14 Anatomy of Flowering Plants

- **Tissue :** A tissue is a group of cells having common origin and performing specific functions. It has main two types :

(1) Meristematic tissue : Actively dividing cells. It has two sub-types. (a) Primary meristematic tissue : It forms primary plant body : (a-1) Apical meristematic tissue : Apex of shoot and root has apical meristematic tissue. It increases height and depth of shoot and root respectively. (a-2) Intercalary meristematic tissue : It is present in grasses and regenerating parts of plants which is eaten up by Herbivorous animals. (b) Secondary Meristematic tissue : It is also called lateral meristematic tissue and is responsible for secondary growth in plant. Vascular combium is present in between xylem and phloem and beneath the bark of a plant as a cork cambium.

(2) Permanent or ameristematic tissue : Normally cells are not dividing as they are highly differentiated in reference to structure and function. It has two main types : (a) Simple tissue (b) Complex tissue

(a) Simple tissue : Only single type of cells. It has three sub-types.

- **(a-1) Parenchyma :** It is present in organs like root, stem, leaf, flower and fruit of a plant. It is responsible for photosynthesis, storage and secretion. They possess intercellular space with thin cellulose cell-wall and spherical, oval or isodimetric in shape.

  Note : It has aerenchyma and chlorenchyma two sub types.

- **(a-2) Collenchyma :** It renders elasticity and flexibility to plants. It is present in tender stem and hypodermis but absent in monocot and underground organs of plant. No intercellular space is found in this tissue as the shape of cells is polygonal. Deposition of pectin is more prominent in the angular walls where number of cells join together. As it does not arrest the growth of a plant, So it is called living mechanical tissue also.

- **(a-3) Sclerenchyma :** Due to deposition of lignin, wall becomes thick. So it is strong, noninelastic and water impermeable. It is dead tissue. No intercellular space is present. It is present in hypodermis, pericycle, xylem and phloem. It provides mechanical support to the plants.

  Sclerenchyma is of two types (i) Fibres (ii) Sclereids.

  (i) Fibres : They are thick walled, elongated and pointed cells, found in various parts of the plants.

  (ii) Sclerieds : They are present in walls of nuts, pulp of fruits like guava, pear, sapota; seed coat of legumes, leaves of tea. As these are the small organs, less strength is required, so they posseses sclereids.

(b) **Complex tissue :** A group of more than one type of cells. As it does conduction, it is also known as conductive tissue. It is of two types.

(b-1) Xylem : In lower plants like pteridophytes and gymnosperms, they posseses tracheids. Tracheids have pointed ends and overlap each other. While in higher plants like in angiosperms, they posseses vessels. Vessels have open end walls and arranged end to end. Both types of xylary components do conduction of water and minerals. They have lignin deposition as secondary wall on the cell wall. Xylem parenchyma is living component and is responsible for storage of starch, lipid, tannin and crystalline substances. While xylem fibers are responsible for mechanical support.

- **(b-2) Phloem :** In gymnosperms, albuminous cells and sieve cells and in angiosperms, sieve tube, companion cells, phloem parenchyma and phloem fibers are present. Sieve tube is made up of many cells arranged longitudinally one above other. The transverse wall separating them become perforated to form sieve plate. Companion cells remain in contact with sieve tube by plasmodesmata.

  Phloem fibers are much elongated, unbranched and provide mechanical support. While phloem parenchyma are elongated and pointed and responsible for storage of mucilage, resin and latex.

  This tissue is responsible for conduction of organic food which is end product of photosynthesis.

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(1) Which tissue is present in plants having regeneration capacity ?

(A) Intercalary (B) Meristematic (C) Primary meristematic (D) All the given

(2) Which tissue is not responsible in formation Bark ?

(A) Secondary meristematic (B) Lateral meristematic

(C) Cork cambium (D) Intercalary meristematic

(3) Which character is proper for meristematic cells ?

(A) Thin cell wall (B) Spherical cells

(C) Thin cytoplasm (D) Large intercellular space

(4) Which is not character of meristematic tissue ?

(A) Continuous divisibility (B) Thin cell wall

(C) Large intercellular space (D) Dense cytoplasm and conspicuous nucleus

(5) Meristematic tissue is also known as non-permanent. Why ?

(A) Location is not definite (B) Increases depths and Heights

(C) Both (A) and (B) (D) None of the given

(6) Which tissue is responsible for formation of axillary bud of leaf-axil ?

(A) Meristematic (B) Permanent (C) Parenchyma (D) Collenchyma

(7) Which tissue is known as "Packing tissue" which is present in nearly all organs of the plant ?

(A) Collenchyma (B) Parenchyma (C) Chlorenchyma (D) Sclerenchyma

(8) Which tissue is known as living mechanical tissue ?

(A) Collenchyma (B) Chlorenchyma (C) Parenchyma (D) Sclerenchyma

(9) Which is not applicable to the cells of a tissue which is responsible for photosynthesis, secretion and storage ?

(A) Large vacuole (B) Thin cell wall

(C) Pectin deposited wall (D) Intercellular space present

(10) The tissue which gives flexibility to plant is called "Collenchyma". Because...

(A) They have polygonal cells (B) They have pectin deposition

(C) (A) and (B) Both (D) None of the given

(11) Which plant tissue is absent in underground organ ?

(A) Parenchyma (B) Collenchyma (C) Meristematic (D) Conductive tissue

(12) Collenchyma is known as "Living mechanical tissue" Because ..... .

(A) Its cells give mechanical support, and it is living tissue.

(B) The deposition of this tissue will not arrest the growth of a plant.

(C) (A) and (B) Both

(D) None of the given

(13) Collenchyma is absent in underground organ. Because...

(A) Function of Collenchyma is being done by sclerenchyma.

(B) No xylem and phloem in underground organs.

(C) There is no need of storage of any compound in underground organs.

(D) There is no need of flexibility in underground organs.

(14) Sclerenchyma is known as "Dead tissue". Because ..... .

(A) Due to deposition of pectin, it becomes impermeable for water.

(B) Due to deposition of lignin, it becomes impermeable for water.

(C) Due to deposition of pectin, its cytoplasm is destroyed.

(D) None of the given

(15) Which tissue renders mechanical support to plant ?

(A) Meristematic - Collenchyma (B) Ameristematic - Collenchyma

(C) Meristematic - Sclerenchyma (D) Ameristematic - Sclerenchyma

(16) Which tissue is present in small organ like seed, leaves for mechanical support ?

(A) Sclerenchyma fibers (B) Xylem fibers (C) Sclereids (D) All of the given

(17) Which character is proper for sclereids ?

(A) Due to deposition of lignin, they possess narrow lumen

(B) They are spherical, oval or short cylindrical

(C) They possess large vacuole and dense cytoplasm

(D) All the given

(18) Which tissue is concerned for formation of wood ?

(A) Parenchyma (B) Collenchyma (C) Sclerenchyma (D) Meristematic

(19) Which pair is mis-matched ?

(A) Meristematic tissue - Formation of axillary bud

(B) Parenchyma - Function of secretion and storage

(C) Sclerenchyma - Renders mechanical support

(D) Collenchyma - Division and Differentiation

(20) Which option is true for a tissue which is present in hypodermis of aerial parts of a plant ?

(A) Sclerenchyma - deposition of lignin - mechanical support

(B) Collenchyma - deposition of pectin - flexibility and elasticity

(C) Parenchyma - deposition of suberin - division and differentiation

(D) Meristematic - deposition of cellulose - Growth and development

(21) What is not stored by xylem parenchyma ?

