15. Circulation

15.0 : Introduction

Q.1. What is circulatory system ?

Ans: The system which transport nutrients, respiratory gases, hormones etc. throughout the body is circulatory system.

Q.2. Who discovered closed circulatory system ?

Ans: William Harvey discovered closed circulatory system.

15.1 : Blood Composition and Coagulation

Q.3. Define Haematology.

Ans: Study of blood is called Haematology.

Q.4. From which layer blood is derived?

Ans: Blood is derived from mesoderm.

Q.5. Describe in detail, the composition of human blood.

Ans: Blood consists of plasma (55%) and blood corpuscles or blood cells (45%).

Plasma :

It is straw coloured alkaline fluid.

It contains 90-92% water and 8-10% suspended and dissolved substances.

Plasma proteins (serum albumin, globulin, heparin, prothrombin, fibrinogen) and nitrogenous wastes (urea and uric acid) are present in plasma.

Fats, cholesterol, glucose (0.1 %), hormones, antibodies, etc. are also present in plasma.

Blood Corpuscles: Blood corpuscles are of three types as given below :

i) **RBC (Red Blood Corpuscles) or Erythrocytes :**

Erythrocytes are circular, biconcave and non-nucleated cells.

Their diameter is 7 μ and are 2.5 μ thick.

In adult male, RBC count is 5.1 to 5.8 million per cubic millimeter while in female it is 4.3 to 5.2 million per cubic millimeter.

Normal life span of a single RBC is about 120 days.

Formation of RBC's is called erythropoiesis.

Erythropoiesis in foetus, takes place in yolk sac, kidney, spleen and liver while in adults, it takes place in red bone marrow.

Stroma of RBC contains haemoglobin which helps in carrying respiratory gases.

Old and worn out RBCs are destroyed in spleen and liver.

ii) **WBC (White Blood Corpuscles) or leucocytes :**

Leucocytes are colourless, nucleated, amoeboid and phagocytic cells. The normal count of leucocytes is 5000 – 9000 per cu mm and their size is about 8 to 15 μ They have a life span of 3– 4 days. They are produced in bone marrow, spleen, lymph nodes, tonsils, etc. Leucocytes are mainly of two types viz. granulocytes and agranulocytes.

iii) **Blood Platelets or thrombocytes :**

Thrombocytes are fragments oflarge cells called megakaryocytes of bone marrow. They are biconvex, nonnucleated and small in size (2.5 to 5 μ). Their average count is about 2.5 lakhs per cubic millimeter. Their life span is about 5–10 days. They help in formation of clot during blood haemorrhage, thus preventing the loss of blood.

Q.6. Name the components of the formed elements in the blood and mention one major function of each of them.

Ans: Formed elements of blood include the blood corpuscles which freely float in the plasma. Blood corpuscles are of following types, each of which is specialised for a specific function:

	Formed elements	Biological function/s
A.	Erythrocytes or RBCs:	Transportation of 97-99% of O_2 as oxyhaemoglobin. Transportation of 23% of CO_2 as carbaminohaemoglobin.
B.	Leucocytes or WBCs: - Neutrophils: - Basophils : - Acidophils : - Monocytes : - Lymphocytes :	 Act as soldiers and eat upon the microbes by phagocytosis. Secrete heparin and histamine so help in anticoagulation. Secrete cytotoxin on the microbes and help in healing of wounds. Act as scavengers and remove damaged and dead cells of the body. Secrete antibodies which provide immunity against the pathogens.
C.	Blood platelets:	Secrete thromboplastin and platelet factors at the injuries and help in blood clotting to prevent excessive bleeding.

Q.7. Why do we consider blood as a connective tissue ?

Ans: Blood is considered a connective tissue for two basic reasons:

i) Embryologically, it has the same origin (mesodermal) as do the other connective tissue types

ii) Blood connects the body systems together bringing the needed oxygen, nutrients, hormones and other signaling molecules and removing the wastes.

Q.8. What is erythropoiesis ?

Ans: Formation of red blood cells is called erythropoiesis.

Q.9. Name the disorders related to total count ofRBCs in the body.

Ans: Polycythemia is the disorder caused due to increase in number of RBCs whereas erythrocytopenia is disorder caused due to decrease in number of RBCs.

Q.10.Enlist the functions of RBCs.

Ans:i) RBCs transport oxygen from lungs to tissues

ii) They transport carbon dioxide from tissues to lungs.

iii) Haemoglobin in RBCs act as a buffer to maintain blood pH.

iv) RBCs maintain blood viscosity.

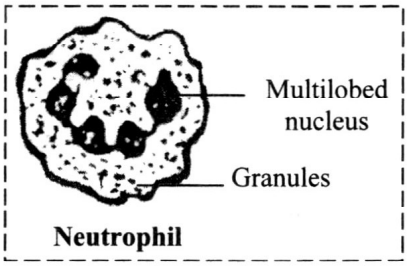
Q.11.Describe different types of leucocytes.

Ans: Leucocytes are of two types: Granulocytes and Agranulocytes.

i) Granulocytes: They are produced in red bone marrow and contain large sized granules in the cytoplasm. Granulocytes are of three types.

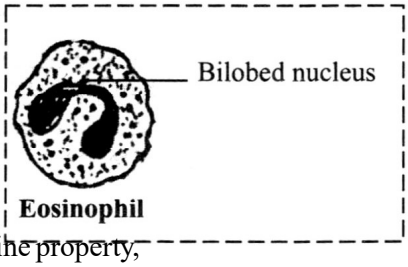
a) Neutrophils (neutro = neutral, philic = affinity)

They constitute about 70% of total WBC.
Nucleus is multilobed containing 3 to 5 lobes.
The granules in cytoplasm of these cells take neutral stain.
Functions : These are chief phagocytic cells.
They protect the body against invasion of bacteria.
Dead neutrophils along with damaged tissue are removed from the body in the form of pus.



b) Eosinophils (acidophils) :

They constitute about 3% of total WBC.
The nucleus is bilobed.
The granules in the cytoplasm of these cells take acidic stain.
Functions :
They are non-phagocytic and their number increases during allergic conditions.They show anti-histamine property.



c) Basophils :

They are the smallest white blood cells which constitute about 0.5% of the total WBCs.
They show twisted nucleus (' S' or comma shaped).
The granules in the cytoplasm of these cells take basic stain.
Functions :
They are non-phagocytic.
They secrete heparin, histamine thus play an important role in local anticoagulation an formation of ground substance.

ii) **Agranulocytes :** They are produced in spleen and do not contain granules in the cytoplasm. Agranulocytes are of two types.

a) **Lymphocytes :** They form 30% of total WBCs.
Nucleus is large, spherical and surrounded by thin layer of cytoplasm.
Functions : They produce antibodies and opsonins to neutralize the harmful effects of foreign matter and their toxins.

b) **Monocytes :** They are the largest leucocytes and constitute **1 to 3%** of total WBC.
They have large amount of cytoplasm and kidney shaped nucleus.
Functions : They are phagocytic in action. They engulf foreign particle e.g. bacteria.
They also remove the damaged and dead cell hence are referred as scavengers.

Q.12. Distinguish between RBCs (Erythrocytes) and WBCs (Leucocytes).

Ans:

No.	RBCs (Erythrocytes)	WBCs (Leucocytes)
i.	RBCs are red.	WBCs are colourless.
ii.	7 μ in diameter.	Size varies between 8 to 15 μ
iii.	Disc shaped, circular, biconcave.	Amoeboid in shape.
iv.	Non-nucleated.	Nucleated.
v.	Life span is about 120 days.	Life span is about 1 to 12 days.
vi.	One cubic millimeter of blood contains about 5.1 million to 5.8 million of RBCs.	One cubic millimeter of blood contains about 5000 to 9000 WBCs.
vii.	They transport respiratory gases.	They kill the disease causing germs.
viii.	It is of one type.	They are of two types a. agranulocytes b. granulocytes.

Q.13. Distinguish between Agranulocytes and Granulocytes.

Ans:

No.	Agranulocytes	Granulocytes
i.	These leucocytes have a **clear cytoplasm** without any granules.	These leucocytes have a **granular cytoplasm**.
ii.	They have rounded or oval nucleus.	They have a single, lobed nucleus.
iii.	They form 28% of the total leucocytes.	They form 72% of the total leucocytes.
iv.	They are of two types the monocytes and lymphocytes.	They are three types of granulocytes (based on their staining properties). Neutrophils, Eosinophils and basophils.
v.	These are produced in the red bone marrow.	They are produced in the bone marrow and lymphoid tissue such as **spleen**, **thymus** and **lymph nodes.**

Q.14. Distinguish between Basophils and Eosinophils.

Ans:

No.	Basophils	Eosinophils
i.	It constitutes 0.5 to 1. 0%.of total WBCs.	It constitutes app. 3% of total WBCs.
ii.	They cause allergic reactions	They are slightly phagocytic.
iii.	Nucleus is S shaped	Nucleus is bilobed
iv.	Granules can be stained by basic dyes.	Granules can be stained by acidic dyes.

Q.15.What is the normal haemoglobin content for human being ?

Ans: For normal male it is 13-18gm/100ml whereas for normal female it is 11.5-16.5gm/100 ml.

Q.16.What is diapedesis?

