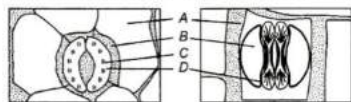


# ANATOMY OF FLOWERING PLANTS

- Cambium activity is
  - More active towards the periphery of stem
  - More active towards the lateral sides of stem
  - More active towards the inner side of stem
  - Same on the both sides
- Cambium is a type of
  - Apical meristem
  - Intercalary meristem
  - Lateral meristem
  - Permanent of mature meristem
- Pith is a central part of the ground tissues generally made up of
  - Parenchyma
  - Collenchyma
  - Chlorenchyma
  - Sclerenchyma
- Interfascicular cambium is found
  - Between pith and vascular bundle
  - Between two vascular bundles
  - In the vascular bundle
  - Outside the bundle
- Meristematic tissue are
  - Premature having ability of division
  - Mature does not have ability of division
  - Premature not having ability of division
  - Complex differentiating in xylem, phloem and cambium
- The 1° and 2° phloem get gradually crushed due to the continued formation and accumulation of 2° xylem
  - 1° xylem remains more or less intact in or near the centre
  - Secondary growth results in an increase in the length of the axisSelect the correct statements
  - I and II
  - II and III
  - I and III
  - I, II and III
- Cork is used as the stopper for bottles, for shock absorption and insulation because of
  - It is light and compressible
  - Non-reactive
  - Sufficiently resistant to fire
  - All of the above
- Medullary rays are formed by the
  - Radially placed parenchymatous cells between vascular bundles
  - Longitudinally placed parenchymatous cells between vascular bundles
  - Laterally placed parenchymatous cells between vascular bundles
  - Obliquely placed parenchymatous cells between vascular bundles
- Identify *A* to *D* in the given diagram and choose the correct option



- A-Epidermal cell, B-Guard cell, C-Subsidiary cell, D-Chloroplast
- A-Epidermal cell, B-Subsidiary cell, C-Chloroplast, D-Guard cell
- A-Epidermal cell, B-Chloroplast, C-Subsidiary cell, D-Guard cell
- A-Guard cell, B-Chloroplast, C-Subsidiary cell, D-Epidermal cell

10. The jute fibres anatomically are  
 a) Bast fibres                      b) Cortical fibres                      c) Xylem fibres                      d) Pith fibres
11. The merismatic tissue responsible for the cutting of vascular tissue (xylem and phloem) is called  
 a) Cork cambium                      b) Vascular cambium                      c) Lateral meristem                      d) Endodermis
12. Secondary phloem of a dicot root is made up of  
 I. sieve tube  
 II. companion cell  
 III. phloem parenchyma  
 Select the correct option for given statement  
 a) I and II                      b) II and III                      c) I and III                      d) All of these
13. The internal structure of a plant stem is observed. There is a discontinuous ring of angular collenchyma below the epidermis. Type of vascular bundles are of the same type as in the stems of solanaceous plants. Sieve tube elements possess simple sieve plates, identify the plant.  
 a) *Helianthus*                      b) *Cucurbita*                      c) *Zea mays*                      d) *Hydrilla*
14. The innermost layer of cortex is called  
 a) Epidermis                      b) Casparian strips                      c) Endodermis                      d) Pericycle
15. Amphistomatic leaf is  
 a) Dicotyledonous leaf                      b) Monocotyledonous leaf  
 c) Both (a) and (b)                      d) None of these
16. Which is not a characteristic of plant cell walls?  
 a) Found only in the sporophyte phase of life cycle  
 b) Among other compounds contains compounds built of simple sugars  
 c) May contain enzymes that are biologically active  
 d) Often contain strengthening polymers
17. The ring arrangement of vascular bundle is the characteristic feature of  
 a) Dicot root                      b) Monocot root                      c) Monocot stem                      d) Dicot stem
18. Primary meristem is  
 a) Apical meristem                      b) Intercalary meristem  
 c) Root apical meristem and shoot apical meristem                      d) Both (a) and (b)
19. I. These tissue are found as layers or patches  
 II. It consists of cells which are thickened at the corners  
 III. It often contains chloroplast  
 IV. Intercellular spaces are absent  
 V. They provide mechanical support to growing parts of plants  
 The above characters are attributed to  
 a) Vascular tissue                      b) Collenchyma  
 c) Parenchyma                      d) Simple sclerenchyma
20. Examples for lateral meristems are  
 a) Phellogen and procambium                      b) Fascicular cambium and procambium  
 c) Procambium and dermatogen                      d) Fascicular cambium and cork cambium
21. Medullary or pith ray is the  
 a) Radial strip of parenchyma which is present between vascular bundles  
 b) Radial strip of collenchyma which is present between vascular bundles  
 c) Radial strip of sclerenchyma which is present between vascular bundles  
 d) The another name of stele
22. Which of the function in the given options does not belongs to the monocot root?  
 a) Conduction of water from the root hairs to the inner tissue  
 b) Storage of food  
 c) The outer most layer or layers of the cortex produce protective exodermis in the older roots  
 d) Presence of secondary growth

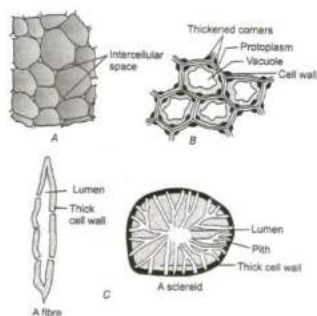
23. Conjoint vascular bundles are common in  
 a) Roots                      b) Stems                      c) Leaves                      d) Both (b) and (c)
24. Periderm is produced from  
 a) Cork cambium              b) Procambium              c) Secondary cortex              d) Vascular cambium
25. In stem, the xylem is  
 a) Exarch                      b) Mesarch                      c) Endarch                      d) All of these
26. Root apical meristem is derived from the  
 a) Plumule part of embryo  
 b) Scutellum part of embryo  
 c) Radical part of embryo  
 d) Endosperm part of embryo
27. Which of the following plants shows multiple epidermis?  
 a) *Croton*                      b) *Allium*                      c) *Nerium*                      d) *Cucurbita*
28. The growth of root and stem in length with the help of apical meristem is called ...A.... Apart from primary growth most dicotyledonous plant exhibit an increase in girth called ...B...  
 Choose the correct combination of A, B and C in respect to the above paragraph  
 a) A-primary growth; B-secondary growth              b) A-secondary growth; B-primary growth  
 c) A-secondary growth; B-tertiary growth              d) A-primary growth; B-tertiary growth
29. Which of the following statement is correct?  
 a) Study of the internal structure is called anatomy  
 b) Plants have cells as the basic unit cells, are organised into tissues  
 c) Tissues are organised into organs  
 d) All of the above
30. In monocotyledonous stem, the vascular bundles are  
 a) Conjoint and open  
 b) Conjoint and closed  
 c) Scattered through out the ground tissue  
 d) Both (b) and (c)
31. Select the wrong statements  
 I. Primary and secondary phloem gets crushed during secondary growth  
 II. During secondary growth, primary xylem remains more or less intact  
 a) I is correct and II is incorrect                      b) II is correct and I is incorrect  
 c) Both are incorrect                      d) Both are correct
32. I. Fat  
 II. Protein  
 III. Sugar  
 IV. Salt  
 Which of the above is/are present in higher concentration with the meristematic cells?  
 a) Only I                      b) I and II                      c) Only IV                      d) III and IV
33. G H Shull observed inbreeding depression in a plant. Miller and Letham isolated a hormone from the immature seeds of that plant. Which of the following characters is not associated with the plant?  
 a) Atactostelic condition in stem  
 b) Bundle sheath in leaf  
 c) Chromosomal number of endospermous cell is 30  
 d) Medulla absent in the root
34. The position of protoxylem in leaf is  
 a) Adaxial                      b) Abaxial  
 c) Surrounded by metaxylem                      d) Lateral
35. The inner, darker and harder portion of secondary xylem that cannot conduct water, in an older dicot stem, is called

- a) Alburnum                      b) Bast                              c) Wood                              d) Duramen
36. The cells arranged in multiple layers between the epidermis and pericycle is called  
a) Pith                              b) Stele                              c) Medullary rays                      d) Cortex
37. Hardness of seed coats is due to the presence of  
a) Sclerenchymatous fibres                      b) Sclereids  
c) Bast                              d) Stone cells
38. Epidermis is derived from  
a) Cambium                              b) Primary xylem                      c) Secondary xylem                      d) Protoderm
39. The activity of cambium in plants is under the control of  
a) Many physiological factors  
b) Many environmental factors  
c) Only water availability  
d) Both (a) and (b)
40. Bark includes  
I. phellogen  
II. phellem  
III. secondary phloem  
IV. secondary xylem  
Select the correct combination  
a) Only I                              b) I, II and III                              c) Only III                              d) All of these
41. Initiation of lateral roots and vascular cambium during secondary growth organs occurs due to activity of  
a) Endodermis                              b) Pericycle                              c) Casparian strip                              d) Periderm
42. I. Sunflower seed  
II. A wheat leaf  
III. Pea plant  
IV. Leaf blade of grass  
Bulliform cells are present in which of the above plants?  
a) I and II                              b) II and III                              c) III and IV                              d) II and IV
43. I. Vessel, II. Tracheids, III. Companion cells  
Which of the following is/are living cells?  
a) I and II                              b) Only III                              c) II and III                              d) Only I
44. Vascular bundles, in which xylem and phloem occur as separate bundles are known as  
a) Collateral                              b) Bicollateral                              c) Radial                              d) Amphivasal
45. In old trees, the greater part of secondary xylem is dark brown due to the  
a) Deposition of inorganic material                              b) Deposition of organic material  
c) Activity of cambium                              d) Activity of secondary xylem
46. Conjunctive tissue is made up of  
a) Parenchymatous cells, *i.e.*, in between the xylem and phloem                              b) Sclerenchymatous cells, *i.e.*, in between the xylem and phloem  
c) Collenchymatous cells, *i.e.*, in between the xylem and phloem                              d) Merismatic cells, *i.e.*, in between the xylem and phloem
47. I. Peripheral vascular bundles are smaller than the centrally located vascular bundles  
II. Phloem parenchyma is absent  
III. Water parenchyma cavities are present within the vascular bundles  
Which of the above characters belong to the monocotyledonous stem?  
a) I and II                              b) II and III  
c) III and I                              d) I, II and III
48. Early wood is formed in dicot plant during  
a) Spring season                              b) Winter season                              c) Autumn season                              d) Summer season

49. The meristem which is particularly present in the mature regions of roots and shoots and produce woody axis and appear later than the primary meristem is called
- a) Secondary meristem                      b) Intercalary meristem  
c) Apical meristem                          d) Tertiary meristem
50. A monocot stem with secondary growth is
- a) *Lilium*                      b) *Cocos*                      c) *Yucca*                      d) *Asparagus*
51. Vessels are absent in this angiosperm.
- a) *Mangifera*                      b) *Magnolia*                      c) *Dillenia*                      d) *Drimys*
52. Conjoint collateral closed vascular bundle is found in
- a) Monocot stem                      b) Monocot root                      c) Dicot stem                      d) Dicot root
53. Palisade parenchyma is absent in leaves of
- a) *Sorghum*                      b) Mustard                      c) Soyabean                      d) Gram
54. The tunica-corpor theory was proposed by
- a) Hofmeister                      b) Nagelli                      c) Strasburger                      d) Schmidt
55. Alburnum is otherwise known as
- a) Periderm                      b) Sapwood                      c) Heartwood                      d) Bark
56. Roots apical meristem occupies the ...A... of roots, while shoot apical meristem occupies the distant most region of the ...B... axis
- Complete the above sentence with the correct combination of A and B
- a) A-tip; B-stem                      b) A-side; B-stem  
c) A-laterally; B-root                      d) A-tip; B-meristamatic
57. Vascular bundle in the laves of dicots are surrounded by
- a) Epidermis                      b) Bundle sheath cells                      c) Pericycle                      d) Both (a) and (c)
58. Intercalary meristem is a derivative of
- a) Lateral meristem                      b) Promeristem                      c) Primary meristem                      d) Secondary meristem
59. Exchange of gases between the outer atmosphere and internal tissue of the stem takes place by (in dicot stem)
- a) Lenticels                      b) Stomata                      c) Hydathodes                      d) Pneumatophores
60. A nail is driven into the trunk of a 30 years old tree at a point 1 m above the soil level. The tree grows in height at the rate of 0.5m a years. After three years, nail will be
- a) 1 m above the soil                      b) 1.5 m above the soil  
c) 2 m above the soil                      d) 2.5 m above the soil
61. Intrafascicular cambium is present in between the
- a) Primary xylem and secondary xylem                      b) Secondary phloem and primary xylem  
c) Primary xylem and secondary phloem                      d) Primary xylem and secondary phloem
62. In dicotyledonous roots, the initiation of lateral roots takes place in
- a) Endodermal cells                      b) Cortical cells                      c) Epidermal cells                      d) Pericycle cells
63. The roots of angiosperms show exarch xylem and their stems have endarch bundles. These are continuous throughout the change occurs in
- a) Epicotyl region                      b) Hypocotyl region                      c) Upper part of root                      d) Lower part of stem
64. The stele found in monocot is
- a) Haplostele                      b) Atactosteale                      c) Dictyosteale                      d) Actinosteale
65. Largest number of chloroplast is found in
- a) Palisade tissue                      b) Spongy tissue                      c) Transfusion tissue                      d) Bundle sheath cells
66. Ground tissue includes
- a) All tissues except epidermis and vascular bundles  
b) Epidermis and cortex  
c) All tissues internal to endodermis  
d) All tissues external to endodermis
67. Cambium is present in between

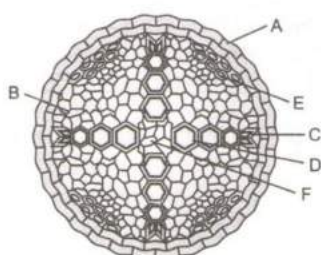


- a) Phloem and xylem  
c) Collenchyma and sclerenchyma
- b) Permanent mature cells  
d) Collenchyma and parenchyma
68. All the following statements regarding sieve tube elements are true except  
a) Their end walls have perforated sieve plates which become impregnated with lignin at maturity  
b) They possess peripheral cytoplasm as well as a large vacuole  
c) Distinct proteinaceous inclusions, the P-proteins are seen evenly distributed throughout the lumen  
d) Long, slender, tube-like structures arranged in longitudinal series
69. 'Exarch' is the condition of vascular bundles in which  
a) Protoxylem lies toward the outside and metaxylem lies inward  
b) Metaxylem lies toward the outside and protoxylem lies inward  
c) Metaxylem lies toward the lateral side and protoxylem lies inward  
d) Protoxylem lies toward the lateral side and metaxylem lies inward
70. Select the correct statements  
I. Epidermal call have small amount of cytoplasm and a large vacuole  
II. Waxy layer cuticle is absent in roots  
III. Root hairs are unicellular, while stem hairs/trichomes are multicellular  
IV. Trichomes are branched/unbranched, soft/stiff and secretory or transpiration preventive  
V. Guard cells are dum-bell-shaped in dicots and bean-shaped in monocots (*e.g.*, grass)  
a) All except I and II  
b) All except III  
c) All except II and IV  
d) All except IV
71. In dicot root, the vascular cambium are  
a) Completely secondary in origin  
b) Completely primary in origin  
c) Secondary as well as primary in origin  
d) Does not exist
72. I. Annual rings are formed as a result of seasonal environmental conditions  
II. Tracheids/vessels elements are larger during periods when water is abundant  
III. Tracheids/vessels elements have thicker wall during periods of water deprivation  
IV. Wood formed in the previous years is darker than newer wood  
Select the combination of correct statements from the options given below  
a) I and II  
b) II and IV  
c) I, II and III  
d) II, III and IV
73. Select the incorrect statements  
I. Excessive loss of water is prevented by epidermis  
II. Stomata develop from epidermal tissue  
III. Photosynthesis is one of the primary function of leaf ground tissue  
a) I and II  
b) II and III  
c) III and I  
d) None of the above
74. Which element of xylem is the characteristic feature of angiosperms?  
a) Tracheids  
b) Phloem  
c) Vessels  
d) Xylem fibre
75. As compared to the dicot root, monocotyledon root have  
a) More xylem bundles  
b) More phloem bundles  
c) Less phloem bundles  
d) Less xylem bundles
76. The function of a vessel is conduction of  
a) Food  
b) Water and minerals  
c) Hormones  
d) All of these
77. Complex tissue includes  
a) Collenchyma  
b) Apical meristem  
c) Conducting tissue  
d) Idioblast
78. Identify the types of simple tissue given in the diagram A, B and C



- a) A-Parenchyma, B-Sclerenchyma, C-Collenchyma  
 b) A-Parenchyma, B-Collenchyma, C-Sclerenchyma  
 c) A-Sclerenchyma, B-Collenchyma, C-Parenchyma  
 d) A-Sclerenchyma, B-Parenchyma, C-Collenchyma

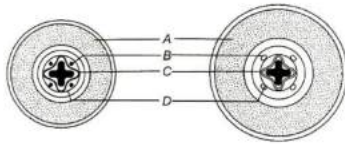
79. In the diagram of TS of stele of dicot root, the different parts have been indicated by alphabets, choose the answer in which these alphabets correctly match with the parts they indicate.



- a) 1. Endodermis, B- Conjunctive tissue, C- Metaxylem, D- Protoxylem, E- Phloem, F- Pith  
 b) 1. Endodermis, B- Pith, C- Protoxylem, D- Metaxylem, E- Phloem, F- Conjunctive tissue  
 c) 1. Pericycle, B- Conjunctive tissue, C- Metaxylem, D- Protoxylem, E- Phloem, F- Pith  
 d) 1. Endodermis, B- Conjunctive tissue, C- Protoxylem, D- Metaxylem E- Phloem, F- Pith
80. The layer of cells outside the phloem meant for giving rise to the root branches is called  
 a) Cambium                      b) Carpus                      c) Endodermis                      d) Pericycle
81. Arrange the following plants in ascending order based on the number of xylem strands in their roots.  
 I. *Trapa*    II. *Pisum*    III. *Castanea*    IV. *Nicotiana*  
 a) II, IV, III, and I                      b) III, IV, II, and I                      c) IV, III, I, and II                      d) I, IV, II and III
82. 'Quiescent centre theory' was proposed by  
 a) Nagelli                      b) Schmidt                      c) Hanstein                      d) Clowes
83. In an annual ring, the light coloured part is known as  
 a) Early wood                      b) Late wood                      c) Heartwood                      d) Sapwood
84. In roots the  
 a) Protoxylem lies towards the periphery  
 b) Metaxylem lies towards the pith (centre)  
 c) Both (a) and (b)  
 d) Endarch condition is found
85. Epidermis is often covered with a waxy thick layer called  
 a) Cuticle                      b) Suberin                      c) Supporting cell                      d) All of these
86. I. Protection of internal tissue  
 II. Prevention of entry of any harmful organism  
 III. Minimising surface transpiration  
 IV. Protection against excessive heating up  
 These are the functions of which of the following?  
 a) Epidermis                      b) Cortex                      c) Hypodermis                      d) Cuticle
87. In a woody dicotyledonous tree, which of the following parts will mainly consist of primary tissues?  
 a) Stem and root                      b) All parts

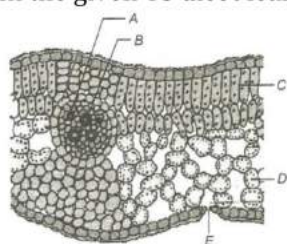
- c) Shoot tips and root tips  
d) Flowers, fruits and leaves
88. Old stem on *Combretum* has  
a) Inter and intraxylary phloem  
b) Inter and extraxylary phloem  
c) Intra and extraxylary phloem  
d) All of the above
89. Atactostele type of stele is found in  
a) Dicot  
b) Monocots  
c) Both (a) and (b)  
d) Only in gymnosperm
90. I. Sieve tube conduct organic food longitudinally  
II. Xylem parenchyma cells stores food and help in lateral conduction of sap  
Select the correct option  
a) I is incorrect, but II is correct  
b) II is incorrect, but I is correct  
c) I and II are correct  
d) I and II are incorrect
91. Growth rings are formed due to activity of  
a) Extrastelar cambium    b) Intrastelar cambium    c) Interstellar cambium    d) Both (b) and (c)
92. Water impermeable, waxy material secreted by endodermal cells is called  
a) Lignin    b) Suberin    c) Conjunctive tissue    d) Pectin
93. Tyloses are balloon-like ingrowths in vessels developing from the adjoining  
a) Fibres through pits on vessel wall  
b) Fibres through the general surface of vessel wall  
c) Parenchyma through pits on vessel wall  
d) Parenchyma through the general surface of vessel wall
94. Select the correct statement from the following  
a) The cells of the permanent tissue do not generally divide  
b) Permanent tissues having all cells similar in structure and function are called simple tissues  
c) Permanent tissues having many different types of cells are called complex tissues  
d) All of the above
95. Tissues involved in secondary growth is/are  
I. intercalary stem  
II. vascular cambium  
III. cork cambium  
Select the correct options from below  
a) I and II    b) II and III    c) I and III    d) I, II and III
96. Which is a characteristic of dicots?  
a) Roots develop from radicle  
b) Secondary growth usually absent  
c) Floral parts in multiple of three  
d) Parallel leaf veins
97. Identify the plant parts whose transverse section shows a clear and prominent pith.  
a) Dicot and monocot stems  
b) Dicot stem and monocot root  
c) Dicot and monocot roots  
d) Dicot stem and dicot root
98. A tree grows at the rate of 0.5 m per year. What will be the height of the board fixed at 1.5 m above the base five years ago?  
a) 4.0 m    b) 3.5 m    c) 1.5 m    d) 4.5 m
99. Mesophylls of monocotyledon leaf are not differentiated into  
a) Palisade tissue  
b) Spongy parenchyma  
c) Bulliform cells  
d) Both (a) and (b)
100. In the given diagram of secondary growth of dicot root, identify *A* to *D* and choose the correct option