(A) Tannin (B) Resin (C) Starch (D) Lipid

(22) What is not stored by phloem parenchyma ?

(A) Mucilage (B) Resin (C) Latex (D) Tannin

(23) Sieve tube of phloem can be considered as living component. Because ..... .

(A) It has only cytoplasm (B) It has only nucleus

(C) It has both cytoplasm and nucleus (D) It possesses companion cells which has nucleus

(24) Instead of companion cell, which cells are present in gymnosperm plants ?

(A) Sclereids (B) Sieve cells (C) Albuminous cells (D) Fat cells

(25) How many components are living and non-living among given list ?

Tracheids, Vessels, Xylem parenchyma, Xylem fibers, Sieve cells, Sieve tube, Phloem fibers, Phloem parenchyma, companion cells.

(A) 4, 5 (B) 3, 6 (C) 6, 3 (D) 5, 4

(26) Which option is not suitable for function phloem component ?

(A) Sieve tube - conduction of the organic food

(B) Companion cells - Regulation of sieve tube by plasmodesmata

(C) Phloem parenchyma - Secretion of Latex and Resin

(D) None of the given

(27) How Tracheids and vessels differs from each other ?

(A) Tracheids shows deposition of pectin, while vessels shows deposition of lignin

(B) Tracheids shows deposition of lignin, while vessels shows deposition of Pectin

(C) Each component of tracheids is open at end, while it is closed in vessels.

(D) Each component of tracheids is closed at end, while it is open in vessels.

(28) Which pair is false for conductive tissue ?

(A) Pteridophyta - Companion cell (B) Gymnosperm - Albuminous cell

(C) Angiosperm - Vessels (D) Gymnosperm - Sieve cells

(29) Which tissue does not have deposition of lignin ?

(A) Collenchyma (B) Sclerenchyma (C) Vessels (D) Phloem fibers

(30) How many components are without deposition ?

Collenchyma, Sclerenchyma, Xylem parenchyma, Phloem parenchyma, Companion cell, Phloem fibers, Xylem fibers

(A) 5 (B) 3 (C) 4 (D) 2

(31) Which is odd of the following ?

(A) Companion cell (B) Albuminous cell (C) Sieve tube (D) None of the given

(32) Deposition of lignin is necessary in xylem. Because...

(A) Xylem wall should be strong against the osmotic pressure which is exerted by soil solution conducted by xylem.

(B) Due to lignin deposition, it will be transformed into living mechanical tissue.

(C) Due to lignin deposition, it will provide flexibility and elasticity to plants.

(D) Due to deposition of lignin, bidirectional conduction of mineral and water becomes possible.

(33) Which option is true for sieve cell and sieve tube ?

(A) Sieve plate is present in sieve tube, but not in sieve cell

(B) Companion cell is present in sieve tube, but not in sieve cell

(C) Conduction efficiency of sieve tube is more than sieve cell

(D) All the given

Answers : (1-D), (2-D), (3-A), (4-C), (5-D), (6-A), (7-B), (8-A), (9-C), (10-C), (11-B), (12-C), (13-D), (14-B), (15-D), (16-C), (17-C), (18-C), (19-D), (20-B), (21-B) (22-D), (23-D), (24-C), (25-D), (26-C), (27-D), (28-A), (29-A), (30-B), (31-B), (32-A), (33-D)

- **The tissue system :** A tissue system is formed by organisation. It is divided into 3.

(A) Epidermal tissue system : It has two type of patterns.

(A-i) Multilayered : It is cutical-less and present in hygroscopic root or orchid.

(A-ii) Unilayered : It is outermost barrel shaped cellular layer, without intercellular space and of parenchymatous tissue. It is cuticularised in stem and leaves to reduce transpiration and for that purpose cells are thick walled. While in root cells are thin walled and Non-cuticularised to absorb the water and mineral from soil. Epidermis of root is known as epiblema which has root-hair.

Root hairs are unicellular while trichomes (hairs of stem and leaves) are multicellular. Epidermis of stem and leaf has numerous pores. These pores open and close by a pair of Guard cell. In dicot plants, these guard cells are bean-shaped and in monocot it is dumbbell-shaped. In monocot, in addition to guard cells, they have one pair of subsidiary cells which are triangular. The stomatal aperture, guard cells and surrounding subsidiary cells are together called stomatal apparatus.

(B) Ground tissue system : All the structures without epidermis and vascular tissue are included in ground tissue system. It has different layers as given below :

(B-i) Hypodermis : For the purpose of protection and mechanical support it is made up of either collenchyma or sclerenchyma.

(B-ii) Cortex : For the purpose of bidirectional conduction and aeration it is made up of loosely packed parenchyma.

(B-iii) Endodermis : Inner most layer of cortex is endodermis. It regulates the exchange of substances between cortex and stele.

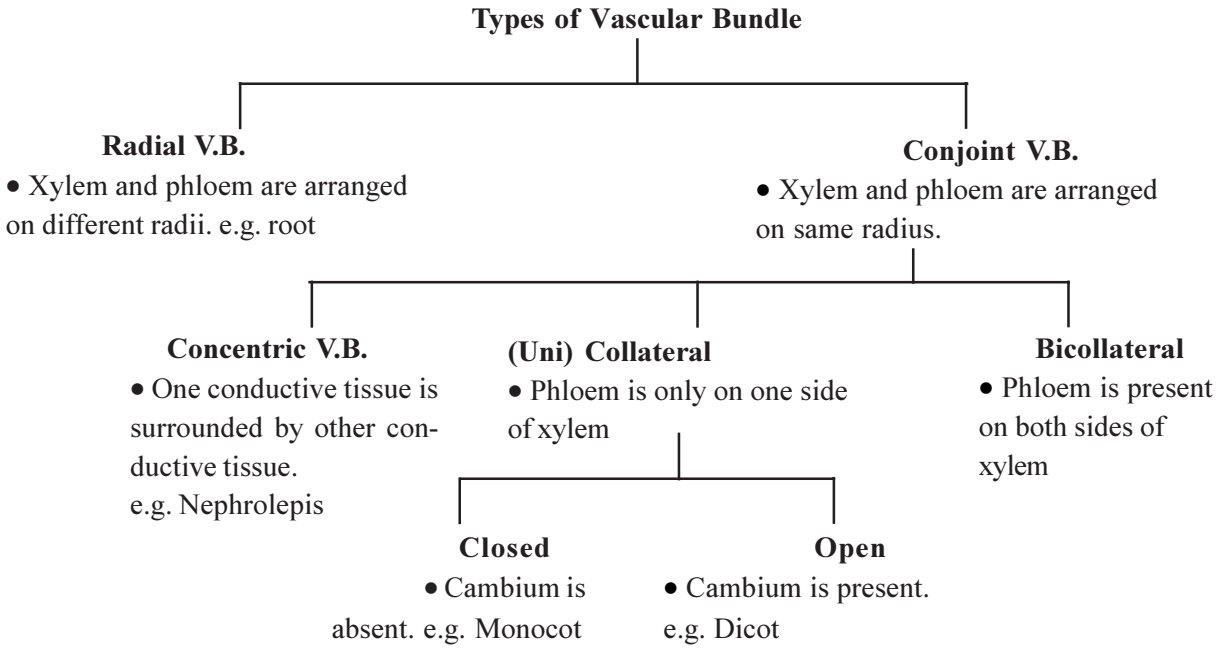
(B-iv) Pericycle : It is responsible for formation of lateral branches. In root it is unicellular parenchyma and in stem it is multilayered and sometime made up to alternatively sclerenchyma and parenchyma.