Ans: Due to amoeboid movement of leucocytes they can squeeze out of blood capillaries, this process is called dipedesis.

Q.17.What is leucopoiesis ?

Ans: Formation of WBCs is called as leucopoiesis.

Q.18.Explain the following terms in brief :

i) Leucocytosis ii) Leucopoiesis iii) Leukemia
iv) Leucopenia. v) Thrombopoiesis vi) Thrombocytosis
vii) Thrombocytopenia

Ans:i) Leucocytosis: Increase in number of WBCs.
ii) Leucopoiesis: Formation of WBCs.
iii) Leukemia: Pathological increase in number of WBCs.
iv) Leucopenia: Decrease in number of WBCs.
v) Thrombopoiesis: Formation of platelets.
vi) Thrombocytosis: Increase in platelet count.
vii) Thrombocytopenia: Decrease in platelet count.

Q.19.Name the cell which produce thrombocytes.

Ans: Megakaryocytes of bone marrow produces thrombocytes.

Q.20.Write a note on blood groups.

Ans: On the surface of plasma membrane of RBC's certain glycoprotein molecules called antigens are present. These antigens differ in different persons and give blood grouping properties to them.

i) ABO blood group system.
ii) Rh-blood group system

i) ABO blood groups : This system was given by Karl land steiner.

a) Antigen: These groups are based on two antigens present on the membranes of 'RBC's namely antigen A and antigen B. Person may have neither of them or one of them or both of them.

b) Antibody: It is γ -globulin protein present in blood plasma, so is called plasma factor. There are two types of antibodies a and b. A person may have neither of them ,one of them or both of them. Antigen A and antibody a and antigen B & antibody b are incompatible to each other. And cause self clumping. On the basis of this four blood groups are recognised.

Blood Group	Antigen	Antibody	Can give blood to	Can receive blood from	Genotype
A	A	b	A, AB	A,O	AA or AO
B	B	a	B, AB	B,O	BB or BO
AB	A,B(Both)	None	AB	All (Universal recipient)	AB
O	None	a,b (Both)	All (Universal donor)	O	OO

Person with blood group 0 is called universal donor as it has no antigen and can donate blood to any person. Person with blood group AB is called universal recipient as it has no antibody in their plasma so can receive blood from any blood group.

ii) Rh blood group system :

Rh factor is an antigenic protein present on the surface of red blood cells in the human beings. It was first discovered by Landsteiner and Weiner on the plasma membrane of rhesus monkey hence it is called as Rh factor. The person who has Rh factor on RBCs are called Rh + ve persons. The person who do not have Rh factor on RBCs are called Rh –ve persons.

Q.21. Describe the process of blood coagulation.

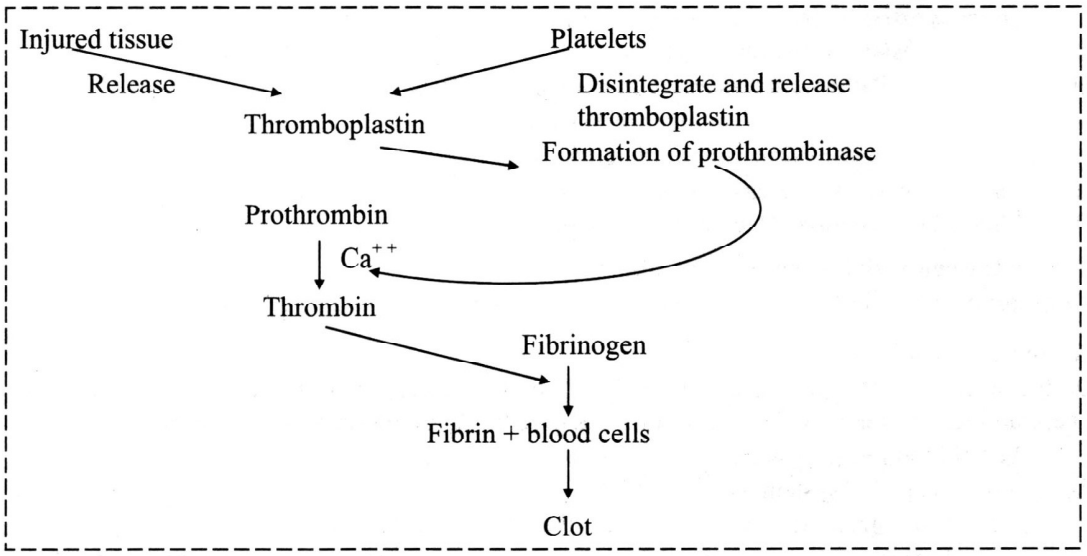
OR

Write a note on coagulation of blood.

OR

Describe the process of clotting of blood.

Ans:i) Conversion of liquid blood into semisolid jelly is called blood coagulation
ii) Platelets and injured tissues releases thromboplastin,that initiates the formation of enzyme **prothrombinase** in the blood.
iii) Prothrombinase in presence of Ca^{++} ions converts inactive plasma protein prothrombin into active **thrombin.**
iv) Thrombin converts soluble fibrinogen into fibrin.
v) **Fibrin** fibres entraps the platelets, blood cells and plasma to form a blood clot.
vi) The normal clotting time is 2 to 8 minutes.



15.2 : Structure and Pumping Action of Heart

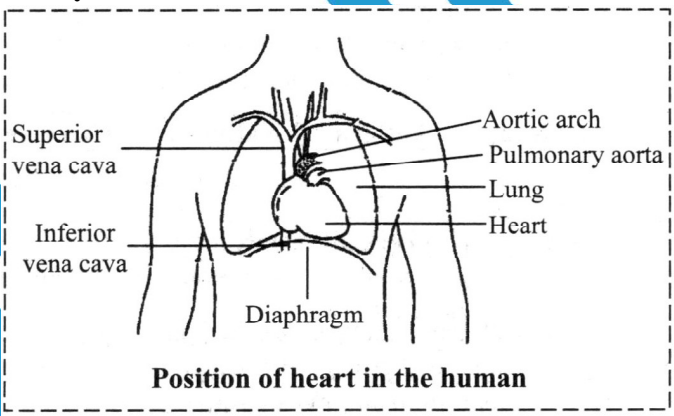
Q.22.Describe the position of heart in the human body.

Ans: Position of heart :

i) It is present inside the thoracic cage between the **two lungs (Mediastinum).**

ii) It is located not exactly in the middle but lies slanting a little to left.

iii) It is protected in the cage of ribs, back bone, breast bone and diaphragm.



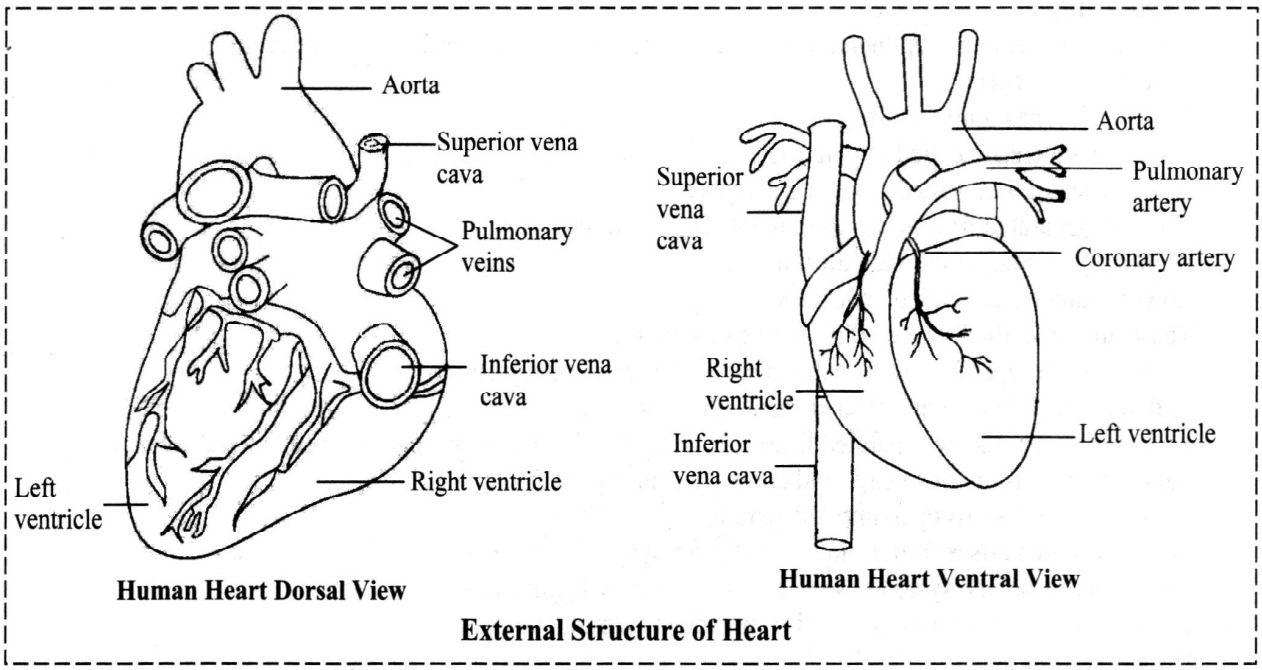
Position of heart in the human

Q.23. With dorsal and ventral view explain external structure of human heart.

