



# HANSRAJ MODEL SCHOOL

PUNJABI BAGH, NEW DELHI

CLASS - IX

SUBJECT - BIOLOGY

TOPIC - L-6, TISSUES  
MODULE-2

# TOPICS TO BE COVERED

ANENT  
TUE

DEFINITION

PROCESS OF ITS  
FORMATION  
(DIFFERENTIATION)

TYPES OF  
PERMANENT  
TISSUE

\*SIMPLE  
PERMANENT  
TISSUE

\*COMPLEX  
PERMANENT  
TISSUE

SIMPLE PERMANENT  
TISSUES:

(a) SIMPLE  
SUPPORTIVE TISSUE:

PARENCHYMA

\*COLLENCHYMA

\*SCLERENCHYMA

(b) SIMPLE  
PROTECTIVE TISSUE:

\*EPIDERMIS

\*CORK

- THEIR LOCATION
- STRUCTURE,
- FEATURES
- FUNCTIONS

TYPES OF  
COMPLEX  
PERMANENT  
TISSUE-

\*XYLEM

\*PHLOEM

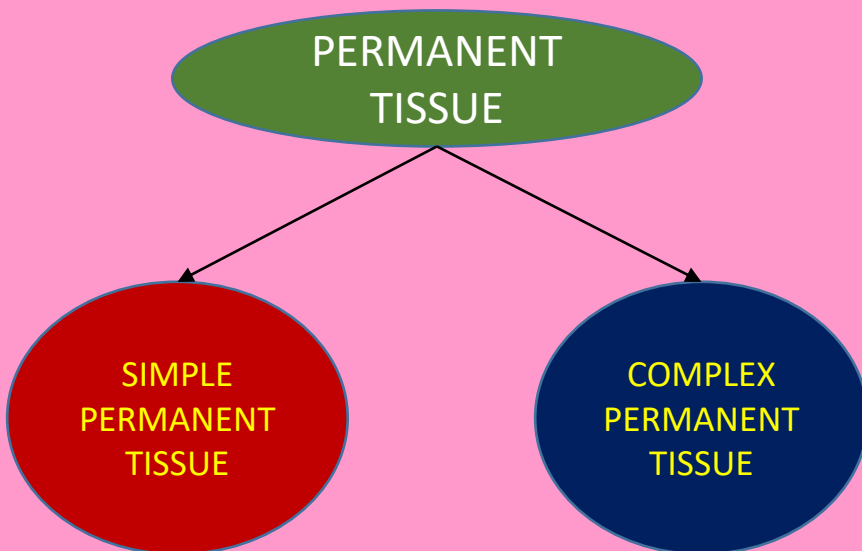
- THEIR LOCATION
- STRUCTURE,
- FEATURES
- FUNCTIONS

# PERMANENT TISSUES

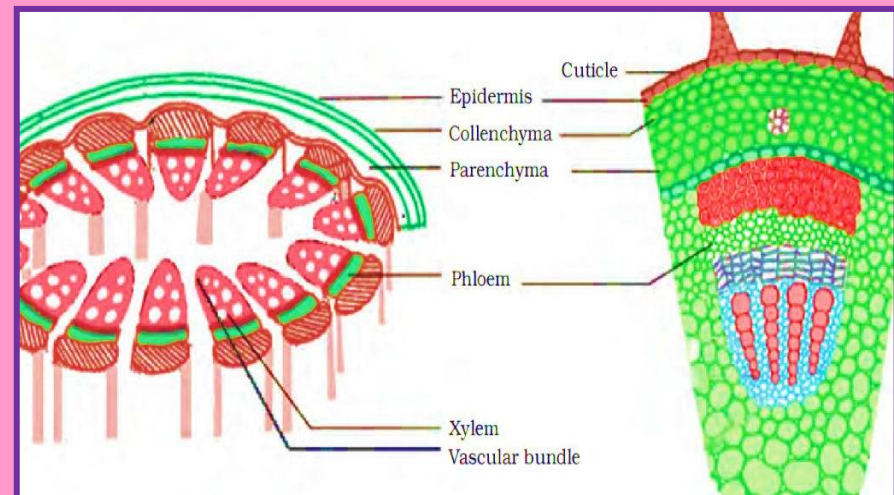
**DEFINITION:** Cells formed by meristematic tissue take up a specific role and lose the ability to divide and form permanent tissue.

