- 1) Left and right ventricles
 - 2) Right and left atria
 - 3) Left atrium and ventricle
 - 4) Right atrium and ventricle
37. Sino – atrial node is present in
- 1) Left ventricle
 - 2) Right ventricle
 - 3) Left atrium
 - 4) Right atrium
38. Chordae tendinae are found in
- 1) Joint capsule of legs
 - 2) Atria of heart
 - 3) Ventricles of heart
 - 4) Ventricles of brain
39. The middle layer of heart wall is known as
- 1) Endocardium
 - 2) Pericardium
 - 3) Epicardium
 - 4) Myocardium
40. The correct pathway of intiation and passing route of conduction of impulse is
- 1) SA node – AV node – purkinje fibre – AV bundle
 - 2) SA node – Purkinje fibre – AV node – AV bundle
 - 3) SA node – AV node – AV bundle – Purkinje fibre

41. To reach the left side of heart the blood must pass through
1) Sinus venosus 2) Kidneys 3) Liver 4) Lungs
42. The small oval depression found on inter atrial septum in adult human is termed
1) Foramen ovale 2) Fossa ovalis 3) Foramen of Monroe 4) Foramen of magnum
43. Heart is present in a space called
1) Mediastinum 2) Pelvis 3) Abdomen 4) Inguinal canal
44. Muscular pouch like projection that arises from atria is called
1) Vermiform appendix 2) Coronary sulcus
3) Auricular appendix 4) Inter ventricular septum
45. The specialized muscle fibres that spread over the walls of ventricles are called
1) Columnae corneae 2) Chordae tendineae
3) Purkinje fibres 4) Bundle of His
46. Ligamentum arteriosum is the modified
1) Whorten’s duct 2) Stenson’s duct 3) Ductus arteriosus 4) Ductus Caroticus
47. The opening of the coronary sinus which open into the atrium is guarded by
1) Valve of Thebesius 2) Eustachian valve
3) Atrio ventricular valve 4) Semilunar valve
48. Bulging of atrio ventricular valves too far into atrium is prevented by
1) Columnae corneae 2) Bundle of His
3) Ligamentum arterisum 4) Chordaetendineae
49. The double layered pericardium of heart is
1) Serous pericardium 2) Outer fibrous pericardium
3) Epicardium 4) Endocardium
50. Tunica media of artery is formed by
1) Smooth circular muscles 2) Rough and cardiac muscles
3) Elastic and collagen fibres 4) Voluntary and involuntary striped muscles

51. Which has the thickest walls
- 1) Right atrium 2) Left atrium 3) Right ventricle 4) Left ventricle
52. Which of the following is valve less
- 1) Arteries 2) Veins 3) Lymphatics 4) Heart
53. Identify the wrong match
- 1) Atrioventricular septum – Atrioventricular apertures
- 2) Inter atrial septum – Fosa ovalis
- 3) Inter ventricular septum – purkinje fibres
- 4) SAN – Cardiomyocytes
54. Which of the following is correct regarding cardiac cycle ?
- 1) End of joint diastole is the beginning of ventricular systole
- 2) End of ventricular systole is the end of atrial diastole
- 3) End of atrial systole is the beginning of ventricular systole
- 4) End of joint diastole is the end of ventricular diastole
55. Atriovenricular valves are open during
- 1) Only during atrial systole 2) Only during ventricular systole
- 3) Both during ventricular systole and ventricular diastole
- 4) Both during ventricular diastole and atrial systole
56. Identify the blood vessel with nutrient rich and CO₂ rich blood.
- 1) Coronary vein 2) Renal vein 3) Hepatic portal vein 4) Pulmonary vein
57. During the foetal stage left atrium receives the blood
- 1) From the lungs through foramen ovale