OR

Draw a neat and well labeled diagram of ventral view of heart. **[Mar 09]**

Ans: Morphology (External structure of heart) :



External Structure of Heart

Origin :
Human heart is mesodermal in origin.
Shape :
It is hollow muscular cone shaped (conical) organ.
It has broad base towards upper side and narrow apex.
Size :
It is roughly of the size of one's clenched fist (own closed fist).
It measures about 12cm long, 9 cm wide and 6cm thick.
Weight :
Weight of human heart is about 250 to 300 gms.
Colour :
It is reddish brown in colour.
Wall of the heart :
It shows three layers viz, pericardium, myocardium and endocardium
Pericardium :
The heart is enclosed in double sac called the **Pericardium.**
Pericardium consists of an **inner serous pericardium and outer fibrous pericardium.**
The **serous pericardium** is composed of two thin, smooth membranes.
i) Inner visceral layer (visceral pericardium) attached to the heart and
ii) Outer parietal layer (parietal pericardium) attached to the fibrous pericardium.
The narrow space present between visceral and parietal layer is called as pericardial cavity.
It contains watery fluid called the **pericardial fluid.**
Fibrous pericardium is tough, loosely fitted inelastic sac around the heart.
Functions of pericardium and pericardial fluid :
i) It protects heart from shock and mechanical injury.
ii) It provides lubrication and avoids friction.
iii) It provides space for free movement of heart.
iv) It avoids over distension (overstreching) of heart.
v) It keeps surface of heart moist thus prevent desiccation.
Myocardium :
It is composed of cardiac muscles.
These muscles are striated involuntary muscles which bring about contraction and relaxation of heart.
Hence, human heart is said to be **myogenic or autorhythmic.**
Endocardium :
It consists of squamous epithelial cells which form lining of myocardium and heart valves.
External structure :
Human heart has four chambers. Upper chambers are called atria [auricles). Atria are small thin walled receiving chambers. Atria are separated from each other by interatrial groove. Right atrium is larger than left atrium. Lower chambers are called ventricles. These are large, thick walled distributing chambers. Ventricles are separated from each other by interventricular groove. Left ventricle is bigger and thicker than right ventricle. Atria and ventricles are separated from each other by oblique groove called atrioventricular sulcus. Superior and inferior vena cava and coronary sinus open into right atrium. Four pulmonary veins open into left atrium. Pulmonary arch arises from right ventricle and Systemic arch arises from left ventricle. Pulmonary trunk and systemic aorta are connected by ligamentum arteriosum. It is remnant of embryonic connection between two blood vessels.
Dorsal view of heart :
It shows two atria and two ventricles. Two pairs of pulmonary veins opening into right atrium. Two major veins, superior and inferior vena cava opening into right atrium. Opening of coronary sinus is seen near coronary sulcus.
Ventral view of heart :
It shows two upper smaller chambers the atria and two lower larger chambers the ventricles. Two main arterial trunks, pulmonary and systemic arch are seen between two atria, arising from left ventricle and right ventricle respectively. Transverse groove separating atria and ventricles can be seen. A pair of coronary arteries can be seen arising from aorta and divide and redivide and supply blood to
cardiac muscles.

Q.24. Write a note on pericardium.

Ans: *Refer Q.23.*

Q.25. With the help of neat and labelled diagram, describe the internal structure of human heart.

OR **[Mar 08, Oct 08, Mar 14]**

Describe the internal structure of human heart.

Ans: Internal structure of human heart : There is no connection/communication at all between the right and left sides of the heart. The right and left sides of the heart are separated by a partition called septum formed of myocardium covered by endocardium. **Interauricular septum** is relatively thin while **interventricular septum** is thick. Human heart is four chambered. It has two atria towards the base and two ventricles towards the apex.

Atrial Auricles: These are receiving chambers. These are thin walled, upper chambers of the heart. There are two atria viz, right atrium and left atrium separated from each other by means of a thin partition called **inter atrial septum.** Inter atrial septum bears a oval shaped depression called **fossa ovalis.**

Fossa ovalis is remnant of an embryonic aperture **foramen ovale** between the two atria in the foetus. It closes at the time of birth.

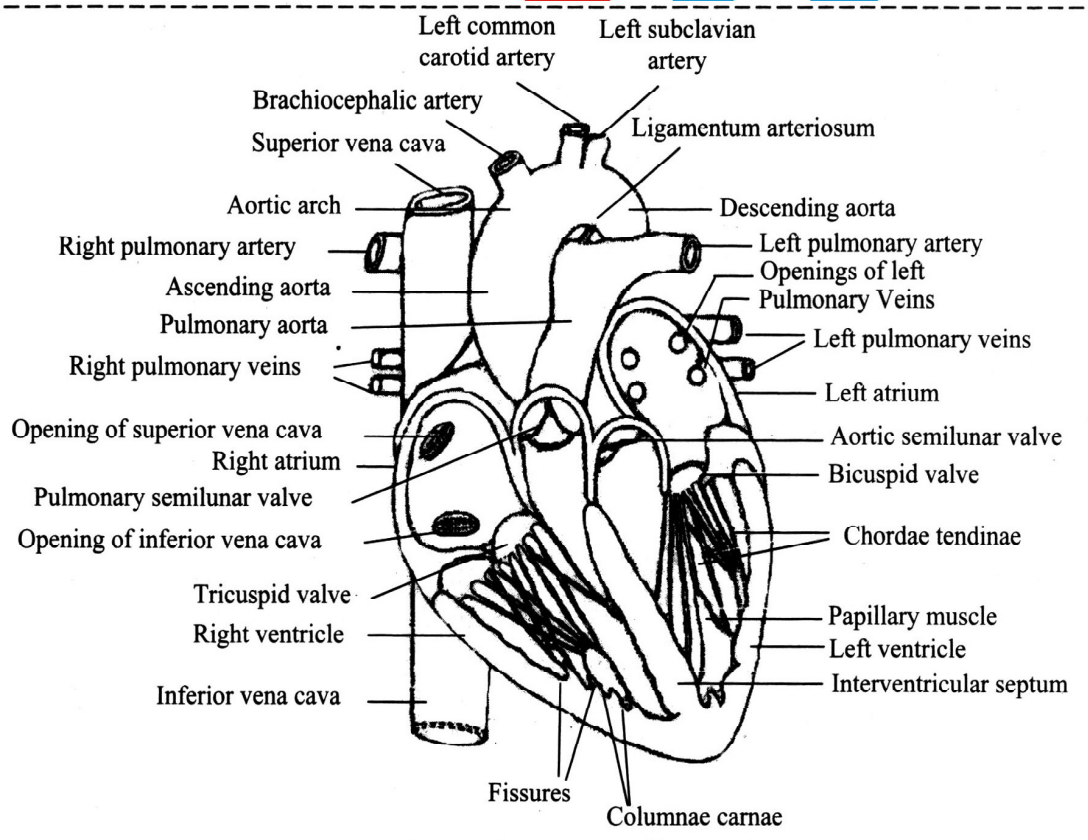
Right atrium :

It receives deoxygenated blood by three veins

A) The superior vena cava (precaval) B. The inferior vena cava (post caval)

C. Coronary sinus

Coronary sinus carries blood from wall of the heart. Openings of these blood vessels are present in right atrium. The opening of inferior vena cava is guarded by a muscular flap, the **Eustachian valve.** Opening of coronary sinus is guarded by valvular fold called valve of **Thebesius** or **Thebesian valve.** The right atrium opens in right ventricle by means of an opening called **right atrio ventricular opening.** It is guarded by a valve made up of connective tissue. This valve has three flaps hence called **Tricuspid valve.**



Internal structure of human heart

Left auricle/ atrium :

It is upper left chamber of the heart. It is comparatively smaller and thick walled than right atrium. It receives oxygenated blood from lungs by four pulmonary veins two from each lung. The left atrium opens into left ventricle by means of left atrio-ventricular opening. The left atrio-ventricular opening is guarded by two flexible flaps or cups called bicuspid valve.

Ventricles :

The ventricles are lower or inferior chambers of the heart. Ventricles are thick walled and are distributing chambers. There are two ventricles viz, right ventricle and left ventricle. Right ventricle is separated from the left ventricle by means of thick slightly curved partition called **interventricular septum.** It prevents mixing of oxygenated and deoxygenated blood in the ventricular part of heart. Both ventricles are **rough walled** and have **ridges and grooves.**

Ridges are of two types. Small ridges are called **columnae carnae** or **trabeculae carnae.** They divide the cavity of ventricle into smaller space as fissures. Bicuspid and tricuspid valves are connected to papillary muscles by special fibrous cords chordae **tendinae.** Other end of chordae tendinae are attached to special muscles called papillary muscles.

Right ventricle:

It is smaller than left ventricle and its wall is also thick. It receives deoxygenated blood from right atrium. It opens into pulmonary arch. Opening of pulmonary arch is guarded by **three semilunar valves.** These valves permit the flow of blood from right ventricle to pulmonary arch. Pulmonary arch is divided into left and right pulmonary arteries, which carry deoxygenated blood to lungs.