**DIFFERENTIATION:** The process of taking up a permanent shape, size and a function by the cells formed by meristematic tissue, is called as differentiation.

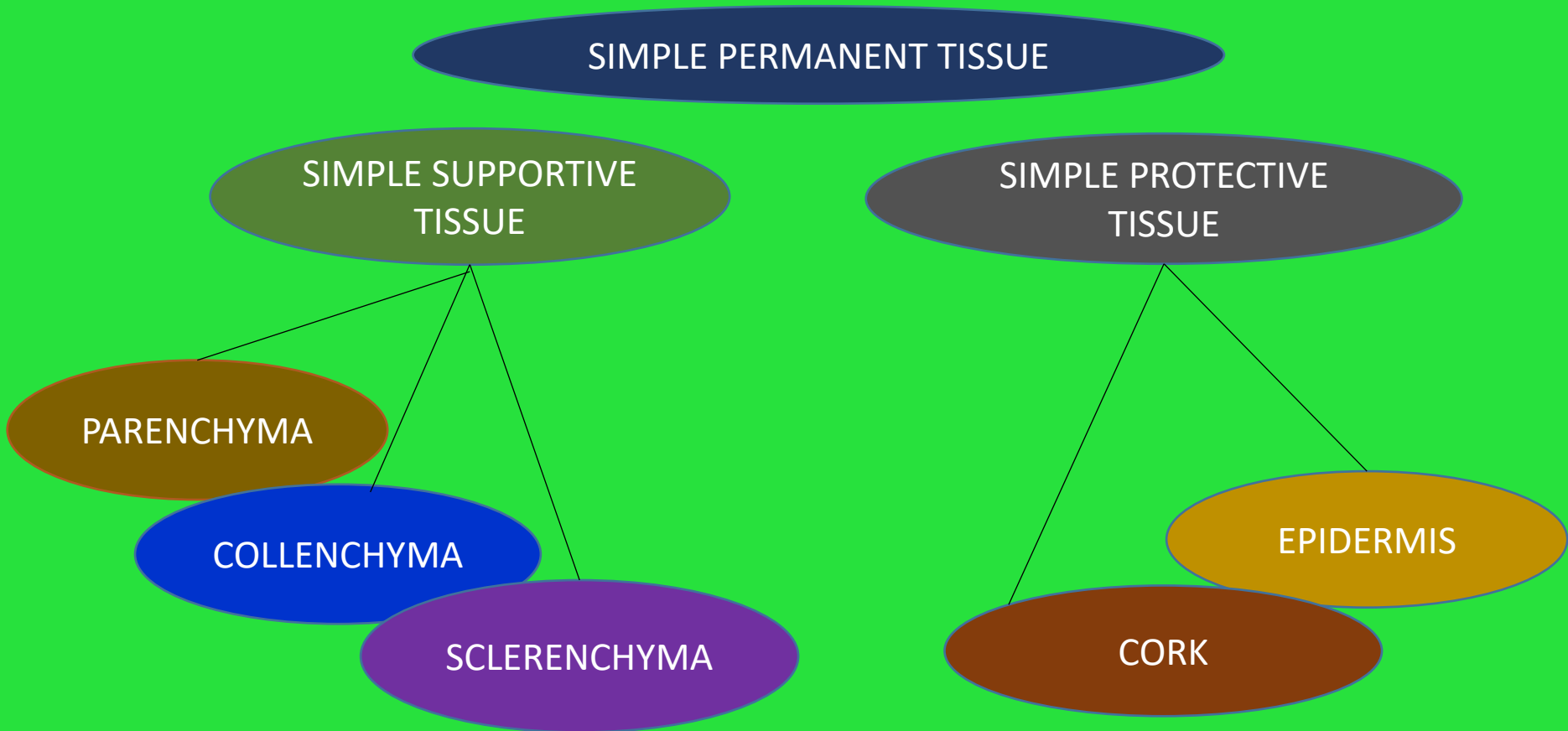
➤ Differentiation leads to the development of various types of permanent tissues.