(B-v) Conjuctive tissue : It is present in between xylem and phloem and made up of parenchyma and sometime of sclerenchyma. In stem it creates medullary rays.

(B-vi) Pith : It is made up of parenchymatous tissue. It is innermost part of stem or Root.

Note : The region between upper and lower epidermis of leaf is known as mesophyll.

(C) Vascular tissue system : Xylem and phloem are collectively called vascular bundle. It is classified as under, according to arrangement of xylem and phloem.



(34) What is the type of vascular bundle which have a phloem and two cambium ?
(A) Bicollateral (B) Concentric (C) Radial (D) None of the given

(35) Which vascular bundle has opposite arrangement to conjoint vascular bundle ?
(A) Radial (B) Unicollateral (C) Open (D) All the given

(36) What is applicable to a vascular bundle of root ?
(A) No cambium between xylem and phloem
(B) Xylem and phloem are on different radii
(C) Both (A) and (B)
(D) None of the given

(37) Which type of vascular bundle is absent in stem ?
(A) Bicollateral (B) Unicollateral (C) Radial (D) Closed

(38) What is special characteristic of Bicollateral V.B. ?
(A) Bicollateral V.B. are same in stem and root as well
(B) Bicollateral V.B. conducts water and mineral bidirectionally
(C) Phloem is only on one side of xylem
(D) Phloem is on both side of xylem

(39) What is not included in stomatal apparatus ?
(A) Subsidiary cell (B) Epidermal cell (C) Guard cell (D) Stomatal aperture

(40) What is wrong for trichomes (stem hairs) ?
(A) It is multicellular (B) It is on aerial organs
(C) Controls transpiration (D) None of the given

(41) What is true for root-hairs ?
(A) It is always multi cellular (B) It is always on aerial organs
(C) Helpful in absorbing water (D) Always covered with cuticle

(42) Which is not observed in hygroscopic (epiphytic) root of orchid ?
(A) Epidermis is multi layered (B) Cuticle is absent on it
(C) Absorbs moisture from air (D) It has lenticels

(43) Which character is not for epidermis of stem ?
(A) Protective in nature (B) Reduced transpiration
(C) No cuticle layer (D) It is unicellular

(44) Which option is true for ground tissue system which has chloroplasts ?
(A) Endodermis is known as Bundle sheath (B) Cortical cells has numerous chloroplasts
(C) It is concerned with photosynthesis (D) It is unilayered

(45) Which sequence is true for ground tissue system from outer to inner side ?
(A) cortex - endodermis - pith - pericycle
(B) cortex - endodermis - pericycle - conjuctive tissue - pith
(C) pith - conjuctive tissue - pericycle - endodermis - cortex
(D) endodermis - pericycle - pith - conjuctive tissue

(46) Which is multilayered region of ground tissue, tissue system and these layers are made up of only Parenchyma ?

(A) Cortex (B) Hypodermis (C) Endodermis (D) Pericycle

(47) Which pair is true for subsidiary cell and companion cell ?

(A) Subsidiary cell - stomatal apparatus, triangular, one pair
Companion cell - phloem, one, Irregular

(B) Subsidiary cell - stomatal apparatus, one, Irregular
Companion cell - phloem, triangular, one pair

(C) Subsidiary cell - phloem, triangular, one pair
Companion cell - stomatal apparatus, triangular, Irregular

(D) Subsidiary cell - phloem, triangular, one pair
Companion cell - stomatal apparatus, one, Irregular

(48) Which is included in Vascular bundle ?

(A) only xylem (B) only phloem (C) xylem and phloem (D) only cambium

Answers : (34-A), (35-A), (36-C), (37-C), (38-D), (39-B), (40-D), (41-C), (42-D), (43-C), (44-A), (45-B), (46-A), (47-A), (48-C)

- **Anatomy of Root :**

(A) Anatomy of sunflower and Maize root : A very thin transverse section of young root of sunflower and maize stained with very dilute solution of safranine, show the structure under the microscope as follows :

	Region	Name of Layer	Maize	Sunflower
(A)	Epidermal tissue system	Epiblema	Structure : Unilayer, barrel shaped cells, parenchymatous tissue, root hairs are present, cuticle is absent Function : Absorption of water and minerals	Like maize root
(B)	Ground tissue system	Exodermis	Structure : Unilayered, parenchymatous tissue, Thick walled. Function : Protection	Absent
		Hypodermis	Structure : Multilayered and sclerenchy matous Function : Mechanical Support	Absent
		Cortex	Structure : Thin walled, parenchymatous, Multilayered, Intercellular space present Function : Conduction and gaseous exchange	Like Maize root
		Endodermis	Structure : Inner most layer of cortex, Unilayesed parenchyma Function : Regulation of conduction	Casperial strips are present on wall of radial endodermis

	Pericycle	Structure : Unilayered, Parenchyma, barrel shaped cells Function : Lateral branch arise from it	Like Maize root
	Conjuctive tissue	Structure : Parenchymatous region between xylem and phloem. It is sometime of sclerenchyma Function : Helps and supports to function of xylem and phloem	Only Parenchyma
	Pith	Structure : Inner most, cells of Parenchyma Function : Support / Storage	Comparatively it is smaller
(C) Vascular tissue system	Stele	Structure : Radial, Alternate, Polyarch, Exarch xylem. Function : Conduction of water - mineral and food	Alternate, Radial, Tetrach, Exarch xylem

Note : Stele includes pericycle, Vascular bundles and pith. In exarch type of xylem, protoxylem remains towards pericycle and metaxylem remain towards pith.

(49) How many layers of ground tissue system are there in sunflower and maize respectively ?
(A) 5, 7 (B) 7, 5 (C) 6, 5 (D) 5, 6

(50) Hypodermis is absent in young root of sunflower. Because...
(A) It has no need of extra-strength, as it is multilayered.
(B) It has no need of extra-protection, as it has sclerenchyma
(C) No need of hypodermis, as it has cuticularised epidermis
(D) No need of hypodermis, as sunflower has tap root system

(51) Sunflower has small pith in compare to maize. Because...
(A) Sunflower is Annual plant
(B) Sunflower has no need of extra-strength
(C) Xylem components are arranged linearly in sunflower
(D) Due to large cortical region, sunflower pith is small

(52) Which layer is made up of only sclerenchymatous tissue in ground tissue system of maize root ?
(A) Hypodermis (B) Pericycle (C) Endodermis (D) Exodermis

(53) Exodermis is present in maize root. Because...
(A) Epiblema is made up of only single layer.
(B) Epiblema is made up of only parenchymous tissue.
(C) Epiblema is easily destroyable due to fibrous root system.
(D) Epiblema is non-cuticularised.

(54) Which layer is absent in stele ?

(A) Pith (B) Pericycle (C) Endodermis (D) All of the given

(55) What is wrong for stele of maize-root ?

(A) Proto and meta-xylem are arranged in V-shape.

(B) Two proto and one meta-xylem are arranged in each and every unit of V.B.

(C) Xylem is endarch.

(D) Protoxylem is arranged towards pericycle.

