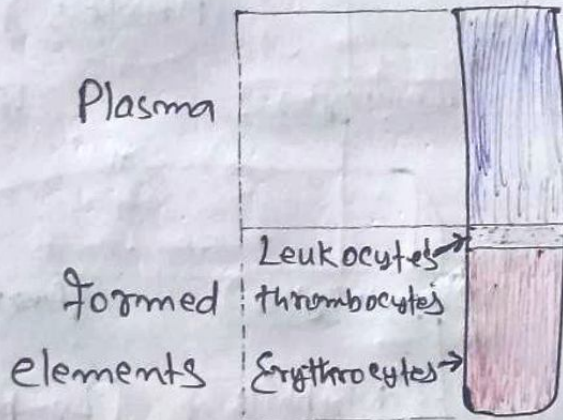


Body fluids and circulation:

⇒ Body fluids are the fluids such as blood, lymph, milk and saliva which are produced in the body and then either circulate within the body or secreted outside it.

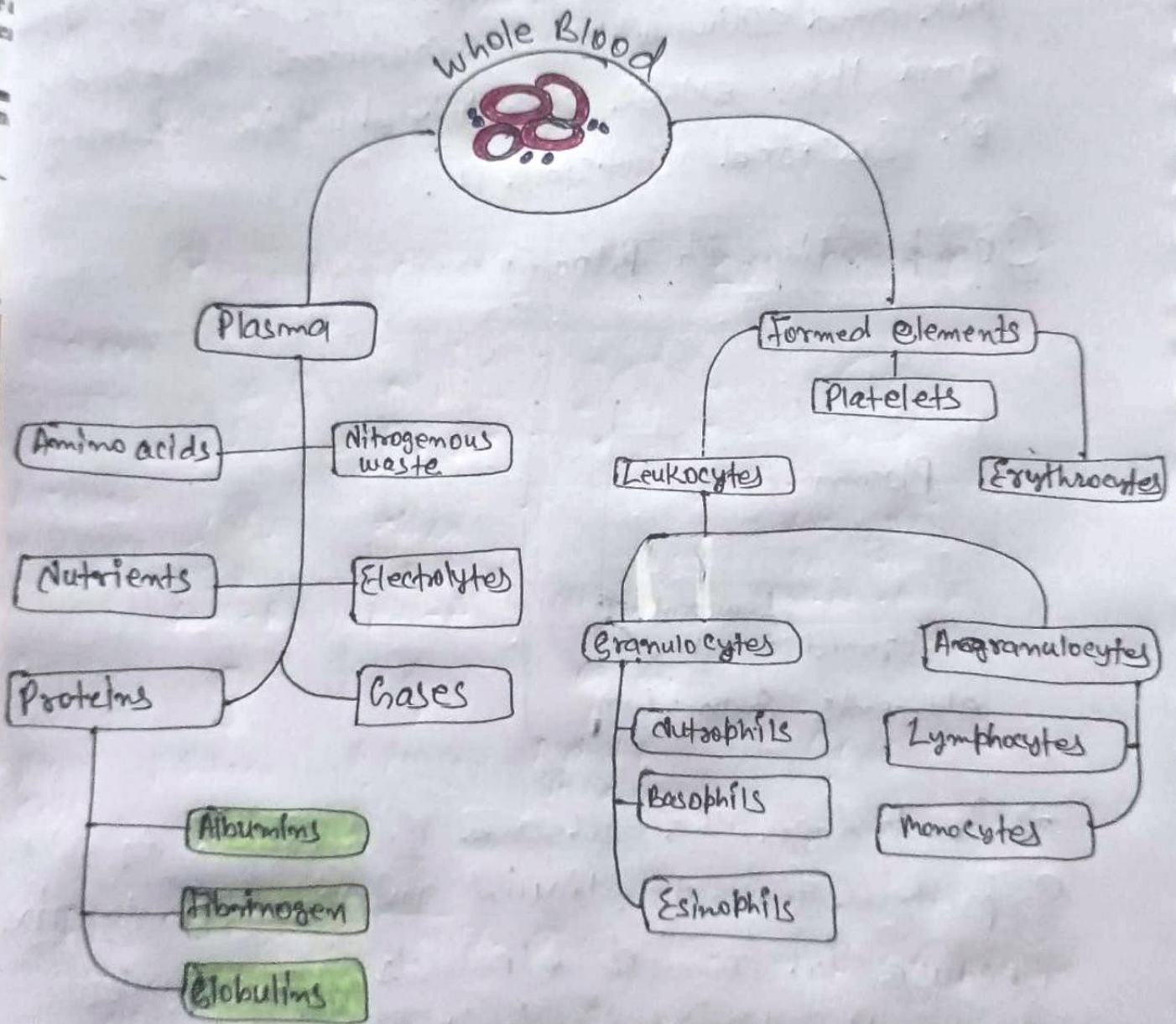
Composition of Blood:



