**Tissues**

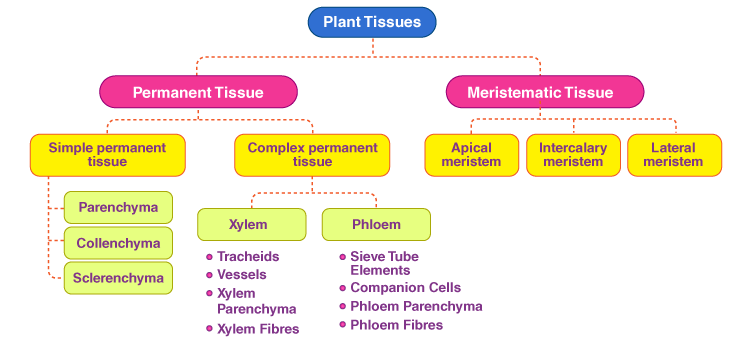
Tissues are a group of cells that combine together to perform a particular function.

## What are Tissues?

In simple terms, tissue can be defined as a group of cells with similar shape and function are termed as tissues. They form a cellular organizational level, intermediate between the cells and organ system. Organs are then created by combining the functional groups of tissues.

The study of tissue is known as histology and study of disease-related to tissue is known as histopathology. The standard tools for studying tissues is by embedding and sectioning using the paraffin block.

## Types of Plant Tissues



The classification of plant tissues are mainly based on the two important criteria:

1. Based on the different part of plants.
2. Based on the different types of cells.

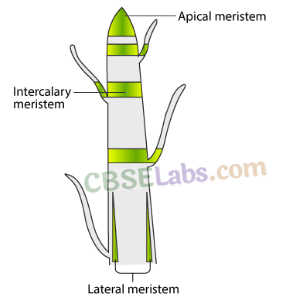
Plant Tissues are broadly categorized into three tissue systems. This classification is on the basis of parts of the plants they are present.

* Epidermis Tissues – cells formed from the outermost surface of the leaves.
* Vascular Tissues – involved in transporting fluid and nutrients internally.
* Ground Tissue – involved in producing nutrients by photosynthesis and preserve nutrients.

Plant tissue is divided into two types. This classification is on the basis of the types of cells, they comprise.

* Meristematic tissues.
* Permanent tissues.

### Meristematic Tissue



Classification of Meristematic Tissues on the Basis of Origin

**Primary (Promeristem)**

* Derived directly from the meristems of embryo.
* They consist of cells derived from primary meristem.
* They add to primary growth of plants.

**Secondary Meristematic Tissues**

* Formed by permanent tissues.
* These are having cells derived from primary permanent tissue.
* They usually add to the diameter of plants.

They are the group of young cells, which consists of continually dividing cells and helps in the increase of length and width of the plant. There are different types of meristematic tissues, which are classified on the basis of positions, functions, plane of divisions, origin and development. The three main types of meristematic tissues depending on the occurrence of the meristematic tissue on the plant body are:

1. **Apical meristem:** Present at the growing tips of stems and roots. Important function: To increase the length of stems and roots.

* It is present at the growing tips of stems and roots.
* Cell division in this tissue leads to the elongation of stem & root, thus it is involved in primary growth of the plant.

1. **Intercalary meristem:** Present at the base of leaves or internodes. Important function: For the longitudinal growth of plants.

* It is present behind the apex.
* It is the part of apical meristem which is left behind during growth period.
* These are present at the base of leaf & internode region.
* These lead to the increase in the length of leaf (Primary), example: in grass stem, bamboo stem, mint stem etc.

1. **Lateral meristem:** Present on the lateral sides of the stems and roots. Important function: To increase the thickness of stems and roots.

* It is also called as secondary meristem.
* It occurs along the sides of longitudinal axis of the plant.
* It gives rise to the vascular tissues.
* Causes growth in girth of stem & root.
* They are responsible for secondary growth

#### Functions of Meristematic Tissue

1. It is responsible for the growth of the new organs.
2. Involved in the movement of water and nutrition within the plants.
3. These tissues are responsible for both primary and secondary growth of the plant.
4. It is the outermost tissue, functions by providing protection from mechanical injury.
5. It gives rise to epidermis layer, cortex, endodermis, ground tissue and vascular tissue

**Features of Meristematic tissues:**

* Thin primary cell wall (cellulosic).
* Intercellular spaces are absent (compact tissue).
* Generally vacuoles are absent, dense cytoplasm & prominent nuclei are present.
* Large numbers of cell organelles are present.
* Active metabolic state, stored food is absent.
* Actively dividing cells are present in growing regions of plants, example: root & shoot tips.

**Permanent Tissues**

A group of cells which are similar in origin, structure and in function. They are involved in complete growth and differentiation during the ineffective of meristematic activity.

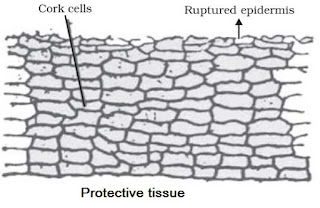
Functions of Permanent Tissues

1. In aquatic plants, these tissues help in floating.
2. Stores food in the form of starch, proteins, oils and fats.
3. They provide hardness to fruits such as nuts, coconut, almond etc.
4. These tissues contain chloroplast which helps in carrying out photosynthesis.
5. Permanent Tissues are also involved in the Secretion, Transportation, and provides mechanical support to the plants.
6. The permanent tissues are composed of those cells which have lost their capability to divide.
7. They have definite shape, size and thickness. The permanent tissue may be dead or living.
8. The division & differentiation of the cells of meristematic tissues give rise to permanent tissues.
9. In cell differentiation, developing tissue and organs change from simple to more complex forms to become specialized for specific functions.
10. The cells of permanent tissue loose the capacity to divide and attain a permanent shape, size and function.

There are three types of permanent tissues:

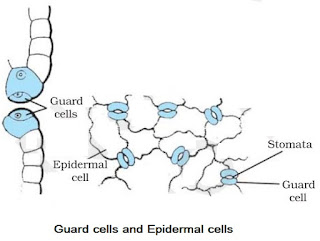
1. Simple Permanent Tissues.

* These are made up of same type of cells which are similar structurally and functionally.
* They include two types of tissue Protective tissues and Supporting Tissues.
* Protective Tissues: These tissues are primarily protective in function.
* They consist of Epidermis and Cork/Phellem



1. Complex Permanent Tissues.
2. Special or Secretory Tissues.

**Epidermis**



* Epidermis forms one cell thick outermost layer of various body organs of plants such as leaves, flowers, stems and roots.
* Epidermis is covered outside by cuticle. Cuticle is a water-proof layer of waxy substance called as cutin which is secreted by the epidermal cells.
* Cuticle is very thick in xerophytes.
* Cells of epidermis of leaves are not continuous at some places due to the presence of small pores called as stomata.
* Each stomata is guarded by a pair of bean-shaped cells called as guard cells. These are the only epidermal cells which possess chloroplasts, the rest being colourless.

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### Functions of Epidermis

* The main function of epidermis is to protect the plant from desiccation and infection.
* Cuticle of epidermis cuts the rate of transpiration and evaporation of water and prevents wilting.
* Stomata in epidermis allow gaseous exchange to occur during photosynthesis respiration.
* Stomata also helps in transpiration.

### Cork or Phellem

* In older roots and stems, tissues at the periphery become cork cells or phellem cells.
* Cork is made up to dead cells with thick walls and do not have any intercellular spaces.
* The cell walls in cork deposit waxy substance called as suberin.
* The cells of cork become impermeable to water and gases due to the deposition of suberin.
* The cork cells are without any protoplasm but are filled with resins or tannins.