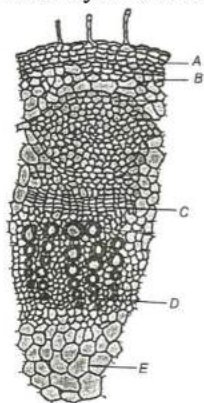


- a) A-Cortex, B-Primary phloem, C-Cambial ring, D-Protoxylem  
 b) A-Cortex, B-Primary phloem, C-Cambial ring, D-Pericycle  
 c) A-Cortex, B-Primary phloem, C-Primary xylem, D-Pericycle  
 d) A-Cortex, B-Primary phloem, C-Primary xylem, D-Protoxylem
101. Anatomically fairly old dicotyledonous root is distinguished from the dicotyledonous stem by  
 a) Absence of secondary xylem  
 b) Absence of secondary phloem  
 c) Presence of cortex  
 d) Position of protoxylem
102. Dendrochronology is  
 a) Secondary growth  
 b) Apical growth  
 c) Seasonal variation  
 d) Determination of age of tree
103. Vascular tissues in flowering plants develop from  
 a) Phellogen  
 b) Plerome  
 c) Periblem  
 d) Dermatogen
104. In dicot, leaves, protoxylem elements  
 a) Face toward the abaxial surface  
 b) Face toward adaxial side  
 c) Are surrounded by metaxylem  
 d) Are scattered in the middle
105. The wood with lower density is ...A... and that of higher density is ...B...  
 Choose the correct combination of options for A and B  
 a) A-autumn wood; B-spring wood  
 b) A-spring wood; B-autumn wood  
 c) A-autumn wood; B-blate wood  
 d) A-spring wood; B-early wood
106. The protoxylem and metaxylem in the stem lies towards  
 a) The pith and root centre, respectively  
 b) The periphery and root centre, respectively  
 c) The root centre and periphery of organ, respectively  
 d) The pith and periphery of organ, respectively
107. Central part of root occupied by parenchymatous (thin or thick walled) cells is called  
 a) Pith  
 b) Endodermis  
 c) Pericycle  
 d) Meristem
108. The histogens are classified on the basis of  
 a) Cells they contain  
 b) Cells they give rise to future tissue  
 c) Meristematic activity  
 d) Cell division
109. Which tissue gives rise to secondary growth?  
 a) Apical meristem  
 b) Adventitious roots  
 c) Germinating seed  
 d) Vascular cambium
110. Generally the silica is deposited on the free sides of  
 a) Dorsiventral leaves  
 b) Monocotyledonous leaves  
 c) Isobilateral leaves  
 d) Both (b) and (c)
111. Monocot root differ from dicot root because of  
 a) Radial vascular bundle  
 b) Large and well-developed pith  
 c) Polyarch xylem bundle  
 d) Both (b) and (c)
112. The vascular bundle, where the phloem is surrounded by xylem is known as  
 a) Amphivasal  
 b) Bicollateral  
 c) Amphicribal  
 d) Radial
113. In rhizome of *Pteridium*, stele, which is composed of two or more than two concentric rings of vascular bundles is called  
 a) Polycyclic  
 b) Siphonosteles  
 c) Ectophloic siphonosteles  
 d) Cladosiphonosteles
114. Stomatal apparatus consists of

- a) Stomatal aperture      b) Guard cell      c) Subsidiary cells      d) All of these
115. The apical meristem of the root is present  
 a) Only in adventitious root      b) In all the roots  
 c) Only in radicals      d) Only in tap roots
116. Among the following attributes of xylem, which are mainly mechanical in function?  
 a) Xylem fibre      b) Xylem parenchyma      c) Tracheids      d) Vessels
117. The quiescent centre in root meristem serves as a  
 a) Site for storage of food which is utilized during maturation  
 b) Reservoir of growth hormones  
 c) Reserve for replenishment of damaged cells of the meristem  
 d) Region for absorption of water
118. On the basis of their structure and location, tissue system is of ..... in plants  
 a) 2 types      b) 3 types      c) 4 types      d) 5 types
119. In the given TS dicot leaf, identify *A* to *E* and choose the correct option

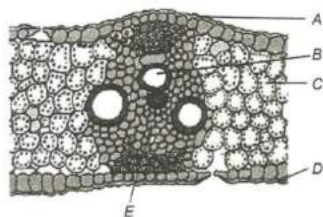


- a) A-Phloem, B-Xylem, C-Palisade mesophyll, D-Spongy mesophyll, E-Stomata  
 b) A-Phloem, B-Xylem, C-Palisade mesophyll, D-Spongy mesophyll, E-Stomata  
 c) B-Xylem, A-Phloem, C-Palisade mesophyll, D-Spongy mesophyll, E-Stomata  
 d) B-Xylem, A-Phloem, C-Palisade mesophyll, D-Spongy mesophyll, E-Hydathodes
120. In the previous question  
 The diagram I stomata belongs to ...A...  
 The diagram II stomata belongs to ...B...  
 a) A-monocots leaf; B-dicots      b) A-dicots leaf; B-monocots  
 c) A-angiosperm; B-gymnosperm      d) A-gymnosperm; B-angiosperm
121. Identify *A* to *E* in the given diagram and choose the correct option



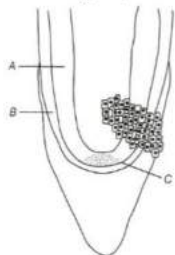
- a) A-Collenchyma, B-Sclerenchyma, C-Cambium, D-Protoxylem, E-Pith  
 b) A-Sclerenchyma, B-Collenchyma, C-Cambium, D-Protoxylem, E-Pith  
 c) A-Parenchyma, B-Collenchyma, C-Cambium, D-Protoxylem, E-Pith  
 d) A-Collenchyma, B-Parenchyma, C-Cambium, D-Protoxylem, E-Pith
122. Lateral roots develop from primordia originated by the division of  
 a) Pericycle cells lying opposite to protoxylem points  
 b) Pericycle cells lying between two protoxylem points  
 c) Endodermal cells lying between two protoxylem points

- d) Endodermal cells lying opposite to protoxylem points
123. Companion cells in plants are associated with  
 a) Vessels                      b) Sperms                      c) Sieve elements                      d) Guard cells
124. Science, which deals with the study of ageing is known as  
 a) Teratology                      b) Gerontology                      c) Limnology                      d) Palaeontology
125. The term leptome is used for  
 a) Xylem                      b) Phloem                      c) Endodermis                      d) Pericycle
126. Grass elongates after cutting (moving) due to  
 a) Primary meristem                      b) Secondary meristem  
 c) Apical meristem                      d) Intercalary meristem
127. Which of the following would be in significant amount in xylem sap?  
 a) Sugar                      b) Nitrates                      c) Phosphates                      d) Water
128. The secondary meristem initiates  
 a) Basal growth                      b) Transverse growth                      c) Radial growth                      d) Vertical growth
129. Xylem fibres are made up of  
 a) Sclerenchyma cells with thin walls  
 b) Sclerenchyma cells with thick wall  
 c) Parenchyma cells with thin wall  
 d) Sclerenchyma cells with no obliteration in central lumen
130. Removal of ringwood of tissue outside the vascular cambium from the tree trunk kills it because  
 a) Water cannot move up  
 b) Food does not travel down and root become starved  
 c) Shoot become starved  
 d) Annual rings are not produced
131. Prickles  
 I. don't have vascular supply  
 II. are epidermal in origin  
 III. help in climbing  
 Select the right combination of statements from the given options  
 a) I and II                      b) II and III                      c) I and III                      d) I, II and III
132. Which one of the following is well-developed present in hydrophytes?  
 a) Aerenchyma                      b) Collenchyma                      c) Stomata                      d) Root system
133. In dicot stem, secondary growth is due to the activity of  
 a) Apical meristem                      b) Lateral meristem                      c) Cork                      d) Bark
134. The meristem responsible for extra stelar secondary growth in dicot stem is  
 a) Interfascicular cambium                      b) Intrafascicular cambium  
 c) Intercalary meristem                      d) Phellogen
135. Casparian thickenings are found in the cells of  
 a) Pericycle of the root                      b) Endodermis of the root  
 c) Pericycle of the stem                      d) Endodermis of the stem
136. In the given TS of monocot leaf, identify A to E. Choose the correct option



- a) A-Abaxial epidermis, B-Xylem, C-Mesophyll, D-Adaxial epidermis, E-Phloem                      b) A-Abaxial epidermis, B-Phloem, C-Mesophyll, D-Adaxial epidermis, E-Xylem

- c) A-Adaxial epidermis, B-Phloem, C-Mesophyll, D-Abaxial epidermis, E-Xylem      d) A-Adaxial epidermis, B-Xylem, C-Mesophyll, D-Abaxial epidermis, E-Phloem
137. Length of petiole increases due to division of  
 a) Apical meristem      b) Lateral meristem      c) Intercalary meristem      d) All of these
138. Phytotron is  
 a) A controlled condition chamber for tissue      b) Leaf culture process  
 c) Special culture of plants      d) Root culture process
139. The tissue which perpetuates itself by active cell division is  
 a) Permanent tissue      b) Ground tissue      c) Meristematic tissue      d) Vascular tissue
140. Amphivasal vascular bundle possess  
 a) Xylem around phloem  
 b) Phloem around xylem  
 c) Phloem on both sides of xylem  
 d) Phloem towards centre and xylem towards periphery
141. Trichomes are epidermal hairs of  
 a) Primary root      b) Primary stem      c) Primary leaves      d) Secondary root
142. I. Protection of internal tissues  
 II. Protection leaves from microbes  
 III. Gaseous exchange  
 IV. Reduction in the rate of transpiration through epidermal cells due to trichomes  
 Which of the function of epidermis is/are relevant from the above given statements?  
 a) Only II      b) I and II      c) II and III      d) I, II, III and IV
143. Identify *A, B* and *C* indicated in diagram of root apex given below

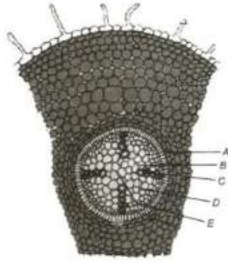


- a) A-Vascular bundle, B-Epidermis, C-Root apical meristem  
 b) A-Cortex, B-Epidermis, C-Root apical meristem  
 c) A-Cortex, B-Protoderm, C-Root apical meristem  
 d) A-Cortex, B-Epidermis, C-Root apical meristem
144. In flowering plants, the main water transporting elements are  
 a) Tracheids      b) Vessels      c) Fibres      d) Both (a) and (b)
145. The vertical section of a dorsoventral leaf through the lamina shows three main parts namely, epidermis, ...A... and vascular system. The epidermis, which covers the upper surface is ...B... and lower surface is covered by ...C... of the leaf.  
 Choose the correct combination of A, B and C  
 a) A-mesophyll, B-adaxial epidermis, C-abaxial epidermis      b) A-endodermis, B-adaxial epidermis, C-abaxial epidermis  
 c) A-endodermis, B-abaxial epidermis, C-adaxial epidermis      d) A-mesophyll, B-abaxial epidermis, C-adaxial epidermis
146. I. Epidermis  
 II. Mesophyll  
 III. Vascular system  
 Which of the above component is made up of parenchyma and have chlorophyll?  
 a) I and II      b) Only I      c) Only III      d) Only II
147. Which of the following is not a part of epidermal tissue system?

- a) Companion cells      b) Trichomes      c) Root hairs      d) Guard cells
148. Which of the following statements is true?  
 a) The collenchyma occurs in layers below the epidermis in monocotyledonous plants  
 b) Sclerenchyma cells are usually dead and without protoplasts  
 c) Xylem parenchyma cells are living and thin-walled and their cell walls are made up of lignin  
 d) The companion cells are specialised sclerenchymatous cells
149. The age of tree by counting annual rings is called  
 a) Dendrochronology      b) Ageing      c) Chronology      d) Countrology
150. Lignification is associated with  
 a) Xylem      b) Phloem      c) Parenchyma      d) Chlorenchyma
151. Conducting tissue for the transport of water and minerals from the roots to the stems and leaves is called  
 a) Xylem      b) Phloem      c) Parenchyma      d) Collenchyma
152. Abaxial surface of the leaf generally bears  
 a) Less stomata than adaxial epidermis      b) More stomata than adaxial epidermis  
 c) Equal stomata than adaxial epidermis      d) Hairs to absorb the minerals
153. Open vascular bundles  
 a) Have cambium in between the primary and secondary xylem  
 b) Have cambium in between the primary and secondary phloem  
 c) Have cambium in between the xylem and phloem  
 d) Don't have cambium in between xylem and phloem
154. The lacunae in vascular bundle of monocot stem is  
 a) Amucilage canal      b) A large-sized vessel  
 c) Lysigenous water cavity      d) Metaxylem
155. Complementary cells are associated with  
 a) Lenticels      b) Hydathodes      c) Rhytidome      d) Bark
156. In which of the following, root system is poorly developed?  
 a) Phaena      b) *Hydrilla*      c) Halophyte      d) Xerophyte
157. Heartwood differs from sapwood in  
 a) Presence of rays and fibres      b) Absence of vessels and parenchyma  
 c) Having dead and non-conducting elements      d) Being susceptible to pests and pathogens
158. The sclerenchyma of the hypodermis in the *Pinus* needle helps in  
 a) Increasing the absorptive surface of the cell      b) Checking transpiration  
 c) Mechanical support      d) Photosynthesis
159. Which one of the following is not a lateral meristem?  
 a) Intrafascicular cambium      b) Interfascicular cambium  
 c) Phellogen      d) Intercalary meristem
160. In dicot stem, vascular bundles are  
 a) Numerous scattered      b) Arranged in a ring  
 c) Without cambium      d) Surrounded by bundle sheath
161. Which of the following statements are true?  
 I. Uneven thickening of cell wall is characteristic of sclerenchyma.  
 II. Periblem forms the cortex of the stem and the root.  
 III. Tracheids are the chief water transporting elements in gymnosperms.  
 IV. Companion cell is devoid of nucleus at maturity.  
 V. The commercial cork is obtained from *Quercus suber*.  
 a) I and IV      b) II and V      c) III and IV      d) II, III and V
162. Which of the above following are simple tissues?  
 I. Parenchyma  
 II. Collenchyma  
 III. Sclerenchyma



- a) I and II                      b) II and III                      c) I and III                      d) I, II and III
163. Non-articulated laticifers are found in  
a) *Nerium*                      b) *Papaver*                      c) *Hevea*                      d) *Achras*
164. I. Epidermal cells  
II. Stomata  
III. Trichomes  
IV. Root hairs  
These are the attributes of  
a) Epidermal tissue system                      b) Ground tissue system  
c) Fundamental tissue system                      d) Vascular tissue system
165. The large empty and colourless cells present at intervals on the upper surface of grass leaf are called  
a) Bulliform cells                      b) Palisade parenchyma  
c) Spongy parenchyma                      d) Accessory cells
166. Velamen is found in  
a) *Vanda*                      b) *Rosa*                      c) *Viscum*                      d) *Santalum*
167. The functions of sieve tubes are controlled by  
a) Cytoplasm of sieve tube cells                      b) Nucleus of sieve tube cells  
c) Nucleus of companion cells                      d) Cytoplasm of companion cells
168. Which of the following have sunken stomata?  
a) *Nerium*                      b) *Mangifera*                      c) *Hydrilla*                      d) *Zea mays*
169. The meristem, in which the cells divide in several planes is  
a) Plate meristem                      b) Rib meristem                      c) Mass meristem                      d) Lateral meristem
170. Cambium activity is highest in  
a) Autumn                      b) Spring                      c) Winter                      d) Rain
171. During the formation of primary plant body specific regions of apical meristem produces  
a) Dermal tissue                      b) Ground tissue                      c) Vascular tissue                      d) All of these
172. Vascular bundle, in which two patches of phloem are present on both sides of xylem is  
a) Collateral                      b) Bicollateral                      c) Concentric                      d) Radial
173. Vascular bundle with cambium is called  
a) Closed                      b) Open                      c) Exarch                      d) Endarch
174. Compound sieve plates are found in  
a) *Cucurbita*                      b) *Vitis*                      c) *Magnolia*                      d) *Corchorus*
175. From evolutionary point of view, tracheids and sieve cells are more primitive than tracheae and sieve tubes respectively. The angiosperms have  
a) Tracheae and sieve tubes                      b) Tracheids, tracheae and sieve tubes  
c) Tracheae, sieve cells and sieve tubes                      d) Tracheids, tracheae and sieve cells
176. I. Phloem transports the food materials usually from the leaves to other parts of the plant  
II. Phloem in the angiosperm is composed of sieve tube elements, companion cells, phloem parenchyma and phloem fibres  
Identify which of the following statement is correct and select the correct option  
a) I and II are correct                      b) I and II are incorrect  
c) I is correct, but II is incorrect                      d) II is correct, but I is incorrect
177. The outermost layer of dicotyledonous root is called  
a) Cortex                      b) Epidermis                      c) Cambium                      d) Periderm
178. Identify *A* to *E* in the given diagram



- a) A-Endodermis, B-Pericycle, C-Protoxylem, D-Metaxylem, E-Pith  
 b) A-Endodermis, B-Pericycle, C-Protoxylem, D-Pith, E-Metaxylem  
 c) A-Endodermis, B-Pericycle, C-Pith, D-Protoxylem, E-Metaxylem  
 d) A-Endodermis, B-Pith, C-Pericycle, D-Protoxylem, E-Metaxylem

179. Choose the wrong statement from the following

- a) Axillary/terminal bud develops from apical meristem  
 b) Merismatic activity occurs at stem apex/root apex  
 c) Permanent tissues are produced by primary and secondary meristem  
 d) None of the above

180. I. It is resistant to microorganisms

- II. It comprises dead elements  
 III. It comprises highly lignified cell wall  
 IV. It is the peripheral part  
 V. It is dark and tough

Which of the above property doesn't belong to heart wood?

- a) I and II                      b) Only IV                      c) Only V                      d) III and I

181. Tracheids

- a) Are the dominant cell types of xylem in angiosperms  
 b) Are primarily found in mosses and liverworts  
 c) Are responsible for water conduction and support in many land plants  
 d) First appeared during Palaeozoic era

182. I. Usually cortex of stem is formed during secondary growth of the stem

- II. It is a couple of layers thick  
 III. It is made up of thin-walled rectangular cells

Select the incorrect statements

- a) I and II                      b) II and III                      c) I and III                      d) None of these

183. Jute is mainly composed of

- a) Xylem                      b) Secondary bast fibre                      c) Phloem                      d) Cortex

184. Which of the following cells are studied during translocation of solutes?

- a) Sieve tube cells                      b) Companion cells                      c) Phloem fibre                      d) Xylem fibre

185. Stellar regions are formed from

- a) Periblem                      b) Plerome                      c) Dermatogen                      d) Tunica

186. Casparian strips are present in the ..... of the root.

- a) Epiblema                      b) Cortex                      c) Pericycle                      d) Endodermis

187. Cork cambium gives rise to

- a) Phellogen and secondary cortex                      b) Phellogen, phelloderm and secondary cortex  
 c) Cork and phellogen                      d) Cork and secondary cortex

188. Simple sieve plate with single perforation is present in

- a) *Cucurbita*                      b) *Prunus*                      c) *Pyrus*                      d) *Vitis*

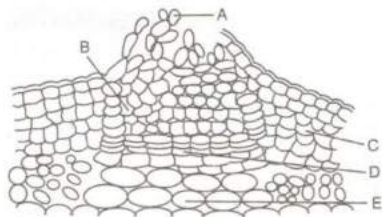
189. Root caps are absent in

- a) Mesophytes                      b) Xerophytes                      c) Hydrophytes                      d) Lithophytes

190. Which cells possess chloroplast and regulate the opening and closing of stomata?

- a) Cuticle cell                      b) Stomatal cell                      c) Guard cell                      d) Subsidiary cell

191. Bamboo and grasses elongate by the activity of  
 a) Secondary meristem    b) Lateral meristem    c) Apical meristem    d) Intercalary meristem
192. At maturity, the sieve plates become impregnated with  
 a) Cellulose    b) Pectin    c) Suberin    d) Callose
193. Cells of collenchyma have thickened corners due to the deposition of  
 a) Cellulose    b) Hemicellulose    c) Pectin    d) All of these
194. Complex tissues are  
 a) Made up of more than one kind of cells  
 b) Xylem and phloem  
 c) Both (a) and (b)  
 d) None of the above
195. In a vascular bundle, if xylem vessels develop in a centripetal fashion, the xylem is likely to be  
 a) Mesarch    b) Centrarch    c) Endarch    d) Exarch
196. In monocot roots, which type of vascular bundles are found?  
 a) Collateral, conjoint and closed    b) Radial with exarch xylem  
 c) Bicollateral, conjoint and closed    d) Radial with endarch xylem
197. All the tissues on the innerside of the endodermis constitutes together to form  
 a) Vascular bundle    b) Conjunctive tissue    c) Pith    d) Stele
198. The cork is impervious to water due to  
 a) Lignin deposition in the cell wall  
 b) Compactness of cell  
 c) Suberin deposition in the cell wall  
 d) All of the above
199. I. Vascular tissue  
 II. Cork cambium  
 III. Xylem and phloem elements  
 IV. Parenchyma and sclerenchyma  
 Choose the correct combination for heterogenous tissue  
 a) I and II    b) II and IV    c) II and III    d) Only III
200. Vascular bundle having phloem at the centre encircled by xylem is known as  
 a) Bicollateral    b) Conjoint collateral    c) Amphivasal    d) Amphicribal
201. In dicotyledonous root, the cortex consists of  
 a) Sclerenchymatous tissue    b) Collenchymatous tissue  
 c) Parenchymatous tissue    d) Endodermis tissue
202. Which of the following is true?  
 a) Vessels are unicellular and with narrow lumen  
 b) Vessels are multicellular and with wide lumen  
 c) Tracheids are unicellular and with wide lumen  
 d) Tracheids are multicellular and with narrow lumen
203. Choose the correct combination of labelling of a lenticels



- a) A-Pore, B- Secondary cortex, C-Cork cambium, D- Cork, E-Complementary cells  
 b) A-Pore, B- Cork cambium, C- Cork, D- Secondary cortex, E- complementary cells  
 c) A-Pore, B-Cork, - Complementary cells    D- Cork cambium, E- Secondary cortex,  
 d) A-Pore, B- Complementary cells , C- Cork, D- Cork cambium, E- Secondary cortex,

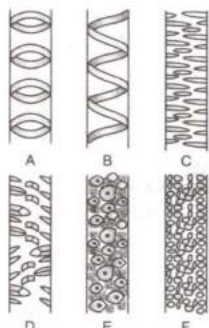




204. Meristematic tissue in vascular bundle is

- a) Phellem
- b) Procambium
- c) Interfascicular cambium
- d) Fascicular cambium

205. The following diagrams show the types of secondary thickening in the xylem vessels. Identify the types labelled from A to F. Choose the correct option from those given.