**SECTION OF A STEM**



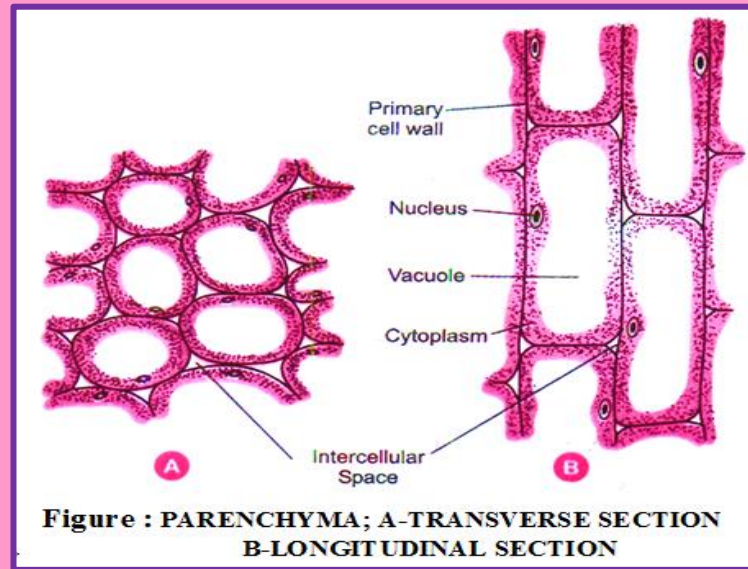
# SIMPLE PERMANENT TISSUE- MADE UP OF ONLY ONE TYPE OF CELLS



# PARENCHYMA TISSUE

## CHARACTERISTICS

- Parenchyma is the most common simple permanent tissue.
- It consists of relatively unspecialised cells with thin cell walls.
- They are living cells.
- They are usually loosely arranged, thus large spaces between cells (intercellular spaces) are found in this tissue.
- Oval or round in shape.
- They have dense cytoplasm and possess large central vacuole.



## FUNCTIONS

- This tissue generally stores food.

## MODIFICATIONS

### CHLORENCHYMA

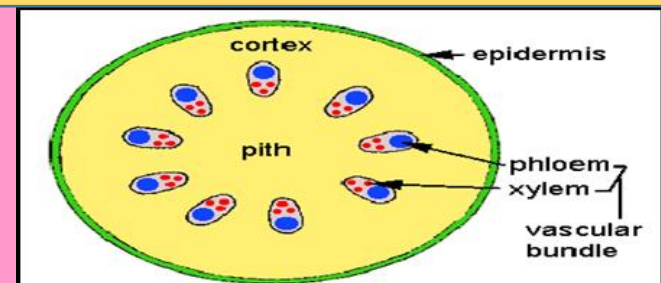
In some situations, parenchyma contains chlorophyll and performs photosynthesis and is called as chlorenchyma

### AERENCHYMA

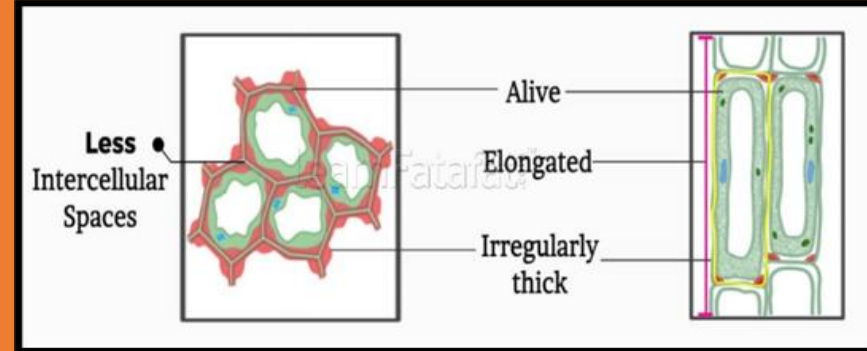
In aquatic plants, large air cavities are present in parenchyma to help them float

## LOCATION

- Soft parts of the plant such as cortex and pith.



