

Past Papers 2021Date: 17 Nov 2025

- Q3: (a) Explain with examples the relationship between the cells, tissues and organs.
(b) Explain the differences in structure and function between a cell wall and a cell membrane.
(c) What is meant by transpiration? Explain in detail the significance of leaf structure in the process of transpiration.
(d) What is meant by the term double circulation? Briefly describe how the heart is adapted to keep blood flowing in a double circulation.

Ans: (A) Relationship between cells, tissues and Organs.

Every living thing is made up of cell. Cell is the building block of all living organisms. It is basic unit of life. Similar cells combine together to form tissues and different tissues work together to perform a similar task is called organ.

For Example, a living body consists of several organ system work together and it is only possible when organs perform their function. Similarly, organs work due to many tissues perform their tasks and the tissue is combination of many cells. The system of living body

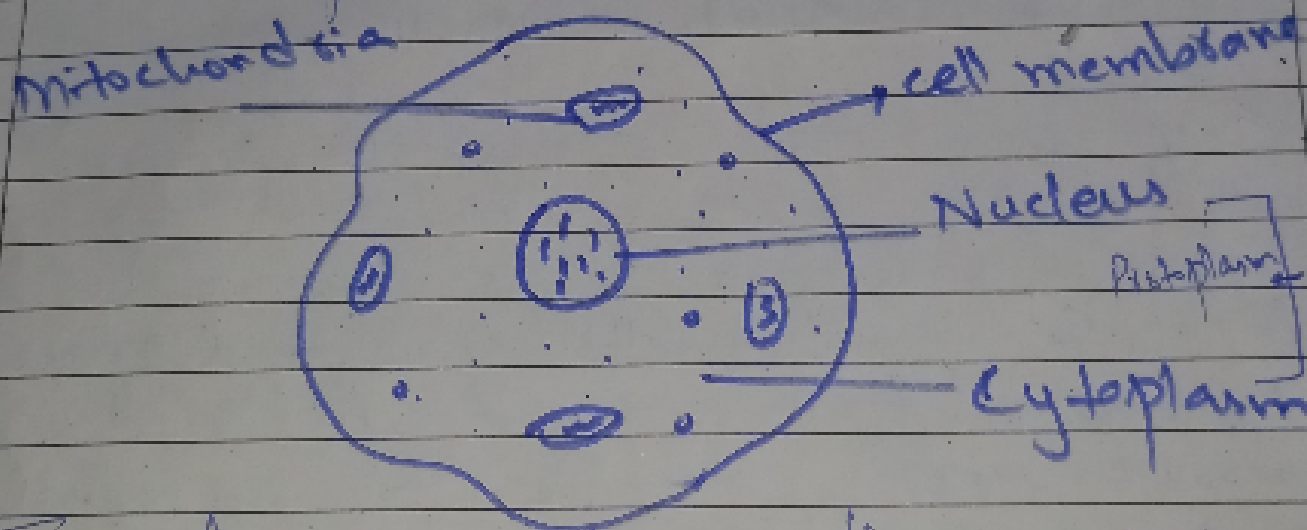
could not do work without these components.

Introduction / Definition of

Cell :- Cell is the building block of Life. Without cell, life is not possible. Cell is discovered by Robert Hooke in 1665 when he observed the honey. The word cell is derived from 'cellulae'.

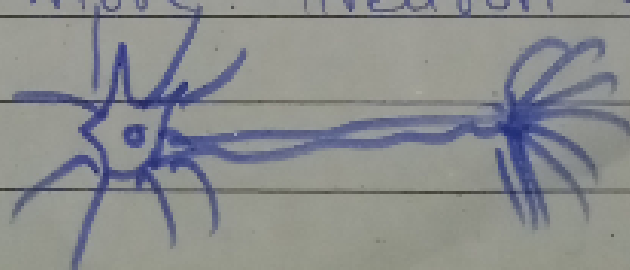
Components of cell: Cell is composed of cell membrane and protoplasm. Protoplasm consists of nucleus and cytoplasm.

For Example :- Animal Cell.

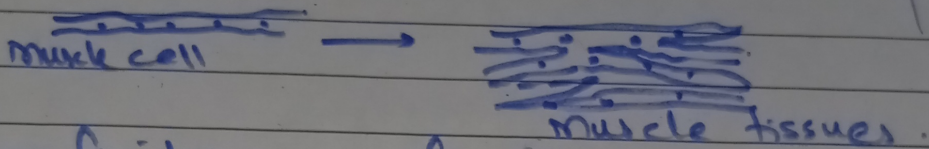


This diagram shows the major components of cell and many other organelles are also present in cytoplasm of cell.