### Functions of Cork

* Cork is protective in function. Cork cells prevent desiccation, infection and mechanical injury.
* Imperviousness, lightness, toughness, compressibility and elasticity make the cork commercially valuable.
* Cork is used for insulation, as shock absorber in linoleum.
* Cork is used in the making of a variety of sport goods such as cricket balls, table tennis, shuttle cocks, wooden paddles etc.

### Differentiation

Differentiation is the process by which the meristematic tissues develop into different types of permanent tissues based on the location and requirements of the plant.

### Apical meristem

Apical meristem is present on the apex of the plant shoot and root. They are rapidly growing tissues and aid in increasing the height of the plant.

### Lateral meristem

Lateral meristem is present on the lateral walls of the stem. They help in the horizontal growth of the plant and increase the stem girth.

### Intercalary meristem

Intercalary meristem can be found between the nodes of the stem and the base of the leaf. They help in branching.

### Simple permanent tissues

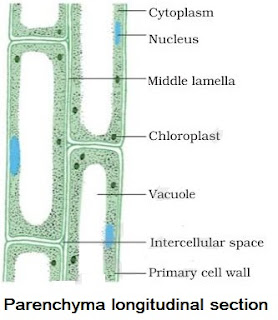
These are tissues that are made up of only one type of cell. They usually have a structural role.

### Complex permanent tissues

Complex permanent tissues are made by the combination of different types of cells. These cells work together to perform a specific task.

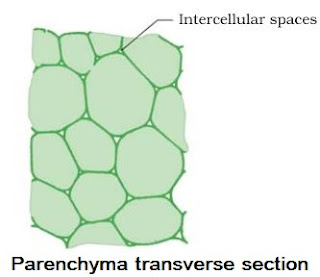
### Parenchyma

Parenchyma tissues are made up of loosely packed cells with thin cell walls and large intercellular spaces. They are live cells and help in support and storage. Two types; Chlorenchyma and Aerenchyma.



* It is the fundamental tissue.
* Tissue first time evolved in bryophyte.
* Thin walled cells, oval or spherical in structure.
* Cell wall mainly composed of cellulose & pectin.
* Large central vacuole for food & water storage.

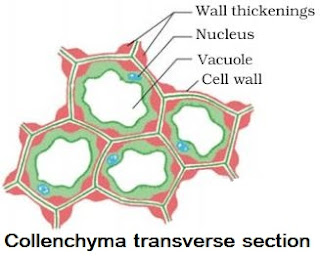
Primary function is food storage.



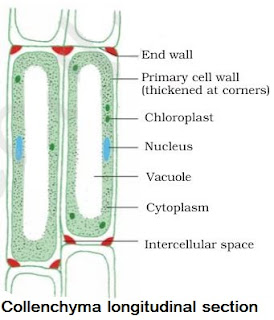
* Some parenchyma involved in excretory substance storage are so called as idioblast, storing such as resin, tannin, gums & oils.
* In typical parenchyma chlorophyll is absent.
* Chloroplast containing parenchyma tissue are chlorenchyma which perform photosynthesis such as mesophyll of leaves.
* In hydrophytic plants aerenchyma (a type of parenchyma containing air spaces) provides buoyancy.
* Parenchyma provides turgidity to cells.

### Collenchyma

Collenchyma tissues are made up of live cells which have irregularly thickened corners and thus, have decreased intercellular spaces. They help in bending various parts of the plant without breaking.



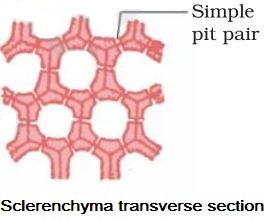
* It is the living mechanical tissue.
* Elongated cells with thick corners.
* Localized cellulose & pectin thickening.



* Provides flexibility to plant parts & easy bending of various parts of plant.
* Present only in herbaceous dicot stem.
* Present at thin margin of leaves.
* Few chloroplasts may be present.
* Gives mechanical strength & elasticity to the growing stems.

### Sclerenchyma (Scleras–hard) Strengthening tissue

Sclerenchyma tissues make up the hard and stiff parts of the plant. They are made up of dead, long and narrow cells. They almost have no intercellular space as the walls are thickened due to the presence of lignin.



* Composed of extremely thick walled cells with little or no protoplasm.
* Cells are dead & possess very thick lignified walls.
* Lignin is water-proof material.
* Intercellular spaces are absent.
* Cells of sclerenchyma are of two types Sclereids and Fibres.

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**Sclereids**

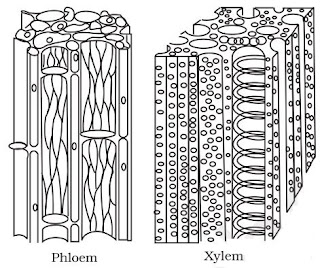
* These are also called grit cells or stone cells.
* These are small cells, where lumen is so small due to higher thickening of cell wall, as present in drup fruit (mango, coconut, walnut) in legume seeds (Macrosclereid).

**Fibers**

* They are very long, narrow, thick, lignified cells. Lumen is large as compared to sclereids.
* They are generally 1-3 mm long.
* In the thick walls of both the fibres and sclereids are present thin areas called as pits.
* Sclrenchyma Fibres are used in the manufacture of ropes, mats & certain textile fibres.
* Jute and coir are obtained from the thick bundle of fibres.

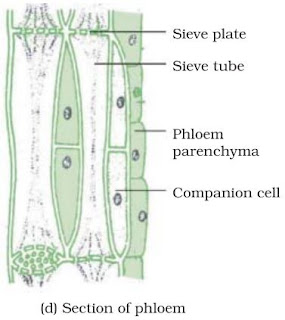
**Complex Permanent Tissues**

* It consists of more than one type of cells which work together as a unit.
* It helps in transportation of organic materials, water & minerals.
* It is also known as conducting or vascular tissue.
* Xylem & phloem together form vascular bundles.



### Phloem

Phloem is made up of the following components – sieve tubes, companion cells, phloem parenchyma and phloem fibres. Phloem conducts food in both directions. Among all the components, phloem fibres are the only dead cells.



* They also consist of both parenchymatous and schlerenchymatous cells.
* Phloem consists of four types of element which are Sieve tubes, Companion cells, Phloem fibre and Phloem parenchyma.

1. **Sieve tubes**

* Sieve tubes are slender tube like structures made up of elongated, thin walled cells placed end to end.
* The end walls of sieve tube cells are perforated by numerous pores, called as sieve plates.
* Nucleus of sieve cell degenerates at maturity. However, cytoplasm persists, because of protoplasmic continuation of sieve tube with companion cell through plasmodesmata.
* Sieve cells possess slime protein or protein which is concerned with growth and repair of sieve cells.

1. **Companion cells**

* Companion cells have dense cytoplasm and prominent nuclei.
* Sieve cells & companion cells are so called sister cells because they originate from single mother cell.

**(iii) Phloem fibre**

* They give mechanical support to sieve tubes.

**(iv) Phloem parenchyma**

* They store food and help in radial conduction of food.