# COLLENCHYMA TISSUE

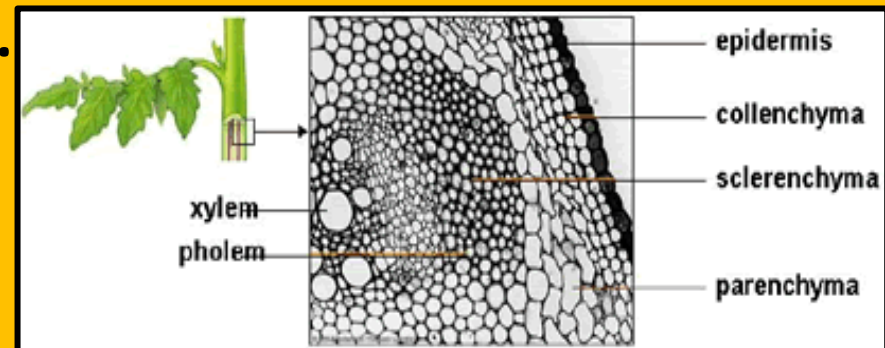


## CHARACTERISTICS

- Cells of this tissue are living.
- They have very little intercellular space.
- The cells are elongated and irregularly thickened at the corners.
- There is very little intercellular space.

## FUNCTIONS

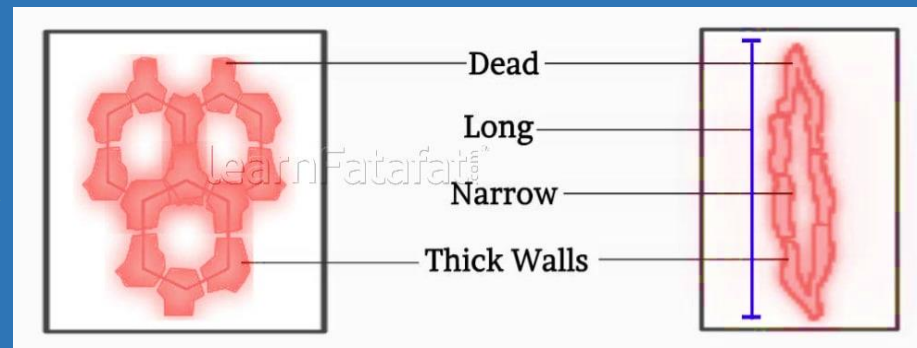
- This tissue provides flexibility and allows bending of various plant parts like tendrils and climbers, without breaking.
- It also provides mechanical support.



## LOCATION

- This tissue is present in leaf stalks below the epidermis.

# SCLERENCHYMA TISSUE



## CHARACTERISTICS

- The cells of this tissue are dead.
- They are long and narrow as the walls are thickened due to lignin.
- Their walls are so thick that there is no internal space inside the cell.

## FUNCTIONS

- This tissue makes the plant hard and stiff
- It provides strength to the plant parts.

## LOCATION

- This tissue is present in stems, around vascular bundles, in veins of leaves and in the hard covering of seeds and nuts e.g. husk of a coconut.