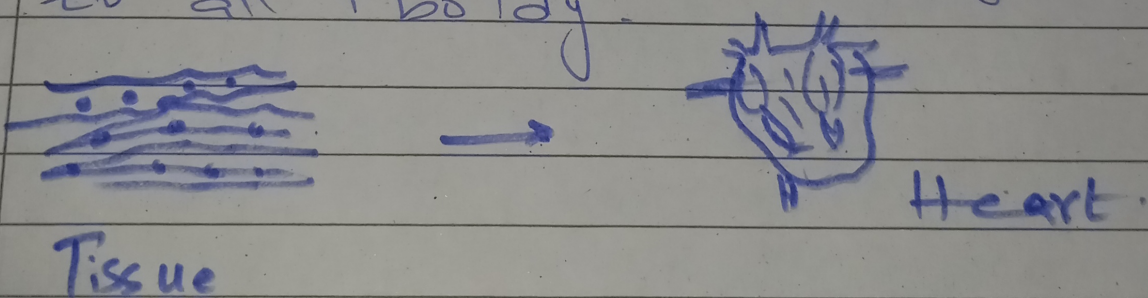
In Animal body, there are many cells such as nephrons, neuron cells, and many more. Neuron cells are like these.



Definition of tissue: Many cells combine to gether to perform a specialized task is known as tissue. For Examples, many neurons^{cells}, muscle cells, connective cells combine to perform the function of co-ordination. OR many muscle cells combine to form muscle tissue which is used for contraction and expansion.



Definition of Organ: Different types of tissues when perform a specialized function is called organ. For instance, when connective tissue, muscle tissue work together in heart then heart pumps and supply blood to all body.



Relationship between cell, tissue and organ with the help of an Example.

For Suppose, when a building builds, it needs rooms, walls,

bricks. First of all, bricks make up the wall then walls form a room and several rooms combine to form a house or building. A house cannot be formed directly without these things. Similarly a living body cannot be formed without these components; cell, tissue and organ. Bricks are just like cells that are the basic unit for a body. Similarly, walls are comparable to tissues and rooms are just like organs. When organs work together then organ systems are performing well and a living body is living life.

In conclusion, The relationship of cells, tissues, and organs are interdependent. These could not do work alone but need each other for a suitable life.

There are millions of trillions of cells in an multicellular organism and these form many tissues in a body. Some important tissues are Connective tissue, Epithelial tissues and muscle tissues. These combine to form organs and the essential

organs are heart, lungs, brain, kidney, liver. These are form a living organism.

(B) Difference in Structure and function between a cell wall and a cell membrane.

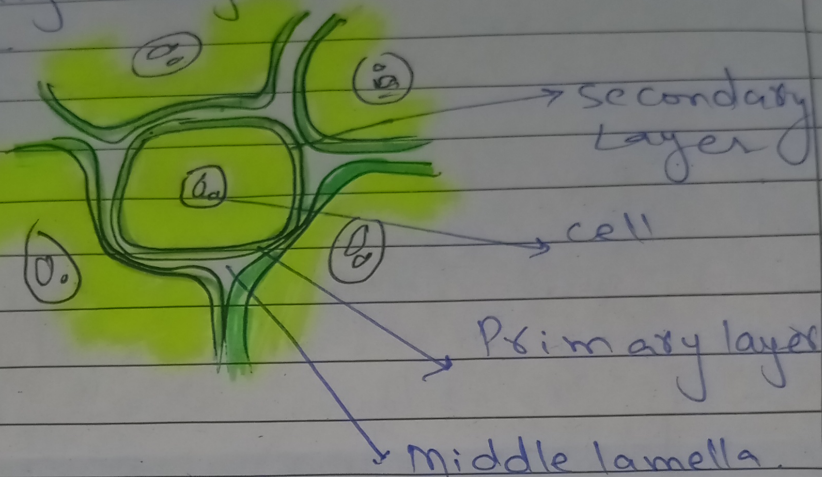
As there are two major components of cell, cell membrane and protoplasm. Therefore, a plant cell consists of cell wall, cell membrane and protoplasm. Cell is present in plants, fungi, algae but absent in animal cells. Cell wall protects the plants, give shape to them and support them while cell membrane act as a barrier between cell and environment in animals.