Answers : (49-A), (50-D), (51-C), (52-A), (53-C), (54-C), (55-C)

- **Anatomy of sunflower and maize stem :**

Region	Layer's name	Maize	Sunflower
(A) Epidermal tissue system	Epidermis	Structure : Unilayered parenchyma, cuticle is present, scattered stomata are present Function: Protection and regulation of transpiration	Multicellular trichomes are present
(B) Ground tissue system	Hypodermis	Structure : 2-4 layers of sclerenchyma Function : Mechanical support	Multilayered collenchyma Flexibility and elasticity
	Cortex	Absent	Structure : Parenchyma with intercellular space, Multilayered Function: Conduction and gaseous exchange
	Endodermis	Absent	Structure : Starch sheath, Inner most layer of cortex Function : control over conduction
	Pericycle	Absent	Structure : Multilayered Alternate parenchyma and sclerenchyma, Hard-bast (Bundle cap) is present above phloem and is schlerenchyma Function: Lateral branches
	Conjuctive tissue	Absent	Structure : Parenchymatous strips from pith to cortex is called medullary rays. Function: Packing tissue or support

	Pith	Absent	Function : support and conduction Structure : Inner most cells of Parenchyma
(C) Vascular tissue system	Vascular bundle	Scatteredly arranged. Small size at periphery and large size toward central part	wavy circular, ring arrangement
		Conjoint, unicollateral and closed - Endarch xylem - Phloem parenchyma absent	Conjoint, unicollateral and open - Endarch xylem - Phloem parenchyma present
		- Lysigenous cavity present	- Lysigenous cavity absent
		- Sclerenchymatous sheath around vascular bundle is present	- Bundle sheath is absent

(56) Which is not participating in formation of medullary rays ?

(A) Parenchymatous pericycle (B) Sclerenchymatous pericycle

(C) Endodermis (D) Conjuctive tissue

(57) Which option is correct for location and function of Hard bast (i.e. Sclerenchymatous pericycle) ?

(A) Location - Sunflower root
Function - Mechanical support

(B) Location - Sunflower stem
Function - Storage of food (starch)

(C) Location - Sunflower stem
Function - Mechanical support

(D) Location - Sunflower root
Function - Storage of food (starch)

(58) Sclerenchymatous bundle sheath is present in and its function is...

(A) Location - Maize root
Function - Storage of water-minerals

(B) Location - Maize stem
Function - Mechanical support

(C) Location - Maize stem
Function - Storage of water-minerals

(D) Location - Maize root
Function - Mechanical support

(59) Ground tissue system of maize stem is not differentiated into cortex, endodermis, pericycle, etc. Because...

(A) It is perennial (B) It shows secondary growth

(C) V.B. are scattered (D) All of the given

(60) What is not applicable for vascular bundle which is devoid of phloem parenchyma ?

(A) Canjoint (B) Unicollateral (C) Open (D) Endarch

(61) Which option is true for location and function of Lysigenous cavity ?

(A) Location - Maize root
Function - Water storage

(B) Location - Sunflower root
Function - Food storage

(C) Location - Maize stem
Function - Water storage

(D) Location - Sunflower stem
Function - Food storage

(62) Which is the similarity between function of trichome (stem hair) and stomata ?

(A) Regulation of transpiration (B) Absorption of water

(C) Protection and gaseous exchange (D) Respiration and photosynthesis

(63) How many sub-layers of ground tissue system are present in a stem which has resin duct ?

(A) 5 (B) 6 (C) 7 (D) 4

Answers : (56-B), (57-C), (58-B), (59-C), (60-C), (61-C), (62-A), (63-B)

- **Anatomy of leaf of sunflower and Maize :**
- **Anatomy of sunflower leaf :**

(A) Epidermal tissue system : Upper and lower epidermis is covered with cuticle. Stomata are guarded by a pair of bean shaped cells and it has multicellular trichomes. Stomata are more in number in lower epidermis compared to upper epidermis.

(B) Ground tissue system (Mesophyll) : Two type of chlorechyma are present between two epidermis. Palisade tissue is made of two layered tightly packed elongated cells just beneath the upper epidermis while loosely packed sponge tissue with large intercellular space is above the lower epidermis. So, it is known as dorsi-ventral leaf or bilateral leaf.

(C) Vascular tissue system : Vascular bundles are scatteredly arranged in mesophyll tissue and are wraped by parenchymatous bundle sheath which are longitudinally, transversaly or obliquely cutin section, as this leaf has reticular venation. Vascular bundle are of conjoint, unicollateral and closed type. Xylem remains towards upper epidermis and phloem is toward lower epidermis.

- **Anatomy of Maize leaf :**

(A) Epidermal tissue system : 5-7 Bulliform cells (Hygroscopic cells) are present in upper epidermis of plant like grass. It is laterally covered with Horn cell. Bulliform cells will shrink in dry weather, to reduce the transpiration by minimizing its open surface due to rolling of leaf blade, when weather becomes adequately moistened, the bulliform cells will absorb water (vapour) from surrounding atmosphere and becomes flaccid to unrol the leaf blade. Like this they are responsible for movement of leaf blade, these cells are known as Motor cells also. During rolling and unrolling of leaf blade, horn cell protects the leaf.

(B) Ground tissue (Mesophyll) system : Only one type of (sponge tissue) chlorenchyma tissue remains in between two epidermis. So, this leaf is known as isobilateral. And that is why the distribution of stomata on both the epidermis is same. Such stomata are guarded by two dumbell shaped cells. The guard cells are also surrounded by triangular subsidiary cells. Stomatal apparatus includes one aperture, two guard cells and two subsidiary cells.

(C) Vascular tissue system : Vascular bundles are transversaly arranged, linearly arranged as this leaf has parallel venation. Vascular bundles are conjoint, unicollateral and closed type, small V.B. are surrounded by parenchymatous bundle sheath and bigger one is by sclerenchymatous bundle sheath.

(64) Which option is correct for location and function of Horn-cells ?

(A) Location - Lower epidermis of maize
Function - Regulation of transpiration

(B) Location - Upper epidermis of maize
Function - Protection of bulliform cells at the time of rolling of leaf

(C) Location - Lower epidermis of maize
Function - Protection of bulliform cells at the time of rolling of leaf

(D) Location - Upper epidermis of maize
Function - Regulation of transpiration

(65) Dicot leaf is known as bilateral. Because ..... .

(A) Distribution of stomata on both the epidermis is unequal.

(B) Distribution of mesophyll tissue between two epidermis is not of same type.

(C) Intensity of green colour of both epidermis is not same.

(D) All of the given.

(66) Monocot leaf is known as isobilateral. Because...

(A) Distribution of stomata on both the epidermis is equal.

(B) Distribution of chlorenchyma in between two epidermis is same.

(C) Intensity of green colour on both epidermis is same.

(D) All the given.

(67) The number of stomata on lower epidermis of dorsiventral leaf is high. Because...

(A) Light impacts directly on upper epidermis

(B) Lower epidermis is non-cuticularized

(C) Sponge tissue remains above the lower epidermis

(D) Distribution of stomata are same on both the epidermis

(68) Bulliform cells are known as Motor cells also. Because...

(A) It stimulate movement of leaf
(B) It renders mechanical support to leaf
(C) It regulates of water
(D) It is responsible for transpiration

(69) Which option is not proper for Motor cells ?

(A) Covered with cuticle
(B) Remain on upper epidermis
(C) It is in 5-7 number
(D) It is also known as bulliform cells

(70) Which option is not proper for vascular bundles of bilateral leaf ?

