Chapter 6
Anatomy of Flowering Plants

NCERT Exercises

Question 1:

State the location and function of different types of meristems.

Solution 1:

Meristem refers to meristematic tissues which consists of actively dividing cells. On the basis of their position in the plant body, meristems are of three types. They are -

(i) **Apical meristem**: It is present at the apices of root and shoot and is responsible for increase in length.
(ii) **Intercalary meristem:** It is present at the bases of leaves above the nodes or below the nodes and is responsible for elongation of the organs.
(iii) **Lateral meristem:** It is present on lateral side and is responsible or increase in girth or diameter.

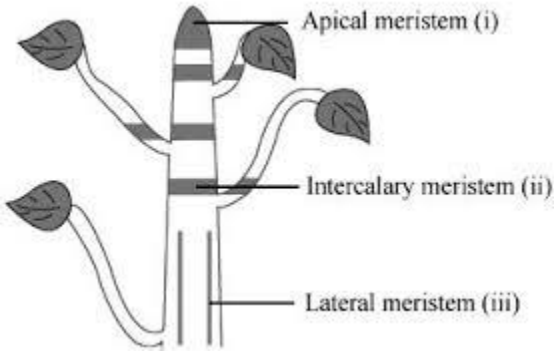

Fig : Diagram showing different types of meristems.

Question 2:

Cork cambium forms tissues that form the cork. Do you agree with this statement? Explain.

Solution 2:

Yes I agree with this statement. Cork cambium (also called phellogen) cuts off cells both on its outer side and inner side. The cells cut off on outer side form cork (also called phellem) and cells cut off on inner side form secondary cortex(also called phelloderm). The cells of cork are dead whereas those of secondary cortex are living. Phellogen, phellem and phelloderm are collectively called periderm.

Question 3:

Explain the process of secondary growth in the stems of woody angiosperms with the help of schematic diagrams. What is its significance?

Solution 3:

Secondary growth refers to the formation of secondary tissues that leads to increase in girth or width of dicot stems due to the activity of cambium and cork cambium. Secondary tissues are formed by two types of lateral

meristems, vascular cambium and cork cambium. Vascular cambium produces secondary vascular tissues while cork cambium forms periderm.

The vascular bundles in dicot stem are conjoint, collateral, open and are arranged in a ring. The cambium present between xylem and phloem in vascular bundles is called fascicular or intrafascicular cambium. Besides this, some cells of medullary rays also become secondarily meristematic and this is called interfascicular cambium. Both these cambia collectively constitute a complete cambialring. This ring of vascular cambium divides periclinally to cut off cells both on inner side and outer side. The cells cuts off on outer side are secondary phloem and inner side are secondary xylem. Amount of secondary xylem cut off is more than secondary phloem and thus with the formation of secondary tissue, increase in girth or diameter occurs. The structure of secondary xylem and secondary phloem is similar to that of primary xylem and primary phloem. With the increase in secondary tissue, the primary xylem and primary phloem get crushed. The ray initials of vascular cambium ring divide by tangential divisions and add new cells. These new cells produced on both the sides of ray initials remain meristematic for sometime and then differentiate into parenchymatous cells of rays. The rays, produced by vascular cambium in between the secondary xylem and secondary phloem, are called secondary medullary rays. They are usually one to few layers in thickness and one to several layers in height. The medullary rays form the radial system responsible for radial conduction of solutes. They maintain connection between pith and cortex .There is a marked difference in activity of cambium with change in season. In spring, the activity of cambium is more and hence the wood elements are larger in size with wide lumen. The activity of cambium is less during autumn and the wood elements are smaller in size with narrow lumen. Spring wood and autumn wood of a year constitute annual ring. (The age of a tree can be determined by counting the annual rings. Number of annual rings correspond to the age of a tree.)

Phellogen cells(cork cambium) divide on both the outer side as well as the inner side to form secondary tissues. The secondary tissue formed on the inner side is called secondary cortex while the tissue formed on outer side is called cork.