Left ventricle :

It is longer and more conical than the right ventricle and form the apex of the heart. It is larger and thick walled than right ventricle as it has to pump the blood to entire body. It gets oxygenated blood from left auricle. It opens into aortic arch, this opening is guarded by three semilunar valves which permit flow of blood from left ventricle to aortic arch. These valves prevent back flow of blood i.e aortic arch to left ventricle.

Q.26.Why does the left ventricle possess thicker wall than the right ventricle?

Ans: Left ventricle possess thicker walls as compared to right ventricle because it has to pump blood to all parts of the body.

Q.27.Describe the various types of valves present in human heart. **[Oct. 09]**

Ans: Heart Valves: There are two.types of valves found in human heart.

i) **Atrioventricular valves (AV):** Prevent back flow of blood from ventricle to atria during ventricular systole (contraction). These are of two types

a) **Tricuspid valve :** Located between right atrium and right ventricle.

b) **Bicuspid valve:** Located between left atrium and left ventricle. Bicuspid valve is also called **Mitral Valve.**

AV valves : open when pressure in the atria is greater than pressure in the ventricle (i.e. during ventricular diastole) and closed when pressure in the ventricles is greater than pressure in the atria (i.e. during ventricular systole).

ii) Semilunar valves: Prevent back flow of blood from arteries (pulmonary arch and the systemic arch) to ventricle during ventricular diastole (relaxation). These are of two types

a) **Aortic valve :** Located between left ventricle and the aorta.

b) **Pulmonary valve :** Located between right ventricle and pulmonary artery (trunk). **Semilunar valves** open when pressure in the ventricles are greater than pressure in the arteries (i.e. during ventricular systole) and closed when pressure in the pulmonary trunk and aorta is greater than pressure in the ventricle (i.e.during ventricular diastole). Valves consists of connective tissue (not cardiac tissue).

Q.28. Differentiate between tricuspid and bicuspid valve.

Ans:

No.	Tricuspid valve	Bicuspid Valve
i.	It guards the opening of right atrium into right ventricle .	It guards the opening of left atrium into left ventricle.
ii.	It is made up of three membranous flaps.	It is made up of two membranous flaps.
iii.	It prevents back flow of deoxygenated blood into right auricle.	It prevents back flow of blood into left auricle.
iv.	Located between right atrium and right ventricle	Located between left auricle and left ventricle.

Q.29. Describe the conducting system of Human heart.

Ans: Working of Heart :

Human heart is composed of cardiac muscles which are capable of alternate contraction (systole) and relaxation (diastole). Human heart is **myogenic** as its contraction is initiated and conducted by the modified

muscle plexuses called **nodal tissues. It consists of following components :**

i) Sinu – Auricular or Sinu-Atrial node (SA node or SAN)
ii) Atria-ventricular node (AV node of AVN)
iii) Bundle of His (bundle of His- Tawara)
iv) Purkinje fibres.

i) Sinu – auricular or sinu-atrial node or SA node or SAN :

A specialised patch of cardiac muscle present in the wall of right atrium near the right side of right atrium [opening of precaval vein] is known as S.A node or SAN.

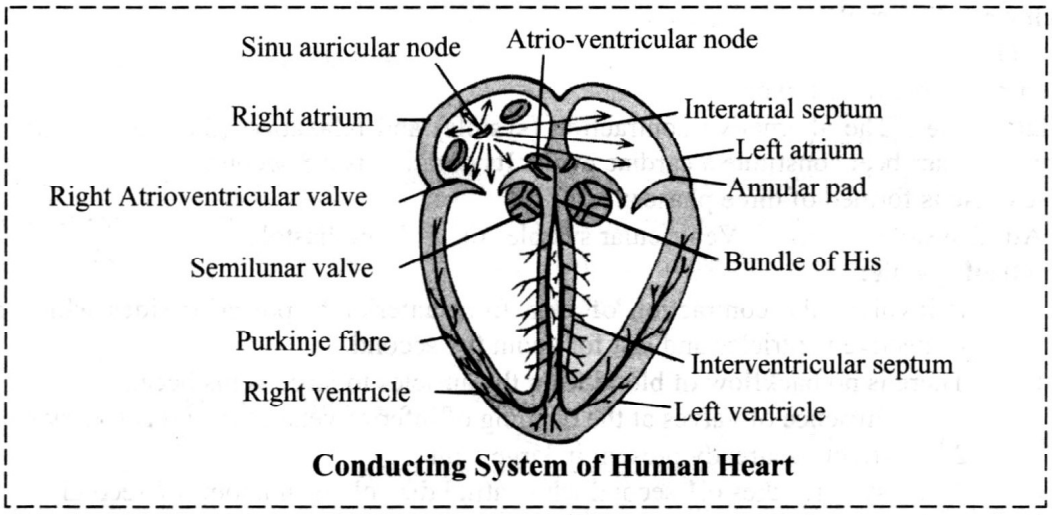
It is also called pacemaker as it is first to originate the cardiac impulses and maintain the pace (or duration) between first and second contraction. It brings about atrial systole and this wave of contraction generated by SA node spread all along the wall of atria and brings their contractions.

ii) Atrio-ventricular node (A.V. node) :

It lies in the right atrium near the junction of inter auricular and inter ventricular septum, close to groove which separates atria and ventricles. It is stimulated by the wave of contraction initiated by S.A node. It generates the cardiac impulses which are conducted to the muscle of the ventricles through bundles of His and Purkinje fibres.

iii) Bundle of His (bundles of His – Tawara) :

a) It arises from AV. node descends in the inter ventricular septum. It spreads the wave of contraction at the speed of 5 mts/sec.
b) It divides into two branches which descends along two side of inter ventricular septum and supply the wall of the ventricle of their own side by a network of fine fibres called purkinje fibres in myocardium of the ventricles.
c) S.A node A.V node. Bundles of His and Purkinje fibres collectively form the conducting **system of the heart.** It is responsible for autorhythrnicity of heart.



Conducting System of Human Heart

Q.30.Write a short note on pacemakers.

Ans: *Refer Q. 29.i.*

Q.31.Which structure in heart is called as pacemaker ?

Ans: Sinoauricular node is called as pacemaker.

Q.32.Why do we call our heart myogenic ?

Ans: Because in man, the nodal tissues of the heart (e.g. S.A node, AV. node, Bundle of His and Purkinje fibres) which collectively form the conducting system of the heart and regulate the heartbeat, are groups of special cardiac muscle fibres.

Q.33.Sino-atrial node is called the pace maker of the heart. Why ?

Ans: Because sino-atrial node has highest degree of rhythmicity and is first to originate the cardiac impulses and determines the rate of heart beat.

Q.34. What is the significance of atrio-ventricular node and atrio-ventricular bundle in the functioning of the heart ?

Ans: Atrio-ventricular node acts as pace-setter and generates the cardiac impulses which are conducted to the

ventricular muscles through the atrio-ventricular bundle (also called Bundle of His) and the Purkinje fibres at the speed of 1– 4 metre/second.

Q.35. Differentiate between S.A. node and A.V. node.

Ans:

No.	S.A. node	A.V. node
i.	Sinu–auricular or sinu–atrial node or SA node or SAN.	Atrio–ventricular node (A.V. node).
ii.	It is specialised patch of cardiac muscle present in the wall of right atrium near right side atrium [opening of precaval vein].	It lies in the right atrium near the junction of inter auricular and inter ventricular septum, close to opening of coronary sinus.
iii.	It is first to originate the cardiac impulses.	It is stimulated by the wave of contraction initiated by S.A. node.
iv.	Wave of contraction generated by SA node spread all along the wall of atria and brings their contractions.	It generates the cardiac impulses which are conducted to the muscle of the ventricles through bundles of His and purkinje fibres.
v.	It is also called **pacemaker.**	It is also called **pace setter.**

Q.36. Define a cardiac cycle.

OR

What is cardiac cycle ?

Ans: The alternative contraction (systole) and relaxation (diastole) of auricles and ventricles resulting in heart beat constitute a cardiac cycle. Its duration is 0.8 second.

Q.37. Describe cardiac cycle.

OR

Write a note on cardiac cycle.

Ans: Cardiac Cycle: The alternative contraction (systole) and relaxation (diastole) of auricles and ventricles resulting in heart beat constitute a cardiac cycle. Its duration is 0.8 second.

Cardiac cycle is formed of three phases :

i) Atrial systole ii) Ventricular systole iii) Joint diastole

i. Atrial systole :

a) It involves the contraction of atria from anterior to posterior sides which pushes blood into respective ventricles and last for about 0.1 second.

b) There is no backflow of blood from the auricles to large veins because

1. Presence of valves at the opening of inferior vena cava and coronary sinus.
2. Blood is already present in large vein

c) Atrial systole takes 0.1 second while atrial diastole is of about 0.7 seconds.

ii) Ventricular systole :

a) It involves simultaneous contraction of ventricles (ventricular systole) and relaxation of atria (atrial diastole)

b) Due to ventricular systole, the pressure on the blood in the ventricle is increased as compared to that of atria.

c) The auricular ventricular valves close rapidly to prevent the backflow of blood from ventricle to auricles.

d) Due to ventricular contraction blood is pumped into pulmonary arch and systemic arch from tight and left ventricles respectively i.e. deoxygenated blood is pumped in pulmonary arch and oxygenated blood is pumped in systemic arch.

e) Ventricular systole is completed in 0.3 sec.

iii) Joint diastole or complete cardiac diastole :

a) Ventricular systole is followed by ventricular diastole.