- a) A-Spiral, B-Annular, C-Reticulate, D-Scalariform, E-Pitted with border, F-Pitted, simple
- b) A-Annular, B-Spiral, C-Scalariform, D-Reticulate, E-Pitted with border, F-Pitted, simple
- c) A-Annular, B-Spiral, C-Scalariform, D-Reticulate, E-Pitted, simple, F-Pitted with border
- d) A-Spiral, B-Annular, C-Scalariform, D-Reticulate, E-Pitted with border, F-Pitted, simple

206. P-proteins are associated with

- a) Sieve tube elements
- b) Xylem parenchyma
- c) Trichomes
- d) Tracheids and vessels

207. A bicollateral vascular bundle has the following arrangement of tissues.

- a) Outer phloem → Outer xylem → Middle cambium → Inner xylem → Inner phloem
- b) Outer cambium → Outer phloem → Middle xylem → Inner phloem → Inner cambium
- c) Outer phloem → Outer cambium → Middle xylem → Inner cambium → Inner phloem
- d) Outer xylem → Outer cambium → Middle phloem → Inner cambium → Inner xylem

208. Permanent or mature cells are formed by

- a) Cell division in the primary meristem
- b) Cell division in the secondary meristem
- c) Both (a) and (b)
- d) Specialisation of secondary meristem

209. Intercalary meristem results in

- a) Secondary growth
- b) Primary growth
- c) Apical growth
- d) None of these

210. Mark the correct sequence of layers found in root anatomy.

- a) Epiblema, cortex, endodermis, pericycle
- b) Cortex, epiblema, pericycle, endodermis
- c) Epiblema, cortex, pericycle, endodermis
- d) Cortex, epiblema, endodermis, epidermis

211. In monocot stem, which of the following is absent?

- a) Endodermis
- b) Hypodermis
- c) Cortex
- d) Both (a) and (b)

212. Consider the following statements and choose the correct option.

- I. The thread like cytoplasmic strands, running from one cell to other is known as plasmodesmata.
- II. Xylem and phloem constitute the vascular bundle of the stem.
- III. The first formed xylem elements are described as metaxylem.
- IV. Radial vascular bundles are mainly found in the leaves.

- a) I is true, but II, III and IV are false
- b) II is true, but I, III and IV are false
- c) III is true, but I, II and IV are false
- d) I and II are true, but III and IV are wrong

213. In the leaf, vascular bundles are found in the

- a) Veins
- b) Palisade tissues
- c) Lower epidermis
- d) Upper epidermis

214. The annular and spirally thickened conducting elements generally develop in the protoxylem when the root or stem is

- a) maturing                      b) Elongating                      c) widening                      d) Differentiating
215. Damaged sieve tubes are sealed by deposition of  
a) Pectin                      b) Callose                      c) Suberin                      d) Lignin
216. Arrange the following in the order of their location from periphery to centre in the entire dicotyledonous plant body.  
I. Fusiform cells II. Trichoblasts III. Collocytes IV. Tyloses  
a) IV , I, II, III,                      b) II , III , I, IV                      c) III , II, I, IV                      d) I , IV, III, II
217. Cork tissue arises from  
a) Periderm                      b) Phellogen                      c) Phelloderm                      d) Phellem
218. As secondary growth proceeds in a dicot stem, the thickness of  
a) Sapwood increases  
b) Heartwood increases  
c) Both sapwood and heartwood increase  
d) Both sapwood and heartwood remains the same
219. A mature sieve tube differs from a vessel in  
a) Lacking a functional nucleus                      b) Absence of lignified walls  
c) Being nearly dead                      d) Lacking cytoplasm
220. Cork cambium of dicot originates from  
a) Epiblema                      b) Pericycle  
c) Cambium of vascular bundles                      d) Endodermis
221. Parenchymatous cells are usually present in the  
I. pericycle  
II. pith  
III. medullary rays  
IV. primary root  
V. secondary root  
VI. primary stem  
VII. secondary stem  
Select the correct combinations from the given options  
a) All except I and III                      b) All except V and VII  
c) All except II and IV                      d) All except VI and III
222. What differentiates leaf of dicots from monocots?  
a) Parallel venation  
b) Differentiation of palisade and spongy parenchyma  
c) Stomata only on upper side  
d) Stomata both on upper and lower sides
223. In dicotyledonous root  
a) 3 to 6 xylem and phloem patches are found  
b) 4 to 8 xylem and phloem patches are found  
c) 2 to 4 xylem and phloem patches are found  
d) 5 to 6 xylem and phloem patches are found
224. Simple tissues which occurs in layers below the epidermis in dicotyledonous plants are  
a) Simple parenchyma                      b) Complex parenchyma  
c) Collenchyma                      d) Simple tissue
225. Intercalary meristem is found between the  
a) Mature tissue                      b) Apical root meristem  
c) Shoot meristem                      d) Two nodes
226. Maximum number of vascular bundles are present in  
a) Monocot stem                      b) Monocot root                      c) Dicot stem                      d) Dicot root
227. Identify A to E in the given TS of dicot stem and choose the correct option



- a) A-Hypodermis, B-Chlorenchyma, C-Endodermis, D-Pericycle, E-Medullary rays  
 b) A-Hypodermis, B-Parenchyma, C-Endodermis, D-Pericycle, E-Medullary rays  
 c) A-Hypodermis, B-Sclerenchyma, C-Endodermis, D-Pericycle, E-Medullary rays  
 d) A-Hypodermis, B-Sclerenchyma, C-Endodermis, D-Pericycle, B-Parenchyma
228. In dicot root, the cork cambium is formed with the help of  
 a) Cortex                      b) Pericycle                      c) Epidermis                      d) Endodermis
229. Quiescent centre is a  
 a) Weak zone                      b) Active zone                      c) Inactive                      d) Strong base
230. In monocot stem, the hypodermis is  
 a) Parenchymatous                      b) Sclerenchymatous  
 c) Collenchymatous                      d) Meristematic
231. Bulliform cells are the modification of  
 a) Abaxial epidermis cell                      b) Adaxial epidermis cell  
 c) Mesophyll                      d) Vascular tissue
232. In dicot stem, secondary xylem lie towards the ...A... and secondary phloem lie towards the ...B....  
 Choose the correct combination of options for A and B  
 a) A-pith; B-periphery                      b) A-periphery; B-pith  
 c) A-periphery; B-laterally                      d) A-pith; B-laterally
233. In which of the following, the phloem is located only on the outer side of the xylem  
 a) Open vascular system                      b) Closed vascular system  
 c) Conjoint vascular system                      d) Radial vascular system
234. Which meristem is responsible for the production of secondary tissues?  
 a) Primary meristem                      b) Root apical meristem  
 c) Shoot apical meristem                      d) Secondary meristem
235. Wood is  
 a) Primary phloem                      b) Primary xylem                      c) Secondary xylem                      d) Secondary phloem
236. Sclerenchyma mainly provides  
 a) Storage tissue to the plants  
 b) Mechanical support to the organs of plants  
 c) Secretory tissue to the plants  
 d) Strength to monocot plants, specially their abundance in the layers below the epidermis
237. Bicollateral conjoint vascular bundles have  
 a) Xylem and phloem, which are arranged in an alternate manner on different radii  
 b) Xylem and phloem, which are situated at the same radius and it has two groups of phloem along the two sides of xylem (inside and outside)  
 c) Xylem and phloem in same radius but it has only one group phloem outside the xylem  
 d) Phloem surrounds the xylem tissues
238. I. Made up of sclerenchymatous cells  
 II. Generally absent in primary phloem  
 III. Much elongated and pointed  
 Given above characters belongs to which of the following?  
 a) Phloem fibre                      b) Xylem fibre                      c) Companion cells                      d) Sieve cells
239. I. It is made up of elongated, compactly arranged cells  
 II. It is usually single layered

III. It is parenchymatous

IV. Large vacuole is present

Which of the above characters belong to the epidermis?

- a) All except I                      b) All except III and IV                      c) All except II                      d) All of these

240. I. They may be branched or unbranched and soft or stiff

II. They may be secretory and help in preventing water loss due to transpiration

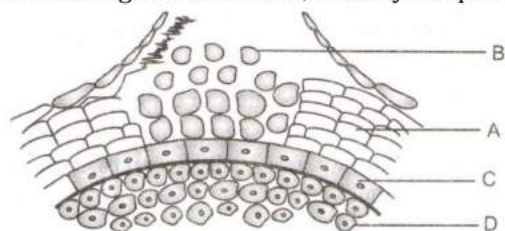
Which of the above characteristics belongs to trichomes

- a) Only I                      b) Only II                      c) I and II                      d) None of these

241. In young stem, the vascular cambium is

- a) Single layered                      b) Bilayered                      c) Trilayered                      d) Does not exist

242. In the diagram of lenticel, identify the parts indicated as A, B, C, D



- a) A-Phellem, B-Complementary cell, C-Phellogen, D-Phelloderm  
b) A-Phellem, B-Complementary cells, C-Phelloderm, D-Periderm  
c) A-Complementary cells, B-Phellogen, C-Phelloderm, D-Periderm  
d) A-Complementary cells, B-Phellem, C-Periderm, D-Phelloderm

243. Fascicular, interfascicular and extra-stelar cambium together constitutes

- a) Ground meristem                      b) Apical meristem                      c) Intercalary meristem                      d) Lateral meristem

244. Secondary phloem remains functional generally

- a) For one year                      b) For less than one year  
c) For many years                      d) As long as plant is alive

245. New protective layers formed after the crushing or breaking of cortical and epidermal layers due to increase in the girth of stem by vascular cambium. These new layers collectively called as

- a) Phellogen                      b) Cork cambium                      c) Periderm                      d) Phelloderm

246. Which of the following tissues consist of living cells?

- a) Vessels                      b) Tracheids                      c) Companion cells                      d) Sclerenchyma

247. In barley stem, vascular bundles are

- a) Open and scattered                      b) Closed and scattered  
c) Open and in a ring                      d) Closed and radial

248. I. Pith is large and well-developed in monocots

II. Monocot root don't undergo any secondary growth

In accordance to the above statements, identify the correct one

- a) I is incorrect, but II is correct  
b) II is incorrect, but I is correct  
c) I and II are incorrect  
d) I and II are correct

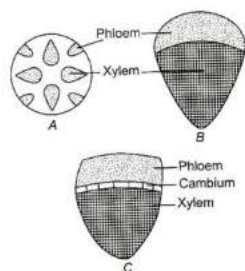
249. Aerenchyma is helpful in plants by

- a) Providing buoyancy in hydrophytes                      b) Absorption in stilt roots  
c) Giving mechanical strength to plants                      d) Giving flexibility to plants

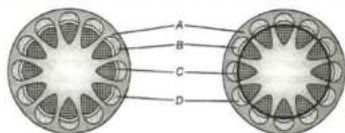
250. Cells having no power of cell division are formed by

- a) Primary meristem                      b) Fascicular cambium                      c) Cork cambium                      d) All of these

251. Identify type of vascular bundle with respect to A, B and C figure



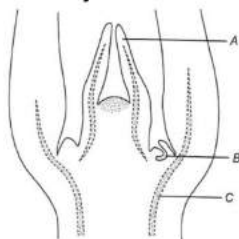
- a) A-Conjoint closed, B-Conjoint open, C-Radial      b) A-Radial, B-Conjoint open, C-Conjoint closed  
 c) A-Radial, B-Conjoint closed, C-Conjoint open      d) A-Conjoint open, B-Conjoint closed, C-Radial
252. Velamen and spongy tissue is found in  
 a) Breathing roots      b) Parasitic roots      c) Tuberous roots      d) Epiphytic roots
253. In previous question, the given diagram is the TS of  
 a) Root and belongs to monocot  
 b) Stem and belongs to monocot  
 c) Root and belongs to dicot  
 d) Stem and belongs to dicot
254. I. Youngest secondary phloem is just outside the cambium, while youngest secondary xylem is present inside the cambium  
 II. Oldest secondary phloem is just inside the primary phloem, while oldest secondary xylem is just above pith  
 III. Secondary medullary ray passes through both secondary xylem and secondary phloem  
 Select the incorrect statement from above  
 a) I and II      b) II and III      c) III and I      d) None of these
255. Collenchyma is  
 a) Living and contains protoplasm      b) Dead and hollow  
 c) Dead and filled with reserve food      d) Living and contains no reserve food
256. The stele is composed of  
 a) Vascular bundle      b) Pith and vascular bundle  
 c) Cortex and endodermis      d) Pith and cortex
257. Vascular cambium of dicot root originates from the tissue located just below...A... bundles, a portion of pericycle tissue above the ...B... forming a complete continuous wavy ring, which later becomes ...C...  
 Choose the correct combination of options for A-C  
 a) A-xylem, B-protoxylem, C-circular  
 b) A-phloem, B-protoxylem, C-circular  
 c) A-phloem, B-metaxylem, C-circular  
 d) A-xylem, B-metaxylem, C-circular
258. Plant length is increased by  
 a) Apical meristem      b) Lateral meristem      c) Dermatogen      d) Periblem
259. Given below the diagram of secondary growth in dicot stem (diagrammatic). Identify A to D



- a) A-Cortex, B-Secondary xylem, C-Secondary phloem, D-Vascular cambium  
 b) A-Cortex, B-Primary phloem, C-Vascular cambium, D-Primary xylem  
 c) A-Cortex, B-Primary xylem, C-Vascular cambium, D-Primary phloem  
 d) A-Cortex, B-Primary xylem, C-Vascular cambium, D-Primary phloem
260. Which one of the following is the correct sequence of tissues present in dicot stem during secondary growth?  
 a) Phellogen, cork, primary cortex, secondary cortex



- b) Cork, primary cortex, secondary cortex, phellogen  
 c) Primary cortex, Secondary cortex, phellogen, cork  
 d) Secondary cortex, cork, phellogen, primary cortex
261. In dicotyledonous stem, the sequence of tissue from outside to inside is  
 a) Phellem → Endodermis → Pericycle → Phloem  
 b) Pericycle → Endodermis → Pericycle → Phloem  
 c) Xylem → Endodermis → Pericycle → Phloem  
 d) Stele → Endodermis → Pericycle → Pheloem
262. In grasses, certain adaxial epidermal cells along the veins modify themselves into large empty, colourless cells called  
 a) Bulliform cells                      b) Companion cells                      c) Guard cells                      d) Subsidiary cells
263. In grasses, the guard cells are  
 a) Kidney-shaped                      b) Sphere-shaped                      c) Dump-bell-shaped                      d) Bean-shaped
264. Heart wood and sapwood of dicot plants are respectively, called as  
 a) Duraman and alburnum                      b) Alburnum and duraman  
 c) Alburnum and phellogen                      d) Duramen and phellogen
265. Interxylary as well as intraxylary phloem is present in  
 a) *Bignonia*                      b) *Mirabilis*                      c) *Strychnos*                      d) *Achyranthes*
266. Identify A, B and C in the given diagram of shoot apical meritem



- a) A-Leaf primordium, B-Axillary bud, C-Vascular bud  
 b) A-Leaf primordium, B-Axillary bud, C-Vascular tissue  
 c) A-Shoot primordium, B-Axillary bud, C-Vascular tissue  
 d) A-Shoot primordium, B-Apical bud, C-Vascular tissue
267. Simple permanent living tissues which are made up of thin-walled similar isodiametric cells are called  
 a) Parenchyma tissues                      b) Collenchyma tissues  
 c) Sclerenchyma tissues                      d) Meristematic tissues
268. Fusiform initial forms  
 a) Vascular rays                      b) Ray parenchyma                      c) Tracheary elements                      d) Primary phloem
269. Polyarch condition is found in which of the following?  
 a) Monocotyledonous stem                      b) Monocotyledonous leaves  
 c) Monocotyledonous roots                      d) Dicotyledonous stem
270. Apical meristems are present at the  
 a) Tips of roots                      b) Tips of shoots  
 c) Lateral sides of roots and shoots                      d) Both (a) and (b)
271. Plant cells that are photosynthetically active are found in the ...A... layer of leaves and are ...B...  
 Choose the correct combination of A and B from the below given options  
 a) A-mesophyll, B-parenchymatous                      b) A-mesophyll, B-collenchymatous  
 c) A-mesophyll, B-sclerenchymatous                      d) A-mesophyll, B-merismatic
272. Which of the following statement is correct?  
 I. Many organs of aquatic plants floats in water  
 II. Large air gaps are present in the collenchyma tissue of lotus leaf  
 a) I is correct, but II is incorrect                      b) II is correct, but I is incorrect  
 c) I and II are correct                      d) I and II are incorrect

273. I. Tracheids  
 II. Vessels  
 III. Fibres  
 IV. Parenchyma  
 All the above structures are the attributes of  
 a) Xylem                      b) Phloem                      c) Meristem                      d) Vascular tissue
274. Lamellar collenchyma is seen in the stem of  
 a) *Cucurbita*                      b) *Leucas*                      c) *Sambucus*                      d) *Monstera*
275. During secondary growth new meristematic tissues arising in the cortical region of the stem are called  
 a) Phellem                      b) Phelloderm                      c) Secondary cortex                      d) Phellogen
276. I. Monocot root  
 II. Dicot stem  
 III. Monocot stem and dicot root  
 IV. Dicot stem and dicot root  
 V. Dicot root  
 Which of the above have well-developed pith?  
 a) I and II                      b) III and IV                      c) IV and V                      d) II and III
277. The cork cambium, cork and secondary cortex are collectively called  
 a) Phellogen                      b) Periderm                      c) Phellem                      d) Phelloderm
278. Sunken stomata is found in leaves of  
 a) *Trifolium*                      b) *Lemna*                      c) *Nerium*                      d) *Lilium*
279. A vascular bundle without pith is  
 a) Protostele                      b) Siphonostele                      c) Solenostele                      d) None of these
280. A leaf primordium grows into adult leaf lamina  
 a) At first by apical meristem and later largely by marginal meristems  
 b) By apical meristem  
 c) By lateral meristem  
 d) By marginal meristem
281. The vascular cambial ring of dicot stem is  
 a) Primary in origin                      b) Secondary in origin  
 c) Embryonic in origin                      d) Partly primary and partly secondary in origin
282. Mesophyll is a tissue which is present in leaf  
 a) Between the upper and lower epidermis  
 b) Below the lower epidermis  
 c) In between endodermis and pericycle  
 d) Below the endodermis and upper on the pericycle
283. I. Roots are unicellular  
 II. Trichomes are multicellular usually  
 Identify the correct statement and select the correct option  
 a) I and II are correct                      b) I and II are incorrect  
 c) I is correct, but II is incorrect                      d) II is correct, but I is incorrect
284. Narrow bands of parenchymatous tissue which passes through the secondary xylem and phloem radially are called  
 a) Pith                      b) Stele  
 c) Primary medullary rays                      d) Secondary medullary rays
285. Quiescent centre is present in  
 a) Shoot apex                      b) Root apex                      c) Both (a) and (b)                      d) Meristematic tissue
286. Tyloses an outgrowth from ray or axial parenchyma cell into the lumen of a vessel, which partially or completely blocks the cavity are present in  
 a) Periderm                      b) Heartwood                      c) Sapwood                      d) Secondary cortex
287. Bark is the non-technical term which refers to  
 a) A few tissue exterior to the vascular cambium                      b) A few tissue interior to the vascular cambium  
 c) All the tissue interior to the vascular cambium                      d) All the tissue exterior to the vascular cambium

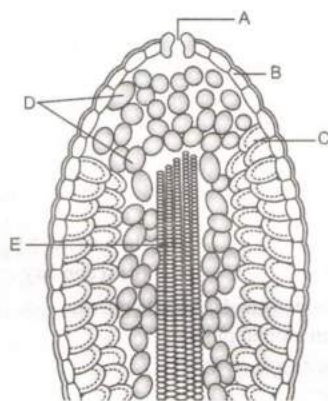
288. From the plants given below, select the monocots having secondary growth in their stem  
 a) Yucca                                      b) Wheat                                      c) Aloe                                      d) Both (a) and (c)
289. Which of the three sub-zones of cortex of dicot stem performs the function of providing mechanical strength to young stem?  
 a) Hypodermis                                      b) Cortical layers                                      c) Endodermis                                      d) Both (a) and (c)
290. Study the following columns and choose the correct combination.