**(v) Leptome**

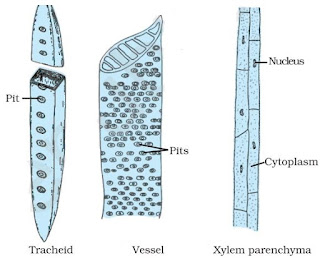
* Main part of phloem involved in conduction of food, which is sieve tube.
* In xylem, only unidirectional movement is possible while in phloem bidirectional movement can occur.
* In phloem, except phloem sclerenchyma all elements are living.

|  |  |  |
| --- | --- | --- |
| **Features** | **Xylem** | **Phloem** |
| **Cells: Living/dead** | Dead | Living |
| **Cell walls: Thickness** | Thick | Thin |
| **Material** | Lignin | Cellulose |
| **Permeability** | Impermeable | Permeable |
| **Cross walls** | None | Sieve plates |
| **Cytoplasm** | None | Yes |
| **Function** | Carries water and salts | Carries sugars |
| **Direction of flow** | Upwards | Down and up |
| **Special features** | Fibres | Companion cells |

### Xylem

Xylem is made up of the following components. The vessels and tracheids – help in the conduction of water and minerals from the soil. Xylem parenchyma helps in food storage, and the xylem fibres provide mechanical support

* It is also known as wood and is a vascular and mechanical tissue.
* Thick walled cells are found in the form of tubular passages.
* Xylem consists of four types of cells called as elements Tracheids, Vessels, xylem parenchyma and xylem sclerenchyma.



**(i) Tracheids**

They are elongated angular dead cells (primitive elements) mainly involved in conduction of water and minerals in gymnosperms.

**(ii) Vessles**

* They are advance element (generally found in angiosperms).
* Vessels are cylindrical tube like structures placed one above the other end to end which form a continuous channel for efficient conduction of water.

**(iii) Xylem parenchyma**

* They are small & thick walled parenchymatous cells subjected for storage of starch (food).

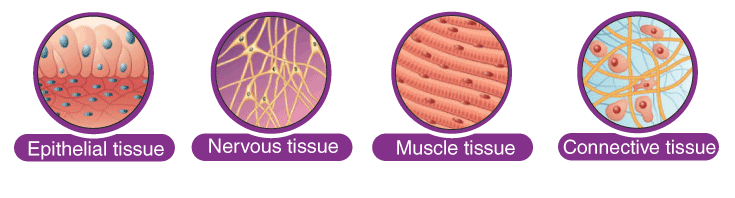
**(iv) Xylem sclerenchyma**

* Thy are non-living fibres with thick walls and narrow cavities provide mechanical support.
* Except xylem parenchyma all other xylem elements are dead.
* The annual rings present in the trunk of a tree are xylem rings.
* By counting the number of annual rings, we can determine the age of  
  a tree.

**Difference between Parenchyma, Collenchyma and Sclerenchyma**

|  |  |  |  |
| --- | --- | --- | --- |
| **Features** | **Parenchyma** | **Collenchyma** | **Sclerenchyma** |
| **Cell shape** | Isodiametric cells which are oval, spherical or polygonal in shape. | Circular, oval or polyhedral. | Variable in shape. Fibres and sclereids. |
| **Cell wall** | Thin cellulosic cell wall. | Uneven thickening on their cell wall. | Lignified secondary cell wall present. |
| **Cytoplasm** | Abundant | Present | Absent |
| **Nucleus** | Present (Living tissue) | Present (Living tissue) | Absent (Dead tissue) |
| **Vacuoles** | Large vacuole | Vacuolated | Absent |
| **Intercellular spaces** | Present | Absent | Absent |
| **Occurrence** | Basically packing tissue, all soft part of plant-pith, cortex, medullary rays. | Dicot stems, petiole and beneath the epidermis. Absent in monocot and roots. | Dicot hypodermis, bundle sheath, pericycl, seed, pulp of fruits. |
| **Functions** | Food storage, photosynthesis. | Provide tensile strength, mechanical support, photosynthesis. | Protection from stress and strain, mechanical strength. |

## Types of Animal Tissues



Animal tissues are grouped into four types:

* Connective Tissue
* Muscle Tissue
* Nervous Tissue
* Epithelial Tissue

The collection of tissues are joined in structural units to serve a standard function of organs. The primary purpose of these four types of tissue differs depending on the type of organism.

### Connective Tissues

They are the group of tissues made up of cells separated by non-living material, called as an extracellular matrix. This tissue provides shape to the different organs and maintains their positions. For example, blood, bone, tendon, adipose, ligament and areolar tissues. There are three types of connective tissue:

* Fluid Connective Tissue.
* Fibrous Conctive Tissue.
* Skeletal Connective Tissue.

#### Functions of Connective Tissue

The connective tissue functions by providing shape and maintains the position of different organs in the body. It functions as the primary supporting tissue of the body. Other important and the major functions of connective tissue in the body are:

1. Insulating.
2. Helps in binding the organs together and provides support.
3. It protects against the invasions of pathogens by their phagocytic activity.
4. Provides shape to the body, conserves body heat and also stores energy.
5. It is involved in the transportation of water,  nutrients, minerals, hormones, gases, wastes, and other substances within the body.

Various types of connective tissues:, are:

* **Areolar tissue:** Found in the skin and muscles, around the blood vessels, nerves, etc.
* **Adipose tissue:** Acts as the storage site of fats; found between the internal organs and below the skin; acts as an insulator for the body.
* **Dense regular connective tissue:** Main components are tendons and ligaments; tendons connect muscles to bones, while ligaments connect two bones together.
* **Skeletal tissue:** Main components of skeletal tissues are cartilage and bone.
* **Fluid tissue:** Blood is the vascular tissue present in animals.

### Muscle Tissue

They are involved in producing force and generating motion, either for the locomotion or for other body movements within internal organs. There are three types of muscle tissue:

* Skeletal Muscle – they  are typically attached to bones
* Cardiac Muscle – found in the heart.
* Visceral or Smooth Muscle – they are found in the inner walls of organs.

#### Functions of Muscle Tissue

Muscle tissues are associated with their movements including walking, running, lifting, chewing, picking and dropping objects, etc. The other major functions of muscle tissue in the body are:

1. Helps in maintaining an erect position, or posture.
2. Helps in the constriction of organs and blood vessels.
3. Involved in both voluntary and involuntary movements.
4. Involved in pumping blood and regulating the flow of blood in arteries.
5. Controls respiration by automatically driving the movement of air both into and out of our body.

### Striated/Skeletal Muscles

All the voluntary movements in our body are carried out by the striated or skeletal muscles. They are called skeletal because these tissues are mostly attached to the bones. They are long, cylindrical, unbranched with striations and multinucleated.

### Unstriated/Smooth Muscles

Almost all involuntary movements in the body are carried out by the smooth or striated muscles. They are long, smooth, spindle-shaped and uninucleate. We can find them in places like the alimentary canal and blood vessels.

### Cardiac Muscles

Cardiac muscles make up our entire heart. These muscles are involuntary in nature and show rhythmic contractions and relaxations. Structurally they may look quite similar to striated muscles, but they are branched, uninucleated and have intercalated discs.

### Nervous Tissue

They are the main tissue components of the brain and spinal cord in the central nervous system. While, in the peripheral nervous system, the neural tissue forms the cranial nerves and spinal nerves.

#### Functions of Nervous Tissue

The nervous tissue forms the communication network of the nervous system and is important for information processing. The other major functions of nervous tissue in the body are:

* Response to stimuli.
* Stimulates and transmits information within the body.
* Plays a major role in emotions, memory, and reasoning.
* Maintains stability and creates an awareness of the environment.
* Nervous tissue is involved in controlling and coordinating many metabolic activities.

### Neurons

These are the cells that form the entire nervous system. Neurons consist of a cell body, axon and axon terminals.

### Epithelial Tissue

They are formed by cells which cover the external parts of the body organs and lines the organ surfaces such as the surface of the skin,  the reproductive tract, the airways, and the inner lining of the digestive tract.