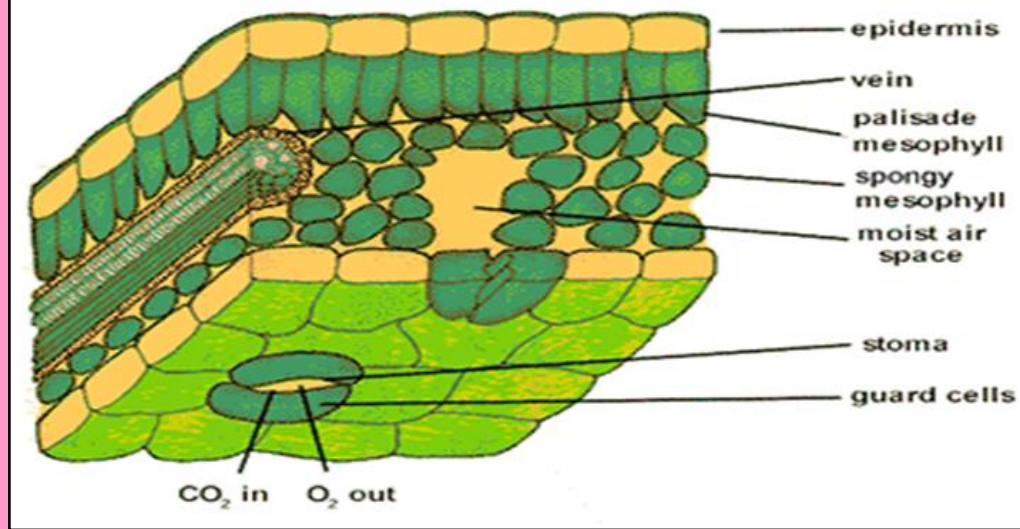
# EPIDERMIS

## LOCATION

It is the outer covering of entire surface of a plant i.e. outermost layer of all soft parts of the plant like young stems, roots, leaves etc.

## STRUCTURE

- Usually epidermis is made up of a single layer of cells.
- In some plants living in very dry habitats, the epidermis may be thicker to prevent water loss.
- Since epidermis has a protective role to play, cells of epidermal tissue form a continuous layer without intercellular spaces.
- Most of epidermal cells are relatively flat. Often their outer and side walls are thicker than the inner wall.



- **STOMATA**- Minute pores or openings in the epidermis.
- **STRUCTURE OF STOMATA**- Stomata are enclosed by two kidney-shaped cells called guard cells.
- **FUNCTIONS OF STOMATA**-
  - (i) Stomata help in exchange of gases with the atmosphere.
  - (ii) Transpiration i.e. loss of water in the form of water vapour, also takes place through stomata.

## FUNCTIONS OF EPIDERMIS

- It protects all the parts of the plant.
- Epidermal cells on the aerial parts of the plant often secrete a waxy, water-resistant layer on their outer surface. This helps in protection against loss of water, mechanical injury and invasion by parasitic fungi.
- Epidermal cells of the roots, whose function is water absorption, commonly bear long hair like parts that greatly increase the total surface area.
- In desert plants, epidermis has a thick waxy coating of **cutin** (chemical substance with waterproof quality) on its outer surface to prevent water loss from plant body.

# CORK

## LOCATION

- It is the outermost protective tissue of old stems and roots.

## STRUCTURE

- Cells of cork are dead and compactly arranged without intercellular spaces.

## FUNCTION

- Cells of cork have a substance called **suberin** in their walls that makes them impervious to gases and water.
- It also prevents entry of microorganisms.