Tissue	Structural Feature	function
1.Collenchyma	Cell walls with high water content	Photosynthesis in young stems
2.Parenchyma	Suberised cell walls	Storage of food
3.Sclerenchyma	Lignified cell walls	Mechanical strength
4.Digestive glands	Dense cytoplasm	Breaking the substrate without water

- a) I and II                                      b) II and III                                      c) I and IV                                      d) I and III
291. The difference in phloem of gymnosperms and angiosperms is due to  
 a) Parenchyma                                      b) Sieve cell                                      c) Companion cell                                      d) Fibers
292. The waxy material deposited in the Casparian strip of the endodermis is  
 a) Pectin                                      b) Suberin                                      c) Cellulose                                      d) Lignin
293. What is/are true about heartwood?  
 I.It does not help in water conduction.  
 II.It is also called alburnum.  
 III.It is dark in colour but very soft.  
 IV.It has tracheary elements, which are filled with tannin, resin, etc.  
 a) II, III and IV                                      b) I and IV                                      c) II and IV                                      d) I, II and III
294. Vascular cambium of stem is  
 a) Partly primary and partly secondary meristem  
 b) Primary meristem  
 c) Secondary meristem  
 d) Intercalary meristem
295. Periderm is made up of  
 I. cork cambium  
 II. cork  
 III. secondary cortex  
 Select the correct combination of options  
 a) I and II                                      b) I and III                                      c) II and III                                      d) I, II and III
296. Casparian strip is found in  
 a) Epidermis                                      b) Pericycle                                      c) Endodermis                                      d) Endothecium
297. I. Peripheral region of the secondary xylem in dicot stem is lighter in colour and known as heart wood  
 II. It is involved in water and mineral conduction  
 Select the correct option from below  
 a) I is correct, but II is incorrect                                      b) I is incorrect, but II is correct  
 c) I and II are correct                                      d) I and II are incorrect



298. Choose the correct combination of labeling of Hydathode.



- a) A-Guard cells            B-Epithem  
C-Mesophyll            D-Epidermis  
E-Vasculature
- b) A- Guard cells            B- Epidermis  
C- Mesophyll            D- Epithem  
E-Vasculature
- c) A-Water pore            B-Epidermis  
C-Mesophyll            D-Epithem  
E-Vasculature
- d) A-Ostiole            B-Epidermis  
C-Mesophyll            D-Epithem  
E-Vasculature

299. Fewer xylary elements that have narrow vessel are found in

- a) Autumn wood            b) Late wood            c) (a) or (b)            d) Both (a) and (b)

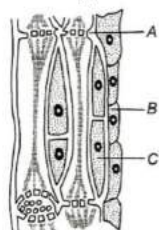
300. The cells without nuclei are present in

- a) Vascular cambium            b) Root hair
- c) Companion cell            d) Members of sieve tube

301. Regulation of flow of fluid both inwardly as well as outwardly is performed by the

- a) Pericycle            b) Endodermis            c) Xylem            d) Phloem

302. In the given diagram of phloem tissue, identify A, B and C



- a) A-Sieve tube cells, B-Xylem parenchyma, C-Companion cell
- b) A-Sieve tube cells, B-Phloem parenchyma, C-Companion cell
- c) A-Sieve pore, B-Xylem parenchyma, C- Companion cell
- d) A-Sieve pore, B-Phloem parenchyma, C-Companion cell

303. Which type of vascular bundles are found in monocot stem?

- a) Collateral, open and endarch            b) Radial, open and diarch
- c) Radial, open and mesarch            d) Collateral, closed and endarch

304. Which of the following is the region of cell division?

- a) Root cap            b) Meristematic region
- c) Root hair zone            d) None of these

305. Vascular cambium in roots takes its origin from  
 a) Pericycle  
 b) Conjunctive parenchyma  
 c) Both (a) and (b)  
 d) None of the above
306. Meristamatic tissue helps in the  
 a) Absorption of water  
 b) Growth of plant  
 c) Absorption of minerals  
 d) Transpiration
307. The phloem of angiosperms differs from that of other vascular plants by the presence of  
 a) Vessels  
 b) Companion cells  
 c) Tylosoides  
 d) Albuminous cells
308. Growth rings are absent or not sharply demarcated in the trees of  
 a) Temperate deciduous  
 b) Tropical evergreen  
 c) Temperate evergreen  
 d) Tropical deciduous
309. Subsidiary cells are the specialised cell in the  
 a) Vicinity of guard cell  
 b) Vicinity of stomatal cell  
 c) Absence of stomatal cell  
 d) Absence of guard cell
310. Axillary bud and terminal bud are derived from the activity of  
 a) Lateral meristem  
 b) Intercalary meristem  
 c) Apical meristem  
 d) Parenchyma
311. Cortex consists of three sub-zones in dicot stem, they are  
 I. hypodermis II. cortical layer  
 III. pericycle IV. endodermis V. epidermis  
 a) All except I and II  
 b) All except II and III  
 c) All except IV and V  
 d) All except III and V
312. Vessels differ from tracheids  
 a) In being living  
 b) In being derived from a single cell  
 c) In having vertical row of cells with crosswalls dissolved  
 d) Because they conduct water
313. Which of the following cells is an epidermal cell containing chloroplast?  
 a) Hydathode  
 b) Stomata  
 c) Guard cell  
 d) None of these
314. Elongation of epidermal cells which helps in the absorption of water and minerals from the soil are called  
 a) Trichomes  
 b) Root hairs  
 c) Emergences  
 d) All of these
315. Old dicot roots differ from dicot stem in  
 a) Absence of cortex  
 b) Absence of primary phloem  
 c) Absence of vascular bundles  
 d) Presence of xylem
316. This is a specialised tissue found in the mesophyll of *Cycas* and *Pinus* leaves.  
 a) Spongy tissue  
 b) Palisade tissue  
 c) Conjunctive tissue  
 d) Transfusion tissue
317. Choose the correct statement  
 a) A group of cell having common origin generally perform common function  
 b) All of the cells in a plant body are capable of dividing  
 c) Permanent tissues have all cells same in function but different in structure  
 d) None of the above
318. Sclerenchyma fibres are  
 a) Thick-walled  
 b) Elongated  
 c) Pointed cells  
 d) All of these
319. Pericycle is present  
 I. Just above the phloem  
 II. on the innerside of endodermis  
 Select the correct option  
 a) I is correct, but II is incorrect  
 b) II is correct, but I is incorrect  
 c) I and II are correct



- d) I and II are incorrect
320. Bicollateral vascular bundles are found in the members of this family  
 a) Malvaceae                      b) Fabaceae                      c) Caesalpiniaceae                      d) Cucurbitaceae
321. The chief function of sieve tube element is to  
 a) Conduct minerals  
 b) Help the plant in forming wood  
 c) Transport water from roots to leaves  
 d) Translocate the organic material from source to sink
322. When cut horizontally both spring and autumn wood appear in concentric rings known as  
 a) Heartwood                      b) Latewood                      c) Sapwood                      d) Annual ring
323. Root cap is not used in water absorption due to  
 a) Presence of epidermis                      b) Presence of endodermis  
 c) Absence of root hairs                      d) Presence of root hairs
324. Epidermis covered with cuticle, bearing trichomes and few stomata is the characteristic feature of  
 a) Root                      b) Dicot stem                      c) Vascular bundle                      d) Monocot stem
325. Border parenchyma or bundle sheath is made up of  
 a) Parenchymatous cell                      b) Sclerenchymatous cell  
 c) Chlorenchymatous cell                      d) All of these
326. Which of the following is not a characteristic feature of bryophytes?  
 a) Dominant gametophytic generation                      b) Filamentous rhizoids  
 c) Amphibious habitat                      d) Vascular tissues
327. Vascular bundles in monocotyledons are considered closed because  
 a) Xylem is surrounded all around by phloem                      b) There are no vessels with perforations  
 c) A bundle sheath surrounds each bundle                      d) There is no secondary growth
328. Primary function of epidermis is  
 a) Photosynthesis                      b) Protection  
 c) Conduction of water and solutes                      d) Mechanical support
329. The number of stomata and epidermal cells in 1 mm<sup>2</sup> leaf area of lower epidermis of the leaves of X, Y and Z plants are given below. Arrange the plants in decreasing order of their stomatal index.

Plant	Number of Stomata	Number of Epidermal Cell
X	30	150
Y	60	240
Z	90	400

- a) X, Y, Z                      b) Y, Z, X                      c) Z, Y, X                      d) Y, X, Z
330. In woody trees, the exchange of gases between the outer atmosphere and the internal tissue of the stem takes place through  
 a) Aerenchyma                      b) Stomata                      c) Pneumatophores                      d) Lenticels
331. Vascular system consists of  
 I. xylem  
 II. phloem  
 III. ground meristem  
 IV. epidermal meristem  
 Select the correct combination from the given options  
 a) I and II                      b) I, II and III                      c) I, II and IV                      d) I, III and IV
332. In dicotyledonous roots, cambium develops in between  
 a) Xylem and cortex                      b) Phloem and meristem  
 c) Xylem and phloem                      d) Two xylem strands
333. In a dicotyledonous stem, the sequence of tissues from the outside to the inside is  
 a) Phellem-pericycle-endodermis-phloem                      b) Phellem-phloem-endodermis-pericycle

- c) Phellem-endodermis-pericycle-phloem                      d) Pericycle-phellem-endodermis-phloem
334. Meristem consists of  
 a) Undivided cells    b) Cells in continuous state of cell divisions  
 c) Dead cells    d) Cells which divide rarely
335. For a critical study of secondary growth in plants, which one of the following pairs is suitable?  
 a) Sugarcane and sunflower                                      b) Teak and pine  
 c) Deodar and fern    d) Wheat and maiden hair fern
336. Cuticle is secreted from  
 a) Epidermis    b) Endodermis    c) Both (a) and (b)    d) Hypodermis
337. I. Parenchyma tissue    II. Collenchyma tissue  
 III. Sclerenchyma tissue  
 Which of the above tissues are found in the ground tissue system?  
 a) I and II    b) II and III    c) I and III    d) I, II and III
338. In the sieve elements, which one of the following is the most likely function of P-proteins?  
 a) Deposition of callose on sieve plates                      b) Providing energy for active translocation  
 c) Autolytic enzymes    d) Sealing mechanism on wounding
339. Example of secondary meristem is  
 a) Fascicular vascular cambium  
 b) Interfascicular cambium  
 c) Cork cambium  
 d) All of the above
340. Mesophyll is well differentiated into palisade and spongy tissue in  
 a) Dicot leaves    b) Monocot leaves    c) Xerophytic stem    d) Hydrophytic stem
341. I. Unicellular hair  
 II. Endodermis with passage cells  
 III. Pith small and inconspicuous  
 IV. Radial vascular bundle  
 V. 2-4 xylem and phloem  
 VI. Cambium ring develops between xylem and phloem  
 The above description refers to which of the following?  
 a) Monocot root    b) Dicot root    c) Monocot stem    d) Dicot stem
342. Vessels are found in  
 a) All angiosperms and some gymnosperms  
 b) Most of the angiosperms and few gymnosperms  
 c) All angiosperms, all gymnosperms and some pteridophytes  
 d) All pteridophytes
343. The outer walls of guard cells (away from stomatal pore) are ...A.... While the inner walls (towards the stomatal pore) are ...B....  
 Choose the correct combination of A and B  
 a) A-thick, B-thin    b) A-thin, B-thick  
 c) A-thin, B-also thin    d) A-thick, B-also thick
344. Intercellular spaces are found in ...A... region. Intercellular spaces are absent in ...B... region. Choose the correct option for A and B  
 a) A-cortex, B-endodermis    b) A-endodermis, B-cortex  
 c) A-endodermis, B-pericycle    d) A-cortex, B-pericycle
345. Quiescent centre is found in plants at  
 a) Root tip    b) Cambium    c) Shoot tip    d) Tip
346. Large number of xylary elements having vessels with wider activity are produced in  
 a) Spring wood    b) Autumn wood    c) Early wood    d) (a) or (c)
347. I. Long tube-like structure, arranged longitudinally and associated with companion cells

II. End wall perforated in a sieve like manner to form sieve plates

Given above two character belong to which attribute of phloem

- a) Sieve tube elements    b) Companion cells    c) Phloem parenchyma    d) Tracheid

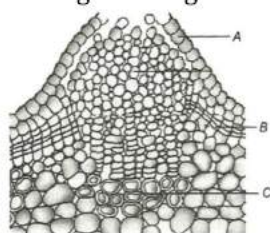
348. Xylem tissue is composed of

- a) Four same kinds of elements    b) Three same kinds of elements  
c) Four different kinds of elements    d) Three different kinds of elements

349. Apical meristem and intercalary meristem are called primary meristem because?

- a) They appear early in plant and contributes to the formation of primary plant body  
b) They make secondary tissue  
c) They make the whole plant body  
d) All of the above

350. In the given diagram of lenticel, label A, B, C in the given option



- a) A-Epidermis, B-Cork cambium, C-Secondary cortex  
b) A-Stomata, B-Cork, Cambium, C-Secondary cortex  
c) A-Stomata, B-Cork cambium, C-Endodermis  
d) A-Epidermis, B-Cork cambium, C-Endodermis

351. I. Cells are living and thin-walled and their cell walls are made up of cellulose

II. They store food material

III. The radial conduction of water in plants takes place by the help of these tissues

Which of the above feature belongs to the xylem parenchyma?

- a) I and II    b) II and III    c) III and I    d) I, II and III

352. The surface area of leaves in monocotyledon plant can be regulated by the help of

- a) Mesophyll cells  
b) Parenchymatous cell  
c) Bulliform cells  
d) Guard cell

353. Desert grasses often roll their leaves due to presence of

- a) Oily surface    b) Bulliform cells    c) Spines    d) None of these

354. I. Long cylindrical tube like structure made up of many cells called vessel members, lignified cell wall and large central cavity

II. Devoid of protoplasm

Above characters belong to which of the following plant elements?

- a) Tracheids    b) Xylem vessel    c) Companion cell    d) Sieve tube

355. Aerating pores are present at places on the cork cambium. These are called

- a) Pneumatophores    b) Hydathodes  
c) Lenticels    d) Stomata

356. The age of tree can't be determined by annual rings if the tree belongs to the

- a) Temperate evergreen    b) Temperate deciduous  
c) Xerophyte condition    d) Tropical forest

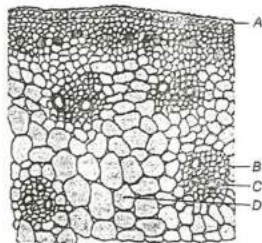
357. Meristematic cells contain more of

- a) Fats    b) Protein    c) Sugar    d) Salts

358. Tyloses thickenings are seen in

- a) Collenchyma    b) Phloem cells  
c) Ray parenchyma only    d) Ray parenchyma and xylem cells

359. Vascular tissue in higher plants develop from which of the following?  
 a) Procambium                      b) Protoderm                      c) Phellogen                      d) Cortex
360. Interfascicular cambium is formed by the joining of  
 a) Medullary rays to xylem cambium  
 b) Medullary rays to intrafascicular cambium  
 c) Medullary rays to lateral fascicular cambium  
 d) Endodermis to intrafascicular cambium
361. I. Primary tissues of plants add length to the roots and shoots  
 II. Secondary tissue of plants adds diameter to the roots and shoots  
 III. Cells of permanent tissue are specialised both structurally and functionally  
 Which of the above statement is/are true?  
 a) All except I                      b) All except II                      c) All except III                      d) I, II and III
362. The size of vascular bundles on the leaflet depends upon the  
 I. leaf margin    II. leaf petiole  
 III. leaf size    IV. leaf venation  
 Select the correct combination of options given below  
 a) I and II                      b) II and III                      c) III and IV                      d) I and IV
363. Interfascicular cambium is a  
 a) Primary meristematic tissue                      b) Primordial meristem  
 c) Type of Protoderm                      d) Secondary Meristematic tissue
364. Duramen is present in  
 a) Inner region of secondary wood                      b) Part of sapwood  
 c) Outer region of secondary wood                      d) Region of pericycle
365. Diffused porous woods are characteristic of plants growing in  
 a) Temperate climate    b) Tropics                      c) Alpine region                      d) Cold winter regions
366. Identify *A* to *D* in the given diagram and choose the correct option



- a) A-Hypodermis, B-Xylem, C-Phloem, D-Ground tissue  
 b) A-Hypodermis, B-Phloem, C-Xylem, D-Ground tissue  
 c) A-Endodermis, B-Phloem, C-Xylem, D-Ground tissue  
 d) A-Endodermis, B-Xylem, C-Phloem, D-Ground tissue
367. Periderm includes  
 I. Phellem  
 II. Phellogen  
 III. Phellogen  
 Select the correct option  
 a) I and II                      b) II and III                      c) III and I                      d) I, II and III
368. Bulliform cells found in  
 a) Seeds of sunflower    b) Leaf of wheat                      c) Pod of pea                      d) Tuber of potato
369. Two cross-sections of stem and root appear simple, when viewed by naked eye. But under microscope, they can be differentiated by  
 a) Exarch condition of root and stem  
 b) Endarch condition of stem and root  
 c) Endarch condition of root and exarch condition of stem

- d) Endarch condition of stem and exarch condition of root
370. The beneficial use of epidermal layer is  
 a) Bast fibre                      b) Mesocarp                      c) Cotton fibre                      d) Jute
371. Axillary bud originates from  
 a) Meristem    b) Shoot apical meristem  
 c) Root apical meristem                              d) Secondary meristem
372. Palisade parenchyma and spongy parenchyma are found in  
 a) Epidermis of leaves                              b) Vascular system of leaves  
 c) Mesophyll of leaves                              d) Endodermis of leaves
373. The length of different internodes in a culm of sugarcane is variable because of  
 a) Shoot apical meristem  
 b) Position of axillary buds  
 c) Size of leaf lamina at the node below each internode  
 d) Intercalary meristem
374. Which of the following cell do not respire?  
 a) Epidermal cell                      b) Cork cell                      c) RBC                      d) Sieve tube cell
375. Outer most layer of primary plant body is  
 a) Endodermis                      b) Epidermis                      c) Mesodermis                      d) Pericycle
376. Viral infection is usually absent in  
 a) Phloem cells                      b) Xylem cells                      c) Pith cells                      d) Apical meristem
377. The most abundant tissues in plants are  
 a) Meristematic tissues                              b) Parenchyma tissues  
 c) Collenchyma tissues                              d) Sclerenchyma tissues
378. In which of the following organs, growth is sub-apical?  
 a) Root                      b) Shoot                      c) Petiole                      d) Pedicel
379. Which of the following characters belong to sclerenchyma?  
 I. Consists of long narrow cells with thick lignified cell walls  
 II. Having few or numerous pits  
 III. They are usually dead and without protoplasts  
 a) I and II                      b) II and III                      c) I and III                      d) I, II and III
380. Amphicribal vascular bundle is vascular bundle in which the  
 a) Xylem is surrounded by phloem  
 b) Phloem is surrounded by xylem  
 c) Phloem is surrounded by xylem laterally  
 d) Xylem is surrounded by phloem laterally
381. The ...A... cells are specialised parenchymatous cells, which are closely associated with sieve tube elements. The sieve tube elements and ...B... cell are connected by pit fields presents between their common ...C... walls.  
 Choose the correct combination of A, B and C from the options given below  
 a) A-companion, B-companion, C-longitudinal  
 b) A-vessels, B-companion, C-longitudinal  
 c) A-tracheid, B-companion, C-lateral  
 d) A-companion, B-companion, C-lateral
382. Exarch and polyarch xylem strands are found in  
 a) Monocot stem                      b) Dicot stem                      c) Monocot root                      d) Dicot root
383. The chief water conducting elements of xylem in gymnosperms are  
 a) Vessels                      b) Fibres                      c) Transfusion tissue                      d) Tracheids
384. Choose the incorrect statement  
 a) Medullary rays connects the pith with pericycle and cortex                      b) Medullary rays make intimate contact with the conducting cells of both phloem and xylem