#### Functions of Epithelial Tissue

This tissue performs a wide variety of functions including:

1. Play a major role in sensory reception, excretion, filtration and other metabolic activities.
2. Provide mechanical strength and resistance to the underlying cells and tissue.
3. It is involved in the movement of materials through the process of filtration, diffusion and secretion.
4. Protects the internal organs against the invasions of pathogens, toxins, physical trauma, radiation, etc.

Epithelial tissues are also involved in secreting hormones, enzymes, mucus and other products from ducts and transporting it to the circulatory system.

### Squamous Epithelium

Squamous epithelium forms an extremely thin and flat layer of tissues. They are semi-permeable and, thus, perfect for gaseous exchange. They are present in the lining of the oesophagus and the mouth.

### Cuboidal Epithelium

As the name suggests, they are cuboidal in shape and form the lining of salivary glands and kidney tubules. They provide mechanical support. They also form glandular epithelium when they form glands.

### Columnar Epithelium

These tissues line the organs which help in absorption and secretion, such as the lining of the intestines. They are made up of elongated cells. When cilia are present in these cells, they form ciliated columnar epithelium like those present in the respiratory tract.

### Stratified Squamous Epithelium

This kind of tissue is formed when multiple layers of squamous epithelium are arranged in a pattern. Our skin is made up of this kind of tissue.

**Question** What is a tissue?

**Answer** Tissue is a group of cells that are similar in structure and are organised together to perform a specific task.

**Question** What is the utility of tissues in multi-cellular organisms?

**Answer** In multicellular organisms, the different types of tissues perform different functions. Since a particular group of cells carry out only a particular function, they do it very efficiently. So, multicellular organisms possess a definite division of labour.

**Question** Name types of simple tissues.

**Answer** Simple permanent tissues are of three types:→ Parenchyma

* Collenchyma
* Sclerenchyma

Parenchyma tissue is of further two types:

• Aerenchyma

• Chlorenchyma

**Question** Where is apical meristem found?

**Answer** Apical meristem is present at the growing tips of stems and roots.

**Question** Which tissue makes up the husk of coconut?

**Answer** Sclerenchyma tissue makes up the husk of coconut.

**Question** What are the constituents of phloem?

**Answer** The constituents of phloem are:

* Sieve tubes
* Companion cells
* Phloem parenchyma
* Phloem fibres

**Question** Name the tissue responsible for movement in our body.

**Answer** Muscular tissue

**Question** What are blood platelets?

**Answer** Blood platelets are the cell fragments present in the plasma of blood which help in the clotting of blood.

**Question** Name the connective tissue that is found between skin and muscles.  
**Answer** Areolar tissue.

**Question** Name the tissue present in the brain.

**Answer** Nervous tissue which comprises of its basic unit called neurons.

**Question** In which of the simple plant tissue, deposition of lignin is found?  
**Answer** Sclerenchyma.

**Question** Name the basic packing tissue of plant.

**Answer** Parenchyma.

**Question** Name the tissue which is present in the veins of leaves.

**Answer** Sclerenchyma.

**Question** Why is cork impervious to gases and water?

**Answer** Due to presence of a chemical substance called suberin.

**Question** What is the function of phloem?

**Answer** Phloem helps in the transport of food from leaves to the various parts of the plant.

**Question** Which body cell provides resistance against infections?

**Answer** White blood cells (WBC) provide resistance against infections.

**Question** Which biochemicals compose the solid matrix of cartilage?

**Answer** Proteins and sugars make up the solid matrix of cartilage.

**Question** Name the connective tissue which helps in the repair of tissues.

**Answer** Areolar connective tissue helps in the repair of tissue.

**Question** Which connective tissue is specialised for fat storage and acts as heat insulator?  
**Answer** Adipose tissue helps in storage of fats and acts as heat insulator.

**Question** Which muscle has spindle-shaped cells?

**Answer** Smooth muscle cells have spindle shaped cells.

**Question** Which meristem is present at growing tips of stems and roots?

**Answer** Apical meristem is present at the growing tips of the stem and roots.

**Question** What does a neuron look like?

**Answer** Neuron look like a star shaped cell with a tail.

**Question** Give three features of cardiac muscles.

**Answer** Three features of cardiac muscles are:

* Cardiac muscles are involuntary muscles that contract rapidly, but do not get fatigued.
* The cells of cardiac muscles are cylindrical, branched, and uninucleate.
* They control the contraction and relaxation of the heart.

**Question** What are the functions of areolar tissue?

**Answer** Functions of areolar tissue:

* It helps in supporting internal organs.
* It helps in repairing the tissues of the skin and muscles.

**Question** Define the term "tissue".

**Answer** Tissue is a group of cells that are similar in structure and are organized together to perform a specific task.

**Question** How many types of elements together make up the xylem tissue? Name them.

**Answer** Xylem is composed of following elements:

Tracheids

Vessels

Xylem parenchyma

Xylem fibres

**Question** How are simple tissues different from complex tissues in plants?

**Answer**

|  |  |
| --- | --- |
| **Simple tissue** | **Complex tissue** |
| These tissues consist of only one type of cells. | These tissues are made up of more than one type of cells. |
| The cells are more or less similar in structure and perform similar functions. | Different types of cells perform different functions. For example, in the xylem tissue, tracheids help in water transport, whereas parenchyma stores food. |
| Three types of simple tissues in plants are parenchyma, collenchyma, and sclerenchyma. | Two types of complex permanent tissues in plants are xylem and phloem. |

**Question**. Differentiate between parenchyma, collenchyma and sclerenchyma, on the basis of their cell wall.

**Answer**

|  |  |  |
| --- | --- | --- |
| **Parenchyma** | **Collenchyma** | **Sclerenchyma** |
| Cell walls are relatively thin, and the cells in parenchyma tissues are loosely packed. | The cell wall is irregularly thickened at the corners, and there is very little space between the cells. | The cell walls are uniformly thickened, and there are no intercellular spaces. |
| The cell wall in this tissue is made up of cellulose. | Pectin and hemicellulose are the major constituents of the cell wall. | An additional layer of the cell wall composed mainly of lignin is found. |

**Question** List any four salient features of meristematic tissue.

**Answer** The salient features of meristematic tissue are:

* This tissue consists of cells which continuously divide to produce new cells.
* The cells of this tissue lack vacuoles.
* The cells of this tissue have dense cytoplasm.
* The cells of this tissue have thin cellulosic cell walls and prominent nuclei.

**Question** Write the four elements of xylem.

**Answer** The four elements of xylem are tracheids, vessels, xylem parenchyma and xylem fibres.

**Question** How is ligament different from tendons?

Or  
Differentiate between tendon and ligament.

**Answer** Ligament is a connective tissue which joins bone to bone and is elastic in nature.

Tendons join bone to muscles and are less elastic as compared to the ligaments.

**Question** Write a short note on the different types of meristematic tissue with their location and functions in the plants.

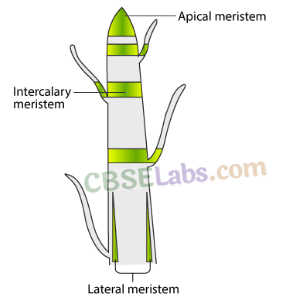
**Answer** The meristematic tissues are classified as apical, lateral and intercalary meristematic tissue based on the region where they are present.

Apical meristem – It is present at the growing tips of stem and roots and results in increase in the length of the stem and the root. Lateral meristem (cambium): It is present on the lateral sides of stem and roots. It helps to increase the girth of the stem or root.

Intercalary meristem – It is present at the base of the leaves or internodes. It helps in the longitudinal growth of plants.