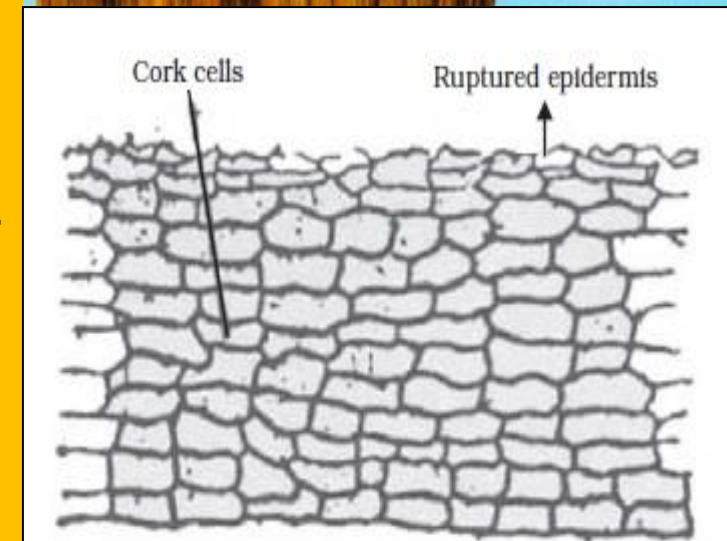
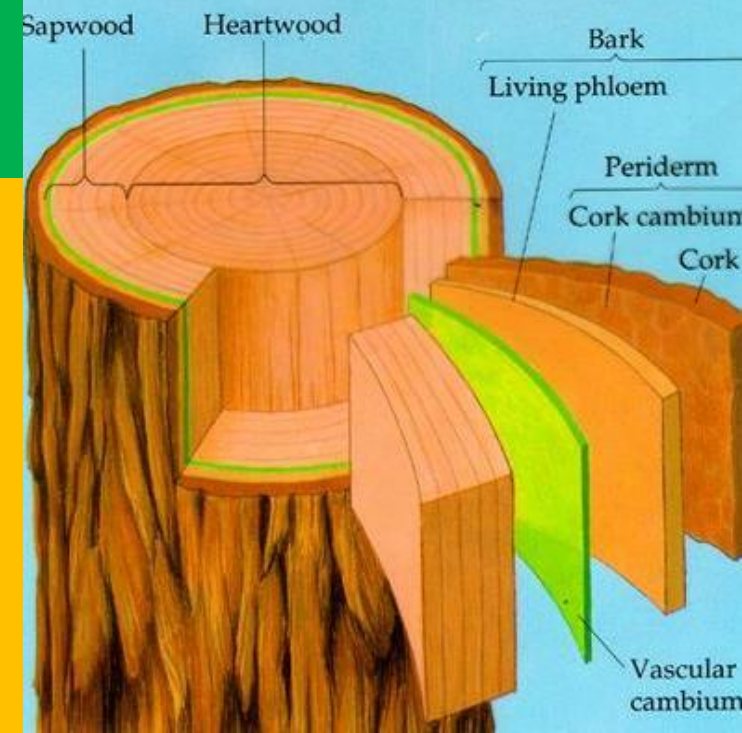


Fig. 6.6: Protective tissue

