Anatomy of Flowering Plants

CHAPTER 6

EXAM DRILL

ANSWERS

1. **(c)** : Pea-Triarch, Gram-tetrarch, Tomato-diarch.

2. **(d)** : In monocot root, cortex is very, wide, cork is not formed and casparian strips are visible only in young root.

OR

(b)

3. **(b)**

4. Cambium is absent is monocot stem as the whole procambium is consumed in the formation of vascular tissues.

5. Epidermal tissue system is derived from protoderm.

6. When subsidiary cells lie above the guard cells the stomata are called sunken.

7. **(c) :** In floating leaves of aquatic plants, stomata are epistomatic, *i.e.*, they are restricted to the upper surface only.

8. **(b)**

9. **(d) :** In dicot root, some cells of the epiblema give rise to thin-walled tubular outgrowths called root hairs. Such cells are called trichoblasts. Trichoblasts are generally smaller than other epiblema cells.

10. **(c)** : In dorsiventral leaf, silica is not normally deposited on the epidermal cells.

11. **(i) (a) :** The given plant material is primary dicot stem. Here hypodermis is collenchymatous. Stomata have kidney shaped guard cells. Medullary rays occur in between vascular bundles for radial conduction. Phloem parenchyma is present in phloem along with other elements.

(ii) (c) **(iii) (d)**

(iv) (c) : Endarch xylem is characterised by metaxylem towards periphery and protoxylem towards pith.

12. **(i) (a) :** P is conjoint and Q is concentric bundles.

(ii) (d) : Y is bicollateral vascular bundle found in *Luffa cylindrica* and *Cucurbita pepo*.

(iii) (c) : X is collateral, Y is bicollateral, W is amphicribal and Z is amphivasal. In amphicribal vascular bundle, xylem forms a central core while phloem surrounds it on all sides. It occurs in some aquatic angiosperms, and the staminal bundles of many dicots (*e.g.*, *Prunus*).

(iv) (c) : Collateral bundle (X) contains a single patch of phloem. In monocot stem, vascular bundles do not have a strip of vascular cambium. They are termed as closed.

(v) (a)

13. The transverse section of monocot leaf is shown below:

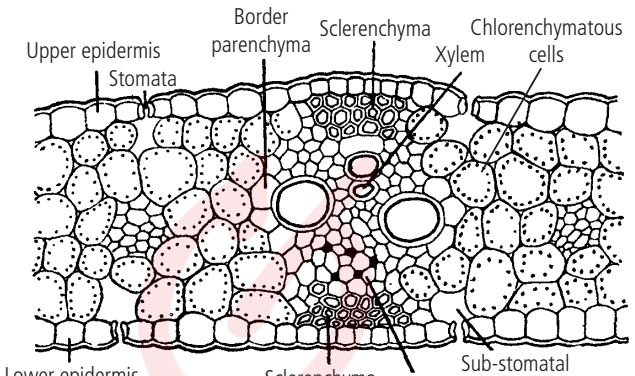

Fig.: T.S. of monocot leaf

14. **(a)** Epiblema of root differs from epidermis of stem in being devoid of distinct cuticle and stomata.

(b) Due to presence of Casparian strips, the endodermal cells do not allow wall to wall movement of substances between cortex and pericycle hence endodermis functions as biological check post.

15. The transverse section of dicot root is shown below :

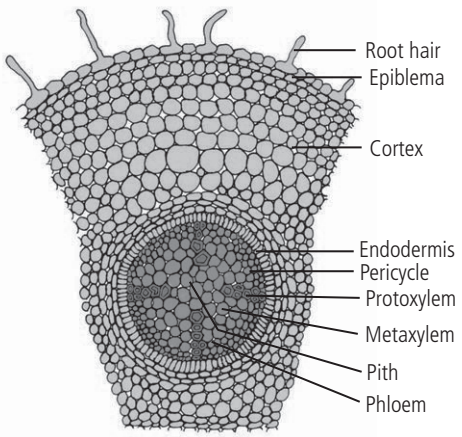

Fig.: T.S. of dicot root (Primary)

16. Monocotyledonous stem can be easily identified by the following features:

(i) Sclerenchymatous hypodermis
(ii) Undifferentiated ground tissue
(iii) Vascular bundles scattered throughout ground tissue
(iv) Vascular bundles conjoint, collateral and closed
(v) Protoxylem cavity present.
(vi) Stomata with dumb-bell shaped guard cell.