- c) Medullary rays help in radial conduction                      d) None of the above
385. I. Elongated or tube like cell with thick and lignified walls and tapering ends  
 II. These are dead and without the protoplasm  
 III. The inner layers of cell walls have thickening which vary in form  
 The above mentioned characters belong to which of the following plant structure?  
 a) Tracheids                      b) Xylem parenchyma                      c) Companion cells                      d) Sieve tube element
386. The first formed primary phloem is referred as ...A... The later formed primary phloem is referred as ...B...  
 Choose the correct combination of A and B  
 a) A–protoxylem; B–metaxylem                      b) A–protophloem; B–sieve tube cells  
 c) A–metaphloem; B–sieve tube cells                      d) A–protophloem; B–metaphloem
387. Identify the type of plant tissue being represented by the set of statements given below  
 I. Their cells are isodiametric (they may be spherical, oval, round, etc.)  
 II. Their cell walls are thin and made up of cellulose  
 III. They may either be closely packed or have small intercellular spaces  
 IV. They perform functions like photosynthesis, storage, secretion, etc.  
 a) Sclerenchyma                      b) Parenchyma                      c) Collenchyma                      d) Meristem
388. Cuticle is absent in which part of plant?  
 a) Leaves                      b) Root                      c) Stem                      d) Pneumatophores
389. A common structural feature of vessel elements and sieve tube elements is  
 a) Thick secondary walls                      b) Pores on lateral walls  
 c) Presence of P-proteins                      d) Eucleate condition
390. Velamen tissue is found in  
 a) Mesophytes                      b) Epiphytes                      c) Hydrophytes                      d) Xerophytes
391. I. Made up of elongated, tapering cylindrical cells which have dense cytoplasm and nucleus  
 II. Cell wall composed of cellulose  
 III. Stores food materials  
 The above mentioned characters belong to which attribute of phloem?  
 a) Sieve tube elements                      b) Companion cell  
 c) Phloem parenchyma                      d) Phloem fibre
392. Kranz anatomy is found in  
 a) Dicotyledonous leaves                      b) Monocotyledonous leaves  
 c) Both (b) and (d)                      d) Isobilateral leaves
393. The phloem fibres of which of the following plant is/are used commercially?  
 I. Jute    II. Flax    III. Hemp  
 Select the correct option  
 a) I and II                      b) II and III                      c) III and IV                      d) I, II and III
394. In any dicot root having secondary growth, the cork is the  
 a) Outer to endodermis and inner to primary cortex  
 b) Inner to endodermis and external to primary phloem  
 c) Inner to endodermis and external to primary xylem  
 d) Outer to endodermis and external to primary phloem
395. The cells without nuclei are present in  
 a) Vascular cambium                      b) Root hair  
 c) Companion cell                      d) Members of sieve tube
396. On the basis of variation in form, structure, origin and development, sclerenchyma may be  
 a) Fibres                      b) Sclereids                      c) Either (a) or (b)                      d) Both (a) and (b)
397. Which statements are correct about guard cells?  
 I. They are modified ground tissue  
 II. They are chlorophyllous  
 III. Its outer wall is thin and inner wall is highly thickened



- IV. They regulate stomatal movement for transpiration and gaseous exchange
- a) All except I                      b) All except II                      c) All except III                      d) All except IV
398. Fibres associated with phloem are.....fibres.
- a) Hard                                  b) Wood                                  c) Surface                                  d) Bast
399. Consider the following statements.
- I. In a dicot root, the vascular bundles are collateral and endarch.  
 II. The innermost layer of cortex in a dicot root is endodermis.  
 III. In a dicot root, the phloem masses are separated from the xylem by parenchymatous cells that are known as the conjunctive tissue.
- a) I is true, but II and III are false                                  b) II is true, but I and III are false  
 c) I is false, but II and III are true                                  d) III is false, but I and III are true
400. First formed primary xylem elements are called ...A... . Later formed primary xylem elements are called ...B....
- A and B in the above statement refers to
- a) A-metaxylem; B-protaxylem                                  b) A-protaxylem; B-metaxylem  
 c) A- protophloem; B-metaphloem                                  d) A-metaphloem; B-protophloem
401. Periderm includes
- a) Phellem, phelloderm, plerome                                  b) Phellem, phellogen, dermatogen  
 c) Phellem, phellogen, phelloderm                                  d) Phellem, phellogen, cortex
402. Gymnosperms lack which of the following structure?
- a) Tracheids                                  b) Vessels                                  c) Xylem                                  d) Phloem
403. A branch or a flower develops in the axil of the leaves by the activity of
- a) Axillary bud                                  b) Apical bud                                  c) Apical meristem                                  d) Tissue
404. During secondary growth of plants, stem phellogen cuts off cells on both sides. The outer cells gets differentiated into ...A... and the inner cells gets differentiated into ...B... cortex
- Choose the correct combination of A and B with reference to above statement
- a) A-cork; B-phellem                                  b) A-secondary cortex; B-phelloderm  
 c) A-secondary cortex; B-primary cortex                                  d) A-cork/phellem; B-secondary cortex
405. Vascular system includes ...A... bundles, which can be seen in the veins and the ...B... . The size of vascular bundles are dependent on the size of ...C... . The veins vary in thickness in the reticulate venation of the ...D... leaves
- Choose the correct combination of A to D
- a) A-phloem, B-midrib, C-veins, D-dicot                                  b) A-xylem, B-midrib, C-veins, D-dicot  
 c) A-vascular, B-midrib, C-veins, D-dicot                                  d) A-vascular, B-midrib, C-veins, D-monocot
406. Estimation of the age of the tree is done by
- a) Counting the epidermal rings                                  b) Measuring the pith diameter  
 c) Counting the annual rings                                  d) Counting the late woods only
407. Meristematic cells have
- a) Thick cell wall and large intercellular spaces                                  b) Thick cell wall and no intercellular spaces  
 c) Thin cell wall and large intercellular spaces                                  d) Thin cell wall and no intercellular spaces
408. Which combination of tissues acts together to provide the support to the hypocotyl of a seedling
- a) Epidermis and collenchyma                                  b) Xylem and parenchyma  
 c) Epidermis and parenchyma                                  d) Xylem and phloem fibres
409. Sclereids are commonly found in the
- I. fruits wall of nuts  
 II. pulp of fruit like guava and pear  
 III. seed coat of legumes  
 IV. micropile of pea
- Select the correct combination
- a) All except I                                  b) All except II                                  c) All except III                                  d) All except IV

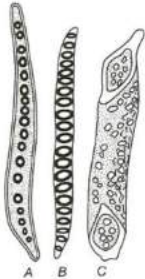
410. The cells of the endodermis are rich in ...A... grains and layer is referred to as ...B... sheath. Select the correct combination of A and B from the options given below

- a) A-protein; B-protein  
 b) A-fat; B-lipid  
 c) A-starch; B-carbohydrate  
 d) A-starch; B-starch

411. Identify from the following, a plant tissue in which lignin does not occur in the cell walls?

- a) Collenchyma  
 b) Sclerenchyma fibres  
 c) Sclereids  
 d) Xylem tracheae

412. Identify A, B and C the given diagram



- a) A-Tracheid, B-Vessels, C-Vessels  
 b) A-Vessels, B-Tracheid, C-Companion cell  
 c) A-Companion cell, B-Vessels, C-Tracheid  
 d) A-Xylem fibre, B-Vessels, C-Vessels

413. Which is true for Meristematic tissue?

- a) Their cells have dense cytoplasm and prominent nuclei  
 b) Their cells are dead with large intercellular spaces  
 c) These are usually modified for storage  
 d) Their cells are most primitive, living and without nuclei

414. A tree grows 5 cm per year. What will be the height of a board fixed 10 cm above the base after 10 years?

- a) 50 cm  
 b) 60 cm  
 c) 10 cm  
 d) 70 cm

415. I. Found only in sporophytic phase of life cycle

II. May contain enzymes that are biologically active

III. Often contain strengthening polymers

Select the correct option for cell wall

- a) All are correct except I  
 b) All are correct except II  
 c) All are correct except III  
 d) All are correct

416. Motor cells are found in

- a) Monocot leaf  
 b) Upper epidermis of monocot leaf  
 c) Brain  
 d) Spinal cord

417. Vascular bundle without cambium is called

- a) Closed vascular bundle  
 b) Open vascular bundle  
 c) Radial vascular bundle  
 d) Conjoint vascular bundle

418. Specialised regions of plants having active cell division are called

- a) Tissues  
 b) Organs  
 c) Meristems  
 d) All of these

419. I. During secondary growth, a complete ring is formed by vascular cambium

II. Interfascicular cambium originates from medullary ray cells

III. Vascular cambium form xylem on the inside and phloem on the outside due to differential action of hormones

Select the correct combination of option

- a) I and II are correct  
 b) II and III are correct  
 c) I and III are correct  
 d) I, II and III

420. In the following, how the sapwood is converted into heartwood?

- a) By degeneration of protoplast of living cells      b) Tylosis formation  
 c) By deposition of resins, oils, gums, etc      d) All of the above
421. Sequence of cellular layers from the periphery towards the cortex in an old dicot stem is  
 a) Epidermis, hypodermis, phellogen, phellogen      b) Epidermis, phellogen, phellem, epidermis  
 c) Epidermis, hypodermis, cortex, endodermis      d) Epidermis, phellem, phellogen, phellogen
422. I. Dicotyledon leaf is also called isobilateral leaf  
 II. Monocotyledon leaf is also called dorsoventral leaf  
 Select the correct option from the options given below  
 a) I and II are correct  
 b) I is correct, but II is incorrect  
 c) II is incorrect, but I is correct  
 d) I and II are incorrect
423. Which of the following statements are not true?  
 I. Cork cambium is otherwise called phellogen.  
 II. Cork is otherwise called phellem.  
 III. Secondary cortex is otherwise called periderm.  
 IV. Cork cambium, cork and secondary cortex are collectively called phellogen  
 a) III and IV      b) I and II      c) II and III      d) II and IV
424. In leaves, the ground tissues consists of  
 a) Epidermis      b) Vascular tissue      c) Mesophyll cells      d) Medullary rays
425. Phloem conducts food by  
 a) Perforated sieve plates      b) Bast fibres  
 c) Xylem parenchyma      d) Xylem fibres
426. Continuous ring of cambium is formed by  
 a) Intrafascicular cambium      b) Interfascicular cambium  
 c) Lateral meristem      d) Both (a) and (b)
427. Ground tissue does not include  
 I. epidermis  
 II. vascular bundle  
 III. sclerenchyma  
 IV. collenchyma  
 V. parenchyma  
 Select the right combination from the above given options  
 a) I and II      b) III and IV      c) I and V      d) I and IV
428. Identify the correct order of the components with reference to their arrangement from outer side to inner side in a woody dicot stem.  
 I. Secondary cortex  
 II. Autumn wood  
 III. Secondary phloem  
 IV. Phellem  
 a) II, III, I and IV      b) III, IV, II, and I      c) IV, I, III and II      d) I, II, IV and III
429. In which of the following, there is no differentiation of bark, sapwood and heartwood?  
 a) Ashok      b) Neem      c) Mango      d) Datepalm
430. ...A... are structures present in the epidermis of leaves. They regulate process of transpiration and ...B... exchange. It is composed of two bean-shaped cells known as ...C... cells.  
 Choose the correct combination of A, B and C from the following options  
 a) A–Stomata, B–gaseous, C–guard      b) A–Stomata, B–gaseous, C–subsidiary  
 c) A–Stomata, B–water, C–subsidiary      d) A–Stomata, B–water, C–guard

# ANATOMY OF FLOWERING PLANTS

## : ANSWER KEY :

1)	c	2)	c	3)	a	4)	b	161)	d	162)	d	163)	a	164)	a
5)	a	6)	a	7)	d	8)	a	165)	a	166)	a	167)	c	168)	a
9)	b	10)	a	11)	b	12)	d	169)	a	170)	b	171)	d	172)	b
13)	b	14)	c	15)	b	16)	a	173)	b	174)	a	175)	b	176)	a
17)	d	18)	d	19)	b	20)	d	177)	b	178)	a	179)	d	180)	b
21)	a	22)	d	23)	d	24)	a	181)	c	182)	a	183)	b	184)	a
25)	d	26)	c	27)	c	28)	a	185)	b	186)	d	187)	d	188)	a
29)	d	30)	d	31)	d	32)	c	189)	c	190)	c	191)	d	192)	d
33)	d	34)	a	35)	d	36)	d	193)	d	194)	c	195)	d	196)	b
37)	d	38)	d	39)	d	40)	b	197)	d	198)	c	199)	d	200)	c
41)	b	42)	d	43)	b	44)	c	201)	c	202)	b	203)	d	204)	d
45)	b	46)	a	47)	d	48)	a	205)	b	206)	a	207)	c	208)	c
49)	c	50)	c	51)	d	52)	a	209)	b	210)	a	211)	a	212)	d
53)	a	54)	d	55)	b	56)	a	213)	a	214)	c	215)	b	216)	b
57)	b	58)	c	59)	a	60)	a	217)	b	218)	c	219)	b	220)	b
61)	c	62)	d	63)	b	64)	b	221)	b	222)	b	223)	c	224)	c
65)	a	66)	a	67)	a	68)	a	225)	a	226)	b	227)	b	228)	b
69)	a	70)	d	71)	a	72)	c	229)	c	230)	b	231)	b	232)	a
73)	d	74)	c	75)	a	76)	b	233)	c	234)	d	235)	c	236)	b
77)	c	78)	b	79)	d	80)	d	237)	b	238)	c	239)	d	240)	a
81)	d	82)	d	83)	a	84)	c	241)	a	242)	a	243)	d	244)	d
85)	a	86)	a	87)	c	88)	b	245)	c	246)	c	247)	b	248)	d
89)	b	90)	c	91)	d	92)	b	249)	a	250)	d	251)	c	252)	d
93)	c	94)	d	95)	b	96)	a	253)	c	254)	d	255)	a	256)	b
97)	b	98)	c	99)	d	100)	b	257)	b	258)	a	259)	b	260)	c
101)	d	102)	d	103)	b	104)	b	261)	a	262)	a	263)	c	264)	a
105)	b	106)	d	107)	a	108)	b	265)	c	266)	b	267)	a	268)	c
109)	d	110)	d	111)	d	112)	a	269)	c	270)	d	271)	a	272)	a
113)	a	114)	d	115)	b	116)	a	273)	a	274)	c	275)	d	276)	a
117)	c	118)	b	119)	c	120)	b	277)	b	278)	c	279)	a	280)	a
121)	d	122)	b	123)	c	124)	b	281)	d	282)	a	283)	a	284)	d
125)	b	126)	d	127)	a	128)	c	285)	b	286)	b	287)	d	288)	d
129)	b	130)	b	131)	b	132)	a	289)	a	290)	d	291)	c	292)	b
133)	b	134)	d	135)	b	136)	d	293)	b	294)	a	295)	d	296)	c
137)	c	138)	a	139)	c	140)	a	297)	d	298)	c	299)	c	300)	d
141)	b	142)	d	143)	c	144)	d	301)	b	302)	d	303)	d	304)	b
145)	a	146)	d	147)	a	148)	b	305)	c	306)	a	307)	b	308)	b
149)	a	150)	a	151)	a	152)	b	309)	a	310)	c	311)	d	312)	c
153)	c	154)	c	155)	a	156)	b	313)	c	314)	b	315)	b	316)	d
157)	c	158)	c	159)	d	160)	b	317)	a	318)	d	319)	c	320)	d



321) d	322) d	323) c	324) b	381) a	382) c	383) d	384) d
325) c	326) d	327) d	328) b	385) a	386) d	387) b	388) b
329) b	330) d	331) a	332) c	389) b	390) b	391) a	392) c
333) c	334) b	335) b	336) a	393) d	394) b	395) d	396) c
337) d	338) d	339) a	340) a	397) a	398) d	399) c	400) b
341) b	342) b	343) b	344) a	401) c	402) b	403) c	404) d
345) a	346) d	347) a	348) c	405) c	406) c	407) d	408) a
349) a	350) a	351) d	352) c	409) d	410) d	411) a	412) d
353) b	354) b	355) c	356) d	413) a	414) c	415) b	416) b
357) d	358) d	359) a	360) b	417) a	418) c	419) b	420) d
361) d	362) c	363) d	364) a	421) c	422) d	423) a	424) c
365) b	366) b	367) d	368) b	425) a	426) d	427) a	428) c
369) d	370) c	371) b	372) c	429) d	430) a		
373) d	374) b	375) b	376) d				
377) b	378) a	379) d	380) a				



# ANATOMY OF FLOWERING PLANTS

## : HINTS AND SOLUTIONS :

1 (c)  
Cambium is generally more active on the inner side than the outer. As a result the amount of secondary xylem produced is more than the secondary phloem and soon form a compact mass

2 (c)  
**Lateral Meristem** The meristem occurs on the sides and take part in increasing girth of the plant. Only one type of primary lateral meristem is found in plants. It is intrafascicular cambium. The cambium lies in vascular bundles of dicot and gymnosperm stem in between phloem and xylem

3 (a)  
The pith or medulla forms the central region of the stem and root. Usually, the pith of dicot stem is largely parenchymatous. It is devoid of chlorophyll in the mature state. The pith is not distinguishable in the mature state. The pith is not distinguishable in monocot stems.

4 (b)  
As growth begins, the cells of medullary rays, which lie in between vascular bundles become active and rise to cambial strip called interfascicular cambium constitute cambium.

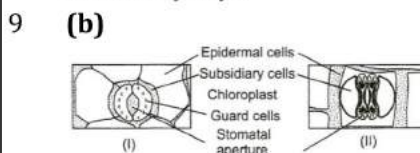
5 (a)  
Tissue is a group of cells performing a particular function. Tissue are mainly of two types  
(i) **Meristematic tissues** These tissues contain immature and young cells that are much active and capable of showing continuous divisions and redivisions. They may be promeristem, primary meristem, secondary meristem, apical meristem, intercalary meristem and lateral meristem.  
(ii) **Permanent tissues** These are made up of mature cells, which have lost the capacity to divide and have attained a permanent shape, size and function, e.g., simple (parenchyma, collenchyma, sclerenchyma), complex (xylem, phloem) and secretory tissue.

6 (a)

Secondary growth increases the girth not length of the plant. Length of the plant increases by apical meristem

7 (d)  
Cork prevents the loss of water by evaporation. It also protects the interior against the entry of harmful microorganisms, mechanical injury and extremes of temperature. Cork is light, compressible, non-reactive and sufficiently resistant to fire. It is used as stopper for bottles, shock absorption and insulation

8 (a)  
**Dicot stem** In between the vascular bundles, there are few layers of radially placed parenchymatous cells. These parenchymatous cells are called medullary rays



**Diagram (I)** Represents the dicotyledon plant because having bean-shaped guard cells

**Diagram (II)** Represents the monocotyledon plant because of having dumb-bell shaped guard cells

10 (a)  
Bast or phloem fibers are present in pericycle (e.g., *Corchorus capsularis* (jute), *Hibiscus cannabinus* (patsan), *Crotalaria juncea* (sunhemp)). These fibres are also known as extraxylary fibers.

11 (b)  
**Vascular Cambium**  
The meristematic layer that is responsible for cutting off vascular tissues (xylem and phloem) is called vascular cambium. In the young stem. It is present in patches as a single layer between the xylem and phloem. Later, it forms a complete ring

12 (d)  
The secondary phloem is made up of sieve tubes, companion cells and phloem parenchyma.