# COMPLEX PERMANENT TISSUE

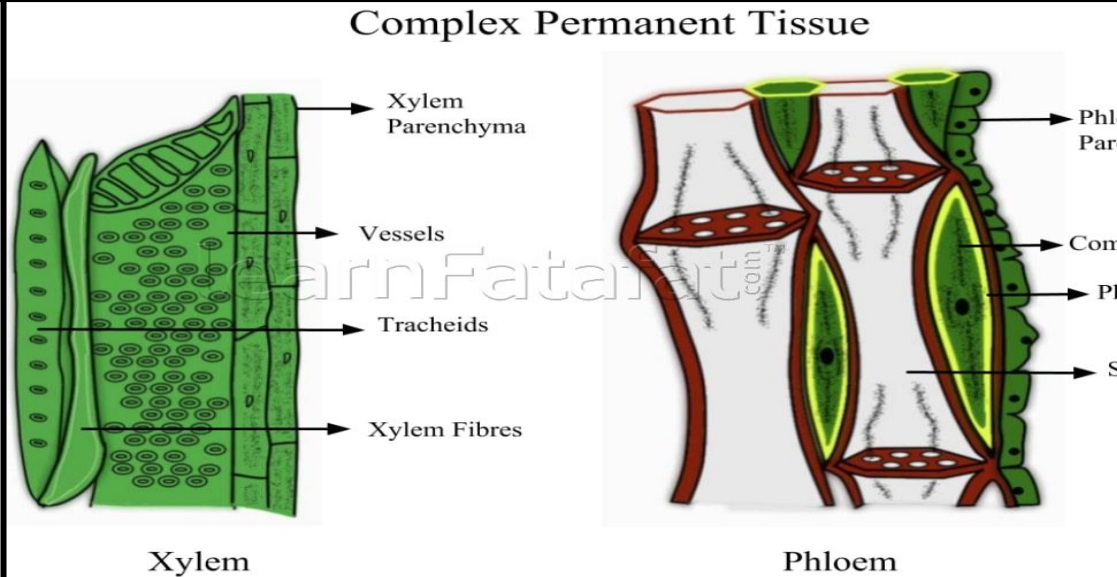
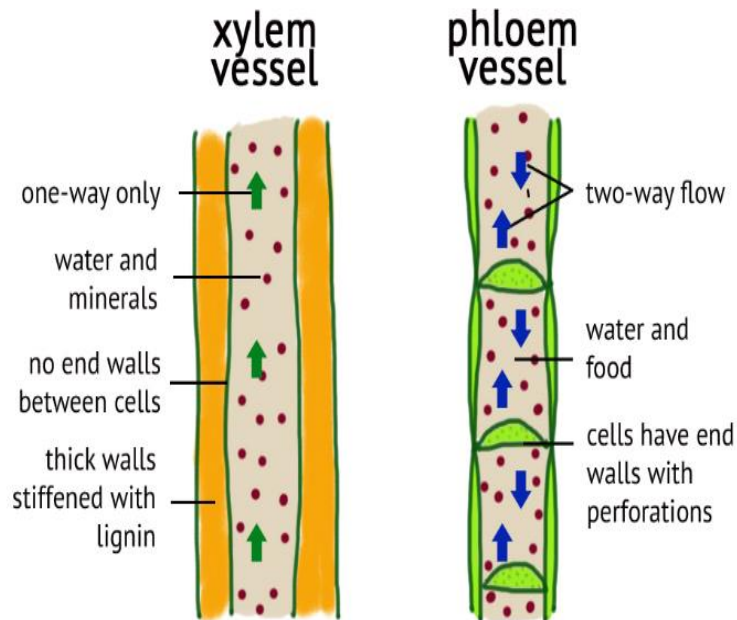
MADE UP OF MORE THAN ONE TYPE OF CELLS