⇒ Centrifuge, the cells and cell fragments are separated from the liquid intercellular matrix, because the formed elements are heavier than the liquid matrix, they are packed in the bottom of the tube by the centrifugal force.

The light yellow colored liquid on the top is the Plasma, which accounts for about 55 percent of the blood volume and red blood cell is called the hematocrit, or packed cell volume.

⇒ Composition of blood



It is a fluid connective tissue composed of different cells (RBCs, WBCs and Platelets).
 The pH of blood is 7.4 i.e. Slightly alkaline.

⇒

* Plasma:- Plasma constitutes 55% of blood volume. It is a viscous fluid and contains 90-92% water. Other than water, plasma contains 6-8% proteins (fibrinogens, albumins and globulins), amino acids, glucose and small amounts of electrolytes (Na^+ , Ca^{++} , Cl^- etc)

* Formed Elements:- include erythrocytes, leukocytes and blood platelets.

⇒ Erythrocytes or RBC are the most abundant cells present in the blood.

⇒ Formed in the bone marrow

⇒ biconcave and without a nucleus

⇒ have a lifespan of 120 days and get destroyed in the spleen (RBC's graveyard)

⇒ Leucocytes or WBC are colourless due to the absence of haemoglobin. They are of two types granulocytes and agranulocytes.

⇒ have a life span of 3-4 days

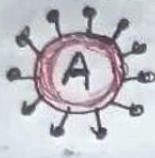
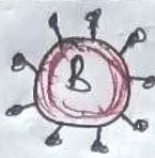








⇒ granulocytes include neutrophils, eosinophils and basophils.

⇒ agranulocytes include lymphocytes and monocytes.

⇒ eosinophils are involved in an allergic reaction.

Blood Platelets or thrombocytes are involved in the clotting of blood. They are formed from the megakaryocyte cell of bone marrow.

Blood groups

	GROUP A	GROUP B	GROUP AB	GROUP O
RED BLOOD CELL TYPE				
ANTIBODIES IN PLASMA	 Anti-B	 Anti-A	None	 Anti-A and Anti-B
ANTIGENS in RED BLOOD CELL	 A Antigen	 B Antigen	 A and B Antigens	None

ABO grouping: There are four types of blood group, A, B, AB and O. It is based on the presence or absence of surface antigens on RBCs (Antigen A and B)

Blood Group	A	B	AB
Antigen on RBCs	A	B	A, B
Antibodies in Plasma	Anti-B	Anti-A	nil
Donor blood type	A, O	B, O	A, B, AB, O (universal)

Rh grouping

⇒ 80% of people have Rh antigen on the surface of RBC. Those who have Rh antigen are called Rh^+ and those without it are Rh^- .

Erythroblastosis fetalis: when the mother is Rh^- and the father is Rh^+ and foetus blood group is Rh^+ , then there are chances of mixing of foetus delivery.

Coagulation of Blood:

⇒ Blood clotting prevents excess loss of blood from an injury. The clot is made up of network of fibrins, which traps dead formed elements.

Inactive Fibrinogen → Fibrin by the enzyme -
- Thrombin.