Difference in Structure between a cell wall and a cell membrane

Cell wall is the upper layer in plants and present adjacent to cell membrane. It is composed of different components vary in different organisms. In Bacteria, cell wall is made up of peptidoglycan. a glucose.

and in fungal cell, it is made up of chitin. In plant cell, cell wall is made up of three layers; primary layer, secondary layer, and middle lamella.

Diagram of cell wall:



Primary layer is the first cell wall made in plants and it is for growth. Middle lamella is between cells and perform a function of glue, to hold different cells together.

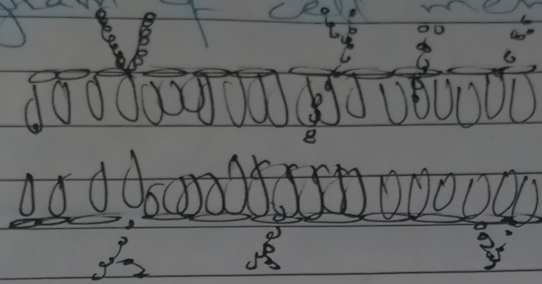
Secondary layer is formed when a cell is grown completely.

The composition of cell wall in plants is cellulose, pectin, hemi cellulose and small amount of minerals.

Structure of cell membrane is quite different from cell wall. Cell membrane, which is also known as cell outer layer. It is composed of proteins, lipids

and its model of structure is known as fluid mosaic model. Proteins are present between lipid bilayer. Cell membrane of animals composed of proteins, phospholipids and small amount of carbohydrates.

Diagram of cell membrane



Difference in function between a cell wall and a cell membrane.

Cell wall has many functions. Firstly, it provides protection to a cell from outer surface or environment. Secondly, it gives shapes to a ~~function~~ plant cell, that is why animal cell is flexible due to absence of cell wall. Thirdly, it supports a plant cell by giving rigidity. The main function of a cell wall is to prevent lysis of a cell material outside the body. It prevents water loss. In

In addition, cell is a permeable membrane, it allows the movement of particles in and out of the cell.

Cell membrane is a semi-permeable membrane, means it allows only a few molecules in and out of a cell. It also protects the cell. It also maintains concentration gradient by movement of Na^+ and K^+ ions. It also involves in cell divisions allowing the cells to divide.

In conclusion, cell wall and cell membrane are two different layers having different compositions and structure. Cell is non living layer/membrane while cell membrane is living membrane. Cell wall is composed of cellulose that's why many cellulose material is indigestible for human because of lack of digestion of cellulose in human body while many herbivores have bacteria in their intestine which help them to digest the cellulose. These both layers are important for cells because both have unique functions.

(C) Transpiration and Significance of leaf structure in the process of transpiration.

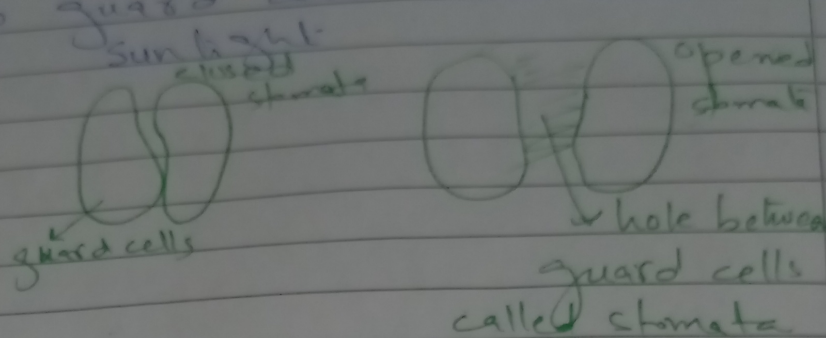
Transpiration is the process of evaporation of water in the form of water vapours from the stomata of plants. It is very important process for maintaining the water balance in body. Transpiration mainly occurs from the leaves because its structure is highly significant for this process. Leaves have stomata in their surface, their surface area is more and cuticle is also waxy surface in leaves, these are factors help in enhancing of transpiration.