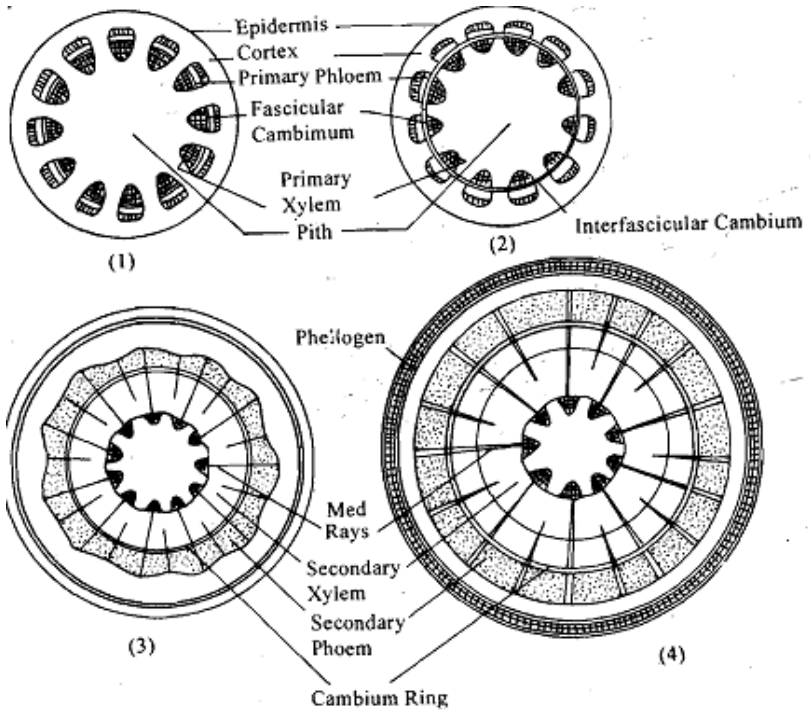

Fig: Diagram showing secondary growth in Dicot Stems

Significance of secondary growth is as follows:

(i) It adds to the girth of the plant thus provides support to increasing weight of aerial parts due to growth.
(ii) It produces a corky bark around the tree trunk that protects the interior from abrasion, heat, cold and infection.
(iii) It adds new vascular tissues for replacing old non-functioning one as well as for meeting increased demand for long distance transport of sap and organic nutrients.

Question 4:

Draw illustrations to bring out the anatomical difference between (a) Monocot root and dicot root (b) Monocot stem and dicot stem

Solution 4:

(a) Differences between monocot root and dicot root are illustrated in the following figure and table.

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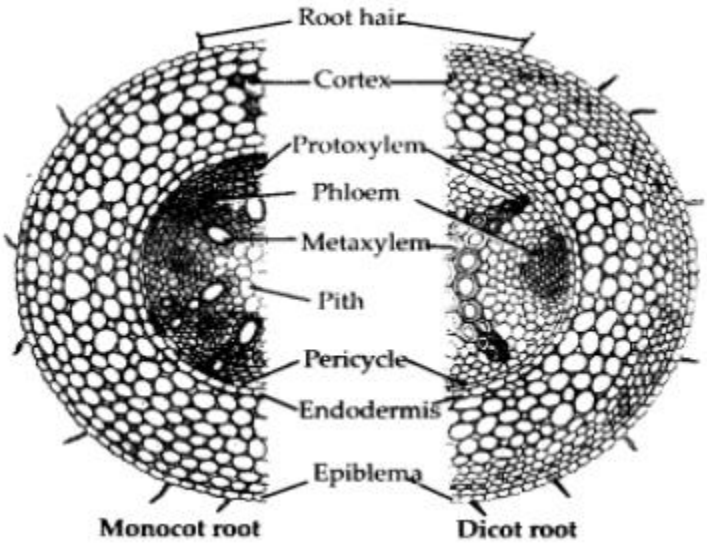
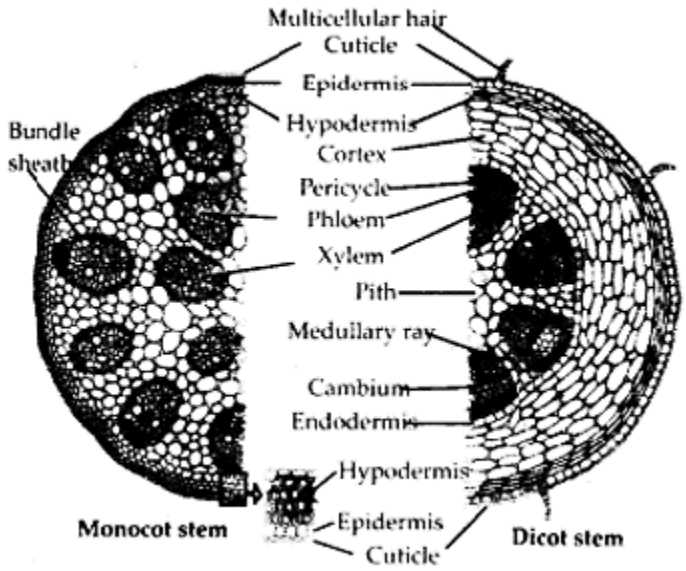