- ❑ Complex tissues are made of more than one type of cells. All these cells coordinate to perform a common function.
- ❑ Xylem and phloem are examples of such complex tissues.
- ❑ Xylem and phloem both are conducting tissues and constitute a vascular bundle.
- ❑ Vascular tissue is a distinctive feature of the complex plants which makes their survival possible in the terrestrial environment.

## COMPLEX PERMANENT TISSUE

XYLEM

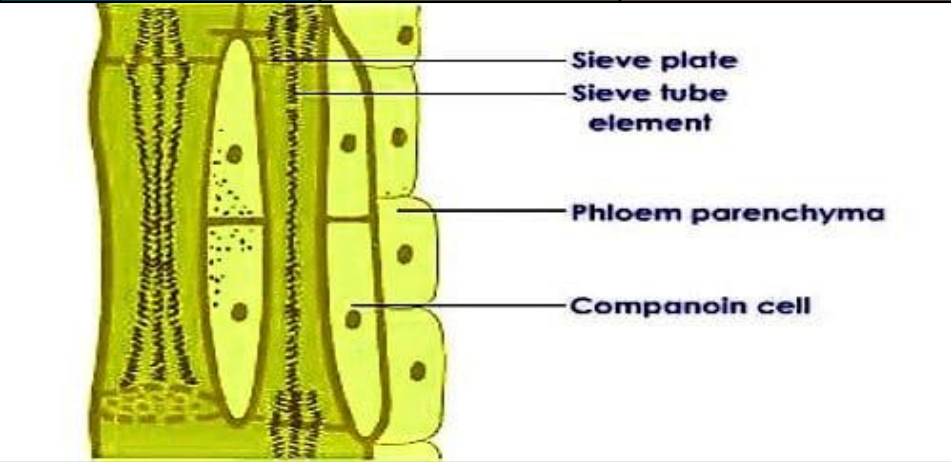
PHLOEM



# XYLEM

| FOUR TYPES OF CELLS                                                                                                                                                                                                                                                                                                                                                                                  | TRACHEIDS                                                                                                                                       | VESSELS                                                                                                                                                     | XYLEM PARENCHYMA                                                                                                                                                                                                                                                                                                                                 | XYLEM FIBRES                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>STRUCTURE</b> <div data-bbox="63 571 710 1076"> <p>The diagram illustrates the components of xylem. On the left, a cross-section of a vessel member shows perforation plates. To its right, a single tracheid is shown with its characteristic tapered ends. Further right, a long, narrow fibre is depicted. Labels include: Perforation plates, Tracheids, Vessel member, and Fibre.</p> </div> | <ul style="list-style-type: none"> <li>Thick walls and many are dead cells when mature.</li> <li>Elongated cells with tapering ends.</li> </ul> | <ul style="list-style-type: none"> <li>Thick walls and many are dead cells when mature.</li> <li>Long tube-like, with thick lignified cell wall.</li> </ul> | <ul style="list-style-type: none"> <li>Living parenchyma cells</li> </ul> <div data-bbox="1141 558 1910 1076"> <p>This diagram shows a cross-section of xylem tissue. It features a large vessel element with pits, a tracheid, and xylem parenchyma cells. Labels include: Pit, Vessel element, Tracheid, and Xylem parenchyma cell.</p> </div> | <ul style="list-style-type: none"> <li>Thick walled sclerenchyma cells.</li> </ul>                                                                                        |
| <b>FUNCTIONS</b>                                                                                                                                                                                                                                                                                                                                                                                     | <ul style="list-style-type: none"> <li>Mechanical support</li> <li>Conducts water and mineral salts.</li> </ul>                                 | <ul style="list-style-type: none"> <li>Mechanical support</li> <li>Conducts water and mineral salts.</li> </ul>                                             | <ul style="list-style-type: none"> <li>Store food</li> <li>Helps in lateral conduction of water</li> </ul>                                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>Mechanical support</li> </ul> <div data-bbox="1468 1285 1924 1385"> <p>HANSRAJ MODEL SCHOOL<br/>PUNJABI BAGH, NEW DELHI</p> </div> |

# PHLOEM- TRANSPORTS FOOD FROM LEAVES TO OTHER PARTS OF THE PLANT

| FIVE TYPES OF CELLS | SIEVE CELLS                                                                                                                                               | SIEVE TUBES                                                                                                                                                                                                | COMPANIAN CELLS                                                                                                                                                                                                                                                                                                                                                                                                       | PHLOEM FIBRES                                                                                         | PHLOEM PARENCHYMA                                                                                    |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| STRUCTURE           | <ul style="list-style-type: none"> <li>Long and narrow cells with tapering end walls. (present in the phloem of Pteridophytes and Gymnosperms)</li> </ul> | <ul style="list-style-type: none"> <li>Elongated tube-like cells, placed end to end</li> <li>Cell wall contains pores. The end walls are perforated, called sieve plates.</li> <li>Living cells</li> </ul> | <ul style="list-style-type: none"> <li>Thin walled cells with active cytoplasm</li> <li>Living cells</li> </ul>                                                                                                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>Thick-walled sclerenchyma cells</li> <li>Dead cells</li> </ul> | <ul style="list-style-type: none"> <li>Thin walled parenchyma cells</li> <li>Living cells</li> </ul> |
|                     |                                                                                                                                                           |                                                                                                                                                                                                            |  <p>The diagram illustrates a cross-section of phloem tissue. It shows a large sieve tube element with a sieve plate at its end. Surrounding the sieve tube element are companion cells. Phloem parenchyma cells are also visible. Labels point to the Sieve plate, Sieve tube element, Phloem parenchyma, and Companion cell.</p> |                                                                                                       |                                                                                                      |
| FUNCTION            | <ul style="list-style-type: none"> <li>Sieve cells are specialised cells for the transportation of organic compounds.</li> </ul>                          | <ul style="list-style-type: none"> <li>Translocation of food</li> </ul>                                                                                                                                    | <ul style="list-style-type: none"> <li>Helps sieve tubes in translocation of food.</li> </ul>                                                                                                                                                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>Mechanical support</li> </ul>                                  | <ul style="list-style-type: none"> <li>Stores food</li> </ul>                                        |