- 2) From the post caval vein through foramen ovale
3) From the lungs through two pulmonary veins
4) From the lungs through four pulmonary arteries
58. The blood vessels of rabbit with more urea and less urea are respectively.
- 1) Hepatic artery and renal arteries 2) Hepatic artery and renal veins
3) Hepatic veins and renal veins 4) Hepatic portal vein and hepatic veins
59. Which of the following does not increase the cardiac output
- 1) Sympathetic neural signals 2) Parasympathetic neural signals
3) Epinephrine & norepinephrine 4) Thyroxine
60. When the pressure in ventricles falls below that of atrial pressure, then
- 1) S-A node starts depolarization wave
2) AV valves open and ventricular filling begins
3) Semilunar valves open and aortic arches filling begins
4) AV valves close and 'LUBB' sound is generated
61. Total number of arteries and veins that either supply to and collect blood from cardiac musculature
- 1) 7 2) 5 3) 4 4) 6
62. The first heart sound, 'lubb' is caused during
- 1) Ventricular diastole 2) Ventricular systole
3) Atrial systole 4) Atrio-ventricular diastole
63. 70% of the ventricular filling occurs during
- 1) Atrial systole 2) Ventricular systole
3) Joint diastolic phase 4) Ventricular diastole
64. Filling of ventricles of heart with blood takes place during

- 1) Ventricular systole 2) Atrial systole
- 3) Both ventricular and atrial systole 4) Joint diastole and atrial systole
65. 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 per minute and is beating at a rate of 90 per minute ?
- 1) 63.30 2) 63.00 3) 00.63 4) 06.30
66. In human, number of pulmonary veins and coronary veins respectively are
- 1) 2 and 4 2) 4 and 2 3) 2 and 2 4) 4 and 4
67. The mitral valve of the heart allows
- 1) Oxygenated blood to enter the left atrium 2) Oxygenated blood to leave the left atrium
- 3) Deoxygenated blood to enter the right ventricle
- 4) Deoxygenated blood to leave the left atrium
68. During joint diastole of heart which valves are closed ?
- 1) Tricuspid valve 2) Bicuspid valve 3) Semilunar valves 4) Mitral valve
69. Which hormone is not increases the heart rate and cardiac output
- 1) Thymosin 2) Thyroxine 3) Epinephrine 4) Nor-epinephrine
70. Stroke volume is
- 1) 30 mL 2) 5L 3) 100 mL 4) 70 mL
71. Which of the following sequences is truly a systemic circulation pathway
- 1) Left ventricle – Aorta – Arteries – Tissues – Veins – Right atrium
- 2) Right ventricle – Pulmonary aorta – Tissues – Pulmonary veins – Left atrium
- 3) Right atrium – Left ventricle – Aorta – Tissues – Veins – Left atrium
- 4) Left atrium – Left ventricle – Pulmonary aorta – Tissues – Right atrium
72. Part of brain containing a centre to moderate the cardiac function through ANS is
- 1) Cerebrun 2) Medulla oblongata 3) Diencephalon 4) Cerebellum

73. Incorrect statement pertaining to the diastolic phase of heart
- 1) Semilunar valves are closed (Aortic and pulmonary valves)
 - 2) Atrioventricular valves are opened
 - 3) Ventricles are getting filled by blood
 - 4) Ventricular pressure is increased
74. Cardiac output can be increased due to these hormones
- 1) Pancreatic hormones
 - 2) Pineal hormone
 - 3) Adrenal medullary hormones
 - 4) Parathyroid hormone
75. The “relay point” that transfers the action potential from pacemaker to ventricles is located at
- 1) Right upper corner of right atrium
 - 2) Right upper corner of right ventricle above the inter ventricular septum
 - 3) Left lower corner of right atrium at the base of inter atrial septum
 - 4) Left anterior corner of right ventricle
76. In which of the following character a vein differs from an artery
- 1) Having valves to control flow of blood
 - 2) Having narrow lumen
 - 3) Having muscular wall
 - 4) Having pigmented wall to give dark look
77. Pain in heart muscle is
- 1) Angina cardius
 - 2) Angina pericardius
 - 3) Angina pectoris
 - 4) Angiogenesis
78. “Vasa Vasorum” refers to
- 1) Jugular anastomosis
 - 2) A network of blood vessels in an organ
 - 3) “Vessels of vessels” nutritive in function
 - 4) Coronary pluxes
79. Coronary artery supplies blood to
- 1) Mammary glands
 - 2) Ribmuscles
 - 3) Skin
 - 4) Heart
80. Based on the duration arrange the following events from minimal time to maximal time