**Question** Show the diagrammatic representation of location of lateral meristem and intercalary meristem in plant body.

**Answer**



**Question** Differentiate between chlorenchyma and aerenchyma.

Or  
Write the difference between aerenchyma and chlorenchyma.

**Answer** Chlorenchyma:

* It is a type of parenchyma which contains chlorophyll.
* It helps to perform photosynthesis.
* It is present in green parts of plants like the leaves.

Aerenchyma:

* This type of parenchyma that has large air cavities in it.
* It helps to provide buoyancy to the plants.
* It is present in the aquatic plants, example in their floating leaves.

**Question** Write the functions of collenchyma in plants.

**Answer** Collenchyma allows easy bending in various parts of a plant (leaf, stem) without breaking. It also provides mechanical support to plants like in the leaf stalks below the epidermis.

**Question** What are the roles of epidermis in plants?

**Answer** The functions of epidermis are:

* Epidermis is usually made up of a single layer of cells and gives protection.
* The epidermis may be thicker in some plants living in dry habitats or often secrete a waxy, water- resistant layer on their outer surface called cutin (chemical substance with waterproof quality) to prevent water loss.
* The epidermis of leaves have small pores called as stomata which help in gaseous exchange and transpiration.
* The epidermal cells of roots bear root hairs that greatly increase the total absorptive surface area of the roots for absorption of water.

**Question** Answer the following:

(i) How is the epidermis of the plants living in very dry habitats adapted?  
(ii) Write functions of guard cells of stomata in the leaf.  
**Answer**  
(i) The epidermis of plants living in dry habitats may be thicker or often secrete a waxy, water-resistant layer on their outer surface called cutin (chemical substance with waterproof quality) to prevent water loss.

(ii) The guard cells of stomata in the leaf help in gaseous exchange and transpiration.

**Question** What is the function of areolar tissues?

**Answer** The functions of areolar tissues are:

* It fills the space inside the organs
* It supports internal organs.
* It helps in repair of tissues.

**Question** Determine the location of the following tissues:

1. Unstriated muscle fibres
2. Cuboidal epithelium
3. Adipose tissue
4. Striated muscle fibres

**Answer**

1. Unstriated muscle fibres: Present in iris of the eye, ureters, blood vessels, alimentary canal and bronchi of lungs.
2. Cuboidal epithelium: Present in lining of kidney tubules and ducts of salivary glands.
3. Adipose tissue: It is found below the skin and between internal orgAnswer:
4. Striated muscle fibres: It is present in muscles of our limbs

**Question** Explain how the bark of a tree is formed. How does it act as a protective tissue?  
**Answer** In the older stem, a strip of secondary meristem replaces the epidermis. The secondary meristem cuts off cells towards outside to form a several-layer thick tissue; This is called the cork or the bark of the tree.

Cells of cork or bark are dead, compactly arranged without intercellular spaces and have a chemical called suberin in their walls that makes them impervious to gases and water. In this way it acts as a protective tissue.

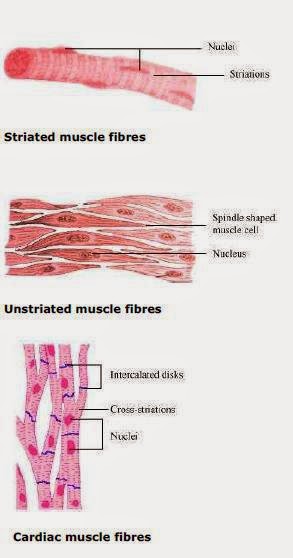
**Question** What are the functions of the stomata?

**Answer** The functions of stomata are:

* The exchange of gases (CO2 and O2) with the atmosphere.
* The loss of excess water in the form of water vapour which is known as transpiration

**Question** Diagrammatically show the difference between the three types of muscle fibres.

**Answer** The three types of muscle fibres are: Striated muscles, smooth muscles (unstriated muscle fibre), and cardiac muscles.

[](file:///\\4.bp.blogspot.com\-yPzYhdISe18\VNXsmg3eghI\AAAAAAAADkQ\0UGXoSfYTNw\s1600\difference-between-muscles.jpg)

**Question** What is the specific function of the cardiac muscle?

**Answer** The specific function of the cardiac muscle is to control the contraction and relaxation of the heart.

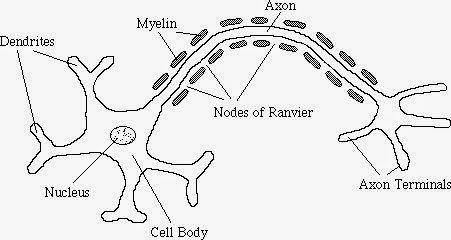
**Question** Differentiate between striated, unstriated and cardiac muscles on the basis of their structure and site/location in the body.

**Answer**

|  |  |  |
| --- | --- | --- |
| **Striated muscle** | **Unstriated muscle** | **Cardiac muscle** |
| **On the basis of structure:** | | |
| Cells are cylindrical | Cells are long | Cells are cylindrical |
| Cells are not branched | Cells are not branched | Cells are branched |
| Cells are multinucleate | Cells are uninucleate | Cells are uninucleate |
| Alternate light and dark bands are present | There are no bands present | Faint bands are present |
| Its ends are blunt | Its ends are tapering | Its ends are flat and wavy |
| **On the basis of location:** | | |
| These muscles are present in body parts such as hands, legs, tongue, etc. | These muscles control the movement of food in the alimentary canal, the contraction and relaxation of blood vessels, etc. | These muscles control the contraction and relaxation of the heart |

**Question** Draw a labelled diagram of a neuron.

**Answer**

[](file:///\\4.bp.blogspot.com\-yPZHAs9jdME\VNXt9cVdngI\AAAAAAAADkc\hJXPpJVg178\s1600\diagram-of-neuron.jpg)

**Question** What are the two main components of blood? Why is blood considered a type of connective tissue?

**Answer** Blood is a special connective tissue consisting of a fluid matrix, plasma, and formed elements. The formed elements are red blood cells (RBCs), white blood cells (WBCs) and blood platelets. Blood is considered as a type of connective tissue as they have the same origin as other types of connective tissue and helps to connect the different parts of the body to facilitate exchange of various components like nutrients and gases.

**Question** Give one function of each of the following.

(i) Stomata

(ii) Root nodules

(iii) Cardiac muscle fibres

**Answer**  
(i) Stomata: Help in exchange of gases in the plants.

(ii) Root nodules: In leguminous plants, the root nodules harbour nitrogen fixing bacteria which convert atmospheric nitrogen into nitrates.

(iii) Cardiac muscle fibres: They help in rhythmic contraction and relaxation of the heart.

**Question** Differentiate between bone and cartilage.

Or  
Differentiate between bone and cartilage with respect to structure, function and location.  
**Answer** Bone:

* Bones have a hard and non-pliable ground substance.
* Its matrix is rich in calcium salts and collagen fibres.
* It is the main tissue that provides structural frame to the body.
* The bone cells (Osteocytes) are present in the spaces called lacunae.
* Bones are present in the limbs and form main skeletal framework of the body.

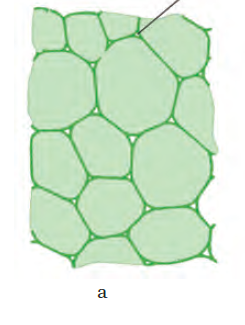
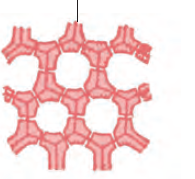
Cartilage:

* Cartilage is pliable, flexible and resist compression.
* Its matrix is rich in protein called chondrin and sugars.
* It is present in bones of the vertebral column, limbs and hands in adults.
* Cells of this tissue (chondrocytes) are enclosed in small cavities within the matrix secreted by them.
* Cartilage is present in the tip of nose, outer ear joints, between adjacent bones of the vertebral column.