Inactive Prothrombin → Thrombin by the enzyme
Thrombokinase.

Ca^{++} plays an important role in the process of Coagulation.

Lymph:-

⇒ Lymph is also a fluid connective tissue.

The lymphatic system drains back the interstitial fluid back to major veins. Lymph consists of lymphocyte cells and is part of the immune system.

⇒ Of the body fats are absorbed in the intestine by lacteals of villi and transported to the blood by lymph.

Circulatory Pathways

There are two types of circulatory systems:

01) Open circulatory system: Blood vessels

are not found and blood is present in the open cavity known as sinuses, where internal organs float. This type of system is present in arthropods and molluscs.

02) Closed circulatory system: Blood vessels

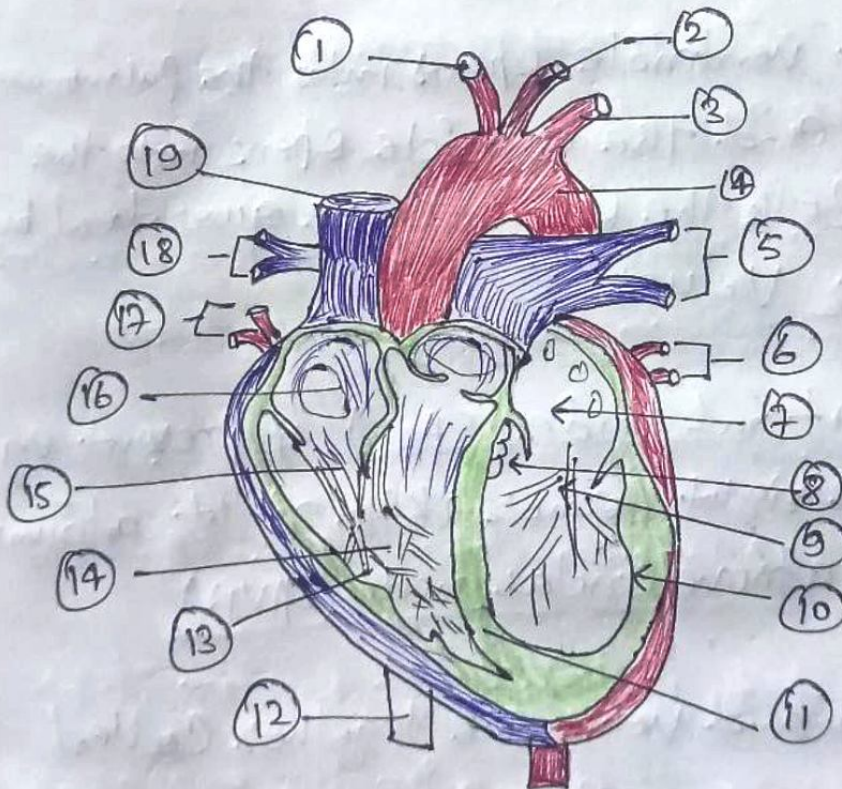
circulate the body. This type of system is present in Annelids and Chordates.

Name	Type of Heart
Fish	2 Chambered, 1-a
Amphibian and Reptiles	3 Chambered, 2-a
Crocodyles, Birds and Mammals	4 Chambered, 2-a

Human Circulatory System

Heart :- four chambered, derived from mesoderm.
 - m. It is present between the two lungs in the thoracic cavity and protected by the pericardium.

STRUCTURE OF THE HUMAN HEART



- ① Brachiocephalic
- ② Left Common Carotid Artery
- ③ Left Subclavian Artery
- ④ Aorta
- ⑤ Left Pulmonary Arteries
- ⑥ Left Pulmonary Veins
- ⑦ Left Atrium
- ⑧ Semilunar valves
- ⑨ Atrioventricular Valve.
- ⑩ Left ventricle
- ⑪ Septum
- ⑫ inferior vena cava
- ⑬ Right ventricle
- ⑭ chordae tendinae
- ⑮ Atrioventricular

- (16) Right Atrium (17) Right Pulmonary vein
 (18) Right Pulmonary Vein (19) Superior vena cava

* A bicuspid (Mitral) valve is present between the left, atrium and ventricle.