- Sclerenchyma fibres are rare. The secondary xylem is formed of vessels, tracheids and xylem parenchyma
- 13 **(b)**  
Hypodermis in the stem of *Cucurbita* is made up of angular collenchyma. Hypodermis is two or three-layered or sometimes altogether absent. The vascular bundles are conjoint, open and bicollateral, *i.e.*, phloem is present on both side of xylem.
- 14 **(c)**  
The innermost layer of cortex is called endodermis. It comprises a single layer of barrel-shaped cells without any intercellular spaces. The tangential as well as radial walls of the endodermal cells have a deposition of water impermeable, waxy material called suberin in the form of casparian strips
- 15 **(b)**  
The isobilateral monocot leaves usually do not show a distinction into petiole and lamina. The leaf base is commonly sheathing, that is covering the stem partially or completely. The venation is parallel. Amphistomatic leaf have stomata on both the surface
- 16 **(a)**  
Cell wall in a plant cell is found in both the phases, *i.e.*, sporophytic and gametophytic.
- 17 **(d)**  
The 'ring' arrangement of vascular bundles is a characteristic of dicot stem. Each vascular bundle is conjoint, open and with endarch protoxylem
- 18 **(d)**  
Both apical meristem and intercalary meristem are primary meristems because they appear early in life of plants and contributes to the formation of primary plant body
- 19 **(b)**  
Collenchyma.  
The **collenchyma** occurs in layers below the epidermis in dicotyledonous plants. It is found either as a homogenous layer or in patches. It consists of cells which are much thickened at the corners due to the deposition of cellulose, hemicellulose and pectin. Collenchymatous cells may be oval, spherical or polygonal and often contain chloroplasts. These cells assimilate food when they contain chloroplasts. Intercellular spaces are absent. They provide mechanical support to the growing parts of the plant such as young stem and petiole of a leaf
- 20 **(d)**  
Lateral meristems occur laterally in the axis, parallel to the sides of stems and roots. This meristem consists of initials, which divide mainly in one plane (periclinal) and results in increase in the diameter of an organ, *e.g.*, cambium of vascular bundles (fascicular, interfascicular and extrastelar cambium), cork cambium or phellogen.
- 21 **(a)**  
**Medullary or pith rays** They are the radial strips of parenchyma which are present between adjacent vascular bundles. The medullary rays connects the pith with pericycle and cork
- 22 **(d)**  
Due to the absence of vascular cambium the monocots don't show secondary growth
- 23 **(d)**  
Both (b) and (c).  
When xylem and phloem within a vascular bundle are arranged in an alternate manner on different radii, the arrangement is called radial, such as in roots. In conjoint type of vascular bundles, the xylem and phloem are situated at the same radius of vascular bundles. Such vascular bundles are common in stems and leaves. The conjoint vascular bundles usually have the phloem located only on the outer side of xylem
- 24 **(a)**  
The periderm consists of phellem (cork), phellogen (cork cambium) and phelloderm. The Phellogen develops in the epidermis, the cortex, the phloem or the root pericycle and produces phellem towards the outside and phelloderm towards the inside.
- 25 **(d)**  
When the xylem is differentiated from the point of origin towards outside (*i.e.*, periphery of axis), it is known as centrifugal xylem. In such cases as represented by stems, the protoxylem is situated towards inside and the metaxylem towards outside. This type of condition of xylem is called endarch.
- 26 **(c)**  
**Root Apical Meristem** It is found at the tip of the main root and its branches. In case of tap root system, the root apical meristem is formed from radicle part of the embryo or its derivatives. In

- adventitious root, the root apical meristem is produced from the derivatives of shoot apex
- 27 **(c)**  
Usually, epidermis consists of single layer of epidermal cells (*i.e.*, uniseriate). But in case of *Nerium*, multiple epidermis is found with thick-walled epidermal cells.
- 28 **(a)**  
The primary growth in plants occur as a result of activity of the apical meristem, which helps in the elongation of roots with the help of root apical meristem and elongation of stem with shoot apical meristem. Dry growth is exhibited by the presence of vascular cambium
- 29 **(d)**  
Study of internal structure of plants is called anatomy. Plants have cells as the basic unit, cells are organised into tissues and in turn the tissues are organised into organs
- 30 **(d)**  
In monocotyledon, the vascular bundles are scattered throughout the ground tissue. They are conjoint and closed (not having vascular cambium)
- 31 **(d)**  
The primary xylem is in the centre of the stem, while primary phloem is pushed outward and crushed into the cortex by the significant activity of vascular cambium. While the secondary phloem differentiates from the cells that divide towards the outside of the stem
- 32 **(c)**  
In the meristematic cells, there is no reserve food materials like fat, protein and sugar. So, salts or inorganic material have more concentration than any other cells
- 33 **(d)**  
Inbreeding is mating between individuals related by descent or ancestry. Inbreeding depression is the reduction or loss in vigour and fertility as a result of inbreeding. Detailed information on inbreeding in maize was published independently by **East** and **Shull**. Maize is a monocot plant. Bundle sheath in leaf and medulla in roots are present in maize.
- 34 **(a)**  
In the leaf of flowering plants, the phloem is always found towards the lower side (abaxial) and xylem towards the upper (adaxial) side.
- 35 **(d)**
- The inner, darker and harder portion of secondary xylem that cannot conduct water, in an older dicot stem is known as heartwood or duramen, whereas the outer, functional, water conducting, younger secondary xylem constitute the sap-wood or alburnum.
- 36 **(d)**  
The cells arranged in multiple layer between epidermis and pericycle constitutes the cortex (dicot stem)  
*It consists of three zones*  
(i) Hypodermis  
(ii) Cortical layer  
(iii) Endodermis
- 37 **(d)**  
Stone cells provide the hardness to seed coats.
- 38 **(d)**  
**Epidermis** Epidermis is the outermost protective layer of plant organs. It is usually simple layered but in the leaves of tropical plants (*e. g.*, oleander, banyan) and velamen of some roots, the epidermis is more than one layer thickness. The epidermal tissue system is derived from the protoderm
- 39 **(d)**  
Both (a) and (b).  
The activity of cambium is under the control of many physiological and environmental factors. In temperate regions, the climatic conditions are not uniform through the year. In the spring season, cambium is very active and produces a large number of xylary elements having vessels with wider cavities. The wood formed during this season is called spring wood or early wood
- 40 **(b)**  
Bark refers to a number of tissue types *viz.*, periderm and secondary phloem
- 41 **(b)**  
Next to the endodermis lies a few layers thick-walled parenchymatous cells referred to as pericycle. Initiation of lateral roots and vascular cambium during secondary growth takes place in these cells
- 42 **(d)**  
In the upper epidermis of monocots (*e. g.*, wheat, maize, cereals, grasses), there are some large cells found in groups which are known as motor cells or bulliform cells. These cells help in rolling of leaves in dry conditions
- 43 **(b)**



- Companion cells are present between the sieve tubes in the phloem of angiosperms. There are living cells with a large nucleus that controls the activity of non-nucleated sieve tubes
- 44 (c) The vascular bundles, in which xylem and phloem occur as separate bundles are known as radial vascular bundles, *eg*, root.
- 45 (b) In old trees, the greater part of secondary xylem is dark brown due to the deposition of organic compounds like tanins, resins, oils, gums, aromatic substances and essential oils in the central or innermost layers of the stem. These substances make it hard, durable and resistant to the attacks of microorganisms and insects. The region comprises dead elements with highly lignified walls and is called heart wood
- 46 (a) The parenchymatous cells which lies between the xylem and the phloem are called conjunctive tissue
- 47 (d) I, II and III.  
The monocot stem has a sclerenchymatous hypodermis, a large number of scattered vascular bundles, each surrounded by a sclerenchymatous bundle sheath, and a large, conspicuous parenchymatous ground tissue. Vascular bundles are conjoint and closed. Peripheral vascular bundles are generally smaller than the centrally located ones. The phloem parenchyma is absent and water-containing cavities are present within the vascular bundles
- 48 (a) The activity of cambium is under the control of many physiological and environmental factors. In temperate regions, the climatic conditions are not uniform through the year. In the spring season, cambium is very active and produces a large number of xylary elements having vessels with wider cavities. The wood formed during this season is called spring wood or early wood
- 49 (c) The meristem that occurs in both roots and shoots and produce the woody axis and appear later than the primary meristem are called the **secondary meristem**
- 50 (c) Secondary growth is the growth in girth of stem and roots. Anamolous or abnormal secondary growth is found in some monocot stems such as *Yucca, Dracaena, Aloe, Agave*, etc.
- 51 (d) Vessels are absent in some angiosperms *eg*, *Drimys*. This is a homoxylous angiosperm.
- 52 (a) In monocot stem, vascular bundles are conjoint, collateral and closed.
- 53 (a) *Sorghum* (family-Poaceae) is a monocot plant. The leaves of monocot do not contain palisade parenchyma, because the mesophyll of monocot leaf is not differentiated into palisade and spongy parenchyma, all being thin-walled, chlorophyllous and irregularly compactly arranged with fewer intercellular spaces.
- 54 (d) **Schmidt** (1924) proposed tunica-carpus theory, which states the presence of two distinct zones in angiospermic shoot apices. The peripheral zone is called tunica and the inner core of cells called corpus surrounded by tunica.
- 55 (b) Sapwood is also known as alburnum. It is the outward or peripheral wood of the plant, consisting of living cells and is light in colour and weight. Alburnum represents the functional part of secondary xylem (wood), where tracheids and vessels are not plugged by tyloses and secondary metabolites are not deposited in tracheary elements.
- 56 (a) The root apical meristem occupies the tip of root, while shoot apical meristem occupies region of stem apex
- 57 (b) **Vascular system** includes vascular bundles, which can be seen in the veins and the midrib. The size of the vascular bundles are dependent on the size of the veins. The veins vary in thickness in the reticulate venation of the dicot leaves. The vascular bundles are surrounded by a layer of thick walled bundle sheath cells
- 58 (c) The meristem, which lies between the regions of permanent tissues is called **intercalary meristem**. Intercalary maristem is a primary meristem.
- 59 (a) Lenticels.

- At certain regions, the phellogen cuts off closely arranged parenchymatous cells on the outer side instead of cork cells. These parenchymatous cells soon rupture the epidermis, forming a lens-shaped openings called lenticels. Lenticels permit the exchange of gases between the outer atmosphere and the internal tissue of the stem. These occur in most woody trees
- 60 (a) After three years, the nail will be one metre above the soil because plants show only apical growth. Only tip of tree will grow, lower part of tree will remain constant.
- 61 (c) In dicot stems, the cells of cambium present between primary xylem and primary phloem are intrafascicular cambium. The cells of medullary cells, adjoining these intrafascicular cambium becomes meristematic and form the interfascicular cambium. Thus, a continuous ring of cambium is formed
- 62 (d) In dicotyledonous roots, initiation of lateral roots and vascular cambium during the secondary growth take place in pericycle cells.
- 63 (b) Root stem transition occurs in hypocotyl region of axis.
- 64 (b) Monocots have **atactostele**, in which vascular bundles are arranged into more than one ring and they are usually found at the centre of stem.
- 65 (a) The leaves of dicot plants are anatomically differentiated into epidermis, mesophyll tissue and vascular bundles. Mesophyll tissue is divided into upper **palisade tissue**, consisting of closely arranged cells with **numerous chloroplasts** and **lower spongy tissue**, which consists of loosely arranged cells separated by large air spaces. The cells of spongy tissue have fewer chloroplasts, hence most of the photosynthesis occur in palisade tissue.
- 66 (a) All tissues except epidermis and vascular bundles constitute the ground tissue or fundamental tissue. It consists of simple tissues such as parenchyma, collenchyma and sclerenchyma. Ground tissue includes cortex, pericycle, medullary rays. In leaves the ground tissue consists of mesophyll.
- 67 (a) In monocotyledons, the vascular bundles have no cambium present in them. Hence, they don't form secondary tissue and referred to as closed vascular bundles. Generally, monocotyledons have the closed vascular bundles
- 68 (a) Sieve tubes are elongated tubular conducting channels of phloem. Each sieve tube is formed of several cells called **sieve tube members, sieve tube cells or sieve elements**. Sieve tube members are placed end to end. The end walls are generally bulged out. They may be transverse or oblique. They have many small pores or sieve pits. Each sieve pore is lined by a layer of **callose**. Due to the presence of sieve pits. The end walls are commonly called **sieve plates**
- 69 (a) **Exarch** It is the condition of vascular bundles in which the protoxylem (earlier formed xylem) lies toward the outside and metaxylem (later formed xylem) lies toward inward
- Endarch** It is the condition of vascular bundles in which the protoxylem (earlier formed xylem) lies toward the inner side and metaxylem (later formed xylem) lies outside
- 70 (d) All except IV. Epidermal cells are elongated compactly arranged and form continuous layer called epidermis. Stomata are present in epidermis of leaves and regulate process of transpiration and gaseous exchange. The epidermal hairs, i.e., root hairs, unicellular elongations and trichomes, multicellular elongation of epidermis on root and shoot helps in absorbing water and preventing water loss, respectively. All of these. The outside of the epidermis is often covered with waxy thick layer called cuticle, which prevents the loss of water. Cuticle is absent in roots. In grasses (monocotyledons), the guard cells are dumb-bell shaped and in dicotyledonous (bean, castor, pea), the guard cells are bean or kidney-shaped
- 71 (a)

- In dicot root, the vascular cambium is completely secondary in origin. It originates from the tissue located just below the phloem bundles, *i.e.*, portion of pericycle tissue
- 72 **(c)**  
In the formation, the heart wood and sap wood, it is not necessarily that the wood formed in previous years is darker than newer wood
- 73 **(d)**  
Under extremely dry conditions, the cuticle is reinforced by a layer of wax. This wax checks the excessive loss of water from the epidermal layer. The epidermis of aerial parts usually bears a number of minute pores called stomata. Each stomata performs the gaseous exchange in plants. Ground tissue system of leaves is called mesophyll. Mesophyll is made up of two types of photosynthetic cells, palisade and spongy
- 74 **(c)**  
Vessel is a long cylindrical tube-like structure made up of many cells called vessel members, each with lignified walls and a large central cavity. The vessel cells are also devoid of protoplasm. Vessel members are interconnected through perforations in their common walls. The presence of vessels is a characteristic feature of angiosperms
- 75 **(a)**  
The anatomy of the monocot root is similar to the dicot root in many respects. It has epidermis, cortex, endodermis, pericycle, vascular bundles and pith. As compared to the dicot root, which have fewer xylem bundles, there are usually more than six (polyarch) xylem bundles in the monocot root. Pith is large and well-developed. Monocotyledonous roots do not undergo any secondary growth
- 76 **(b)**  
**Vessels** are long, tubular having lignified cell wall and are components of xylem tissue. The cross wall (end wall) at both the ends of vessels, dissolves and form a pipe-like channel. They function in ascent of sap in angiosperms. Conduction of food materials occurs through the sieve tubes, which are cellulosic, thin-walled and are component of phloem tissues.
- 77 **(c)**  
Idioblast (modified parenchyma cells) and collenchyma are simple permanent tissue and apical meristems are simple meristematic tissue.
- Conducting tissues (*i.e.*, xylem and phloem) are complex conducting tissue made up of different types of cells.
- 78 **(b)**  
A-parenchyma, B-collenchyma, C-sclerenchyma
- 79 **(d)**  
A-Endodermis B-Conjunctive tissue C-Protoxylem D-Metaxylem E-Phloem F-Pith
- 80 **(d)**  
Pericycle is the external layer of stele. It forms a single layer between endodermis and conducting tissues. The roots or root branches are produced endogenously from the pericycle.
- 81 **(d)**  
Only one xylem strand occurs in the slender root of the hydrophyte *Trapa natans*. In *Nicotiana*, the roots are diarch. In *Pisum*, the root is triarch. In *Castanea*, the root is tetrarch.
- 82 **(d)**  
**Clowes** proposed quiescent centre theory.
- 83 **(a)**  
Spring wood plus autumn wood of a year constitute annual ring. The spring wood (also called early wood) is light in colour and constitute major part of annual ring. The autumn wood (also called late wood) is darker in colour. Wood consists of secondary xylem. The central hard, tough and darker region of wood constitutes heart wood while peripheral portion constitutes sap wood. But these are not specified in annual rings.
- 84 **(c)**  
In roots the protoxylem lies towards the periphery and metaxylem lies toward the centre. Such arrangement is called exarch
- 85 **(a)**  
The outside of the epidermis is often covered with waxy thick layer called cuticle, which prevents the loss of water. Cuticle is absent in roots
- 86 **(a)**  
*The various function of the epidermis are*  
(i) Protection of internal tissues  
(ii) Prevention of entry of harmful organisms  
(iii) Minimising surface transpiration by having thick cuticle  
(iv) Exchange of gases through stomata  
(v) Protection against excessive heating up and sudden changes in temperature with the help of hair (as in sunflower)
- 87 **(c)**

In a woody dicotyledonous tree, shoot tips and root tips consist of primary tissues.

88 (b)

In *Combretum* and *Entada*, the cambium shows abnormal behavior by cutting phloem on the inner as well as at certain places for a short period and then resumes normal activity.

89 (b)

Monocots have atactostele, in which vascular bundles are arranged into more than one ring and they are usually found at the centre of the stem

90 (c)

Phloem lie towards the pericyclet on the outside of vascular bundle. Phloem consists of sieve tubes, companion cells, phloem parenchyma and phloem fibres. The companion cells and phloem parenchyma are connected with sieve tubes through pits. They help in lateral flow of organic food. The companion cells also control the functions of the sieve tubes. The sieve tubes conduct organic food longitudinally

91 (d)

Intrastelar cambium is the cambium present between xylem and phloem (*i.e.*, within the stele), and the interstelar cambium, is present between steles (vascular bundle) and show growth rings formation.

92 (b)

Suberin.

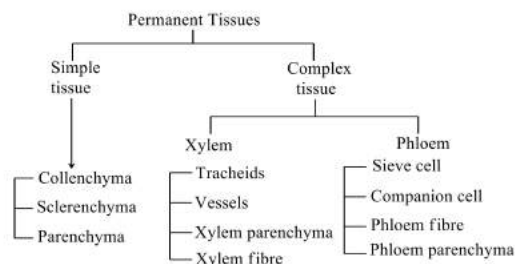
The innermost layer of cortex is called endodermis. It comprises a single layer of barrel-shaped cells without any intercellular spaces. The tangential as well as radial walls of the endodermal cells have a deposition of water impermeable, waxy material called suberin in the form of casparian strips

93 (c)

Tyloses are protrusions of the axial and ray parenchyma cells, which enter in tracheary elements.

94 (d)

The cell of the permanent tissues do not generally divide further. Permanent tissues having all cells similar in structure and function are called simple tissues. Permanent tissues having different types of cells together are called complex tissues



95 (b)

The tissue involved in secondary growth are two lateral meristems

(i) Vascular cambium

(ii) Cork cambium

96 (a)

In dicots, flower parts in four or five or multiple of these. They have leaf veins in the form of a net and secondary growth is present.

97 (b)

A thin-walled pith is generally present in monocot roots, while in dicot roots, a thin-walled conjunctive tissue is present in between vascular elements. Thin-walled pith is also well marked in dicot stems but absent in monocot stems.

98 (c)

The increase in height of a plant is due to apical meristem. Therefore, the height of the board remains same after five years.

99 (d)

In dicotyledon leaves, the mesophyll tissue is differentiated into the palisade tissue and spongy parenchyma but in monocot such differentiation is not seen

101 (d)

In dicotyledonous root, the condition of xylem is exarch as the protoxylem away from the centre and metaxylem towards the centre. In dicotyledonous stem (*e.g.*, *Cucurbita*), the condition of xylem is endarch as the metaxylem away from the centre and protoxylem towards the centre.

102 (d)

**Dendrochronology** is the branch of Botany that deals with the determination of age of a tree by counting and analyzing the annual growth rings of the tree.

103 (b)

In flowering plants, vascular tissues develop from plerome of apical meristem.

104 (b)

Generally in leaves of dicots, the protoxylem (newly formed xylem) face towards the adaxial (upper) surface or side

105 (b)

A–spring wood, B–autumn wood.

The spring wood is lighter in colour and has a lower density whereas the autumn wood is darker and has higher density. The two kinds of woods that appear as alternate concentric rings, constitutes an annual ring. Annual rings seen in a cutted stem give an estimate of the age of the tree

106 (d)

In stems, the protoxylem lies towards the centre (pith) and the metaxylem lies toward the periphery of organ. This type of primary xylem is called endarch

107 (a)

The centre of monocot root or dicot root is occupied by pith. It consists of parenchymatous (thin-walled or thick-walled) cells which may be rounded or angular. Intercellular spaces are present in the pith cells. The pith cells stores food. Pith is small or inconspicuous in dicots and large, conspicuous in monocots

108 (b)

The histogens are the group of cells, which give rise to future tissues. Major histogens of stem are as follows

2. **Dermatogen** forms external layers like epidermis.
3. **Plerome** forms central core of tissues like pith and vascular bundles.
4. **Periblem** forms the region between central core and epidermis such as endodermis, cortex, etc.

109 (d)

Vascular cambium gives rise to secondary growth.

110 (d)

Isobilateral leaves or monocotyledons leaves are thickened on the free side, where silica and cutin are deposited. These deposition protects the leaves from herbivores

111 (d)

Differentiation between dicot and monocot root

Dicot Root	Monocot Root
1. Cortex is narrow	Cortex is very wide

2. Small inconspicuous pith	Pith is large and generally conspicuous
3. Fewer xylem bundle	More than six (polyarch) xylem bundles
4. Secondary growth is present	Secondary growth is absent

112 (a)

In amphivasal vascular bundle, the phloem is surrounded by xylem.

113 (a)

The stele composed of two or more than two concentric rings of vascular bundles is called polycyclic, as found in *Pteridium* rhizome.

114 (d)

The stomatal aperture, guard cells and the surrounding subsidiary cells are together called stomatal apparatus

115 (b)

Apical meristems are primary meristems, which are located in the growing points (roots and shoot apices), as well as buds in the axils of leaves. The various organs increase in length due to activity of apical meristem.

116 (a)

Xylem fibres.

**Xylem or Wood fibres** They are sclerenchymatous fibres associated with xylem. Xylem fibres are mainly mechanical in function.

Xylem fibres have highly thickened walls and obliterate central lumens. These may either be septate or aseptate

117 (c)

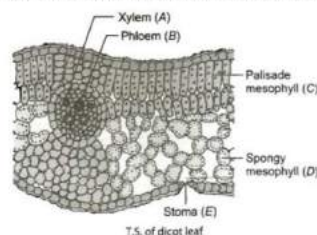
In root meristem, the quiescent centre serves as reserve for replenishment of damaged cells.