	Features	Monocot root	Dicot root
i.	Cortex	Comparatively	Very wide
ii.	Endodermis	Less thickened and casparian strips are more prominent	Later become highly thickened. Casparian strips are visible only in young root
iii.	Passage cells	Generally absent.	Generally occur opposite the protoxylem point
iv.	Pericycle	Produces lateral roots, cork cambium and part of the vascular cambium.	Produces lateral roots only.
v.	Vascular bundles	2 to 5 or sometimes 8.	8 or more number.
vi.	Pith	Either absent or very small.	Well – developed.

(b) Differences between monocot and dicot stems are illustrated in the following figure.



	Features	**Monocotyledonous stem**	**Dicotyledonous stem**
i.	Vascular bundles	(a) Scattered (b) Conjoint, collateral, (c) Bundle sheath usually present. (d) Phloem parenchyma absent. (e) Xylem vessels arranged either in Y or V shaped manner.	(a) Vascular bundles in ring (b) Conjoint, collateral or bicollateral and open. (c) Bundle sheath absent. (d) Phloem parenchyma present. (e) Not sol
ii.	Pith (Medulla)	Absent	Made up of parenchymatous cells situated in the centre of stem.
iii.	Ground tissue	Ground tissue is not differentiated into the cortex and pith	Differentiated in to the cortex and pith.
iv.	Hypodermis.	Usually sclerenchymatous	Collenchymatous
v.	Endodermis	Absent	One layered, starchy sheath which is usually not well differentiated.
vi	Pericycle	Absent	Made up of one or more

.			layers of parenchymatous and/or sclerenchymatous cells.
vii.	Medullary rays	Absent	Found in between vascular bundles

Question 5:

Cut a transverse section of young stem of a plant from your school garden and observe it under the microscope. How would you ascertain whether it is monocot stem or a dicot stem? Give reasons.

Solution 5:

Vascular bundles in dicot stem are arranged in a ring whereas in monocot stem vascular bundles are scattered throughout the ground tissue. On the basis of arrangement of vascular bundles it can be ascertained whether the young stem is dicot or monocot. Besides undifferentiated ground tissue, sclerenchymatous hypodermis, oval or circular vascular bundles with Y shaped xylem are other differentiating features of monocot stem.