(A) Scatteredly arranged in mesophyll tissue
(B) Cut in transverse or longitudinal direction
(C) The bundle sheath is sclerenchymatous
(D) Xylem remains towards upper epidermis

(71) Which option is wrong for Vascular bundle of bilateral leaf ?

(A) Linearly arranged in mesophyll tissue

(B) Have parenchymatous or sclerenchymatous bundle sheath

(C) All are transversally cut
(D) Phloem is remain toward lower epidermis

(72) Which option is wrong for Vascular bundle of leaf ?

(A) Radial (B) Conjoint (C) Closed (D) Unicollateral

Answers : (64-B), (65-D), (66-D), (67-A), (68-A), (69-A), (70-C), (71-C), (72-A)

Secondary grwoth : The lengthwise growth of roots and stems is due to apical meristem and this type of growth is known as primary growth. After primary growth, the secondary growth takes place by lateral meristems like vascular cambium and cork cambium. Due to secondary growth the thickness (girth) of plant increases.

Lateral meristematic tissue which remain between xylem and phloem is called intrafascicular cambium and cells of medullary rays between two vascular bundle transformed into meristematic cells is known as interfascicular cells. Both these meristematic tissue joins together to form cambium ring.

Cambium ring forms xylem inside very fast and phloem out side comparative less fast. Newly formed xylem and phloem is known as secondary xylem and secondary phloem. The secondary vascular tissue exerts pressure on primary xylem and phloem, so, these primary tissue becomes dead and forms wool in future.

During winter, cambium is less active, so it will form less wood, it is known as autum wood or late wood. While in spring season, cambium is very active and forms more wood (i.e. xylem elements) which is known as spring wood or early wood.

These wood has two distinct region. Inner blackish part is heart wood or duramen which gives mechanical support to plant. It stores tannin and other Substances. It is hard and durable. It has lost its power of conduction. While outer yellowish part is sap wood or alburnum which gives capacity for conduction to the plants.

Due to high pressure of secondary growth on primary tissue, it will transformed into wood. secondary medullary rays are also formed. Thus, there is increase in girth of plant outer layers like Cortex and epidermis will break down. So, some cells of Cortex will transform into cork cambium (Phallogen). This cork cambium will form new cortex (secondary cortex) inside which is known as phelloderm also, while cork or phellem outside. These phellogen, phelloderm and phellem collectively known as periderm.

By the formation of periderm the stomata are closed. To replace this, some aerating pores are formed in the bark which are called lenticels. Through these pore exchange of gases and evaporation of water can take place.

Note : In dicot root vascular cambium originates in the form of strips from the tissue located just below the phloem bundles. These strips extend both ways in between xylem and phloem and ultimately units with each other to form a continuous ring. Further events are similar to those already describe above for a dicot stem. Initially plant has early or soft bark, at the end of season hard bark is formed.

(73) Some root shows secondary growth, although they have closed vascular bundle. Because...

(A) Pith transforms into cambium (B) Previously they have cambium ring

(C) Medullary rays performs secondary growth (D) All of the given

(74) Meristematic tissue forms initially in which location in secondary growth of dicot root ?

(A) Between Xylem and Phloem (B) Below the Xylem

(C) Below the Phloem (D) Above the Xylem

(75) What is applicable for secondary growth of root ?

(A) No formation of cambium ring (B) No secondary growth takes place

(C) Secondary growth increase length and depth of root (D) Root does not posses cambium

(76) Which is not included in the formation of periderm ?

(A) Phellem (B) Phelloderm (C) Vascular cambium (D) Phellogen

(77) Which compound is deposited on the wall of phloem cells ?

(A) Cellulose (B) Suberin (C) Lignin (D) Pectin

(78) What is called a meristematic tissue formed from cortex ?

(A) Phallogen (B) Cambium ring (C) Vascular cambium (D) Interfascicular cambium

(79) In which region, dead plant cells can be seen ?

(A) Phellem (B) Phelloderm (C) Bark (D) Phellogen

(80) When does formation of phellogen take place ?

(A) After formation of cambium ring (B) Along with formation of cambium ring

(C) Before the formation of cambium ring (D) Phellogen never becomes inactive

(81) Which two tissues are responsible for formation of cambium ring ?

(A) Phellem - Phelloderm (B) Cambium ring - Phellogen

(C) Interfascicular cambium - Intrafascicular cambium

(D) Interfascicular cambium - Phellogen

(82) From where does Interfascicular cambium forms ?

(A) Cortex (B) Endodermis (C) Pericycle (D) Medullary rays

(83) What is proper for sap wood or alburnum ?

(A) It is yellowish (B) It is conducting

(C) It is hard and durable (D) A and B

(84) What is not applicable for duramen ?

(A) It is blackish (B) It is hard and durable

(C) It gives mechanical support (D) It is conducting in nature

(85) Which one exerts pressure on primary xylem ?

(A) Secondary xylem (B) Secondary phloem

(C) (A) and (B) both (D) Phellogen

Answers : (73-A), (74-A), (75-D), (76-C), (77-B), (78-A), (79-C), (80-B), (81-C), (82-D), (83-D), (84-D), (85-C)

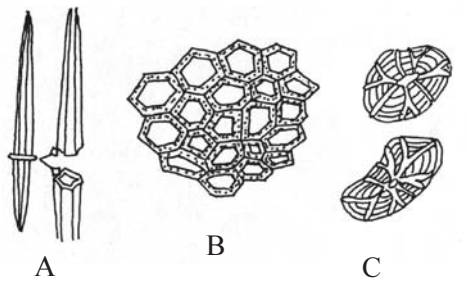
(86) What is correct from A-B-C in the given figure ?

(A) Suberized sclerenchymatous fibers in A

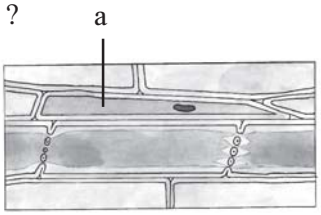
(B) Pectin deposited sclereids in figure B

(C) Lignin deposited sclereids in figure C

(D) All of the given



(87) Which option is correct for name and function of "a" in the given figure ?



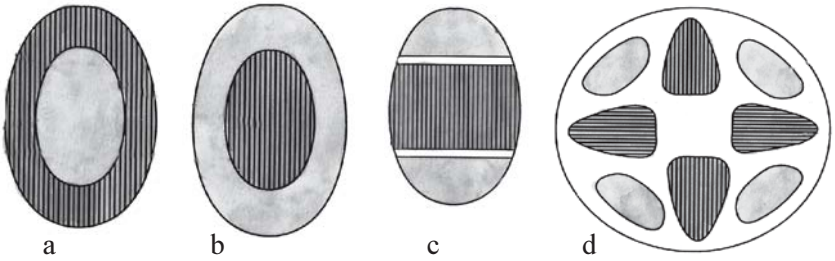
(A) Name - Albumin cell
Function - Helpful in water storage

(B) Name - Companion cell
Function - Helpful in water storage

(C) Name - Albumin cell
Function - Helpful in food storage

(D) Name - Companion cell
Function - Helpful in food storage

(88) Which option for the name of vascular bundle is wrong in reference to its relative figure ?

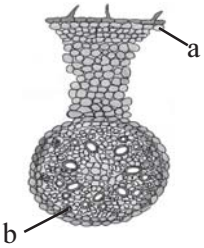


(A) Amphivessel
(B) Amphicribral
(C) Bicollateral
(D) Open

(89) What is wrong for vascular bundle for given figure of transverse section of plant ?