17. The epidermis is the outermost layer of the primary plant body. It is made up of elongated compactly arranged cells with no intercellular spaces. They are generally without chloroplast and form a continuous layer. Epidermis is usually single layered but in the leaves of some tropical plants, multilayered epidermis is present. For example, leaves of *Ficus* and *Nerium* have multilayered epidermis.
Epidermal cells are parenchymatous with a small amount of cytoplasm lining the cell wall and a large vacuole. The outside of the epidermis is often covered with a waxy thick layer called the cuticle. Cutin makes the epidermis less permeable to water and hence prevents the loss of water and protects against mechanical injuries. The cuticle is very well developed in xerophytes but absent in hydrophytes.

OR

In all dicotyledonous stems, the vascular bundles are conjoint (with both xylem and phloem) and open (with cambium). They may be collateral (as in Malvaceae) or bicollateral (as in Cucurbitaceae).
The xylem is characteristically endarch. Protoxylem elements have annular and spiral thickenings and the metaxylem elements have scalariform and pitted thickenings. Phloem is composed of sieve tubes, companion cells and phloem parenchyma. The intrafascicular cambium is present between the primary xylem and primary phloem.

18. Pericycle is the outer boundary of vascular strand that is one to several cells in thickness. In roots, it gives rise to lateral branches. Part of vascular cambium is also formed by it. Pericycle of young roots is made up of thin walled cells. In stem, pericycle may be parenchymatous, sclerenchymatous or both. Sclerenchymatous pericycle is both protective and supportive. Parenchymatous pericycle helps in exchange of material between cortex and vascular bundles. Pericycle is absent in stems and roots of aquatic plants.

19. Differences between open and closed vascular bundles are as follows:

S. No.	Open vascular bundle	Closed vascular bundle
(i)	Vascular bundle contains a strip of cambium in between phloem and xylem (intrafascicular cambium).	Intrafascicular cambium is absent.
(ii)	Phloem and xylem do not lie in direct contact with each other.	Phloem and xylem occur in direct contact with each other.
(iii)	Open vascular bundles can be collateral and bicollateral.	Closed vascular bundles can be collateral or concentric.
(iv)	Open vascular bundles occur in dicot and gymnosperm stems.	Closed vascular bundles are found in leaves and monocot stems.

20. Epidermis bears two types of appendages-trichomes and emergences.
(i) Trichomes : They are unicellular or multicellular outgrowths of epidermis which are of two types hair and scales. Hairs are elongated structures that may be glandular or non-glandular. The non-glandular hair may be unicellular or multicellular, branched or unbranched, straight or peltate, etc. in outline. The non-glandular hairs form a sort of air trapping mechanism which reduces the rate of transpiration and the effect of high or low temperature. Root hairs are also considered to be trichomes.
Glandular hairs take part in secretion of various substances. They often possess endodermal type of cells below their secretory region to prevent back flow. Depending upon secretion, glandular hairs are salt secreting, nectar secreting, mucilage secreting, etc.
Scales are multi-cellular flattened trichomes where the stalk is small or absent, *e.g*, in the pitcher of *Nepenthes*, ramenta of some ferns.
(ii) Emergences : Emergences are multicellular appendages which also possess some tissues from inside the organ. The most common emergences are prickles, *e.g.*, rose. Prickles are one type of emergences with no vascular supply. They are stiff and sharp in appearance. They provide protection to the plants from the animals and they also check excessive transpiration. In some plants (*e.g.*, rose) they also help in climbing.

OR

Various types of vascular bundles are:
(i) Radial vascular bundles : Radial vascular bundles are common in roots. Xylem and phloem are present in the form of separate bundles and the two types are present in an alternate manner. They remain at different radii of an axis and are separated by non-conducting tissues.
(ii) Conjoint vascular bundles - Conjoint vascular bundles are not common in roots. Here xylem and phloem are present on the same radius of an axis. Two types of conjoint vascular bundles are collateral and bicollateral vascular bundles. In collateral vascular bundles, phloem and xylem remain together on the same radius (arranged side by side) with the xylem towards the pith (*i.e.*, internal) and the phloem towards the outer side (*i.e.*, external). In bicollateral vascular bundles, phloem remain on both sides of the xylem.
(iii) Concentric vascular bundles : In this type of vascular bundle, one type of vascular tissue completely surrounds the other type and the later forms a solid core. There are two types of concentric vascular bundles. Amphicribal or Hadrocentric where phloem surrounds the xylem and xylem

forms a central core and amphivasal or Leptocentric where xylem surrounds the phloem completely, and phloem forms a central core.