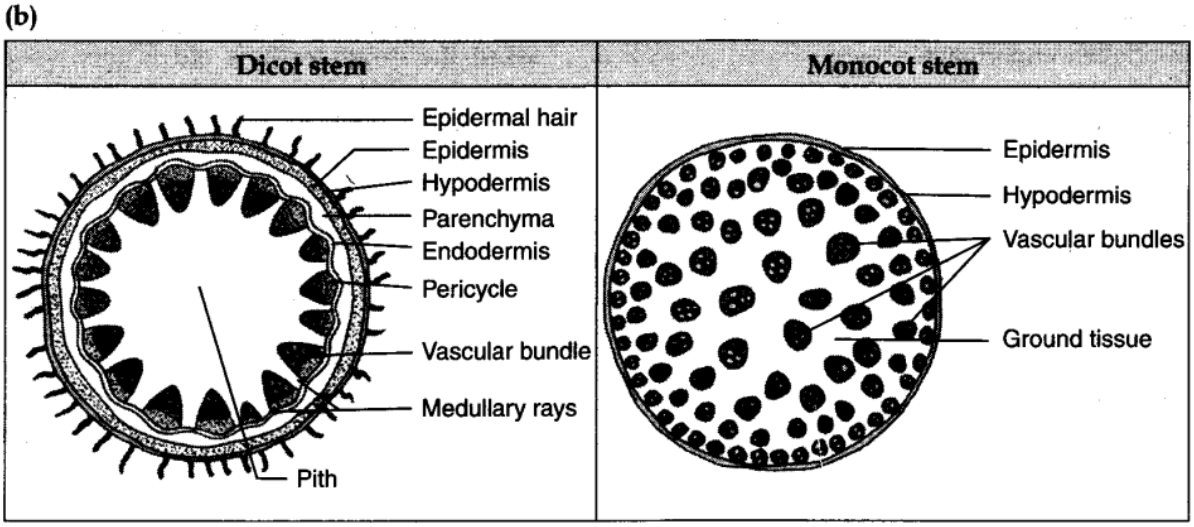


Fig : Vascular Bundles are arranged in a ring in dicot stems and in monocot stems vascular bundles are scattered in ground tissue.

Question 6:

The transverse section of a plant material shows the following anatomical features – (a) the vascular bundles are conjoint, scattered and surrounded by a sclerenchymatous bundle sheath, (b) phloem parenchyma is absent. What will you identify is as?

Solution 6:

The plant material is identified as monocot stem.

Question 7:

Why are xylem and phloem called complex tissues?

Solution 7:

Complex Tissues are made up of more than one type of cells and these work together as a unit.
Xylem elements are responsible for conduction of water and mineral salts from the roots to the other parts of the plant. Xylem elements are highly lignified and dead except xylem parenchyma. It consists of

i) Xylem vessels
ii) Xylem tracheids
iii) Xylem fibres
iv) Xylem parenchyma

Phloem is a complex tissue associated with translocation of food. Phloem elements are living except phloem fibres. It consists of –

i) Sieve tubes
ii) Companion cells
iii) Phloem fibres
iv) Phloem parenchyma

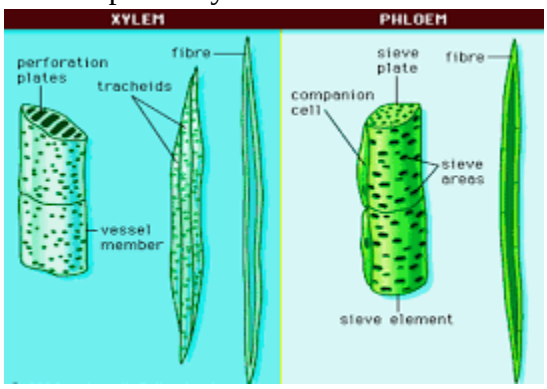


Fig. : Complex tissues – Xylem and phloem.

Question 8:

What is stomatal apparatus? Explain the structure of stomata with a labeled diagram.

Solution 8:

The stomatal apparatus consists of the following –

a) A stoma –This is a small apperture or opening present in the epidermal cells of the leaf. This is called a stomatal apperture (singular- stoma, plural – stomata).
b) Two bean shaped guard cells surrounding the stomatal apperture. (It is to be noted that guard cells are dumb bell shaped in monocots and bean shaped in dicots.)
c) Subsidiary cells – These are specialized epidermal cells in the vicinity of guard cells.

Function – Change in the turgidity or flaccidity of the guard cells is associated with stomatal opening and closure. Stomata are essentially involved in gaseous exchange and transpiration.

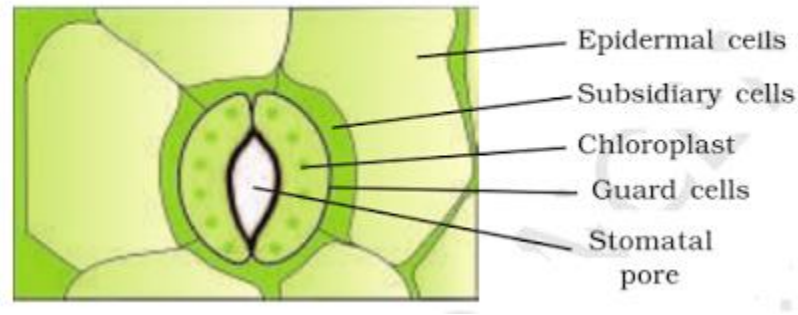


Fig.: Stomatal Apparatus

Question 9:

Name the three basic tissue systems in the flowering plants. Give the tissue names under each system.

Solution 9:

The three basic tissue systems in flowering plants are epidermal tissue system, ground tissue system and vascular tissue system. Epidermal tissue system comprises of epidermal cells, stomata, trichomes and hairs. Ground tissue system consists of cortex, endodermis, pericycle, pith and medullary rays, in the primary roots and stems. In leaves, the ground tissue consists of thin walled chloroplast containing cells and is called mesophyll. The vascular tissue system consists of complex tissues, the phloem and the xylem.