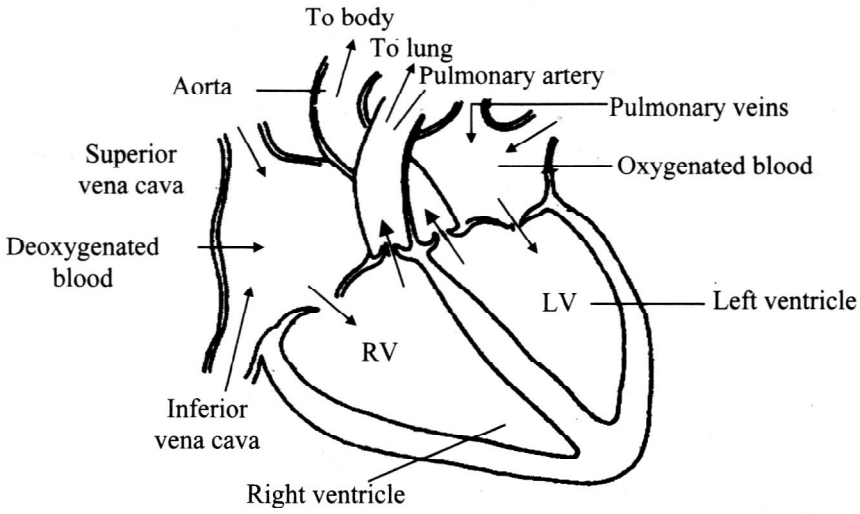
b) As atria are already in diastole, so all chambers of the heart enter the diastolic phase.

c) They remain relaxed for 0.3 sec.

d) To prevent backflow of blood from great arteries to ventricles the semilunar valves close rapidly.

e) The rapid closure of semilunar valves at the beginning of ventricular diastole produces the second heart sound called "dub" or diastolic sound.

f) Joint diastole takes only 0.4 second. So a cardiac cycle is completed in 0.8 seconds



Circulation of blood in heart

Q.38. Differentiate between systole and diastole.
Ans:

No.	Systole	Diastole
i.	It involves contraction of the heart chambers.	It involves relaxation of the heart chambers.
ii.	Blood pressure increases.	Blood pressure decreases.
iii.	During systole blood is ejected out of the heart chambers.	During diastole heart chambers receive the blood.

Regulation of cardiac activity

Q.39. Describe how cardiac activity is regulated in our body.
Ans:i) Activities of heart is regulated by specialized muscles present in heart which are autoregulated.
ii) Cardiovascular centres lies in the medulla oblongata of the brain.
iii) Sinoauricular node receives sympathetic and parasympathetic nerves which secretes adrenaline and acetylcholine respectively.
iv) Adrenaline stimulates and increases the heart beat whereas acetylcholine decreases the heart beat.

Q.40. What is sinus arrhythmias? "
Ans: It is phenomenon in which during inspiration heart rate increases and during expiration it falls.

15.3 : Blood Vessels

Q.41. Define angiology.
Ans: Study of blood vessels is called angiology.

Q.42.Describe the blood vessel in closed circulatory system.
Ans:i) Blood circulates throughout the body in hollow tubular vessels called **blood vessels.**
ii) They are of three types :
a) Arteries b) Veins c) Capillaries
iii) Arteries and veins are joined together by capillaries in tissues.
iv) The thickness of blood vessel walls also varies enormously, being largest in the large arteries, much less in veins of comparable diameter, and only a single cell thick in the capillaries.

Q.43. Write a note on structure of artery.
Ans:i) Arteries carry blood from the heart to different parts of body.
ii. They are thick walled, muscular and elastic.
iii) Arteries divide into smaller vessels called arterioles.
iv) Arterioles divide and redivide to form capillaries.
v) Arteries show high pressure to ensure efficient circulation of blood.

Q.44. Write a note on vein.

Ans: i) Veins carry blood from different parts of the body to the heart.
ii) Most veins show presence of valves to prevent backward flow of blood against force of gravity.
iii) They have thin wall resulting in spacious lumen.
iv) As lumen is spacious, blood pressure in veins is low.

Q.45. Write a short note on capillaries.

Ans: Capillaries :

i) These are tiny vessels with walls made up of squamous epithelium.
ii) The wall of capillary is permeable and allows water and dissolved substances (except proteins) to flow in and out of it.
iii) Thus, exchange of respiratory gases, nutrients, excretory products between tissue and blood takes place through the wall of capillary.
iv) Capillaries unite to form venules.
v) Arteries end in capillaries and veins begin as capillaries.

Q.46.Describe the histological structure of an artery.

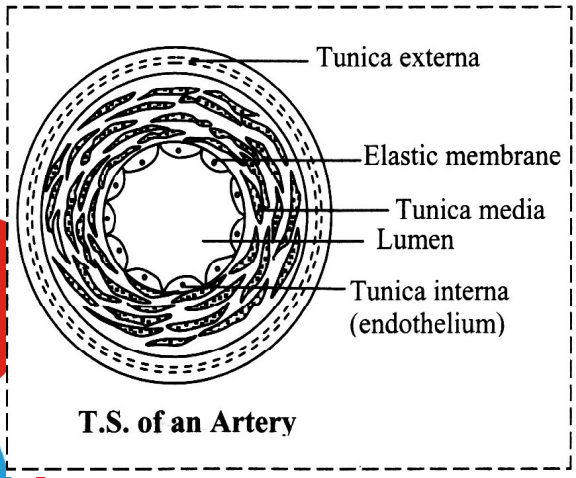
Ans:Histological structure of an artery :

In transverse section of an artery, three layers can be seen. They are :

i) Tunica Externa :
It is the outer layer made up of fibrous and elastic connective tissue. These are collagen fibres in th layer.

ii) Tunica media :
It is the middle layer made up of smooth muscle fibres and network of elastic fibers. It withstands the high blood pressure during ventricular systole and therefore it is thick.

iii) Tunica intern a or intima :
It is the inner layer made up of single layer of flat endothelial cell. This flat endothelium is surrounded by elastic layer.



T.S. of an Artery

Q.47.Describe the histological structure of a vein.

Ans: Histological structure of vein :

In transverse section of a vein, three layers can be seen.
They are :

i) Tunica externa :
It is the outermost thin layer made up of fibrous connective tissue. It is a thin layer.

ii) Tunica media :
It is middle layer made up of thin layer of smooth involuntary muscle fibers.

iii) Tunica interna :
It is the inner layer made up of connective tissue and some elastic fibers. Lumen of veins is lined by squamous epithelium forming endothelium. Due to thin wall lumen is spacious.

Q.48. Distinguish between arteries and veins.

Ans:

No.	Arteries	Veins
i.	They carries blood away from the heart.	They carries blood towards heart.
ii.	In these blood flows under great pressure.	Blood flows under less pressure.
iii.	Their walls are elastic, thick and muscular.	Walls are thin, non-elastic, fibrous.
iv.	Their cavity is small.	Cavity is large.
v.	They do not have valves.	They have valves.
vi.	These are deep seated.	Mostly superficial in location.
vii.	Oxygenated blood flows except pulmonary artery.	Deoxygenated blood flows except pulmonary vein.
viii.	Colour of the blood is scarlet	Colour of the blood is purple.

15.4 : Pulmonary and Systemic Circulation

Q.49. What is double circulation ?

Ans: Double circulation involves circulation of blood twice through the heart to supply it once to the body.

Q.50.What is meant by double circulation? What is its significance ?

Ans: Double circulation involves circulation of blood twice through the heart to supply it once to the body. It is more efficient than single circulation of fishes because blood flows at higher pressure and speed which increases the rate of not only nutrient supply to the body tissues but also faster removal of wastes from them.

Q.51.With the help of a neat and labelled diagram, explain double circulation in man.

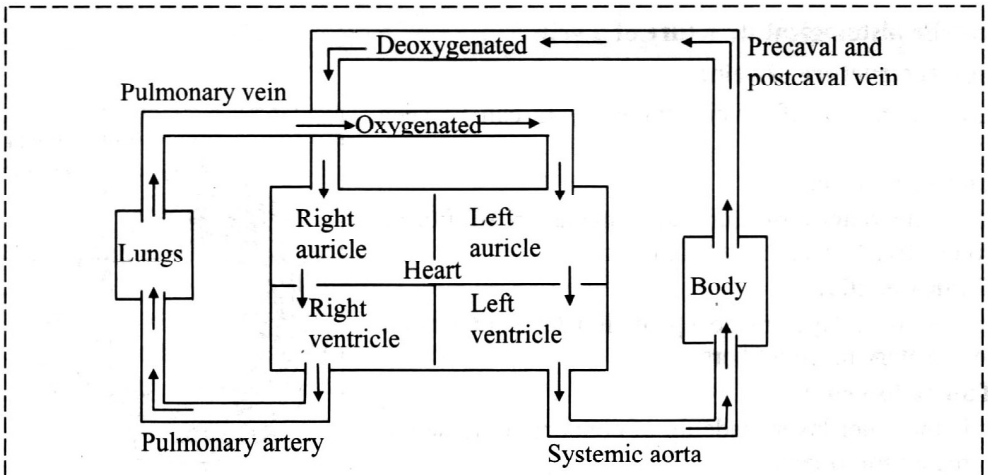
OR

Write a note on double circulation.