- 1) Ventricular systole – cardiac diastole – atrial systole
 - 2) Atrial systole – ventricular – systole – cardiac diastole
 - 3) Atrial systole – cardiac diastole – ventricular systole
 - 4) Cardiac diastole – atrial systole – ventricular systole
81. Smooth muscles are absent injectible material medicine and with no risk of any kind can be achieved by injecting it into the
- 1) Veins
 - 2) Arterioles
 - 3) Capillaries
 - 4) Arteries
82. Fastest distribution of some injectible material / medicine and with no risk of any kind can be achieved by injecting it into the
- 1) Arteries
 - 2) Veins
 - 3) Lymph vessels
 - 4) Muscles
83. The cardiac out put can be measured as
- 1) Stroke Volume X number of heart beats per hour
 - 2) Stroke Volume X number of heart beats per second
 - 3) Stroke volume X number of heart beats per minute
 - 4) Stoke Volume X number of heart beats per day
84. Which one of the following statement is true regarding human beings
- 1) The cardiac output in healthy human being is always constant
 - 2) The cardiac output in healthy human being is variable
 - 3) The cardiac output in healthy human being is equal to one systole
 - 4) The cardiac output in healthy human being is equal to one diastole
85. The wave of atrial contraction cannot pass over directly to the ventricles because
- 1) The muscles of atria are not continuous with ventricles
 - 2) The muscles of atria are continuous with ventricles
 - 3) The muscles of atria are voluntary but those of ventricles are involuntary
 - 4) The muscles of atria are involuntary but those of ventricles are voluntary

86. The tri and bi – cuspid valves are closed due to
- 1) Increased pressure in left ventricle
 - 2) Increased pressure in right ventricle
 - 3) Decreased pressure in both ventricles
 - 4) Increased pressure in both ventricles
87. Semi – lunar valves of pulmonary artery and systemic arche get closed due to
- 1) Decreased pressure in pulmonary artery and systemic arche
 - 2) Increased pressure in pulmonary arch and systemic arche
 - 3) Decreased pressure in both the atria
 - 4) Increased pressure in both the ventricles
88. The volume of blood pumped out by each ventricle per each heart beat is called
- 1) Cardiac output
 - 2) stroke volume
 - 3) Auricular output
 - 4) Residual volume
89. In the wall of artery two elastic laminae are present on either side of
- 1) Tunica externa
 - 2) Tunica media
 - 3) Tunica Interna
 - 4) Pericardia
90. Partial obstruction of blood flow to myocardium is called
- 1) Myocardial Ischemia
 - 2) Angina pectoris
 - 3) Myocardial Infarction (MI)
 - 4) CAD
91. Name of the severe pain that accompainies Myocardial Ischemia
- 1) MI
 - 2) CAD
 - 3) Angina pectoris
 - 4) Angioplastis
92. Name of phenomenon in which complete obstruction in coronary artery
- 1) MI
 - 2) CAD
 - 3) Angioplastis
 - 4) Angina pectoris