Question 10:

How is the study of plant anatomy useful to us?

Solution 10:

Study of plant anatomy is helpful in understanding structural adaptations in plants with respect to their different environmental conditions. It also helps us in distinguishing between dicots, monocots and gymnosperms. This gives us an idea of the physiological state of the plants and so can be useful in crop improvement. Internal structures also help us to predict the strength of wood and hence its utility for commercial activities. Study of plant fibres such as jute, flax and hemp etc. may prove useful in their commercial exploitation.

Question 11:

What is periderm? How does peridem formation take place in the dicot stems?

Solution 11:

Phelloderm, phellogen and phellem together constitute the periderm. Periderm is protective in function. Dicot stems produce cork cambium or phellogen in the outer cortical cells. Phellogen cells divide on both the outer side as well as the inner side to form secondary tissues. The secondary tissue produced on the on the inner side of the phellogen is called secondary cortex or phelloderm. On the outer side phellogen produces cork or phellem.

Question 12:

Describe the internal structure of a dorsiventral leaf with the help of labeled diagram.

Solution 12:

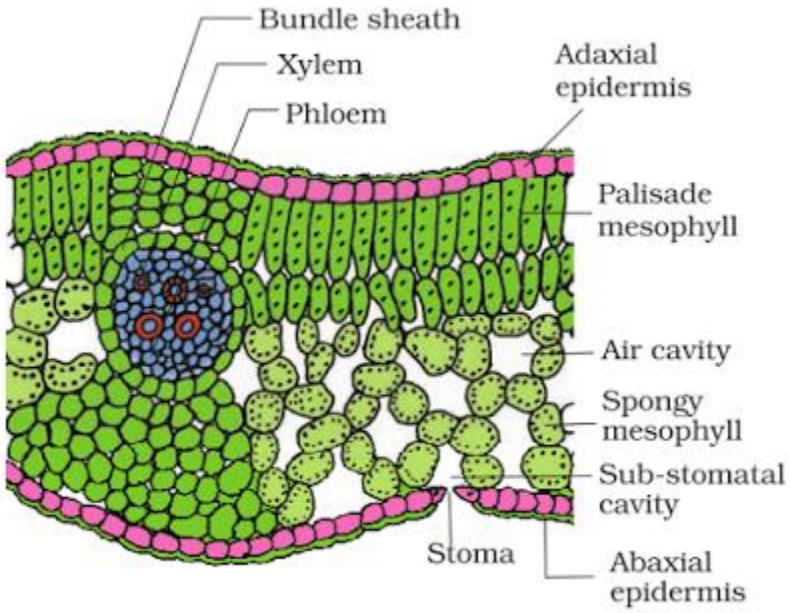


Fig.: Internal Structure of a dorsiventral leaf.

Dorsiventral leaves are found in dicots. The important anatomical features of dorsiventral leaves are discussed below:

(a) Upper epidermis: This is generally outermost single made of parenchymatous cells. The epidermal cells have sometimes outgrowths called papillae, e.g., in Gladiolus. The epidermal cells are devoid of chloroplast and stomata are absent on upper epidermis.

(b) Lower epidermis: It is just like upper epidermis but here stomata are present. Chloroplasts are absent in lower epidermis also, except the guard cells of stomata.

(c) Mesophyll: In between upper and lower epidermis mesophyll tissues is present which can be divided into two regions:

(i) Palisade parenchyma: These are elongated columnar cells without intercellular spaces. These have chloroplast in the and are generally arranged in two layers.
(ii) Spongy parenchyma: It is found below palisade parenchyma and are spherical or oval with intercellular spaces. They also have chloroplasts but number of chloroplasts is more in palisade parenchyma than spongy parenchyma.

(d) Vascular bundles: Vascular bundles are generally found at the boundary between the palisade and the spongy regions. The vascular bundle in midrib region is largest. Vascular bundles are conjoint, collateral and closed. Each vascular bundle is surrounded by a bundle sheath of parenchymatous cells. In the vascular bundle, xylem is present towards upper epidermis and phloem towards lower epidermis. Further in xylem, protoxylem is towards upper epidermis

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