(A) Radial
(B) Closed
(C) Tetrach
(D) Endarch xylem

(90) What is true for "a" and "b" indicated in given figure ?



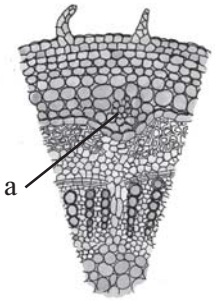
(A) a = Exodermis
b = Protoxylem

(B) a = Hypodermis
b = Protoxylem

(C) a = Exodermis
b = Metaxylem

(D) a = Hypodermis
b = Metaxylem

(91) What is name of "a" in the given figure and its function ?



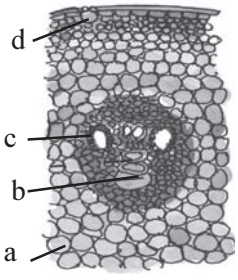
(A) a = Lysigenous cavity
b = Water storage

(B) a = Resin duct
b = Strength and durability

(C) a = Lysigenous cavity
b = Food storage

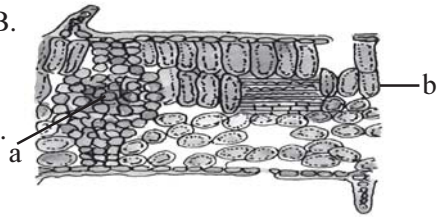
(D) a = Resin duct
b = Photosynthesis

(92) Which symbol is indicated Lysigenous cavity and ground tissue respectively ?



(A) b, a
(B) c, b
(C) a, c
(D) a, d

(93) What is correct labelling for "a" and "b" in the given figure ?



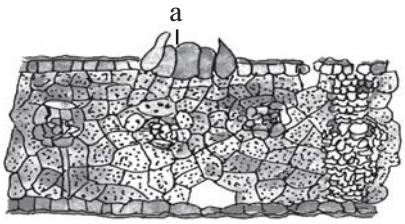
(A) a = Transverse vascular bundle
b = Palisade tissue

(B) a = Longitudinal V.B.
b = Palisade tissue

(C) a = Longitudinal vascular bundle
b = Spongy tissue

(D) a = Transverse V.B.
b = Spongy tissue

(94) What is alternative name of "a" in the given figure ?



(A) Horn cell (B) Bulliform cell

(C) Sclereids (D) Palisade cell

Answers : (86-D), (87-D), (88-D), (89-D), (90-A), (91-B), (92-A), (93-B), (94-B)

(95) Match the column :

Column - I	**Column - II**
(1) Collenchyma	(p) Lignified cells - in all organ
(2) Parenchyma	(q) air-exchange
(3) Sclerenchyma	(r) Albuminous cells are present
(4) Phloem	(s) Only in aerial organ - Pectin deposited cells
	(t) Only in hypogeal organ - Pectin deposited cells

(A) (1 - s), (2 - p), (3 - r), (4 - q) (B) (1 - t), (2 - s), (3 - q), (4 - p)

(C) (1 - s), (2 - q), (3 - p), (4 - r) (D) (1 - r), (2 - p), (3 - q), (4 - s)

(96) Match the column :

Column - I	**Column - II**
(1) Endodermis of sunflower stem	(p) Region contains lysigenous cavity
(2) Cortex of sunflower stem	(q) Region of parenchyma and sclerenchyma
(3) Pericycle of sunflower stem	(r) Unicollateral, Conjoint, open
(4) Vascular bundle of sunflower stem	(s) Starch storing parenchyma
	(t) Region of resin duct
	(u) Conjoint, unicollateral, closed

(A) (1 - t), (2 - s), (3 - p), (4 - q) (B) (1 - s), (2 - t), (3 - q), (4 - r)

(C) (1 - u), (2 - s), (3 - r), (4 - t) (D) (1 - p), (2 - r), (3 - s), (4 - u)

(97) Match the column :

Column - I	**Column - II**	**Column - III**
(1) Leaf of grass	(p) Motor cell	(v) Formation of stomatal apparatus
(2) Stem of Maize	(q) Albumin cell	(w) Necessary for phloem in angiosperm
(3) Stem of Cycus	(r) Sclereids	(x) Necessary for the mechanical support
(4) Seed-coat of seed	(s) Companion cell	(y) Necessary with sieve cell
	(t) Subsidiary cell	(z) Necessary for rolling of leaf in monocot

(A) (1-q-v), (2-p-z), (3-r-w), (4-t-x) (B) (1-r-y), (2-s-w), (3-t-v), (4-q-x)

(C) (1-p-x), (2-r-y), (3-s-v), (4-t-w) (D) (1-p-z), (2-s-w), (3-q-y), (4-r-x)

(98) Match the column :

Column - I	Column - II
(1) Leaf of maize	(p) Radial V.B. with definite number of protoxylem
(2) Stem of sunflower	(q) Vascular bundle in which xylem remains toward upper epidermis
(3) Root of sunflower	(r) Vascular bundle are scattered in transverse section
(4) Stem of maize	(s) Open vascular bundle around the medullary rays
	(t) Radial Vascular bundle around small pith

(A) (1 - q), (2 - s), (3 - t), (4 - r) (B) (1 - p), (2 - s), (3 - r), (4 - t)

(C) (1 - r), (2 - s), (3 - t), (4 - q) (D) (1 - p), (2 - r), (3 - t), (4 - s)

(99) Match the column :

Column - I	Column - II
(1) Hypodermis	(p) Gaseous exchange and conduction
(2) Cortex	(q) Protection and regulation of transpiration
(3) Endodermis	(r) Lateral root or lateral branch arises
(4) Pericycle	(s) Regulation of exchange between cortex and stele
	(t) Flexibility and Mechanical support

(A) (1 - s), (2 - p), (3 - t), (4 - r) (B) (1 - t), (2 - q), (3 - s), (4 - r)

(C) (1 - t), (2 - p), (3 - s), (4 - r) (D) (1 - q), (2 - p), (3 - s), (4 - t)

(100) Match the column :

Column - I	Column - II
(1) Isobilateral leaf	(p) Exodermis is present in ground tissue
(2) Tetrorch root	(q) Resin duct is present in cortex
(3) Dorsi-ventral leaf	(r) Motor cells are present in upper epidermis
(4) Polyarch root	(s) Casperian strips are present in endodermis
	(t) More stomata in lower epidermis

(A) (1 - t), (2 - s), (3 - r), (4 - q) (B) (1 - r), (2 - q), (3 - t), (4 - p)

(C) (1 - r), (2 - p), (3 - t), (4 - s) (D) (1 - r), (2 - s), (3 - t), (4 - p)

Answers : (95-C), (96-B), (97-D), (98-A), (99-C), (100-B)

- **A - Assertion and R - Reason type questions :**

  Choose the correct answer from given options :

  (A) A and R both correct. R is correct explanation of A

  (B) A and R both correct. R is not correct explanation of A

  (C) A - True, R - False

  (D) A - False, R - True

(101) Assertion A : Tissue of Node is known as intercalary meristematic tissue.

Reason R : This tissue arranged between two permanent tissue

(A) (B) (C) (D)

(102) Assertion A : Lateral meristematic tissue is included in primary meristematic tissue.

Reason R : Primary meristematic tissue develops primary plant organs.