ANSWERS

1) 4	2) 3	3) 2	4) 3	5) 2	6) 4	7) 4	8) 4	9) 2	10) 2
11) 1	12) 2	13) 4	14) 4	15) 1	16) 4	17) 1	18) 2	19) 1	20) 3
21) 1	22) 2	23) 3	24) 1	25) 4	26) 2	27) 1	28) 1	29) 2	30) 2
31) 2	32) 2	33) 2	34) 3	35) 2	36) 3	37) 4	38) 3	39) 4	40) 3
41) 4	42) 2	43) 1	44) 3	45) 3	46) 3	47) 1	48) 4	49) 1	50) 1
51) 4	52) 1	53) 3	54) 3	55) 4	56) 3	57) 2	58) 3	59) 2	60) 2
61) 4	62) 2	63) 3	64) 4	65) 4	66) 4	67) 2	68) 3	69) 1	70) 4
71) 1	72) 2	73) 4	74) 3	75) 3	76) 1	77) 3	78) 3	79) 4	80) 2
81) 3	82) 2	83) 3	84) 2	85) 1	86) 4	87) 2	88) 2	89) 2	90) 1
91) 3	92) 1	93)	94)	95)	96)	97)	98)	99)	100)

EXERCISE – II

1. Study the following

- I) Blood pressure is monitored by pressure sensors in the aorta
- II) Volume of blood is controlled by hormones such as ADH and aldosterone
- III) Blood performs postman's job and police man's job in the body
- IV) Albumins provide capillary osmotic pressure

Which of the above are correct ?

- 1) only II and III 2) only III and IV 3) only I and III 4) I, II, III and IV

2. Study the following with respect to lymphatic system

- I) Lymph capillaries are microscopic and open ended tubes.
- II) Lymph vessels and ducts are provided with valves
- III) Walls of lymph vessels and ducts are similar to those of veins
- IV) Left lymphatic duct or cheliferous duct is the largest lymphatic duct

Which of the above are true ?

- 1) Only II and III 2) Only III and IV 3) Only I and III 4) II, III and IV

3. study the following

- a) Thoracic duct part of the body
- b) Lymph from the lower part of the body
- c) Lymph vessels
- d) Lymph capillaries
- e) Left subclavian vein

Find out the correct order with respect to lymphatic system

- 1) b – c – d – a – e 2) b – d – a – c – e 3) b – d – c – a – e 4) b – d – a – e – c

4. Thoracic duct collects the lymph from

- A) Right arm and right part of the thorax
- B) Left arm and left part of the thorax
- C) Right side of the head and neck
- D) Lower parts of the body
- E) Left side of the head.

- 1) A, D, E 2) B, D, E 3) A, C, E 4) B, C, D

5. Arrange the following in a sequence on the basis of spreading of contraction wave.

A) A. V. node B) Bundle of His C) Purkinjee fibres D) S – A node

E) Bundle branches

1) D – B – A – C - E 2) A – D – B – C – E 3) D – A – B – E – C 4) A– B– C– D - E

6. Select the correct statements from the following pertaining to lymphatic system.

A) Lymphatic system is an open circulatory system

B) Lymphatic system arises as open ended capillaries from the tissues

C) Digested fats absorbed into lacteals are finally transported to blood vascular system

D) Lymph is finally drained into right and left internal jugular veins and also includes the entire ECF

1) A & B

2) B & C

3) A & C

4) B & D

7. List – I

List – II

A) Factor – II

1) Christmas factor

B) Factor – V

2) Prothrombin of plasma

C) Factor – IX

3) Proaccelerin

D) Factor – X

4) Stuart – Prower factor

E) Factor – XIII

5) Proconvertin

6) Fibrin stabilizing factor

	A	B	C	D	E		A	B	C	D	E
1)	2	3	1	5	6	2)	2	5	1	4	6
3)	2	1	3	5	6	4)	2	3	1	4	6

8. Study the following

I) Bacteria, viruses etc are phagocytised by the WBC in the lymph nodes

II) Colloidal osmotic pressure of plasma favours the movement of about 85 percent of the ECF into the capillaries at the venular ends.

III) Lymph is similar in its composition to the blood's plasma, except that it contains a much lower concentration of proteins and other nutrients than plasma.

IV) coagulation factors are absent in lymph

Which of the above are correct ?