Definition of transpiration:

The removal of water in the form of water vapours from the plant body is known as transpiration. There are three types of transpiration occur in plants:

i) Stomatal transpiration:- It is the transpiration occurs through stomata, small holes in leaves of a plant. Stomata is covered

with two guard cells and can
open in



80-90% occurs through stomata

ii, Lenticular transpiration. It is the transpiration occurs through lenticles of plants. lenticles are very tiny holes in stems and roots. These are not present in all body, that is why, lenticular transpiration occurs in very minute quantity.

iii, Cuticle transpiration. It is the process of transpiration occurs through cuticle - the waxy membrane or covering of leaves. 10+20% of transpiration occurs through cuticles. When stomata are closed due to dry season then cuticle - evaporates water vapours and causes the leaf to moist.

Significance of transpiration.

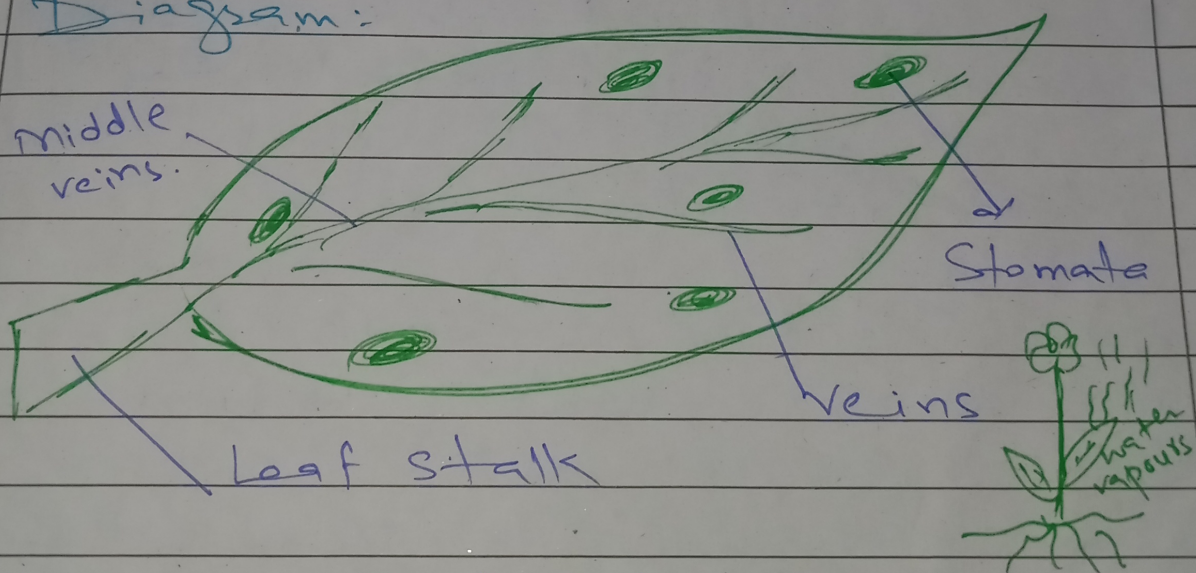
It is every essential process to maintain the body water. It creates transpiration pull which cause the xylem tissues to carry more water and to provide to

all parts of plant body. The water evaporates through transpiration will also become the part of water cycle that is essential for life in the Earth.

Significance of Leaf Structure in the process of transpiration:

Leaf is an important part of plants because it is the platform for photosynthesis. With photosynthesis, it is also important for transpiration. because it has significant features such as; stomatas, cuticles, surface area.

Diagram:



Leaves are the primary source of transpiration because these contain stomatas. Stomata opens in day time during sunlight. When it opens, it causes

-the removal of water in the form of vapours. Guard cells, surrounding the stomata are means for controlling the opening and closing of stomata and to prevent greater loss of water. Second feature is the waxy covering^(cuticle) which allows the evaporation when stomatas are closed. Third and important feature of leaf is greater surface area. Higher the ~~greater~~ surface area, higher will be the rate of transpiration because of more stomatas in the leaf layer.

In conclusion, leaf structure plays a crucial role in transpiration which is very important for the homeostasis of plant body. Water movements remain continuously due to transpiration. But sometimes, transpiration in greater quantity causes the more loss of water and it can damage the plant's tissues and organs.