21. Three functions of epidermal tissue system are as follows:
(i) The epidermal tissue system forms a covering of all the plant parts and therefore, provides protection to the underlying tissues.
(ii) It helps in the reduction of surface evaporation of water due to presence of cuticle.
(iii) It forms water and mineral absorptive system of the root.
(iv) Presence of epidermal hair form an insulating layer over the surface.
(v) Prickles and stinging hair protect the plant from herbivores.
(vi) Glandular hairs provide aroma to the plants.
(vii) Stomata take part in exchange of gases and transpiration.
(viii) Trichomes present on the surface of some seeds and fruits help in their dispersal.

22. Anatomically there can be three types of leaves – dorsiventral (bifacial), isobilateral (equifacial) and unifacial.
(i) Dorsiventral (Bifacial) : The leaves are commonly horizontal in orientation with distinct upper and lower surfaces. The upper surface is also called inner, adaxial or ventral surface. The lower surface is correspondingly called outer, abaxial or dorsal surface. Mesophyll is distinguishable into palisade and spongy tissues with palisade usually restricted to the upper side.
(ii) Isobilateral (Equifacial) : The leaf is placed in such a way that both its surfaces receive equal amount of sunlight. A distinction into upper and lower surfaces is absent. Mesophyll is usually indistinguishable (or palisade tissue is present in equal amount on both the sides).

23. (a) X is T.S. of dicot stem and Y is T.S. of monocot stem.
(b) Differences between X (Dicot stem) and Y (Monocot stem) are as follows :

S.No.	Dicot stem	Monocot stem
(i)	Vascular bundles are arranged in ring around the pith.	Vascular bundles scattered throughout the ground tissue.
(ii)	Endodermis is present.	Endodermis is absent.

(c) X is found in sunflower and *Cucurbita* whereas Y is found in maize and grass.

24. The T.S. of dicot stem shows following structures:
(i) Epidermis : It is single outermost layer of stem composed of brick-shaped cells with their outer walls cutinised. It generally bears uni-or multicellular protective trichomes. Stomata are few in numbers.
(ii) Cortex : Depending on the species, it may be entirely parenchymatous or the outer few layers may be collenchymatous forming the hypodermis, followed by the parenchymatous cortex. The young stem contains chlorenchyma. In ribbed stems, the ridges are collenchymatous and the furrows contain only parenchyma.
The innermost layer of the cortex is called endodermis. It is the starch sheath composed of barrel-shaped cells with abundant starch grains.
(iii) Pericycle : It is in the form of semilunar patches of sclerenchyma. Each patch associated with phloem of vascular bundle is called the hard bast.
(iv) Medullary rays : In between the vascular bundles there are few layers of parenchymatous cells which constitute medullary rays. These are slightly larger in size as compared to the other cortical cells.
(v) Vascular bundles : In all dicotyledonous stems, the vascular bundles are conjoint and open. They may be collateral (as in Malvaceae) or bi-collateral (as in Cucurbitaceae).
The xylem is characteristically endarch. Protoxylem elements have annular and spiral thickenings and the metaxylem elements have scalariform and pitted thickenings. Phloem is composed of sieve tubes, companion cells and phloem parenchyma. The fascicular cambium is present between the primary xylem and primary phloem.
(vi) Pith : This is the central portion of the stem consisting of rounded, parenchymatous cells with plenty of intercellular spaces.

OR

The fundamental or ground tissue system is developed from the ground meristem. It constitutes the main bulk of the plant body that includes all the tissues except epidermis and vascular strands.
Ground tissue system is differentiated into hypodermis, cortex, endodermis, pith and medullary rays.
(i) Hypodermis : It is collenchymatous in dicot stem and sclerenchymatous in monocot stem. It provides strength and rigidity.
(ii) Cortex : It lies between endodermis and the hypodermis.
(c) Endodermis (Starch sheath) : It is mostly single layered and is made up of parenchymatous barrel shaped compactly arranged cells. The inner and radial walls of endodermal cells have casparian strips. In roots, thick walled endodermal cells are interrupted by thin walled cells just outside the protoxylem patches. These thin walled endodermal cells are called passage cells. Endodermis behaves as water tight layer to check the loss of water and air tight layer to check the entry of air in xylem elements.
(ii) It is the outer boundary of vascular strand that is one to several cells in thickness. In roots, it gives rise to lateral branches. In stem, pericycle may be parenchymatous, sclerenchymatous or both.
(iii) Pith : The central part of the ground tissue is known as pith or medulla. Usually this is made up of thin walled parenchymatous cells which may be with or without intercellular spaces.
(iv) Medullary rays : The medullary rays are non-vascular areas which occur between vascular bundles in dicot stems for lateral conduction. These are made up of parenchyma cells.

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