118 (b)

On the basis of their structure and location, there are three types of tissue systems. These are epidermal tissue system, the ground or fundamental tissue system and vascular or conducting tissue system

119 (c)

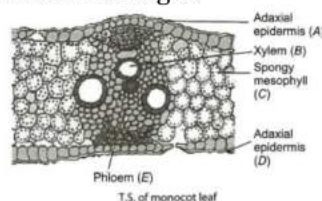
TS of dicot root. Palisade and spongy mesophyll tissue are the characteristic of dicot leaves



- 120 **(b)**  
In gasses, *i.e.*, monocots, the guard cells are dumb-bell shaped
- 121 **(d)**  
T.S. of dicot root (A-collenchyma, B-parenchyma, C-cambium, D-protoxylem, E-pith)
- 122 **(b)**  
Root is that part of plant body which grow and down into earth. The primary roots develop from radicle and gives secondary and tertiary roots. Lateral roots develop endogeneously *i.e.*, from pericycle.
- 123 **(c)**  
Companion cell is a thin-walled elongated cell, which is associated with sieve tube. The sieve tube elements lack nucleus, they remain living being dependents upon the adjacent companion cell nucleus.
- 124 **(b)**  
**Gerontology** is the study of ageing and senescence.
- 125 **(b)**  
The term **leptome** is used for soft-walled conducting part of the phloem; it includes sieve elements, companion cells and parenchyma cells.
- 126 **(d)**  
Intercalary meristem.  
The meristem which occurs between mature tissues is known as intercalary meristem. They occurs in grass and regenerate the parts removed by grazing herbivores
- 127 **(a)**  
In plants, xylem conducts the water and minerals. Thus, in xylem sap, sugar would be in significant amount.
- 128 **(c)**  
The secondary meristem initiates radial growth.
- 129 **(b)**  
**Xylem or Wood fibres** They are sclerenchymatous fibres associated with xylem. Xylem fibres are mainly mechanical in function.  
Xylem fibres have highly thickened walls and obliterate central lumens. These may either be septate or aseptate
- 130 **(b)**  
Vascular cambium forms phloem tissue outside. Food synthesised in the leaves move to different parts of the plant through the phloem.
- 131 **(b)**  
Prickles are the example of emergences. These are multicellular epidermal sharp and stiff outgrowth,

which do not have vascular supply. They protect the plant from excessive transpiration, grating animals and in some, helps the plant in climbing

- 132 **(a)**  
The cortex of hydrophytes is well developed. Major portion of it is occupied by well-developed prominent air cavity called **aerenchyma**, which increase buoyancy and allows a rapid gaseous exchange.
- 133 **(b)**  
In a dicot stem, secondary growth occurs due to lateral meristem.
- 134 **(d)**  
Cork cambium or phellogen is a lateral meristem as it is responsible for increase in the thickness of stem. It is secondary in origin and function. It gives rise to secondary tissues like cork and secondary cortex.
- 135 **(b)**  
Endodermis is innermost distinct layer of cortex. The endodermis is uniseriate and almost universally present in the roots. The cells of endodermis are living and characterized by presence of Casparian strips or Casparian bands on their anticlinal walls. The strip is formed during the early ontogeny of the cell and is a part of primary wall. The strip is typically located close to the inner tangential wall. Thin-walled **passage** cells are also found in the endodermal layer, which lie against the protoxylem poles.
- 136 **(d)**  
T.S of monocot leaf. In monocot leaf the adaxial and abaxial both surfaces same and equally receive sunlight



- 137 **(c)**  
The **intercalary meristems** are responsible for localised growth. Perhaps they have been detached from the mother meristem, *e.g.*, meristem present at the base of leaves in many monocots, in the internode of grasses, at the top of peduncles of *Plantago* and *Taraxacum*, etc.
- 138 **(a)**  
**Phytotron** is a device or chamber, in which plants can be grown under controlled conditions.

- 139 (c) Meristematic tissue is a group of cells specialized for the production of new cells, *i.e.*, perpetuates itself by active cell division.
- 140 (a) In amphivasal vascular bundle, phloem is surrounded by xylem, *e.g.*, *Dracaena*.
- 141 (b) The cells of epidermis bear a number of hairs. The root hairs are unicellular elongations of the epidermal cells and helps to absorb water and minerals from the soil. On the stem the epidermal hairs are called trichomes. The trichomes in the shoot system are usually multicellular. They may be branched or unbranched and soft or stiff. They may even be **secretory**. The trichomes help in preventing water loss due to transpiration
- 142 (d) The epidermis performs various function like the protection of internal tissue. The stomata in the epidermis helps in gaseous exchange and the trichome helps in the reduction of transcription rate
- 144 (d) Both (a) and (b) (tracheid and vessels). **Tracheids** are elongated or tube like cells with thick and lignified walls and tapering ends. These are dead and are without protoplasm. The inner layers of the cell walls have thickenings which vary in form. In flowering plants, tracheids and vessels are the main water transporting elements
- 145 (a) A dorsoventral leaf in its vertical section through union shows three main parts, *i.e.*, epidermis, which covers both upper or adaxial epidermis and lower or abaxial epidermis, among which the lower possesses cuticle mesophyll and vascular bundle
- 146 (d) Only II. Mesophyll, which possesses chloroplasts and carry out photosynthesis, is made up of parenchyma
- 147 (a) Companion cells are characteristic elements of phloem tissue associated with the sieve tubes in the angiosperms. They are absent in pteridophytes and gymnosperms.
- 148 (b) Sclerenchyma are considered thick-walled lignified supportive tissue characterised by the absence of living protoplast. Their principal function is to provide mechanical support.
- 149 (a) Dendrochronology is the determination of age of tree by counting annual rings (these rings are formed by activity of cambium in dicot root and stems).
- 150 (a) Lignification is associated with xylem. The walls of xylem cells are made up of lignin.
- 151 (a) Xylem is a complex tissue which performs the function of transport of water or sap inside the plant. Simultaneously, it also provides mechanical strength. Xylem is also known as wood. It consist of four types of cells  
Tracheids, vessels (both tracheary elements), xylem and phloem
- 152 (b) The abaxial epidermis generally bears more stomata than the adaxial epidermis. The later may even lack stomata. The tissue between the upper and the lower epidermis is called mesophyll
- 153 (c) Cambium is present between xylem and phloem. Such vascular bundles because of the presence of cambium, possesses the ability to form secondary xylem and phloem tissue and hence, is called open vascular bundles
- 154 (c) During primary growth, protoxylem elements are crushed and they form a distinct cavity known as lysigenous water cavity.
- 155 (a) Loosely arranged cells of a lenticel are called complementary cells.
- 156 (b) Hydrophytes are those plants that grow in water conditions. Water conduction systems are not well developed in them. So, roots are poorly developed. Roots are required only for anchorage, while halophytes are those plants that grow in high salty or marshy areas. In those plants, root system is very well developed. Roots may be entirely absent in hydrophytes like *Wolffia*, *Salvinia*, *Ceratophyllum* or poorly developed in *Hydrilla*.
- 157 (c)

As a result of continued secondary growth in subsequent years, the older part of secondary xylem or wood becomes non-functional as it loses the power of conduction. The cells of this wood are filled with resins or tannins produced by adjacent functional cells. The activities of vessels become blocked by tyloses. Due to these activities, non-functional, secondary xylem becomes hard, durable and blackish in colour, called heartwood.

158 (c)

Sclerenchyma cells are thick-walled, lignified and dead at maturity. These provide mechanical support to the *Pinus* needle. Sclerenchyma may be fibrous or sclereid.

159 (d)

Intercalary meristems are the portions of apical meristems, which are separated from the apex during the growth of axis and formation of permanent tissues.

160 (b)

The characteristic features of vascular bundles of dicot stem are as follows:

5. Vascular bundles are arranged in a ring.
6. They are conjoint, *i.e.*, xylem and phloem are present on the same radius.
7. They are open, *i.e.*, a cambium layer is found between xylem and phloem.
8. They are not surrounded by bundle sheath.
9. The position of protoxylem is towards the centre, *i.e.*, endarch.

161 (d)

Sclerenchyma is composed of dead cells. The cell wall is heavily thickened due to deposition of lignin.

According to histogen theory, periblem is the middle dermatogen, which gives rise to cortex of root and stem.

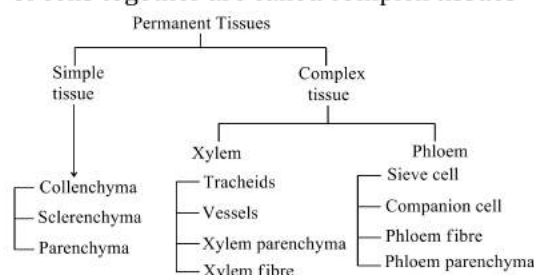
Tracheids are most primitive type of conducting elements in xylem. The xylem of gymnosperms consists of tracheids only. Companion cells are thin-walled elongated cells in phloem. They are living, contain dense protoplasm and large elongated nucleus.

Cork is produced by a number of plants. However, it is commercially obtained from the cork oak tree (*Quercus suber*).

162 (d)

I, II and III.

The cell of the permanent tissues do not generally divide further. Permanent tissues having all cells similar in structure and function are called simple tissues. Permanent tissues having different types of cells together are called complex tissues



163 (a)

*Nerium* belongs to family-Apocynaceae (dogbane family). *Nerium* contains latex cells that do not form a network. Thus, called **non-articulate** laticiferous. Family-Urticaceae, Asclepiadaceae, Moraceae, Euphorbiaceae and Apocynaceae bear such type of latex cells.

164 (a)

Epidermal cells are elongated compactly arranged and form continuous layer called epidermis. Stomata are present in epidermis of leaves and regulate process of transpiration and gaseous exchange. The epidermal hairs, *i.e.*, root hairs, unicellular elongations and trichomes, multicellular elongation of epidermis on root and shoot helps in absorbing water and preventing water loss, respectively

165 (a)

**Bulliform cells** or **motor cells** specialized large, empty, vacuolated colourless, thin-walled cells present in the upper epidermis of isobilateral leaf of monocots. They function in rolling up of leaves during water stress or xerophytic conditions.

166 (a)

Velamen tissue is found in the aerial roots of certain epiphytic orchids (*e.g.*, *Vanda*).

167 (c)

Nucleus of companion cells.

**Sieve tube elements** are long, tube-like structures, arranged longitudinally and are associated with the companion cells. Their end walls are perforated in a sieve-like manner to form the



- sieve plates. A mature sieve elements possesses a peripheral cytoplasm and a large vacuole but lacks a nucleus. Functions of sieve tubes are controlled by the nucleus of companion cells
- 168 (a) *Nerium* is a xerophytic plant. It has sunken stomata in leaf, which is an adaptive structure in xerophytic plants for reducing the water loss during transpiration. *Nerium* has several layer of epidermis.
- 169 (a) In plate meristem, the cells divide in several planes and consequently, there is an increase in the area of the organ. It results in the formation of flat structures, e.g., in epidermal growth and leaf formation.
- 170 (b) The cambium activity is seen in the temperate trees in two seasons of the year. In the spring season, cambium activity is highest as a result more amount of wood is formed due to long duration of favourable period. This type of wood is known as spring wood or early wood. In autumn season, cambium activity is arrested as a result dark-coloured, narrow band of autumn wood or late wood is formed. The two woods jointly constitute the annual rings or growth rings.
- 171 (d) During the formation of primary plant body, specific regions of apical meristem produce dermal tissue for hardning and vascular tissue for transport and ground tissue
- 172 (b) Vascular bundle, which possess both xylem and phloem are called conjoint vascular bundle. In bicollateral conjoint vascular bundle, phloem present on both outer and inner side of xylem, e.g., *Cucurbita*.
- 173 (b) When cambium is present between phloem and xylem tissue of a vascular bundle, the vascular bundle is called open but if cambium is absent, the vascular bundle is called closed.
- 174 (a) Compound sieve plate consists of several pore regions, which are separated by bars of wall thickening, e.g., *Vitis*.
- 175 (b) In angiosperms, xylem consists of tracheids, vessels or tracheae, xylem fibres and xylem parenchyma. Tracheae are absent in pteridophytes and gymnosperms. In angiospermic phloem, sieve elements are sieve tubes, while in gymnosperms and pteridophytes sieves cells are found.
- 176 (a) Phloem transports food material, usually from leaves to other parts of the plant. Phloem in angiosperms is composed of sieve tube elements, companion cells, phloem parenchyma and phloem fibres. Gymnosperms have albuminous cells and sieve cells
- 177 (b) In dicotyledous root, the outermost layer is epidermis. Many of the epidermal cells protrude in the form of unicellular root hairs which absorb water and minerals and increases the surface area
- 179 (d) Meristematic activity is characterised by the presence of meristematic tissue which are present at root apex (root apical meristem), shoot apex (shoot apical meristem) between mature tissues, intercalary meristem and in mature regions (lateral meristem)
- 180 (b) Only V. In old trees, the greater part of secondary xylem is dark brown due to the deposition of organic compounds like tanins, resins, oils, gums, aromatic substances and essential oils in the central or innermost layers of the stem. These substances make it hard, durable and resistant to the attacks of microorganisms and insects. The region comprises dead elements with highly lignified walls and is called heart wood
- 181 (c) Tracheids are elongated and their cell walls are usually extensively thickened by deposition of lignin. Water flows from one tracheid to another through unthickened regions (pits) in the cell walls.
- 182 (a) Cells arranged in multiple layers between epidermis and pericycle constitutes the cortex. It is divided into three regions  
(i) Hypodermis, few layer of collenchymatous cells

- (ii) Cortical layer cells, rounded thin walled parenchymatous cells  
 (iii) Endodermis
- 183 **(b)**  
 Jute fibres occur in long wedge-shaped bundles outside the xylem (*i.e.*, phloem fibres). It is most important of bast fibres and comes second in production only to cotton among natural fibres.
- 184 **(a)**  
 Sieve tube cells are studied during the translocation of solutes because they have interconnected lumen. Sieve tubes takes part in the conduction of organic food
- 185 **(b)**  
 Vascular tissue, pericycle and pith are stellar regions, and are formed from plerome.
- 186 **(d)**  
 Endodermis is the innermost limiting layer of cortex which separates the vascular tissue from cortical cells. In some dicots the endodermal cells bear characteristic thickening on their walls, the Casparian thickenings. The thickenings are restricted to radial and inner tangential walls.
- 187 **(d)**  
 Cork cambium or phellogen cells divided perclinically cutting off cells towards the outside and inside. The cells cut off towards the outside become suberised and dead. These are compactly packed in radial rows without intercellular spaces and form cork or phellem. Cork is impervious to water due to suberin and provides protection to underlying tissues. The cells cut off from cork cambium towards inside add to the cortex and are called secondary cortex cells or phelloderm.
- 188 **(a)**  
 In phloem, sieve tubes possess the perforated oblique or transverse sieve plates. Sieve plates are called simple when they consist of one region of pores (*e.g.*, *Cucurbita*, *Nicotiana*) or compound when they consist of several pored regions separated by bars or wall thickenings (*e.g.*, *Vitis*).
- 189 **(c)**  
 In hydrophytes, root caps are absent.
- 190 **(c)**  
 The guard cells possess chloroplast and regulate the opening and closing of stomata
- 191 **(d)**  
 Intercalary meristematic tissues are intercalated in between the permanent tissues. They may be present either at the base of internodes (*e.g.*, grasses, wheat, etc) or at the base of leaf (*e.g.*, *Pinus*) or at the base of node (*e.g.*, mint). The activity of intercalary meristem also adds to the length of plant or its organs.
- 192 **(d)**  
 Sieve plates are formed by two adjoining end walls of neighbouring sieve elements of sieve tube of phloem. At maturity, these become impregnated with callose pad, which may be seasonal callose (for only limited unfavourable period) or definitive callose (formed permanently in functionless old sieve tubes).
- 193 **(d)**  
 Cellulase, hemicellulose, pectin. *All of the above*  
 The **collenchyma** occurs in layers below the epidermis in dicotyledonous plants. It is found either as a homogenous layer or in patches. It consists of cells which are much thickened at the corners due to the deposition of cellulose, hemicellulose and pectin. Collenchymatous cells may be oval, spherical or polygonal and often contain chloroplasts. These cells assimilate food when they contain chloroplasts. Intercellular spaces are absent. They provide mechanical support to the growing parts of the plant such as young stem and petiole of a leaf
- 194 **(c)**  
**Complete Tissue** They are permanent tissue which contains more than one type of cells. All types of cells of a complex tissue work as a unit. The common complex permanent tissues are conducting tissue, xylem and phloem
- 195 **(d)**  
 When the protoxylem elements lie at the periphery and metaxylem in the centre, the condition is said to be **exarch**. Here, the direction of development is centripetal, *e.g.*, root.
- 196 **(b)**  
 When xylem and phloem groups are located on different radii, the bundles are said to be radial, *e.g.*, root. The protoxylem elements lie at the periphery and metaxylem in the centre, this condition is called exarch, *e.g.*, root
- 197 **(d)**  
 Stele is the inside of endodermis, such as pericycle, vascular bundles and pith
- 198 **(c)**  
 The cork (phellem) is impervious to water due to suberin deposition in the cell wall
- 199 **(d)**

- Xylem and phloem are called the heterogenous tissues
- 200 (c) When phloem is surrounded by xylem on all sides, such concentric vascular bundle is called **amphivasal** or **leptocentric**. Such vascular bundle is found in *Dracaena*, *Yucca*, *Aloe*, etc.
- 201 (c) In dicotyledonous root, the cortex consists of several layer thin walled parenchyma cells. These parenchyma cells have intercellular space. The inner most layer of the cortex is called **endodermis**. It surrounds the vascular tissue
- 202 (b) Vessels or tracheae are made up of a row of cells placed one above the other with their intervening walls absent or variously poured. These have wide lumen for conduction of minerals and water. While tracheids are unicellular and have a narrow lumen.
- 203 (d) A-Pore B- Complementary C- Cork D- Cork cambium E- Secondary cortex
- 204 (d) The cambium present between the xylem and phloem of vascular bundle is called **vascular cambium**. It is a **lateral meristem** that gives rise to secondary xylem and phloem and occurs in the form of a thin strip. Vascular cambium is also called **fascicular cambium**.
- 206 (a) P-proteins or phloem proteins are found in the phloem, particularly sieve tube elements of the flowering plant, where it may block or hinder translocation through sieve pores.
- 207 (c) In a bicollateral vascular bundle, the phloem occurs in two groups one outside the xylem and the other inner to it, *i.e.*, two groups of phloem, one on each side of xylem.  
So, the correct sequence is  
Outer phloem → Outer Cambium → Middle xylem → Inner cambium → Inner phloem
- 208 (c) Divisions of cells in both primary and secondary meristems results in the formation of new cells, which become structurally and functionally specialised and lose the ability to divide. Such cells are called permanent or mature cells
- 209 (b) **Intercalary meristem** is present at the base of internodes, *e.g.*, in grasses (Gramineae) or at the base of leaves, *e.g.*, in *Pinus* or at the base of nodes, *e.g.*, mint.  
Intercalary meristem is the part of apical meristem and responsible for increase in length.
- 210 (a) Anatomically, root is distinguishable into following layers or regions sequentially  
Epiblema → Cortex → Endodermis → Pericycle → Vascular system → Pith  
**Epiblema** is the outermost piliferous layer of root tissue.  
**Cortex** is the extrastelar fundamental tissue of the sporophyte.  
**Endodermis** is the most innermost layer of cortex, surrounding the pericycle.  
**Pericycle** is an external layer of stele or the layer between endodermis and conducting tissues.
- 211 (a) Anatomically, the monocot stem is composed of epidermis, hypodermis, ground tissue and vascular bundles.
- 212 (d) Plasmodesmata are thread-like cytoplasmic strands running from one cell to other and these make connection between adjacent cells.  
Each vascular bundle is made up necessarily of xylem and phloem elements and the cambium may or may not be present.  
The first differentiated xylem is called protoxylem, whereas those differentiated afterwards are called metaxylem.  
Radial vascular bundles are mainly found in the roots. In these, there are separate and alternate strands of phloem and xylem present on different radii.
- 213 (a) In leaves, the tissues, which constitute the conduction system (*i.e.*, vascular bundles) are situated near or at the centre of the midrib and generally form a ring composed of xylem (towards upper surface) and phloem (towards lower surface). The structure of large veins is more or less similar to that of a midrib. The small veins consist of only of few conducting cells.
- 214 (c) Vessels or tracheae are made up of a row of cells, placed one above the other, with their intervening

walls absent or variously pitted. The walls of vessels are lignified and hard, but not very thick. The cell cavity or the lumen is wide. The thickening may be annular, spiral, scalariform, reticulate and pitted.

215 **(b)**  
Damaged sieve tubes are sealed by the deposition of calloses across the sieve plates blocking the sieve pores.

216 **(b)**  
The correct sequence of structures in order of their location from periphery to centre in a dicot plant is :  
Trichoblasts → Collocytes → Fusiform cells → Tyloses

217 **(b)**  
Mature stems of woody plants have a peripheral water proof tissue called cork (phellem). It is a result of the activity of cork cambium (phellogen) during secondary growth. Cork takes the place of epidermis in the stem and roots of older woody plants.

218 **(c)**  
In dicot stem, secondary growth results in the increase in thickness of both sapwood and heartwood.

219 **(b)**  
A mature sieve tube lacks lignified walls.

220 **(b)**  
In dicots, as a result of production of enormous amount of secondary tissues, a pressure is exerted on the peripheral tissue, which are sloughed off. From the outer layer of pericycle, the phellogen (cork cambium) is arise, which cuts off phellem (cork) on the outer side and secondary cortex or phelloderm towards the inner side.