OR

Describe the systemic and pulmonary circulation.

Ans: Double circulation: When blood passes through the heart twice during one complete circulation in the body, then it is known as double circulation. Double circulation consists of systematic circulation and pulmonary circulation.



Double Circulation

i) Pulmonary circulation :

The flow of blood from right ventricle to left atrium through pulmonary arch and lungs is known as **pulmonary circulation.**

Pulmonary Circuit : Blood flows from the right ventricle → pulmonary artery → lungs → oxygenation of blood → 4 pulmonary veins → left atrium. This is the short circuit between lungs and the heart. Deoxygenated blood from right ventricle is carried to the lungs for oxygenation through pulmonary arteries. From the lungs the oxygenated blood is brought back to the left auricle through pulmonary veins. This is called pulmonary circulation.

Systemic circulation :

The flow of blood from left ventricle to right atrium through aortic arch and body organs is known as systemic circulation. Systemic Circuit: It involves the flow of blood from the left ventricle → aorta → arterioles → blood capillaries → organs + tissues → venules → veins → vena cava (superior and inferior) → right atrium. This is a long circuit supplying blood to all parts of the body. Thus blood passes twice through the heart during one complete cycle.

Q.52. What is coronary circulation ?

Ans:i) Coronary circulation is the circulation of blood to the heart muscles.

ii) Cardiac muscles of heart receive oxygenated blood through coronary arteries.

iii) Coronary veins collect deoxygenated blood and join to form coronary sinus which opens into right arium.

15.5 : Heart Beat and Pulse

Q.53.Define heart beat and pulse.

Ans:Heart beat : The rhythmic contraction and relaxation of heart is called heart beat.

Pulse: Pulse is a pressure wave that travels through the arteries after each ventricular systole.

Q.54. Write a short note on heart beat and pulse.

Ans: Heart beat :

i) Alternate systole and diastole of heart chambers.
ii) Hormones, autonomic nervous system, exercise and emotions etc., influence heart beat.
iii) Occurs due to impulses produced by SA and AV nodes.
iv) Heart beat is created by cardiac muscles.

Pulse :

i) The wave of distension due to the pumping of ventricles along the arteries is called arterial pulse.
ii) It may be felt by palpating radial artery near the wrist.
iii) Each heart beat generates one pulse in the arteries.
iv) Pulse rate in normal human being is 72 times per minute.

Q.55. Write a short note on cardiac output.

Ans:i) It is the volume of blood ejected from the ventricles of heart in one minute.
ii) It is also called as stroke volume.
iii) Heart pumps about 72 X 70 ml = 5040 ml i.e. 5 litres of blood per minute which is called as cardiac output.

Q.56.What is tachycardia and bradycardia ?

Ans: Tachycardia means increased heart rate over 100 beats per minute whereas Bradycardia means slow heart rate below 60 beats per minute.

Q.57. Which factors affect the pulse rate?

Ans: Following factors affect the pulse rate :

i) Pulse rate is higher in children.
ii) Pulse rate is higher in females.
iii) In sitting or lying position pulse rate is low.
iv) Pulse rate increases during emotional state of anger, fear etc.
v) Pulse rate increases during exercise.

15.6 : Rhythmicity of Heart Beat

Q.58.What is the heart rhythm?

Ans: It is called heart beat.The rhythmic contraction and relaxation of cardiac muscles is known as heart beat.It is involuntary or automatic.The contraction and relaxation of heart muscles are called systole and diastole respectively.One complete cardiac cycle completes in 0.8sec.

Q.59.Which system of the body controls the heart beat?

Ans: The nervous and endocrine system control the heart beat.

Q.60.What is the rate of heart beat ?

Ans: Our heart beats for 70-80 times in a minute. The average rate of heart beat is 72 times / minute.

Q.61.Which instrument is used to measure the blood pressure ?

Ans: Sphygmomanometer is used to measure the blood pressure.

Q.62.What is Blood pressure? Explain the term systolic and diastolic Blood Pressure.

Ans: Blood Pressure: Lateral pressure or force that the flowing blood exerts on the wall of arteries is called arterial blood pressure.

i) **Systolic Blood Pressure (SBP): (Gk. systole = contraction):** The maximum blood pressure occuring during the contraction or systole of left ventricle is called systolic blood pressure. Its normal reading is 120 mm Hg.
ii) **Diastolic Blood Pressure (DBP): (Gk. Diastole = Expansion) :** The minimum blood pressure occuring during the relaxation of the heart muscles is called diastolic blood pressure. Its normal reading is 80 mm Hg.

Q.63.What are the components of conducting system ?

Ans:S.A.node, A.V.node, bundle of His, right and left bundle branches and Purkinje fibres are components of conducting system.

15.7 : Blood Related Disorders

Q.64.Explain the terms hypertension and hypotension.

Ans: Hypertension: Blood pressure above normal range is called high blood pressure (high BP) or hypertension. It is about 150 mm Hg/90 mm Hg. **Hypotension :** Blood pressure below normal range is called low blood pressure (low BP) or hypotension. It is about 90 mm Hg/60 mm Hg.

Q.65.Define blood pressure. Explain different factors responsible for hypertension.

Ans: Lateral pressure or force that the flowing blood exerts on the wall of arteries is called arterial blood pressure.

Factors responsible for hypertension :

i) Diet rich in saturated fats and salts.
ii) Smoking
iii) Mental tension and stress.
iv) Old age
v) High viscous blood which increases friction during the flow.
vii) Loss of flexibility and elasticity of the arteries.
vii) Atherosclerosis and arteriosclerosis
viii) Presence of extra glucose in blood as in case of diabetic person.

Q.66.Which disorder is commonly called silent killer ?

Ans: Hypertension is commonly called silent killer.

Q.67.What is angina pectoris ?

Ans: Angina pectoris is the pain in the chest that results from a reduction in blood supply to cardiac muscles due to narrowed and hardened coronary arteries.

Q.68. Write a short note on the following

i) Hypertension :

A persistent rise in B.P is called high blood pressure or hypertension.
Systolic pressure more than 140 mm Hg and diastolic arterial blood pressure of more than 90 mm Hg.

Causes :

a) Diet rich in saturated fats and salts.
b) Smoking,alcoholism and adulterated food.
c) Mental tension and stress.
d) Old age.
e) High viscous blood which increases friction during the flow.
f) loss of flexibility and elasticity of arteries.
g) Atherosclerosis and arteriosclerosis.
h) Increased secretion of renin,epinephrine or aldosterone.
i) Obesity.

Effects :

Renal failure, left ventricular failure,myocardial infarction,cerebral haemorrhage and retinal haemorrhage.

Symptoms :

a) Headache,giddiness.
b) External dyspnoea (Get tired when walking or climbing stair cases).
c) Bleeding from nose,sweating,palpitation.
d) Excessive high B.P.about 220/120mm Hg . It may cause rupturing of blood vessel of eyes causing the blindness.

ii) Coronary artery disease :

i) It is also known as atherosclerosis.
ii) It is a narrowing of coronary arteries so that supply blood to the heart is reduced.

Cause :

It is caused due to deposition of fatty substance called plaque on the inner wall of arteries. As plaque grows heart muscles cannot get the blood or oxygen it needs.

Symptoms :

Chest pain (angina)or heart attack (myocardial infraction). Coronary artery disease is the leading cause of death.

iii) Angina Pectoris : (Angina = pain,pectoris = chest region) Angina or angina pectoris (latin for squeezing of the chest) is chest pain, discomfort or tightness that occurs when an area of heart muscle does not get enough oxygen rich blood.

Cause :

i) It is due to narrowed and hardened coronary arteries.
ii) It is caused due to deficiency of oxygen supply to the heart muscles.

Symptoms :

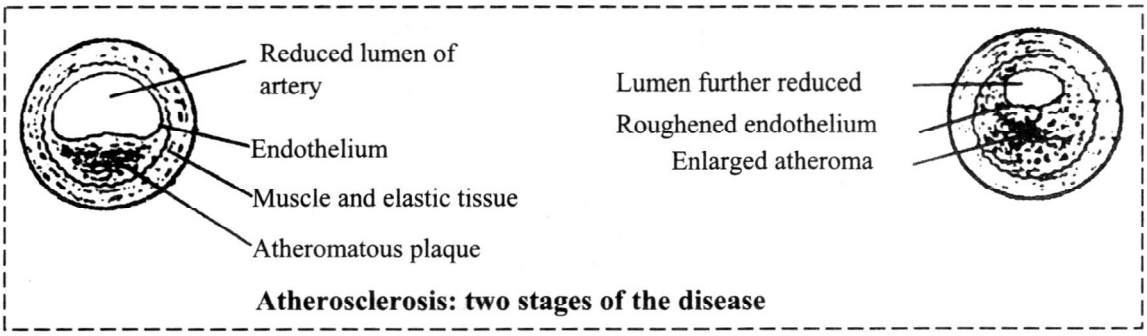
i) This pain normally starts in the centre of the chest and spreads down the left arm,left shoulder,neck,lower jaw.
ii) Heaviness and severe pain in the chest.
iii) Angina pectoris after occurs during exertion due to more demand of oxygen.
iv) Pain disappears with rest.
iv) Heart failure: It is also known as congestive heart failure (CHF).
Cause: Chronic infection toxic, severe anemia or hypothyroidism.
i) It is caused due to degeneration of heart muscles by many different diseases.
ii) Advanced age malnutrition.
iii. Diseases of the heart valves.
iv) Chronic infections.
v) Toxins.
vi) Severe anemia (rare).
vii. Hypothyroidism.