1) Only II and IV 2) Only III and IV 3) I, II and III 4) Only I and III

9. Match the following

A) Fibrinogen 1) Eleventh factor

B) AHF – B / AHG 2) Seventh factor

C) Proconvertin 3) Third factor

D) Thromboplastin 4) Nineth factor

	A	B	C	D		A	B	C	D
1)	4	1	2	5	2)	3	4	5	2
3)	4	5	2	3	4)	2	3	4	5

10. Arrange the following activites that occur in blood clotting in a sequence

A) Conversion of fibrinogen to fibrin B) Action of fibrin stabilizing factor

C) Formation of prothrombinase D) Conversion of prothrombin into thrombin

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

11. Arrange the following in sequence related to blood clothing.

A) Release of factor XIII

B) Release of tissue thromboplastin

- C) Soluble fibrinogen protein D) Activation of prothrombin E) Clot retraction
- 1) B, D, C, A, E 2) B, D, A, C, E 3) D, B, C, A, E 4) D, B, C, E, A
12. Arrange the following layers in sequence (from outer to inner)
- A) Endocardium B) Visceral layer C) Myocardium D) Pericardial cavity
- E) Fibrous pericardium F) Parietal layer
- 1) F, D, B, E, C, A 2) F, B, E, C, D, A 3) F, E, B, D, A, C 4) E, F, D, B, C, A
13. Identify the correct statements from the following
- A) Citrates prevent clotting of blood by making factor number – IV unavailable
- B) Heparin inactivates antithrombin to prevent clotting of blood
- C) Vit – K is essential for synthesis of prothrombin
- D) Platelets are used for blood clotting and not necessary for clot retraction
- 1) A & D only 2) A & C only 3) B, C & D 4) A, B, C
14. Find out the wrong statement
- i) Contraction of the ventricles raises the pressure in ventricles, due to which AV valves are closed
- ii) When pressure in aortic arches exceeds the pressure of ventricles, semilunar valves open
- iii) When pressure in ventricles falls below that in aortic arches, semilunar valves are closed
- 1) only I 2) only ii 3) only iii 4) all the above
15. Read the following
- A) Prothrombin B) Proconvertin
- C) Christmas factor D) Stuart–Prower factor
- Identify the factors formed in the liver in the presence of vitamin K
- 1) A and B only 2) A, B and C only 3) B and D only 4) A, B, C and D

16. Match the following and choose correct one

Column – I

Column – II

A) SA – Node

1) Ventricles

B) Papillary muscles

2) Atria

C) Ligamentum

3) Inter atrial arteriosum septum

4) Connects aorta and pulmonary trunk

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

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

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

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

17. Match the following

List – A

List – B

A) Hageman’s factor

I) Clot retraction

B) Fibrin stabilizing factor

II) Incomplete double circulation

C) Incompletely divided ventricle

III) Cartilagenous fishes

D) Physiological uraemia

IV) Intrinsic pathway

V) Branchial heart

	A	B	C	D
1)	V	IV	I	III
3)	IV	III	II	I

	A	B	C	D
2)	iv	I	II	III
4)	V	II	III	I

(ASSERTION AND REASON)

(Note : In the following questions a statement of Assertion(A) is followed by a statement of Reason(R).

1) Both (A) and (R) are true and (R) is correct explanation of (A).

2) Both (A) and (R) are true and (R) is not correct explanation of (A)

3) (A) is true but (R) is false 4) (A) is false but (R) is true

18. (A) : Spleen acts as haemopoietic organ until the fifth month of gestation.