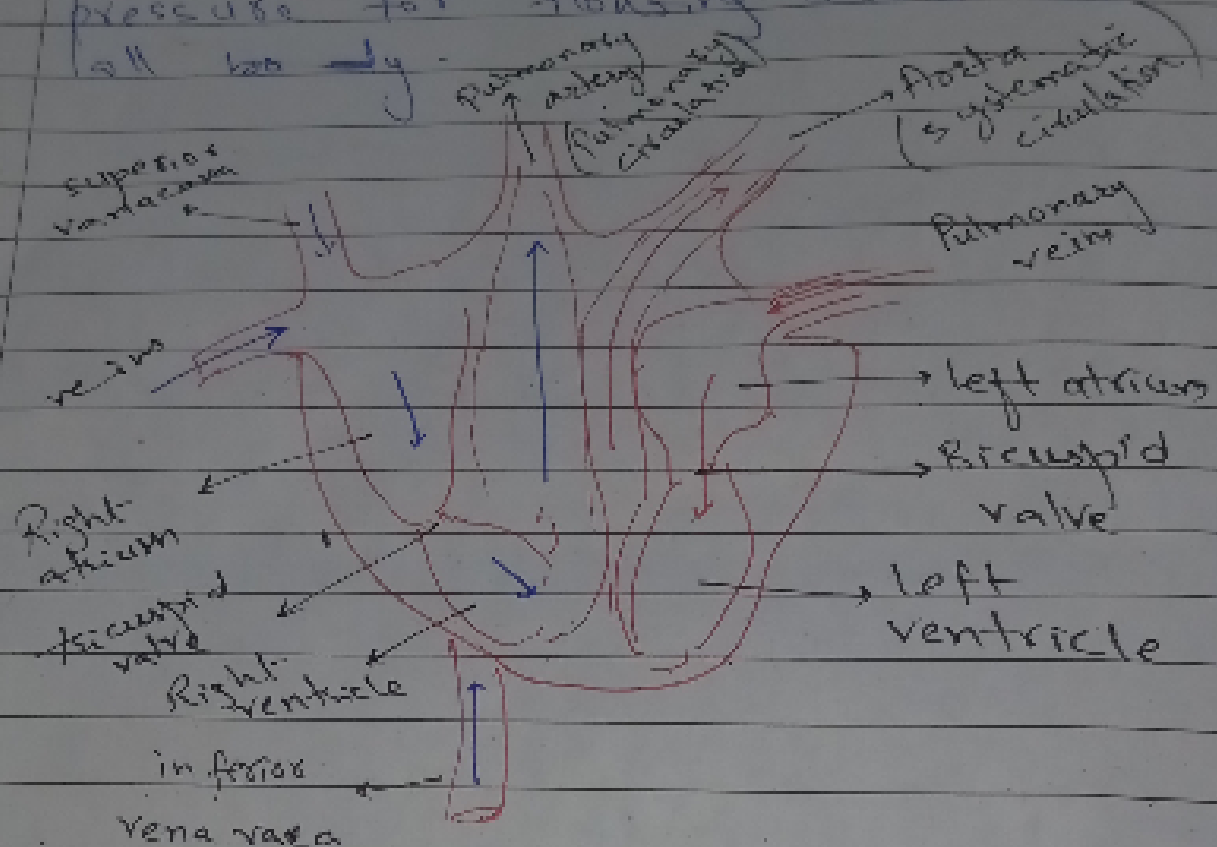
(D) Double Circulation and how heart is adapted to keep blood flowing in a double circulation.

In mammals including man, blood flows in body through double circulation and heart is responsible for double circulation.

Double circulation means two way of flowing of blood; pulmonary and systematic circuits. Heart is adapted in a very unique way to perform these two circuits to flow blood. Heart of man consists of four chambers; atria and ventricles which are separated by valves and these causing the flow of blood from body to heart then to lungs and then back to the heart and then to whole body.

Double Circulation:- It is the process of flowing of blood by two circuits or two ways. In double circulation, deoxygenated blood goes to lungs through Pulmonary Circulation and then oxygenated blood goes to whole body through Systematic

Circulation. It is two way of circulation which balances the blood flow and enhance blood pressure for flowing blood to all body.



Double circulation starts from pulmonary circuit when vena cava (veins) take deoxygenated blood all parts of body to the right atrium then right atrium push the blood to right ventricle through tricuspid valve and then blood sends to Lungs through pulmonary artery. In lungs blood purifies and became oxygenated. Then systematic circulation occurs.

when pulmonary veins carry oxygenated blood from lungs to left atrium and it pushes the blood to left ventricle through bicuspid valve. and then blood supplies to whole body to aorta.