Q.69.Describe hypertension. Add a note on angina pectoris. **[Mar 2013]**

Ans: *Refer Q. 68. (i) and (iii)*

Q.70. Explain the term atherosclerosis.

Ans:i) Condition in which there is deposition of saturated fats inside inner wall of coronary artery or its branches.
ii) Further, there is deposition of muscles over this due to roughness by deposition of these fibres platelets start accumulating over it known us plaque.
iii) It leads to blocks in the artery and subsequently disturbance in blood flow to heart.



Atherosclerosis: two stages of the disease

15.8 : ECG

Q.71.Who discovered the technique of electrocardiography ?

Ans: Einthoven discovered the technique of electrocardiography.

Q.72.What is Electrocardiogram ?

OR

Write a note on ECG.

Ans:i) Electrocardiogram (ECG) is a graphic record of the action potentials generated by heart muscles during each heart beat.
ii) It depicts the electrical potentials as a series of graph-like tracings, or waves.
iii) Interpretation of these details reveal abnormalities in the heart's anatomy or function.
iv) The technique was discovered by Einthoven in 1903, hence known as Father of Electrocardiography.
v) The device used to record ECG is called electrocardiograph.
vi) ECG is useful to detect abnormal functioning of heart as in coronary artery.

Q.73. Explain the working of ECG.

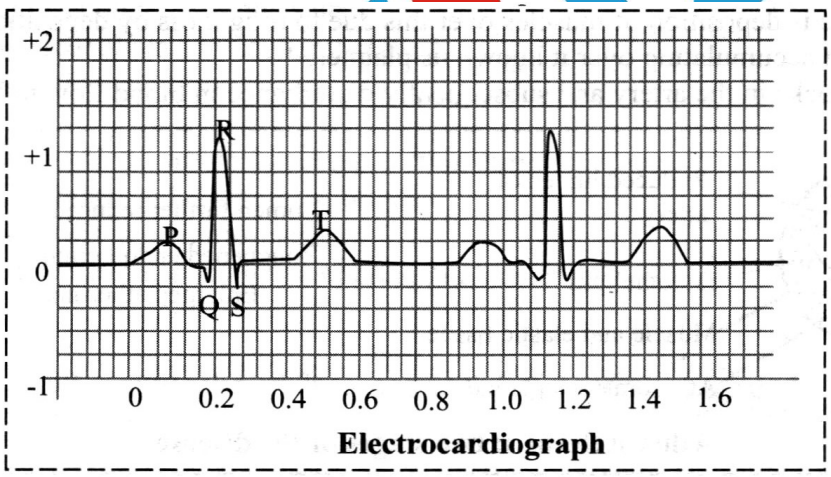
Ans:i) The electrical activities of heart are recorded by EeG machine.
ii) In order to record an EeG, many electrodes (or leads) are attached to various parts of the body.
iii) Two electrodes are connected to the chest of the patient above the heart while the third electrode is a reference connection to upper and lower limb.Special jelly is applied to improve electrical conduction.
iv) Electrodes are placed on the chest with the help of rubber suction cup.
v) These electrodes are connected to the EeG machine by electrical wires called leads.
vi) ECG machine is switched on.
vii) The electrodes detect the electrical impulses generated by the heart and transmit them to the ECG machine.
viii) The machine produces a graph of these cardiac electrical impulses which is printed on paper as electrocardiogram.

Q.74. Describe the graph obtained by electrocardiograph machine.

OR

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

Ans:i) The graph obtained during ECG has five waves called P,Q,R,S,T.
ii) Each of these waves represents a particular event in the muscles of the heart.
iii) **P wave** shows impulse generation in sinuatrial node, causing atrial depolarization. This results in atrial contraction.
iv) Q, Rand S waves are together known as **QRS complex.**
v) It shows ventricular depolarization and ventricular contraction.
vi) During QRS the impulse travels from SA node to AV node and then to bundle of His and Purkinje's fibre system.
vii) **T wave** shows ventricular relaxation which is developed due to ventricular repolarization.



Electrocardiograph

Q.75. Give the uses of ECG.

Ans:i) It is used to detect abnormalities of heart beat.
ii) It detects abnormalities like hypertension, coronary thrombosis, rheumatic diseases, tachycardia, bradycardia, angina pectoris, myocardial infarction, ischemic heart disease etc.
iii) It indicates efficiency of conducting system.
iv) It gives information oflung conditions.
v) It gives information of electrolyte imbalance.

Q.76. Differentiate between P-wave and T-wave.

Ans:

No.	P-wave	T-wave
i.	It indicates the impulse of contraction generated by S.A. node.	It indicates the ventricular relaxation.
ii.	It indicates atrial depolarisation.	It indicates ventricular repolarization.
iii.	It is of atrial origin.	It is of ventricular origin.
iv.	It is a small upward wave.	It is a dome shaped.

15.9 : Lymphatic System

Q.77. Write a note on lymph.

Ans: i) Lymph is the colourless liquid connective tissue that does not have RBCs.
ii) It is translucent alkaline medium that is present between blood capillaries and tissues.
iii) It is blood minus RBCs, platelets and some plasma proteins.
iv) It contains carbon dioxide and metabolic wastes.

Q.78. What is lymphatic system? Explain the functional significance oflymphatic system.

OR

Give an account of lymphatic system of man.

Ans: Lymphatic system consists of

i) Lymph
ii) Lymphatic vessels
iii) Lymph nodes

i) Lymph :

Lymph is extracellular, colourless body fluid (fluid portion of blood that oozes out of capillaries). 85% of this tissue fluid return back to venous end of blood capillaries. Rest of it diffuses into thin walled lymph capillaries, which form a network in tissue spaces. Lymph capillaries terminate blindly in tissue spaces.

ii) Lymphatic vessels :

a) Lymph capillaries join to form larger and thicker walled lymphatic vessels which in turn join and rejoin to form larger and larger lymphatic vessels ultimately lymph drains into venous blood through right lymphatic duct and left lymphatic duct (thoracic duct).
b) Thoracic duct is largest lymphatic vessel in body. It receives blood from the left side of head, neck,chest,left upper extremity and entire body below the ribs.
c) Right lymphatic duct collects lymph from upper right side of the body.
d) Lymphatic vessels arising from intestine are called as lacteals because they are milky in appearance.
e) Lymphatic vessels are provided with valves, which allow flow of lymph from tissues to heart (i.e unidirectional flow).

iii) Lymph nodes :

a) Along with lymphatic vessels, at several places, there are groups of swollen, small compact, nodular masses of lymphoid tissue and connective tissue, called lymph nodes.
b. They contain lymphocytes and lymph capillaries formed from lymphatic vessel which enters lymph node.
c. Lymph nodes are scattered throughout the body but are maximum in the neck., armpit and groin.

Functions :

i) Lymph nodes produce lymphocytes.
ii) They act as filters, as they have sinuses lined with phagocytic cells (macrophages) that engulf microbes (like bacteria), toxins, RBCs, and foreign particles, carried to them through lymph,

Significance of lymphatic system :

a) Lymph forms a medium for exchanges of substances between blood and tissue cells.
b) Lymphatic system drains excess tissue fluid from the extracellular spaces back into the blood.
c) Lymphocytes produced in lymph nodes destroy pathogens.
d) Fluid lost by blood in tissue spaces is regained by it through lymphatic system.
e) Swollen lymph nodes (in diseases) are palpable, thus help in diagnosis of certain diseases (e.g. Hodgkin's disease).
f) Lymph absorbs lipids from villi of intestines (lymphatics in villi of intestine are called lacteals).
g) Lymph helps to maintain body temperature by distributing body heat.

Q.79. What are the differences between blood and lymph ?

Ans:

No.	Blood	Lymph
i.	It is red coloured fluid.	It is light yellow coloured fluid.
ii.	It contains erythrocytes.	It does not contain RBCs
iii.	It contains more proteins	It contains less proteins
iv.	Blood does not form lymphocytes	Lymph forms lymphocytes
v.	It flows through blood vessels	It flows through lymph vessels.