**Question** Explain the basic criteria for classification of permanent tissue in plants.  
**Answer** The permanent tissues are classified on the basis of the following criteria:

1. Simple (made of one type of cell) or complex (made of more than one type of cells)
2. Cell wall: Thin or thick
3. Type of cell: living or dead
4. Type of function the tissue performs: epidermis is protective, parenchyma is packing or supportive tissue and sclerenchyma makes up conducting tissue.

**Question** Identify the given two slides A and B as a parenchyma or sclerenchyma. Sclerenchyma can be identified by which characteristic?

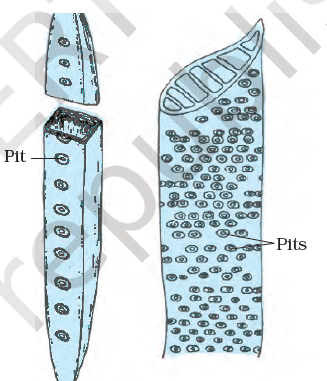
 

Slide A Slide B

**Answer** Slide A is parenchyma and Slide B is sclerenchyma.

Sclerenchyma can be identified by the type of cells which are long and narrow as the walls are thickened due to presence of lignin.

**Question** (i) Identify the given figures.

  
(ii) Give any two major differences between the structures identified.

(iii) Describe the role performed by these two in the plant body.

**Answer**  
(i) Structure (A) is a tracheid and structure (B) is a vessel.

(ii) Tracheid:

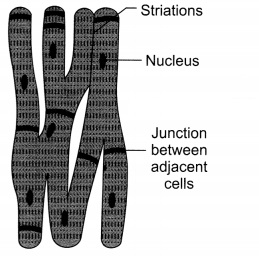
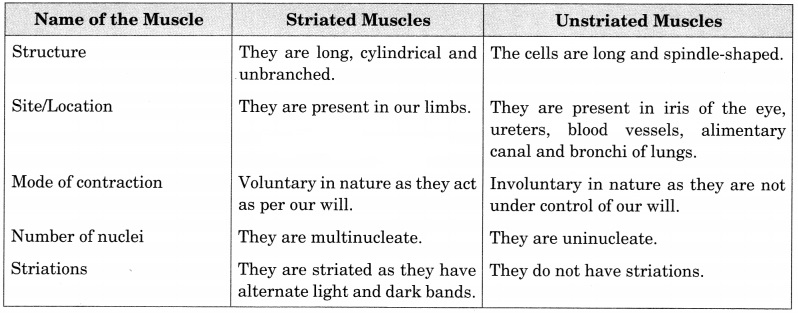
* Tracheids are elongated or tube-like cells with thick and lignified walls and tapering ends.
* They are in the form of single cells.

Vessel:

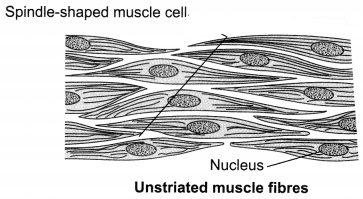
* Vessel is a long cylindrical tube-like structure made up of many cells called vessel members.
* They are composed of a number of cells fused together.

(iii) Tracheids and vessels help in vertical transport of water and minerals in the plants. They also help to provide mechanical strength to the plants.

**Question** Draw a well labelled diagram of cardiac muscle found in the human body. Write two differences between striated and smooth muscles.

  
**Answer**  


**Question** Draw a labelled diagram of unstriated muscle tissue and mention its occurrence, features and functions.

**Answer**  
  
(i) The cells are long and spindle-shaped.

(ii) They do not have striations.

(iii) Involuntary in nature as they are not under control of our will.

(iv) The cells of smooth muscles are uninucleate.

(v) Smooth muscle fibres are present in iris of the eye, ureters, blood vessels, alimentary canal and bronchi of lungs.

**Question** Name the kinds of muscles found in your limbs and lungs. How do they differ from each other structurally and functionally?

**Answer** Striated muscle fibres are found in limbs whereas smooth muscle fibres are present in lungs. The differences in their structure are:

(i) Striated muscle fibres have alternate light and dark bands which are not present in the smooth muscle fibres.

(ii) Striated muscle fibres are cylindrical and multinucleate whereas the smooth muscle fibres are spindle-shaped and uninucleate.

(iii) Striated muscles are voluntary in nature (under control of our will) whereas the smooth muscle fibres are involuntary in nature (not under control of our will).

**Question** What are neurons? Where are they found in the body? What function do they perform in the body of an organism?

**Answer** The cells of nervous tissue are called nerve cells or neurons. Neurons are the structural and functional unit of the nervous system. They are found in the brain, spinal cord and nerves.

Their functions are:

* They are highly specialised for transmitting the stimulus from one place to another within the body on being stimulated.
* They help to coordinate the various functions of the body.

**Question** Animals of colder regions and fishes of cold water have thicker layer of subcutaneous fat. Describe why?

**Answer** The thick layer of subcutaneous fat acts as insulator and prevents the heat of the body to escape out. The layer of fat acts as a subcutaneous insulation of body for thermoregulation.

**Question** Name the following

* 1. Tissue that forms the inner lining of our mouth.

**Answer** Epithelial tissue

* 1. Tissue that connects muscle to bone in humans.

**Answer** Tendon

* 1. Tissue that transports food in plants.

**Answer** Phloem

* 1. Tissue that stores fat in our body.

**Answer** Adipose tissue

* 1. Connective tissue with a fluid matrix.

**Answer** Blood

* 1. Tissue present in the brain.

**Answer** Nervous tissue

**Question** Identify the type of tissue in the following: skin, bark of tree, bone, lining of kidney tubule, vascular bundle.

**Answer**

* Skin: Stratified squamous epithelial tissue
* Bark of tree: Simple permanent tissue
* Bone: Connective tissue
* Lining of kidney tubule: Cuboidal epithelial tissue
* Vascular bundle: Complex permanent tissue

**Question** Name the regions in which parenchyma tissue is present.

**Answer** Leaves, fruits, and flowers are the regions where the parenchyma tissue is present.

**Question** What is the role of epidermis in plants?

**Answer** Epidermisis present on the outer surface of the entire plant body which perform following role:

It is a protective tissue of the plant body.

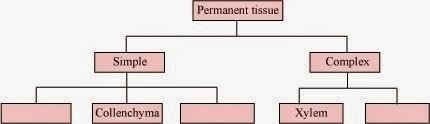
It protects the plant against mechanical injury.

It allows exchange of gases through the stomata.

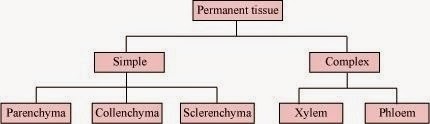
**Question** How does the cork act as a protective tissue?

**Answer** The outer protective layer or bark of a tree is known as the cork. It is made up of dead cells. Therefore, it protects the plant against mechanical injury, temperature extremes, etc. It also prevents the loss of water by evaporation.

**Question** Complete the table:

[](file:///\\1.bp.blogspot.com\-1Ceshw_EdfY\VNXv1wLszRI\AAAAAAAADko\rKesY5vsHVI\s1600\tissue-question-15.jpg)

**Answer**

[](file:///\\1.bp.blogspot.com\-HTjnHXONqTA\VNXwBjr1ehI\AAAAAAAADkw\3OBgleCQZgU\s1600\tissue-answer-15.jpg)

**Question** If a potted plant is covered with a glass jar, water vapours appear on the wall of glass jar. Explain why.

**Answer** The water is lost by the plant in the form of water vapour due to the process of transpiration. These water vapours appear on the wall of the glass jar.