* A tricuspid valve is present between the right, atrium and ventricle.

* The right ventricle opens into the pulmonary artery and the left ventricle opens into the aorta. Both the openings are guarded by semilunar valves.

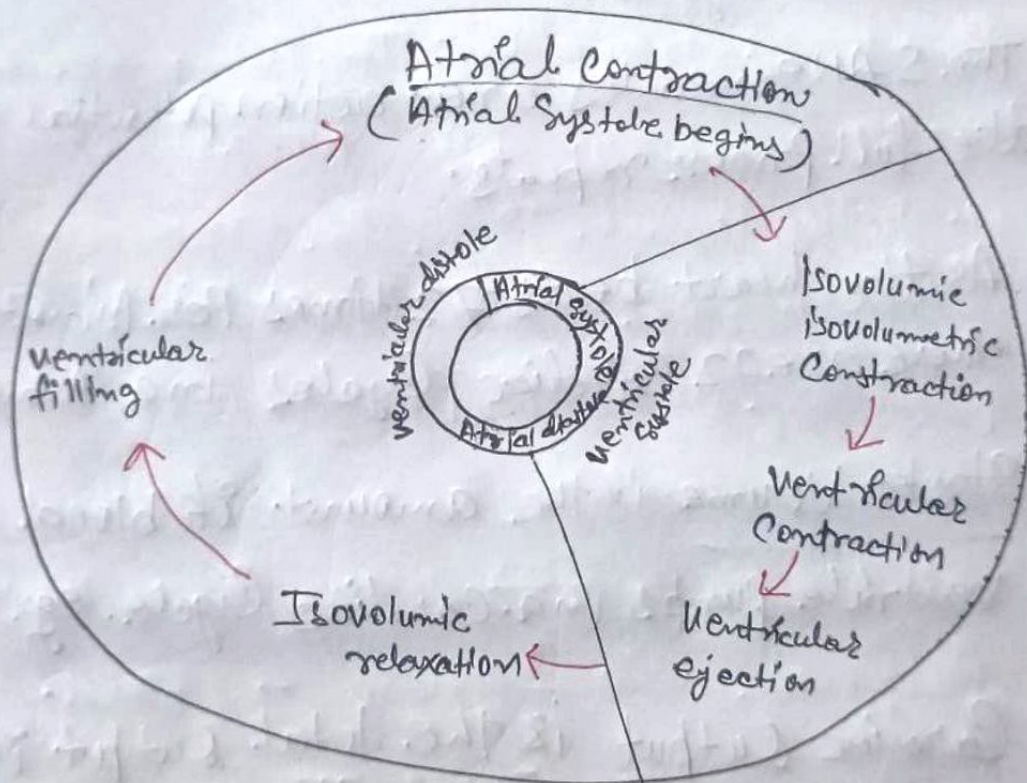
* The Sinoatrial node (SAN) is present on the upper right corner of the right atrium and the atrioventricular node (AVN)

* Arteries and veins are together called blood vessels, which transport blood to various parts of the body and bring back to the heart

* Arteries and veins are made up of three layers

- 1) Inner tunica intima - Squamous endo-
-thelium.
- 2) Middle tunica media - elastic fibres and
Smooth muscles (thin in the veins)
- 3) Out tunica externa - Fibrous connective
tissue having collagen fibres.

CARDIAC CYCLE



* At the start of the cycle, all the four chambers remain in a relaxed state known as joint diastole.

* Joint diastole is followed by atrial systole, on the generation of action potential from SAN node.

* The action potential then gets transferred to

⇒ AVN and then to the bundle of His leading to the contraction of the ventricle.

eg: ventricular systole and at the same time atrial diastole occurs.

* Ventricular diastole follows with the closure of semilunar valves.

* This completes the one full cycle of the Cardiac Cycle.

* The SAN generates a new action potential and the full process repeats.

* As the heart beats 72 times per minute, so there are 72 Cardiac Cycles in a minute.