(A) (B) (C) (D)

(103) Assertion A : Although more than one type of cells forms xylem and phloem, still it is called tissue.

Reason R : This is actually complex tissue. All types of cells performs same type of function.

(A) (B) (C) (D)

(104) Assertion A : Sclereids are present in unripened fruits.

Reason R : Small organ, i.e. unripe fruits, need less strength, so they posses suberinize components.

(A) (B) (C) (D)

(105) Assertion A : Xylem parenchyma is living and phloem parenchyma is non-living component.

Reason R : Non-deposited cells are present in xylem parenchyma and it is non deposited in phloem parenchyma also.

(A) (B) (C) (D)

(106) Assertion A : Tracheids are present in Nephrolepis and maize.

Reason R : Lower plants like maize and Nephrolepis, can do even by less efficient tracheids.

(A) (B) (C) (D)

(107) Assertion A : Exodermis is present in maize.

Reason R : Their root system is shallow. So there is more possibility of destruction of epiblema. In absence of epiblema, exodermis will give protection to plant.

(A) (B) (C) (D)

(108) Assertion A : Bulliform cells of upper epidermis of dorsiventral leaf is also known as motor cells.

Reason R : Mesophyll of this leaf is differentiated into palisade and sponge.

(A) (B) (C) (D)

(109) Assertion A : Bulliform cells of upper epidermis of dorsiventral leaf is also called as motor cells.

Reason R : As these cells stimulates movement in leaf, they are so called.

(A) (B) (C) (D)

(110) Assertion A : In annual plant, initiation of secondary growth starts by formation of cambium ring with the help of interfascicular cambium and intrafascicular cambium.

Reason R : It is necessary to form cambium ring before secondary growth starts.

(A) (B) (C) (D)

(111) Assertion A : There is no cambium in Vascular bundle of dicot root, still secondary growth takes place.

Reason R : Parenchymatous cells forms cambium ring and makes possible the secondary growth.

(A) (B) (C) (D)

(112) Assertion A : Plants like maize and grass shows rolling of leaf blade by motor cells.

Reason R : As these type of plants belongs to tropical region. They try to reduce rate of transpiration by reducing their open surface by rolling leaf blade.

(A) (B) (C) (D)

Answers : (101-A), (102-D), (103-A), (104-C), (105-B), (106-D), (107-A), (108-D), (109-D), (110-A), (111-A), (112-A)

- **True and False (T - F) type questions :**

Choose correct option for given true-false sentences.

(113) Assertion x : Early wood forms during spring and is not strong.

Assertion y : Late wood forms during autumn and is strong.

(A) Both are true (B) Both are false

(C) x true, y false (D) x false, y true

(114) Assertion x : Mesophyll tissue is uniform in dorsiventral leaf.

Assertion y : Mesophyll tissue is of two types in isobilateral leaf.

(A) Both are true (B) Both are false

(C) x true, y false (D) x false, y true

(115) Assertion x : Medullary rays forms intrafascicular cambium.

Assertion y : Interfascicular cambium joins with intrafascicular cambium.

(A) Both are true (B) Both are false

(C) x true, y false (D) x false, y true

(116) Assertion x : Phellem, Phelloderm and phellogen forms periderm.

Assertion y : Secondary growth takes place by intrafascicular cambium in dicot root.

(A) Both are true (B) Both are false

(C) x true, y false (D) x false, y true

(117) Assertion x : Intercalary meristematic tissue is present in internode.

Assertion y : intrafascicular cambium is known as secondary meristematic tissue.

Assertion z : Permanent or ameristematic tissue never undergo division.

(A) x, z - false, y - true (B) x, y - false, z - true

(C) x, y - true, z - false (D) x, z - true, y - false

(118) Assertion x : Hypodermis of aerial organ has cells with deposition of pectin.

Assertion y : Sieve cells are acompanied by albumin cell in gymnosperm.

Assertion z : Phloem parenchyma is the only living component of phloem.

(A) x, z - false, y - true (B) x, y - false, z - true

(C) x, y - true, z - false (D) x, z - true, y - false

(119) Assertion x : In maize stem, small V.B. remain at periphery and large V.B. towards pith.

Assertion y : In compare to tetrach root, polyarch root has small pith region.

Assertion z : Collenchyma is present out side the cortex in dicot (sunflower) stem.

(A) x, z - false, y - true (B) x, y - false, z - true

(C) x, y - true, z - false (D) x, z - true, y - false

(120) Assertion x : Hypodermis is made up of collenchyma and exodermis is of sclerenchyma in root of maize.
Assertion y : Water storage occurs in phloem parenchyma in a vascular bundle which has Lysigenous cavity.
Assertion z : All the vascular Bundles cut transversaly and are arranged in a raw in isobilateral leaf.

(A) x, z - false, y - true (B) x, y - false, z - true

(C) x, y - true, z - false (D) x, z - true, y - false

Answers : (113-A), (114-B), (115-D), (116-C), (117-A), (118-C), (119-D), (120-B)

- **Questions for NEET :**

(121) Assertion x : N. Grew is known as father of plant anatomy while K. A. Chaudhary is known as father of Indian Plant Anatomy.
Assertion y : The term Tissue has been coined by Nehemiah Grew.
Assertion z : Karl Nageli has divided plant tissue into meristematic and permanent.

(A) All are false (B) All are false

(C) x, y - false, z - true (D) x, z - false, y - true

(122) Which tissue is responsible for enlargement of leaf blade ?

(A) Interfascicular cambium (B) Intercalary meristem

(C) Plate meristem (D) Phallogen

(123) Assertion A: There is no apical meristem in algae and fungi, still they increases in length and volume.
Reason R : Every cell of algae and fungi is divisible, so they do not need meristem.

(A) Both A and R true, R is right explanation of A.

(B) Both A and R true, R is not right explanation of A.

(C) A is true, R is false.

(D) A is false, R is true.

(124) Which tissue is present in pulp of fruits ?

(A) Parenchyma (B) Collenchyma (C) Sclerenchyma (D) Chlorenchyma

(125) Assertion A : Sometime sieve tube and companion cells are known as "sister cells".
Reason R : Both are evolved from same mother cell.

(A) Both A and R true, R is correct explanation of A.

(B) Both A and R true, R is not correct explanation of A.

(C) A is true, R is false.

(D) A is false, R is true.

(126) Xylem fibers are not useful to mankind, but phloem fibers are useful. Because...

(A) Phloem fibers are long, while xylem fibers are inelastic.

(B) Phloem fibers are short, while xylem fibers are elastic.

(C) Xylem fibers can be weaved, while phloem fibers cannot be

(D) All of the given

(127) In which plant, Hydathode gland is absent ?

(A) Tomato (B) Pistia (C) Eichhornia (D) Passion flower

(128) Assertion A : Pericyle of sunflower stem is known as Heterogenous.

Reason R : It is made up of more than one type of tissue.

(A) A and R true, R is correct explanation of A.

(B) A and R true, R is not correct explanation of A.

(C) A is true, R is false.

(D) A is false, R is true.

(129) Which two cells take part in formation of Lysigenous cavity ?

(A) Protoxylem - metaxylem (B) Protoxylem - xylem fibers

(C) Protoxylem - xylem parenchyma (D) Metaxylem - xylem fibers

(130) Which option is true for location of passage cell ?

(A) Opposite to metaxylem in endodermis (B) Opposite to protoxylem in endodermis

(C) Opposite to metaxylem in pericycle (D) Opposite to protoxylem in pericycle

(131) Assertion A : Dorsiventral leaf is known as isobilateral leaf.