Quick Review

	Eosinophils/Acidophils	Basophils	Neutrophils
Diameter	10–12 microns	10–12 microns	10–12 microns
% of total WBC	1-3%	Upto 1%	60–70%
Granules of cytoplasm stain with	Acidic dyes (like eosin), which stain them orange red.	Basic dyes (like methylene blue) stain them purple.	Neutral dyes stain them pale liliac. They are amphiphilic i.e. take both acidic and basic stain.
Cytoplasmic granules	Granules are coarse and many.	Granules are coarse and few.	Granules are pale, fine and many.
Nucleus	Bilobed, 2 lobes connected by thin strand of chromatin (appears like spectacle)	Twisted (irregular, S–shaped).	Multi lobed (2–5 lobes) connected by thin strands of chromatin.
Life span	1 to 12 days	8 to 12 days	3 to 12 days
Function	Slightly phagocytic (particularly for parasites i.e. worms like *Wuchereria Bancrofti*; hook worm, round worm), therefore eosinophils increase in parasitic infestation. e.g. Ascariasis (round worms). They also combat effect of histamine in allergic conditions (e.g. bronchial asthma, hay fever). (Therefore increase in eosinophils called Eosinophillia, seen in allergic conditions). These also help in healing of wounds, as they destroy toxin of the microbes. The number of eosinophils present in the blood stream is under the control of hormones produced by the adrenal cortex in response to stresses of various kinds. Eosinophils engulf complexes of antigen–antibody developed by an immune reaction.	Basophils are similar to mast cells in tissues. Cytoplasmic granules release heparin (anticoagulant, which prevents clotting of circulating blood) They also release histamine, thus increasing inflammatory response (e.g. in allergic reactions)	Acts as phagocytes. Therefore provide protection against viruses, bacteria, preventing diseases caused by them.

	Monocytes	Lymphocytes
Size	Large, 12–16microns diameter, Largest blood cells.	Smaller 2 types: i. large (10–12 microns diam) ii small (8 microns diameter, slightly larger than RBC).
% of total WBC	2–8%	20–30%
Nucleus	Single, eccentric, kidney-shaped.	Single, large, spherical.
Cytoplasm	Clear, abundant	Clear, scanty
Life span	3 days	24 hours in lymph and some live for 200 days in blood or even more.
Site of production	RBM	RBM and lymph nodes, spleen, etc. (They are found in all tissues of body except brain and spinal cord). Their greatest concentration is in lymph glands, spleen, lymphoid nodules in intestinal mucosa.
Function	Phagocytic like neutrophils (destroying viruses, bacteria). In tissues, they transform into large macro- phages, which are phagocytic, and destroy microbes and cell debris macrophages live for long.	B- lymphocytes transform into plasma cells, which produce antibodies and antitoxins to combat specific antigens and toxins respectively, providing specific immunity.

Multipal Choice Questions

1. Which one of the following produces antibodies ? antibodies ?
a) Monocytes b) Erythrocytes
c) Erythrocytes d) Thrombocytes

2. Which of the following are called scavengers?
a) Lymphocytes b) Thrombocytes
c) Erythrocytes d) Monocytes

3. Which of the following are scavenger cells ? **[Oct 2013]**
a) Lymphocytes b) Erythrocytes
c) Basophils d) Macrophages

4. Leucocytosis means
a) increased WBC count
b) decreased WBC count
c) no WBC production
d) destruction of WBC

5. Which one of the following leucocytes are phagocytic in function ?
a) Lymphocytes b) Neutrophils
c) Eosinophils d) Basophils

6. Which of the following is agranular?
a) Neutrophils b) Eosinophils
c) Basophils d) Monocytes

7. Plasma protein which initiates blood coagulation is
a) prothrombin b) pericardium
c) thrombin d) fibrin

8. The most important mineral for blood coagulation is
a) calcium b) magnesium
c) sodium d) iron

9. Which is the correct order in which the proteins participate in clotting of blood ? **[Mar 2013]**
a) Prothrombinase → Prothrombin → Thromboplastin → Thrombin
b) Thromboplastin → Prothrombinase → Prothrombin → Thrombin
c) Prothrombin → Thromboplastin → Thrombin → Prothrombinase
d) Thrombin → Prothrombin → Thromboplastin → Prothrombinase

10. The study of blood is called
a) angiology b) haematology
c) histology d) angiography

11. Blood is in origin.
a) endodermal b) mesodermal
c) ectodermal d) cranio epithelial

12. Blood is
a) epithelial tissue b) connective tissue
c) nervous tissue d) muscular tissue

13. Auricular systole in a cardiac cycle lasts for about
a) 0.4 seconds b) 0.1 seconds
c) 0.8 seconds d) 0.7 seconds

14. Thickest part of human heart is
a) right atrium b) left atrium
c) right ventricle d) left ventricle

15. The covering of heart is
a) perichondrium
b) pericardium
c) periosteum
d) peritoneum

16. Left atrioventricular aperture is guarded by
a) tricuspid valve
b) eustachian valve
c) bicuspid valve
d) semilunar valve

17. The pulmonary trunk and systemic aorta are connected by
a) Chordae tendinae
b) Columnae camae
c) ligamentum arteriosum
d) Purkinje fibres

18. Atrio – ventricular node is located in
a) left atrium b) left ventricle
c) right atrium d) right ventricle

19. Cardiac cycle is completed in_____ sec.
a) 1 b) 0.8
c) 30 d) 60

20. Which of the following prevent backward flow of blood ?
a) Auricles b) Ventricles
c) Valves d) S.A. Node

21. Which are receiving chambers of heart ?
a) Auricles b) Ventricles
c) Valves d) Arteries

22. Thickest wall is of
a) left atrium b) left ventricle
c) right atrium d) right ventricle

23. Ventricles are present in
a) heart b) brain
c) both a) and b)
d) neither a) nor b)

24. Heart beat is controlled by
a) hormones only
b) nerves only
c) both nerves and hormones
d) none of these

25. Which one of the following blood vessel is not lined by smooth muscles ?
a) Artery b) Vein
c) Pulmonary artery d) Capillary

26. Blood vessel which ends in capillaries is
a) artery b) vein
c) pulmonary d) coronary sinus

27. Study of blood vessels is called
a) Immunology
b) Haemocytology
c) Angiology
d) Histology

28. The arteries and veins are joined by
a) arterioles b) venules
c) capillaries d) lymph

29. Which of the following consists of smooth muscles ?
a) Tunica media
b) Tunica intema
c) Tunica extema
d) Both a) and c)

30. Which of the following is incorrect about arteries?
a) They are deep- seated.
b) They are without valves
c) Tunica media is thin
d) They have narrow lumen

31. Right atrium receives deoxygenated blood from
a) superior vena cava
b) inferior vena cava
c) left auricle
d) both a) and b)

32. The course of blood from right ventricle to left atrium of heart via lungs is called
a) Systemic circulation
b) Pulmonary circulation
c) Oxygenation
d) Cardiac cycle

33. Right ventricle pumps deoxygenated blood into
a) left ventricle
b) pulmonary aorta
c) dorsal aorta
d) left atrium

34. Circulation in humans is
a) pulmonary circulation
b) systemic circulation
c) single circulation
d) double circulation

35. _____is most commonly used to feel pulse. Lymphatic system consists of
a) Radial vein
b) Brachial artery vessels
c) Brachial vein
d) Radial artery

36. Duration of heart beat in man is
a) 0.8 sec / beat b) 0.6 sec/ beat
c) 0.2 sec/ beat d) 0.5 sec/ beat

37. In Sphygamomanometer, sphygmos means
a) pressure b) pulse
c) systole d) blood

38. The normal value of systolic pressure is
a) 120 mm of Hg b) 80 mm of Hg
c) 150 mm of Hg d) 50 mm of Hg

39. The normal value of diastolic pressure is
a) 120 mm of Hg
b) 80 mm of Hg
c) 150 mm of Hg
d) 50 mm of Hg

40. The pacemaker of human heart is___.
a) AV - node b) SV- node
c) SA - node d) M- node

41. The deposition of fatty substance in the lining of arteries is called
a) Arteriosclerosis
b) Atherosclerosis
c) Angina pectories
d) Angiology

42. ECG is useful to detect abnormal functioning of
a) liver b) heart
c) brain d) lungs

43. Father of Electrocardiogrphy is
a) Waston b) Calvin
c) Einthoven d) Fernad Widal

44. 'P' wave of ECG is normally
a) a small downward wave
b) a large, upward wave
c) a small upward wave
d) dome shaped upward wave

45. In ECG, which of the following waves develops due to ventricular repolarisation ?
a) R b) S
c) T d) Q

46. QRS is related to
a) atrial contraction
b) ventricular contraction
c) atrial relaxation
d) ventricular relaxation

47. Lymphatic system consists of
a) lymph, lymphatic capillaries, blood vessels
b) lymph, lymphatic capillaries, lymphatic vessels and lymph nodes
c) lymphatic capillaries, lymph vessels
d) lymph, lymphatic vessels and lymph nodes

48. Lymph nodes are maximum in
a) neck b) armpit
c) groin d) all of these

Answer Keys

1.	c)	2.	d)	3.	d)	4.	a)	5.	b)	6.	d)	7.	a)	8.	a)	9.	b)	10.	b)
11.	b)	12.	b)	13.	b)	14.	d)	15.	b)	16.	c)	17.	c)	18.	c)	19.	b)	20.	c)
21.	a)	22.	b)	23.	c)	24.	c)	25.	d)	26.	a)	27.	c)	28.	c)	29.	a)	30.	c)
31.	d)	32.	b)	33.	b)	34.	d)	35.	d)	36.	a)	37.	b)	38.	a)	39	b)	40.	c)
41.	b)	42.	b)	43.	c)	44.	c)	45.	c)	46.	b)	47.	b)	48.	d)				