* Stroke Volume is the amount of blood each ventricle pumps in a Cardiac Cycle. eg: 70ml

* Cardiac Output is the total output of blood from each ventricle in a minute eg: stroke volume multiplied by the no. of heart beats per minute, which is 5L in a healthy individual.

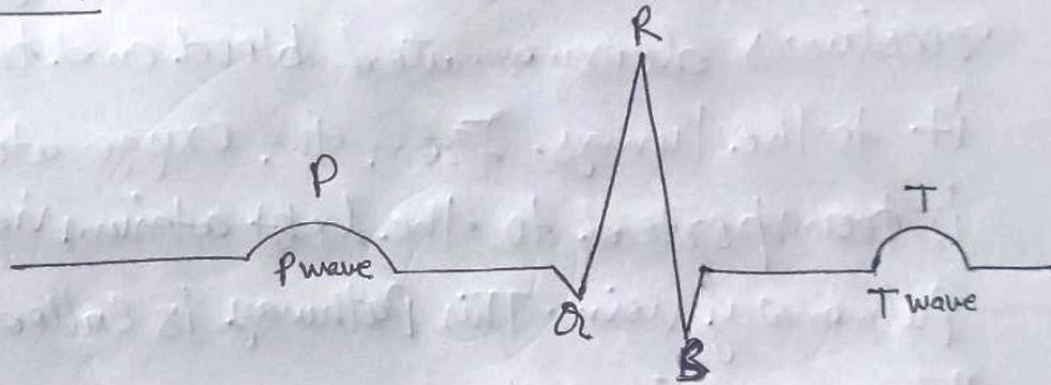
* In each Cardiac Cycle, two distinct sounds are produced i.e. 'lub' and 'dub' two distinct ⇒

⇒ Sound are produced e.g. - lub and dub, which can be heard using a Stethoscope.

* The first sound "lub" is produced when bicuspid and tricuspid valves close at the time of ventricular Systole.

* The second sound "dub" is produced when semilunar valves close at the time of ventricular diastole.

ECG



Depolarisation of the atria

QRS Complex
Depolarisation of the ventricles

Repolarisation of the ventricle

⇒ The electrical activity of the cardiac cycle can be recorded in a graphical form by electrocardiogram or ECG.

Various phases of each cardiac cycle are represented by a letter from P to T.

* P wave → excitation or depolarisation of atria

* QRS Complex → depolarisation of ventricles.

* T → repolarisation of ventricles (normal excited)

⇒ The no. of QRS Complex recorded in a time a time period tells the heart rate of the patient. Any abnormality or disease can be diagnosed by ECG if the graph shows any deviation from a regular pattern.

Double Circulation

⇒ Pulmonary Circulation: The Pulmonary artery receives deoxygenated blood and transports it to the lungs. From the oxygenated blood is transported to the left atrium via the Pulmonary vein. This pathway is called the Pulmonary Circulation.

Pulmonary artery → deoxygenated blood,
Pulmonary vein - Oxygenated blood.

⇒ Systemic Circulation: The oxygenated blood goes to the aorta from left ventricle. The oxygenated blood then gets transported from the aorta to various tissues by arteries, arterioles and capillaries.

⇒ Hepatic Portal System: The vascular connection between the liver and digestive tract. The hepatic portal vein collects intestinal blood and transports to the liver and then it goes to the systemic circulation.

Regulation of Cardiac Activity

The heart is myogenic as its activity is regulated by nodal tissues.

The heart's function is moderated through ANS (Autonomic nervous system) by a neural centre in the medulla oblongata.

Disorders of the Circulatory System

⇒ High Blood Pressure (Hypertension) :- The normal blood pressure of a human being is 120/80 mm Hg. 120 is Systolic pressure and 80 is the diastolic pressure.

⇒ Coronary Artery Disease (CAD) : It is also referred to as atherosclerosis. It affects the supply of blood to the heart.

⇒ Angina (Angina pectoris)

⇒ Heart failure :-

⇒ Coronary thrombosis.