(R) : Spleen is the largest lymphatic organ

19. (A) : In a pregnant woman, legs are swollen due to accumulation of fluids (ECF) in the legs.
 (R) : The enlarged uterus exerts pressure on the abdominal veins, thus increase the capillary hydrostatic pressure in a pregnant woman.
20. (A) : Blood clotting is cascade of complex enzymatic reaction.
 (R) : Each factor activates the many molecules of the next reactions.
21. (A) : Warfarin prevents the synthesis of blood clotting factors II, VII, IX and X.
 (R) : It is antagonistic to Naphthoquinone (Vit – K).
22. (A) : Blood serum has no property of clotting.
 (R) : The serum is plasma without clotting proteins.
23. (A) : In each heart beat, 70mL of blood is pumped by each ventricle.
 (R) : The duration of a cardiac cycle is directly proportional to the number of heart beats.
24. (A) : Hepatic portal system does not allow blood from the gut to reach the heart directly.
 (R) : Excess of sugars from the gut are converted in to glycogen in the liver before the blood reaches the heart.
25. Which of the following structures are found only in embryonic stages
- | | | | |
|--------------------------|---------------------|------------------|------------|
| A) Ligamentum arteriosum | B) Eustachian valve | | |
| C) Ductus arteriosus | D) Fossa ovalis | E) Foramen ovale | |
| 1) B, C, E | 2) A, C, E | 3) A, C, D | 4) A, B, D |

26. Arrange the following in a sequence of blood flow from the abdominal organs to lungs.

A) Pulmonary arch

B) Right atrium

C) Inferior vena cava

D) Right ventricle

E) Pulmonary artery

1) C, D, B, A, E

2) C, B, D, A, E

3) B, C, D, A, E

4) D, C, B, E, A

27. Identify the correct statements from the following

A) SAN is located in the upper right corner of right atrium

B) AVN is located in the lower right corner of right atrium

C) Pulmonary arch arises from left anterior angle of left ventricle.

D) Columnae corneae project from the inner walls of ventricle.

1) B & D

2) A & C

3) A & D

4) B & C

28. Study the following statements regarding blood pressure and select the correct ones.

I) Normal diastolic blood pressure is 120 mm Hg

II) Normal systolic blood pressure is 80 mm Hg

III) If the blood pressure of an individual is above 140 / 90, it is considered as hypertension

IV) Blood pressure is measured in the brachial artery of an arm by using sphygmomano – meter

1)All

2) I and II only

3) I, II & IV only

4) III & IV only

29. Match the following

A) Sinu – atrial node

1) Fossa ovalis

B) Right atrio – ventricular aperture

2) Pace Maker

- | | |
|-------------------------------|--------------------|
| C) Inter – atrial septum | 3) Tricuspid valve |
| D) Inter – ventricular septum | 4) Bicuspid valve |
| | 5) Bundle of H is |

	A	B	C	D		A	B	C	D
1)	1	2	3	5	2)	2	3	4	5
3)	2	3	1	5	4)	5	4	3	2

30. Match the following

List – I

List – II

A) Coronary artery

I) Cessation of normal disease circulation of blood due to sudden stoppage of heart contraction

B) Angina pectoris

II) Due to low blood pressure

C) Myocardial

III) Due to narrowing of infarction blood vessels to the heart

D) Cardiac arrest

IV) Atherosclerotic heart disease

V) Localized death of heart tissue

	A	B	C	D		A	B	C	D
1)	IV	III	I	V	2)	IV	II	I	III
3)	IV	III	V	I	4)	III	II	I	IV

31. Select the correct pair of statements from the following

I) In the wall of arteries tunica media is much

II) In the lumen of arteries endothelial lining gets double folded to form valves

III) All veins of human body carry deoxygenated blood only

IV) Veins contain only one elastic lamina inner to tunica media

1) I & II

2) II & III

3) I & IV

4) III & IV

32. The following are statements about blood vessels of human beings.

I) Tunica media of both arteries and veins formed by smooth muscles and elastin

II) Arteries and arterioles have two elastic lamina one on either side of the muscle layer

III) Veins have one elastic lamina outer to the muscle layer

IV) Tunica interna in both arteries and veins is formed by simple squamous epithelium without basement membrane.

Which of the above are true ?

1) I, II & III

2) I & II

3) III & IV

4) II & IV

Key

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