**Question** Name the different components of xylem and draw a living component.

**Answer** Xylem consists of four elements which are:

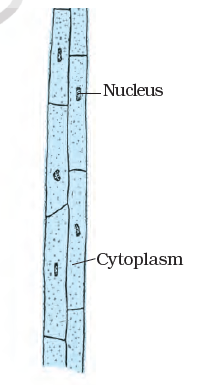
(a) tracheids

(b) vessels

(c) xylem parenchyma

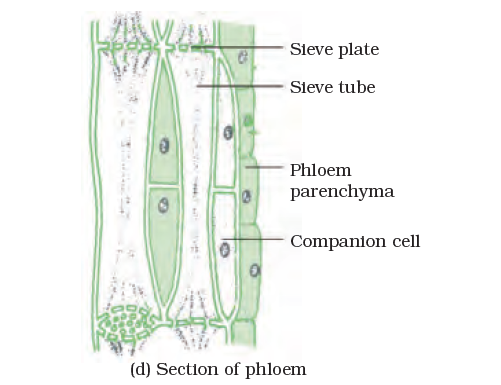
(d) xylem fibres

The only living component of xylem is xylem parenchyma whose basic structure is shown below:



**Question** Draw and identify different elements of phloem.

**Answer** Phloem has four elements called sieve tubes, companion cells, phloem fibres and the phloem parenchyma.



**Question** Write true (T) or false (F).

(a) Epithelial tissue is protective tissue in animal body.

(b) The lining of blood vessels, lung alveoli and kidney tubules are all made up of epithelial tissue.

(c) Epithelial cells have a lot of intercellular spaces.

(d) Epithelial layer is permeable layer.

(e) Epithelial layer does not allow regulation of materials between body and external environment.  
**Answer**  
(a) True

(b) True

(c) False

(d) True

(e) False

**Question** Differentiate between voluntary and involuntary muscles. Give one example of each type.

**Answer** Voluntary muscles are present in our limbs as skeletal muscles and can be moved by our conscious will whenever we want. Involuntary muscles cannot function on their own. They cannot be controlled by our will or desire. The cardiac muscle and the smooth muscles are involuntary in nature.

**Question** Differentiate the following activities on the basis of voluntary (V) or involuntary (IV) muscles.

(a) Jumping of frog

(b) Pumping of the heart

(c) Writing with hand

(d) Movement of chocolate in your intestine

**Answer**  
(a) (V)

(b) (IV)

(c) (V)

(d) (IV)

**Question** Fill in the blanks.

(a) Lining of blood vessels is made up of \_\_\_\_\_\_\_

(b) Lining of small intestine is made up of \_\_\_\_\_\_\_

(c) Lining of kidney tubules is made up of \_\_\_\_\_\_\_

(d) Epithelial cells with cilia are found in \_\_\_\_\_\_\_ of our body.

**Answer**  
(a) Squamous epithelium

(b) Columnar epithelium

(c) Cuboidal epithelium

(d) Respiratory tract

**Question** Water hyacinth floats on water surface. Explain.

**Answer** The parenchyma present in the swollen petiole of water hyacinth is called aerenchyma which has large cavities to provide buoyancy and help them float on the water surface.

**Question** Which structure protects the plant body against the invasion of parasites?  
**Answer** The epidermis of plants has thick cuticle and waxy substances to prevent the invasion of parasites.

**Question** Fill in the blanks.

(а) Cork cells possesses \_\_\_\_\_\_\_on their walls that makes it impervious to gases and water.  
(b) \_\_\_\_\_\_\_ have tubular cells with perforated walls and are living in nature.  
(c) Bone possesses a hard matrix composed of and \_\_\_\_\_\_\_ and \_\_\_\_\_\_\_  
Answer:  
(a) suberin

(b) sieve tubes

(c) calcium and phosphorus

**Question** Why is epidermis important for the plants?

**Answer** The outermost layer of cells covering an organism is called epidermis. It is usually made up of a single layer of cells and gives protection.

The epidermis may be thicker in some plants living in dry habitats or often secrete a waxy, water- resistant layer on their outer surface called cutin (chemical substance with waterproof quality) to prevent water loss.

The stomata present on the epidermis of leaves helps in gaseous exchange and the loss of water vapour by transpiration.

The epidermal cells of roots bear root hairs that greatly increase the total absorptive surface area of the roots for absorption of water.

**Question** Fill in the blanks.

(a) \_\_\_\_\_\_\_ are forms of complex tissue.

(b) \_\_\_\_\_\_\_ have guard cells.

(c) cells of cork contain a chemical called \_\_\_\_\_\_\_

(d) Husk of coconut is made of \_\_\_\_\_\_\_ tissue.

(e) \_\_\_\_\_\_\_ gives flexibility in plants.

(f) \_\_\_\_\_\_\_ and \_\_\_\_\_\_\_ are both conducting tissues.

(g) Xylem transports and \_\_\_\_\_\_\_ and \_\_\_\_\_\_\_ from soil.

(h) Phloem transport from \_\_\_\_\_\_\_ and \_\_\_\_\_\_\_ to other parts of the plant.

Answer:  
(a) Xylem and phloem

(b) Stomata

(c) suberin

(d) sclerenchyma

(e) Collenchyma

(g) water; minerals

(h) Food; leaf

**Question** Differentiate between

(i) Xylem and phloem

(ii) Vessel and sieve tube

(iii) Tracheid and vessel

**Answer** (i) Xylem and phloem –

Xylem:

* Xylem consists of tracheids, vessels, xylem parenchyma and xylem fibres.
* All the cells of xylem except the xylem parenchyma are dead.
* Xylem helps to transport water and minerals.
* The transport is unidirectional through xylem.

Phloem:

* Phloem has four elements called sieve tubes, companion cells, phloem fibres and the phloem parenchyma.
* All cells of phloem are living except the phloem fibres.
* Phloem transports food from leaves to other parts of the plant.
* The transport is bidirectional through the phloem.

(ii) Vessel and sieve tube –

Vessel:

* They are tubular structures having a hollow lumen and composed of dead cells.
* Vessel helps to conduct water and minerals in plants.
* The walls of vessels are lignified.
* They also provide mechanical strength to the plants.
* Their end walls are completely dissolved.

Sieve Tube:

* They are tubular structures having vacuolated cytoplasm and composed of living cells.
* They help to transport food from leaves to other parts of the plant.
* Their walls are not lignified.
* They do not provide mechanical strength to the plants.
* Their end walls have perforations in form of sieve plate.

(iii) Tracheid and vessel \_

Tracheid:

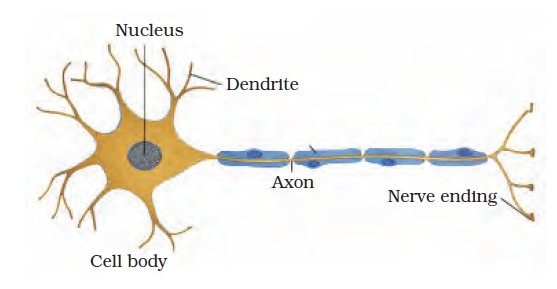
* Tracheids are elongated or tube-like cells with thick and lignified walls and tapering ends.
* They are in the form of single cells.
* The inner layers of the cell walls are more thickened.
* They have narrow lumen.
* They have pointed ends.