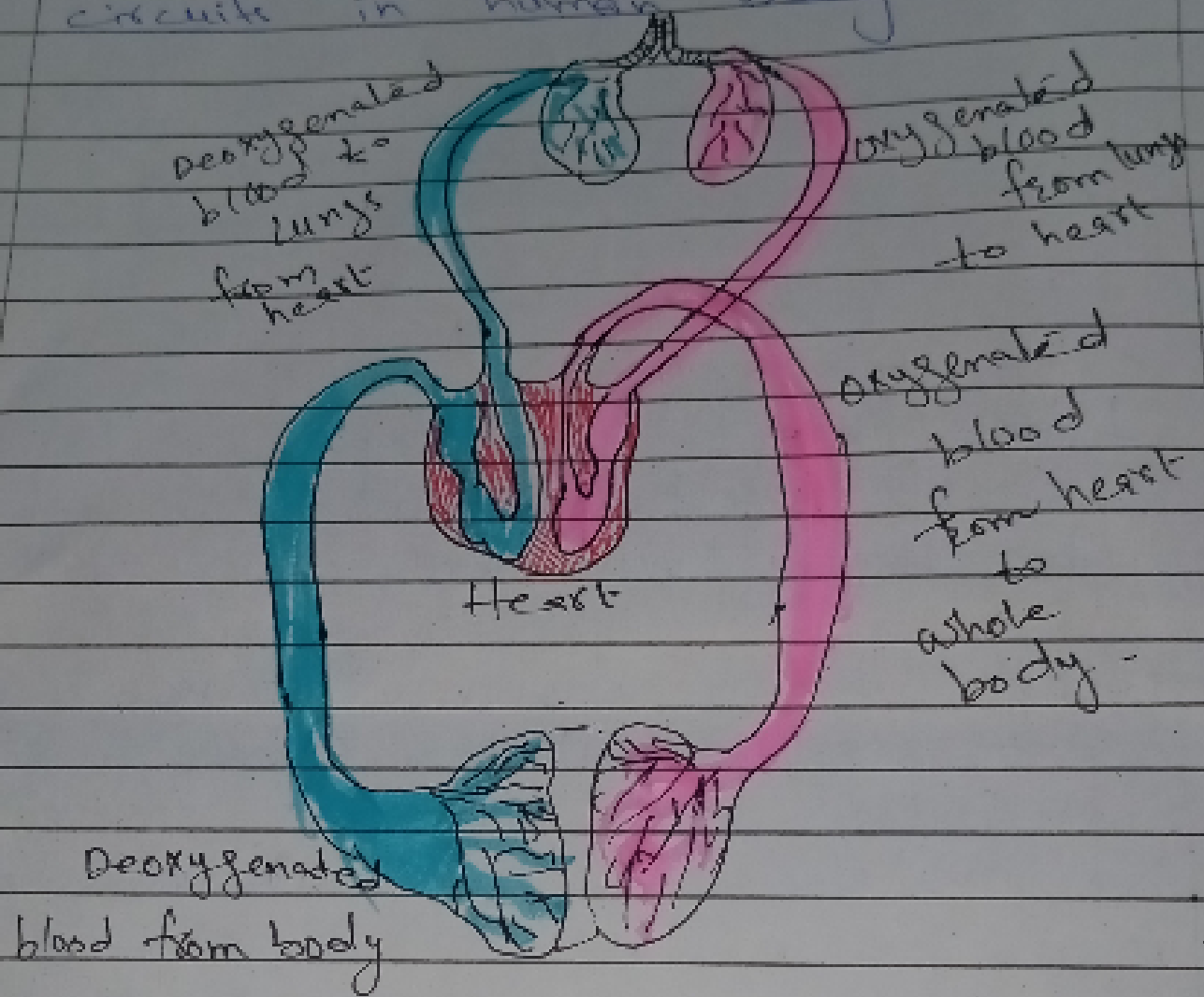
How heart is adapted to keep blood flowing in a double circulation.

when blood flows through pulmonary circulation then the pressure will be built for the systematic circulation and it is very helpful to create more blood pressure so that blood can reach to all parts of body. In addition, double circulation prevents the mixing of oxygenated and deoxygenated blood, allowing the oxygen rich blood reach to all body.

The valves between the chambers of heart and between the ventricles and arteries help in pushing more powerly so that blood flowing will be in good condition.

Following diagram shows the

circuits in human body -



This shows the double circulation performed by the heart.

In conclusion, heart plays an essential role to perform double circulation which helps to pump blood to whole body. This enables the flowing of blood to each and every part of body and it is crucial for a body to so that it can work properly.