Reason R : Isobilateral leaf has same number of stomata on both the surface.

(A) A and R true, R is right explanation of A.

(B) A and R true, R is not right explanation of A.

(C) A is true, R is false.

(D) A is false, R is true.

(132) Which type of cells are present in pith of Root of monocot plant like Canna ?

(A) Parenchyma (B) Collenchyma (C) Sclerenchyma (D) (A) and (B) both

(133) Assertion A : Grafting is not possible in monocot.

Reason R : As monocot plants are annual, they are devoid of cambium.

(A) A and R true, R is correct explanation of A.

(B) A and R true, R is not correct explanation of A.

(C) A is true, R is false.

(D) A is false, R is true.

(134) Which tissue is not included in lateral meristematic tissue ?

(A) Interfascicular meristem (B) Intrafascicular meristem

(C) Intercalary meristem (D) Phallogen

(135) What is main function of phallogen ?

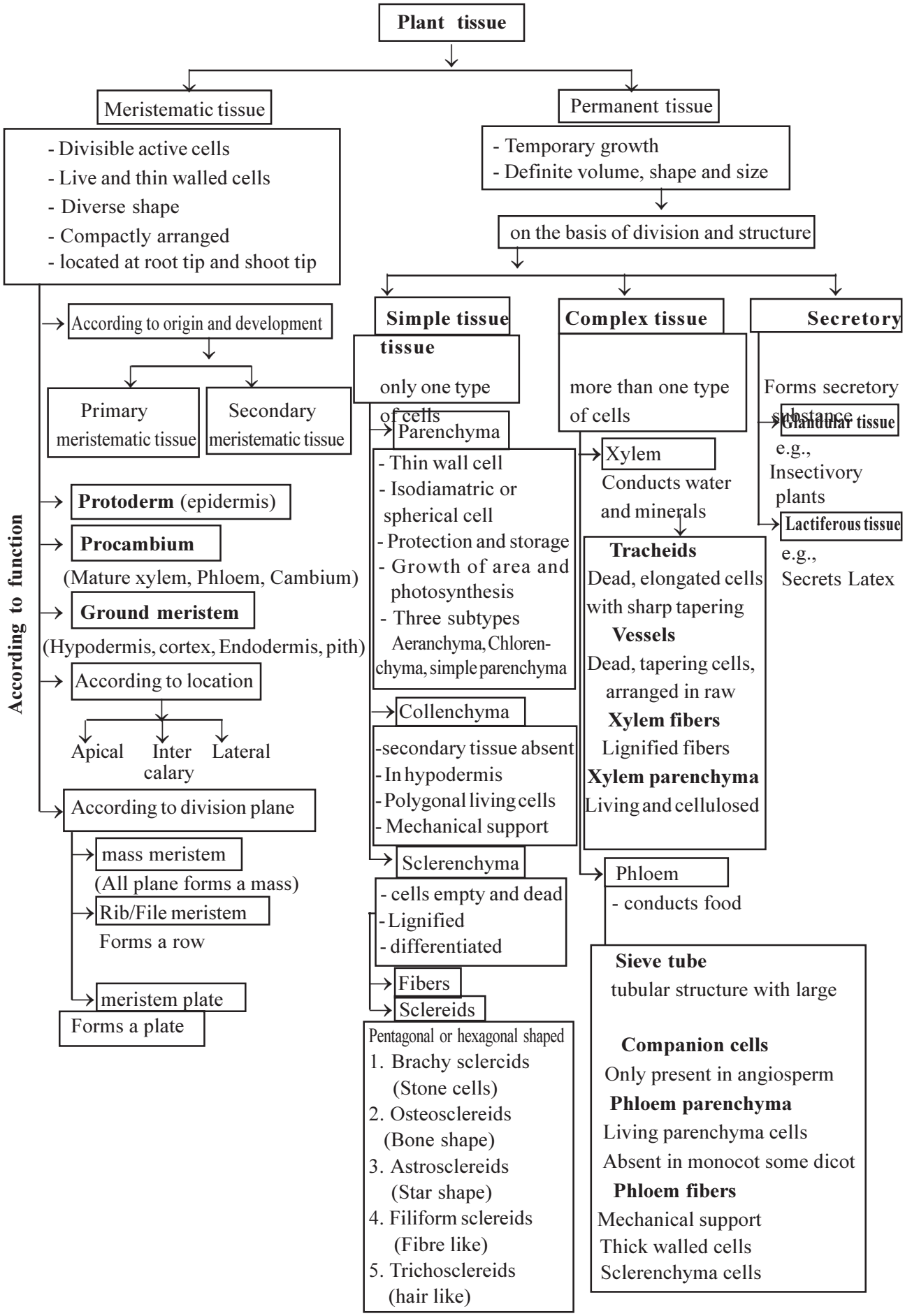
(A) Formation of secondary conducting tissue, for lateral growth

(B) Lateral growth by formation of secondary cortex and phellem.

(C) Secondary growth by formation of secondary cortex and secondary conducting tissue.

(D) Lateral growth by formation of secondary conducting tissue and periderm.

Answers : (121-B), (122-C), (123-A), (124-C), (125-A), (126-A), (127-D), (128-A), (129-C), (130-B), (131-D), (132-C), (133-A), (134-C), (135-B)


Plant tissue
Meristematic tissue
- Divisible active cells
- Live and thin walled cells
- Diverse shape
- Compactly arranged
- located at root tip and shoot tip
Permanent tissue
- Temporary growth
- Definite volume, shape and size
on the basis of division and structure
Simple tissue
tissue
only one type of cells
Complex tissue
more than one type of cells
Secretory
Forms secretory substance
Glandular tissue
e.g., Insectivory plants
Lactiferous tissue
e.g., Secrets Latex
Parenchyma
- Thin wall cell
- Isodiamatric or spherical cell
- Protection and storage
- Growth of area and photosynthesis
- Three subtypes Aeranchyma, Chloren-chyma, simple parenchyma
Collenchyma
-secondary tissue absent
- In hypodermis
- Polygonal living cells
- Mechanical support
Sclerenchyma
- cells empty and dead
- Lignified
- differentiated
Fibers
Sclereids
Pentagonal or hexagonal shaped
1. Brachy sclercids (Stone cells)
2. Osteosclereids (Bone shape)
3. Astrosclereids (Star shape)
4. Filiform sclereids (Fibre like)
5. Trichosclereids (hair like)
Xylem
Conducts water and minerals
Tracheids
Dead, elongated cells with sharp tapering
Vessels
Dead, tapering cells, arranged in raw
Xylem fibers
Lignified fibers
Xylem parenchyma
Living and cellulosed
Phloem
- conducts food
Sieve tube
tubular structure with large
Companion cells
Only present in angiosperm
Phloem parenchyma
Living parenchyma cells
Absent in monocot some dicot
Phloem fibers
Mechanical support
Thick walled cells
Sclerenchyma cells
According to function
According to origin and development
Primary meristematic tissue
Secondary meristematic tissue
Protoderm (epidermis)
Procambium
(Mature xylem, Phloem, Cambium)
Ground meristem
(Hypodermis, cortex, Endodermis, pith)
According to location
Apical
Inter calary
Lateral
According to division plane
mass meristem
(All plane forms a mass)
Rib/File meristem
Forms a row
meristem plate
Forms a plate