Vessel:

* Vessel is a long cylindrical tube-like structure made up of many cells called vessel members.
* They are composed of a number of cells fused together.
* Their walls are less thickened.
* They have wide lumen.
* They have blunt ends.

**Question** What is nervous tissue? Draw a well labelled diagram of neuron. (Label any 4 parts)

**Answer** Nervous tissue is a tissue made of neurons. It is divided into two parts: the central nervous system (CNS) consisting of the brain and spinal cord; and the peripheral nervous system (PNS) which regulates and controls the various functions and activities of the body.



**Question** Write the differences between animal tissue and plant tissue.  
**Answer** Plant Tissue:

* The tissue is well differentiated into meristematic tissue and permanent tissue.
* The tissue can grow throughout life due to activity of meristematic tissue.
* They are autotrophic in nature.
* The tissue has more amount of dead tissue which provides mechanical strength to the plants.
* The tissue organisation is comparatively simple.

Animal Tissue:

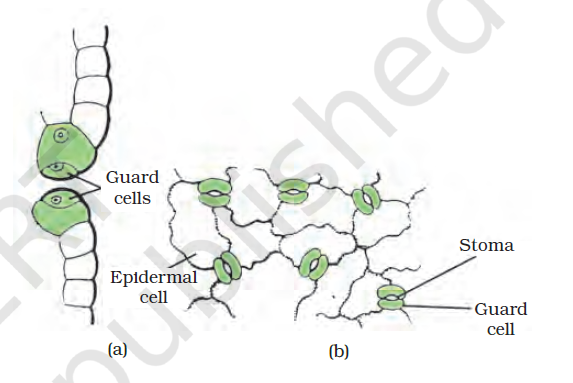
* The tissue is not much differentiated like the plant tissue.
* The tissue does not show growth throughout life.
* They are heterotrophic in nature.
* The tissue has more amount of living tissue than dead tissue.
* The tissue is complex as it is organised into organs and organ systems.

**Question** Write a note on the protective tissue in plants. (Give appropriate diagram also)  
**Answer** The protective tissues in plants are epidermis and the cork.  
(i) Epidermis: The outermost layer of cells covering an organism is called epidermis. It is usually made up of a single layer of cells and gives protection.

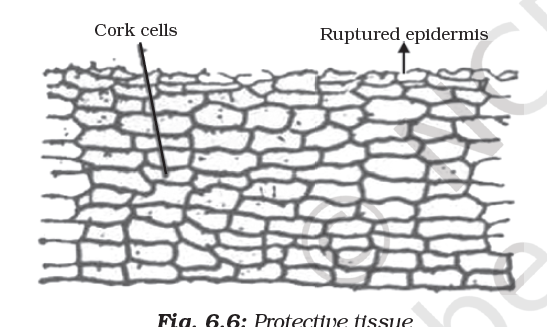
The epidermis may be thicker in some plants living in dry habitats or often secrete a waxy, water- resistant layer on their outer surface called cutin to prevent water loss.

The epidermis of leaves have small pores called stomata which are enclosed by two kidney-shaped cells called guard cells. Stomata help in gaseous exchange and transpiration.

The epidermal cells of roots bear root hairs that greatly increase the total absorptive surface area of the roots for absorption of water.



(ii) Cork: A strip of secondary meristem replaces the epidermis of the older stem and cuts off cells towards compactly arranged without intercellular spaces and have a chemical called suberin in their walls that makes them impervious to gases and water.



**Question** Explain the significance of the following:

(i) Hair-like structures on epidermal cells.

(ii) Epidermis has thick waxy coating of cutin in desert plants.

(iii) Small pores in epidermis of leaf.

(iv) Numerous layers of epidermis in cactus.

(v) Presence of a chemical suberin in cork cells.

**Answer**  
(i) To increase the total absorptive surface area for absorption of water.

(ii) To prevent water loss by transpiration and protection from pathogens.

(iii) To help in gaseous exchange and transpiration.

(iv) To prevent water loss by transpiration.

(v) To make tissue impervious to gases and water.

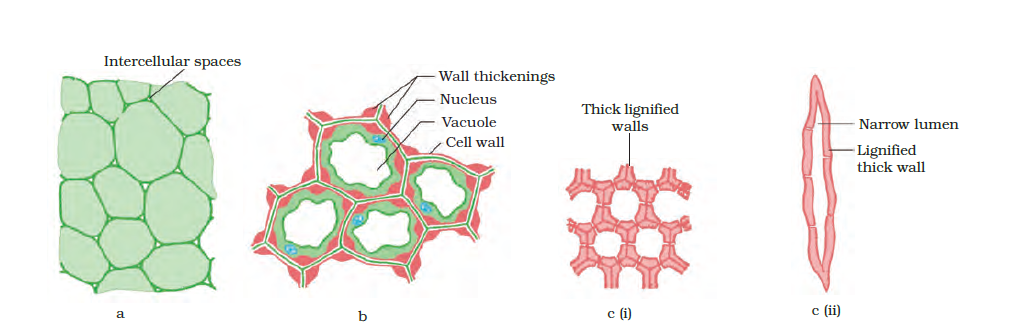
**Question** Differentiate between sclerenchyma and parenchyma tissues. Draw well labelled diagram.

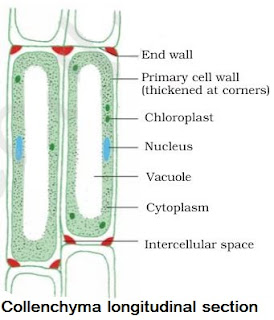
**Answer** Parenchyma:

* Cells are thin walled and thickened with cellulose.
* It is made up of living cells.
* Cells are usually loosely pac ked with large intercellular spaces.
* Helps to store nutrients and water in stem and roots.
* It is called chlorenchyma if it contains chlorophyll and performs photos ynthesis. The parenchyma of
* aquatic plants have large cavities to provide buoyancy to the plants to help them float, it is then called aerenchyma.

Sclerenchyma:

* Cells are thick and thickened with lignin.
* This tissue is made up of dead cells.
* There are no intercellular spaces between the cells.
* Provides strength to the various parts of the plant.
* The cells are long and narrow, make the plant hard and stiff. This tissue provides strength to the plants and is present in stems, around vascular bundles, in the veins of leaves and in the hard covering of seeds and nuts.





**Question** Describe the structure and function of different types of epithelial tissues. Draw diagram of each type of epithelial tissue.

**Answer** Epithelial tissues are the covering or protective tissues and cover most organs and cavities in the animal body. These cells are tightly packed, form a continuous sheet and are almost without any intercellular spaces between them. E.g., skin, the lining of the mouth, the lining of blood vessels, lung alveoli and kidney tubules are all made of epithelial tissue.

All epithelium is usually separated from the underlying tissue by an extracellular fibrous basement membrane. The types of epithelium on the basis of their structure and functions are:

(a) Squamous epithelium: Consists of flattened cells. Present in oesophagus and lining of the mouth. Skin epithelial cells are arranged in many layers to prevent wear and tear and are called stratified squamous epithelium.

(b) Columnar epithelium: Has tall or ‘pillar-like’ cells. It forms the inner lining of the intestine.

(c) Cuboidal epithelium: Has cube-shaped cells. It forms the lining of kidney tubules and ducts of salivary glands, where it provides mechanical support.

(d) Ciliated epithelium: Have cilia on the outer surfaces of epithelial cells. The cilia can move and their movement pushes the mucus in the respiratory tract forward to clear it.

(e) Glandular epithelium: Has gland cells which secrete substances at the epithelial surface.