221 **(b)**  
Parenchyma cells are usually present in cortex, pericycle, pith and medullary rays, in the primary stems and roots. In leaves, the ground tissue consists of thin-walled chloroplast containing cells and is called mesophyll

222 **(b)**  
In dicot leaf, mesophyll tissues are of two types- palisade parenchyma and spongy parenchyma with large intercellular spaces. Whereas in monocot leaf, mesophyll is made up of only spongy parenchyma, which has very small intercellular spaces.

223 **(c)**

There are usually two to four xylem and phloem patches. Later, a cambium ring develops between the xylem and phloem. All tissues on the innerside of the endodermis such as pericycle, vascular bundles and pith constitutes the stele

224 **(c)**  
The **collenchyma** occurs in layers below the epidermis in dicotyledonous plants. It is found either as a homogenous layer or in patches. It consists of cells which are much thickened at the corners due to the deposition of cellulose, hemicellulose and pectin. Collenchymatous cells may be oval, spherical or polygonal and often contain chloroplasts. These cells assimilate food when they contain chloroplasts. Intercellular spaces are absent. They provide mechanical support to the growing parts of the plant such as young stem and petiole of a leaf

225 **(a)**  
The meristem which occurs between mature tissues is known as intercalary meristem. They occurs in grass and regenerate the parts removed by grazing herbivores

226 **(b)**  
In monocot root, the vascular strand has a large number (25-30 in maize) of alternate radial bundles of xylem and phloem.

228 **(b)**  
Cork cambium is formed by pericycle in the dicotyledonous roots. It is absent in monocot root that's why secondary growth does not take place in the monocots

229 **(c)**  
Quiescent centre concept in concern of root apex organization was proposed by **Clowes** (1961). According to which, a region called quiescent centre is found below the root cap. It is a zone of inactive cells that act as reservoir of cells and used when other meristematic cells are damaged.

230 **(b)**  
The monocot stem has a sclerenchymatous hypodermis, a large number of scattered vascular bundles, each surrounded by a sclerenchymatous bundle sheath, and a large, conspicuous parenchymatous ground tissue. Vascular bundles are conjoint and closed. Peripheral vascular bundles are generally smaller than the centrally located ones. The phloem parenchyma is absent and water-containing cavities are present within the vascular bundles

- 231 **(b)**  
In grasses, certain adaxial epidermal cells along the veins modify themselves into large, empty, colourless cells. These are called bulliform cells. When the bulliform cells in the leaves have absorbed water and are turgid, the leaf surface is exposed. When they are flaccid due to water stress, they make the leaves curl inwards to minimise water loss
- 232 **(a)**  
The cambial ring becomes active and begins to cut off new cells, both towards the inner and the outer sides. The cells cut off towards the pith, mature into secondary xylem and the cells towards the periphery mature into secondary phloem
- 234 **(d)**  
Secondary meristem.  
The cylindrical meristem, *i.e.*, fascicular vascular cambium, interfascicular cambium and cork cambium are examples of secondary or lateral meristem and are responsible for producing secondary tissue
- 235 **(c)**  
The secondary xylem or wood is distinguishable as spring wood and autumn wood by presence of annual rings. Later on, due to excessive growth, it termed as heartwood and sap wood. Wood is superior to any metal in its availability, cheapness, toughness, strength and elasticity.
- 236 **(b)**  
The sclerenchyma cells are commonly found in the fruit walls of nuts; pulp of fruits like guava, pear and sapota; seed coats of legumes and leaves of tea. Sclerenchyma provides mechanical support to organs
- 237 **(b)**  
In bicollateral vascular bundle, xylem and phloem are present on the same radius and one xylem group is present in between the two phloem groups, *e.g.*, *Cucurbita*.
- 238 **(c)**  
**Phloem fibres** (bast fibres) are made up of sclerenchymatous cells. These are generally absent in the primary phloem but are found in the secondary phloem. These are much elongated, unbranched and have pointed, needle like apices. The cell wall of phloem fibres is quite thick. At maturity, these fibres lose their protoplasm and become dead. Phloem fibres of jute, flax and hemp are used commercially
- 239 **(d)**  
All of these.  
Epidermal cells are elongated compactly arranged and form continuous layer called epidermis. Stomata are present in epidermis of leaves and regulate process of transpiration and gaseous exchange. The epidermal hairs, *i.e.*, root hairs, unicellular elongations and trichomes, multicellular elongation of epidermis on root and shoot helps in absorbing water and preventing water loss, respectively
- 240 **(a)**  
Trichomes are multicellular, branched or unbranched and soft or stiff epidermal hairs of stem of the plant. They may be secretory and help in preventing excessive loss of water
- 241 **(a)**  
Single layered.  
**Vascular Cambium**  
The meristematic layer that is responsible for cutting off vascular tissues (xylem and phloem) is called vascular cambium. In the young stem. It is present in patches as a single layer between the xylem and phloem. Later, it forms a complete ring
- 242 **(a)**  
Lenticel is composed of complementary cells, and phelloderm form outside sequentially.
- 243 **(d)**  
**Lateral meristem** is that meristem, which occur on the sides and helpful in increasing width of stem and root. They divide mainly in one plane (periclinal), **increasing the diameter** of an organ, *e.g.*, cambium (fascicular and interfascicular cambium), extra stellar cambium, cork cambium and marginal meristem of some leaves.
- 244 **(d)**  
Secondary phloem remains functional as long as plant is alive.
- 245 **(c)**  
As the stem continues to increase in girth due to the activity of vascular cambium, the outer cortical and epidermis layers get broken and need to be replaced to provide new protective cell layers. Hence, sooner or later, another meristematic tissue called **cork cambium** or **phellogen** develops, usually in the cortex region, which forms new layers, which is called periderm
- 246 **(c)**

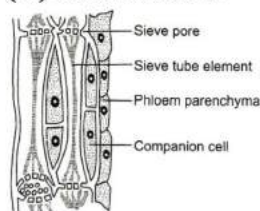
- Companion cells are present between sieve tubes in the phloem of angiosperms. These are the living cells with large nucleus that controls the activity of non-nucleated sieve tubes.
- 247 **(b)**  
The vascular bundles in *Hordeum vulgare* (barley) plant are scattered in ground tissues, many in number and vary in size-smaller towards periphery and bigger towards centre of the ground tissue, oval or rounded in outline, conjoint, collateral and closed.
- 248 **(d)**  
Pith is well developed in the monocots and is small, inconspicuous in dicots  
In monocot, is there is no secondary growth due to the absence of vascular cambium between the xylem and phloem. But secondary growth is the characteristic of dicotyledonous plants
- 249 **(a)**  
Parenchyma is most primitive type of permanent tissue. In hydrophytes (aquatic plants), parenchyma develops abundant air spaces and is known as **aerenchyma**. Aerenchyma helps in floatation.
- 250 **(d)**  
Permanent or mature cells don't have the power of division. They are formed by the division of both types of meristems *i.e.*, primary meristem (shoot apical meristem, root apical meristem) and secondary/lateral meristems (fascicular, cork, cambium)
- 251 **(c)**  
A-radial, B-conjoint closed, C-conjoint open  
10. Radially arranged vascular tissue found in the dicot root  
11. When vascular bundle is present in between xylem and phloem it is called open otherwise close-vascular bundle
- 252 **(d)**  
Velamen and spongy tissues are found in the **epiphytic roots**. These are hygroscopic and absorb water from the atmosphere.
- 253 **(c)**  
Root and belongs to dicot
- 254 **(d)**  
Youngest secondary phloem is just outside the cambium, while youngest xylem is present inside the cambium. Oldest secondary phloem is just inside the primary phloem, while oldest secondary xylem is just above pith secondary rays passes through both
- 255 **(a)**  
Collenchyma is a specialised supporting simple permanent tissue of living cells filled with protoplasm and characteristically possessing unevenly distributed thickenings of cellulose, pectin and hemicellulose on their wall.
- 256 **(b)**  
Stele is composed of pith and vascular bundle. On the basis of orientation of xylem and phloem the vascular bundles of stele are classified as collateral, bicollateral and concentric. Pith is formed of large parenchymatous cells.
- 257 **(b)**  
This is the description of secondary growth in roots
- 258 **(a)**  
Apical meristems are present at the apices of shoots and root of the plants and possess actively dividing cells. These meristems are virus free and are responsible for increase in length and all primary tissues of the plant body originated from them.
- 260 **(c)**  
The correct sequence of tissue from cambium present in dicot stem during secondary growth is primary cortex, secondary cortex, phellogen and cork.
- 261 **(a)**  
*In dicotyledonous stem, the sequence of tissue from the outside to the inside is*  
Phellem → endodermis → pericycle → phloem → xylem
- 262 **(a)**  
In grasses, certain adaxial epidermal cells along the veins modify themselves into large, empty, colourless cells. These cells are called bulliform cells. When the bulliform cells in the leaves have absorbed water and are turgid (called motor cells) the leaf surface is exposed. When they are flaccid due to water stress, they make the leaves curl inwards to minimize water loss.
- 263 **(c)**  
In grasses (monocotyledons), the guard cells are dumb-bell shaped and in dicotyledonous (bean, castor, pea), the guard cells are bean or kidney-shaped
- 264 **(a)**  
Duraman and albrunum

- 265 (c) In *Strychnos*, both interxylary and intraxylary phloem are present.
- 267 (a) **Parenchyma** forms the major component within organs. The cells of the parenchyma are generally isodiametric. They may be spherical, oval, round, polygonal or elongated in shape. Their walls are thin and made up of cellulose. They may either be closely packed or have small intercellular spaces. The parenchyma performs various functions like photosynthesis, storage, secretion, etc.
- 268 (c) Fusiform initial divided to form secondary phloem on the outer side and secondary xylem on the inner side. With the formation of secondary xylem (tracheary elements) on the inner side, the vascular cambium moves gradually to the outside by adding new cells. This phenomenon is called dilation.
- 269 (c) Monocotyledonous roots.  
The anatomy of the monocot root is similar to the dicot root in many respects. It has epidermis, cortex, endodermis, pericycle, vascular bundles and pith. As compared to the dicot root, which have fewer xylem bundles, there are usually more than six (polyarch) xylem bundles in the monocot root. Pith is large and well-developed. Monocotyledonous roots do not undergo any secondary growth
- 270 (d) The meristem which occurs generally at the tip of either roots or shoots are called apical meristem
- 271 (a) The photosynthetic cells are found in mesophyll and are parenchymatous in nature
- 272 (a) Many organs of aquatic plant float in water. The mesophyll between upper and lower epidermis is differentiated into palisade parenchyma and spongy parenchyma. Intercellular spaces are present among the spongy parenchymatous cells
- 273 (a) Xylem.  
*Xylem is composed of four types of tissue*  
(i) **Tracheids** Elongated or tube like cells with thick lignified walls and tapering ends. These are main water transporting elements
- (ii) **Vessels** A long cylindrical tube with lignified walls and large central cavity. It is a characteristic feature of angiosperms
- (iii) **Xylem fibres** have thickened walls and obliterated central lumen either septate or aseptate
- (iv) **Xylem parenchyma** is a thin cellulose and used to store food in the form of starch or fat
- 274 (c) **Schleiden** (1839) discovered and coined the term collenchyma. Lamellar collenchyma is characterized by deposition of heavy thickenings in the tangential radial cell walls, e.g., stems of *Sambucus* and *Raphanus*.
- 275 (d) Phellogen or cork cambium is the meristematic tissue which arises in the cortical region. Phellogen is a couple of layers thick. It is made of narrow, thin-walled and nearly rectangular cells
- 276 (a) Monocot root and dicot stem have well developed and conspicuous pith (central part of vascular bundles)
- 277 (b) The periderm is a secondary protective structure and is made up of cork cambium (phellogen), cork (phellem) and secondary cortex (phellogen).
- 278 (c) Stomata are adapted for water loss but plants which grow in xeric habitat have sunken type of stomata in their lower epidermis of leaves to minimize the loss of water, e.g., *Nerium*.
- 279 (a) The stele without pith is **protostele**. The protostele is most primitive stele, which consists of a solid core of xylem surrounded by phloem and pericycle.
- 280 (a) The leaf primordium has an apical meristem at its tip, which becomes inactive at early stage of development. Further increase in length occurs by intercalary meristem. Simultaneously marginal meristem (cells of margin of leaf axis) divide and redivide to form leaf lamina.
- 281 (d) The vascular cambial ring of dicot stem is partly primary and partly secondary in origin.
- 282 (a)

- Mesophyll, which possesses chloroplasts and carry out photosynthesis, is made up of parenchyma
- 283 (a) Roots arises as a result of activity of root apical meristem, while trichomes are multicellular extension of epidermis on stem to prevent the loss of extra water from the surface
- 284 (d) Secondary medullary rays.  
The primary xylem is in the centre of the stem, while primary phloem is pushed outward and crushed into the cortex by the significant activity of vascular cambium. While the secondary phloem differentiates from the cells that divide towards the outside of the stem
- 285 (b) **Clowes** (1961) by autoradiographic studies of DNA synthesis found a reservoir of cells having low DNA, RNA and protein concentration in the **root apex** and named it as **quiescent centre**. These cells do not divide but may become active.
- 286 (b) Tyloses are found in heartwood. Sometimes, the xylem parenchyma develops balloon-like structure to which penetrates into the adjacent xylem. Vessels, which are called tyloses, blocks the lumen of the xylem.
- 287 (d) Due to activity of the cork cambium, pressure builds up on the remaining layers, peripheral to phellogen and ultimately these layers die and slough off. Bark is the non-technical term that refers to all tissue exterior to the vascular cambium
- 288 (d) As mentioned earlier that secondary growth does not takes place in the monocots. But there are some exception like yucca and aloe in which the secondary growth occurs
- 289 (a) Hypodermis consists of a few layers of collenchymatous cells just below the epidermis, which provides mechanical strength to the young stem. **Cortical layers** below the hypodermis consists of rounded thin-walled parenchymatous cells with conspicuous intercellular spaces
- 291 (c) The companion cells are found in angiosperms only. In gymnosperms, no companion cell is present but some special parenchyma cells are associated to sieve cells, which are known as 'albuminous cells'.
- 292 (b) Endodermis is the innermost layer of cortex. A special thick band or strip is present on radial and tangential walls of endodermal cells. This band is called Casparian strip. These band-like thickenings are made of a waxy material, suberin.
- 293 (b) Heartwood is also called duramen. It represents the central wood of the plant. It is dark in colour and heavier in weight. Living cells are absent. It represents non-functional part of the secondary xylem (wood).
- 294 (a) Vascular cambium of stem is partly primary and partly secondary meristem.
- 295 (d) The periderm is the secondary protective structure and is made up of cork cambium (phellogen), cork (phellem) and secondary cortex (phellogen)
- 296 (c) Endodermis is the last layer of cortex and is single layered. It is characterized by presence of **Casparian strips**.
- 297 (d) The peripheral region of secondary xylem, is lighter in colour and is known as the sapwood. It is involved in the conduction of water and minerals from the roots to leaves
- 298 (c) A-Water pore B-Epidermis  
C-Mesophyll D-Epithem  
E-Vasculature
- 299 (c) The autumn wood or latewood has less active cambium and, thus forms fewer xylem elements
- 300 (d) The cells of sieve tube do not possess nuclei.
- 301 (b) The endodermis regulates the flow of fluid both inwardly as well as outwardly by functioning as biological check post of the vascular bundles
- 302 (d) *Phloem tissue have following attributes*  
(i) Sieve tube  
(ii) Phloem parenchyma  
(iii) Companion cell



(iv) Phloem fibres



303 (d)

In a monocot stem, the vascular bundles are scattered and surrounded by a thick-walled bundle sheath. These vascular bundles are conjoint collateral, closed and endarch.

304 (b)

Meristematic region is the region of cell division, which is situated below the root cap.

305 (c)

In roots, conjunctive parenchyma cells on the lateral sides of phloem bundles and the pericycle cells lying outside the protoxylem ends become meristematic. These give rise to a wavy band of vascular cambium.

306 (a)

Both primary and secondary meristems contribute to the growth of plants. Shoot apical meristem and root apical meristem help the plant to grow in length while the lateral meristem helps the plant to grow in width.

307 (b)

**Companion cells** are thin-walled elongated cells connected with sieve tube cells through plasmodesmata, in phloem cells. They are characteristic of angiosperms, function in controlling metabolic activities of sieve tube cells by nucleus of companion cells.

308 (b)

Annual growth rings are present in trees, which grow in regions with contrasting seasonal variations in evergreen tropical forests. There is no distinct change in season so, the growth rings are diffused.

309 (a)

Sometimes, a few epidermal cells, in the vicinity of the guard cells become specialised in their shape and size and are known as subsidiary cells.

310 (c)

It is the shoot apical meristem, which gives rise to lateral buds. The lateral buds, however, remain suppressed due to apical dominance.

311 (d)

All except II and IV.

Hypodermis consists of a few layers of collenchymatous cells just below the epidermis, which provides mechanical strength to the young stem. **Cortical layers** below the hypodermis consist of rounded thin-walled parenchymatous cells with conspicuous intercellular spaces.

312 (c)

Vessels are a composite structure formed by dissolution of end walls of a row of vessel elements, while tracheid is an individual cell.

313 (c)

Guard cells are the specialised epidermal cells containing chloroplasts.

314 (b)

Roots have unicellular root hairs, which arise as tubular unbranched outgrowths of the cells of piliferous layers of epiblema (epidermis). They increase the absorptive surface of the roots.

315 (b)

Cambium gives off secondary phloem towards the outer side and secondary xylem towards the inner side. In old stems the primary phloem of the root is usually crushed, while in dicot stems the primary phloem, secondary phloem, cambium, primary xylem and secondary xylem are present.

316 (d)

In *Cycas* leaflets, transfusion tissue or hydrostereon are present on each side of the midrib in between the palisade and spongy tissue. Transfusion tissue is made up of horizontally arranged tracheids, which supply water and minerals to palisade and spongy tissue up to margins. Transfusion tissue facilitates lateral conduction of water because there are no lateral veins.

Leaf of *Pinus* also contains transfusion tissue (needle).

317 (a)

A group of cells which have a common origin generally perform some function. For *e.g.*, a meristematic tissue formed in the body may be either apical or secondary but it continues to divide.

319 (c)

**Pericycle** is a few-layered thick tissue. It lies inner to the endodermis and outside the vascular strand. The pericycle is made up of both parenchymatous and sclerenchymatous fibres.

320 (d) In a bicollateral vascular bundle, the phloem occurs in two groups, one outside the xylem and the other inner to it, *i.e.*, the two groups of phloem one on each side of xylem. These are characteristically found in the stems of members of family-Cucurbitaceae, *e.g.*, *Cucurbita*, *Luffa*, etc.

321 (d) The chief functions of sieve tube elements is to translocate the organic material from the source to sink.

322 (d) The spring wood is lighter in colour and has a lower density whereas the autumn wood is darker and has higher density. The two kinds of woods that appear as alternate concentric rings, constitutes an annual ring. Annual rings seen in a cutted stem give an estimate of the age of the tree

324 (b) The transverse section of a typical young dicotyledonous stem shows that the epidermis is the outermost protective layer of the stem covered with a thin layer of cuticle. It may bear trichomes and a few stomata

325 (c) Each vascular bundle is surrounded by a sheath of parenchymatous cells called bundle sheath. They are chlorophyllous in nature

326 (d) Bryophytes are simple, small, amphibious (*i.e.*, they require both water and land) plants, but do not have vascular tissue system (atracheata).

327 (d) The vascular bundles containing cambium are said to be **open** but if no cambium develops, they are referred as **closed**. Due to absence of cambium, the secondary growth is not found. In most monocotyledons, closed vascular bundles are found.

328 (b) Generally, the epidermis layer does the function of protection but it modifies to the different structures to give the various structures (like-root hairs, trichomes, stomata etc) to perform the various functions in an organism

329 (b) Stomatal index (SI) =  $\frac{S}{S+E} \times 100$

Plant	Number of	Number of	SI

	Stomata (S)	Epidermal Cell (E)	
X	30	150	16.6
Y	60	240	20.0
Z	90	400	18.3

So, the arrangement of plants in decreasing order of their stomatal index in Y, Z, X.

330 (d) Lenticels are small pores formed on the surface of stems and roots of higher plants. Lenticels usually arise below the stomata of the original epidermis, where loose packing tissue becomes waterproofed with suberin, leaving large intercellular spaces through which gas exchange can take place.

331 (a) The vascular system consists of complex tissue, the phloem and the xylem. The xylem and phloem together constitutes the vascular bundles

332 (c) The initiation of vascular cambium during secondary growth phase takes place in pericycle which is present in between xylem and phloem

333 (c) In a dicotyledonous stem, the sequence of tissues from the outside to the inside is Phellem → endodermis → pericycle → phloem → xylem.

334 (b) Meristem consists of cells in state of continuous cell division. These cells are most active and show high rate of cell division and metabolism.

335 (b) The increase in diameter or thickness is due to the formation of secondary tissues as a result of the activities of vascular cambium and cork cambium. This secondary growth is characteristic of dicot stem and root.

336 (a) The outer tangential wall of epidermal cells are covered by a fatty substance **cutin**, which forms the **cuticle**. The cuticle is very well developed in xerophytes but absent in hydrophytes. It is secreted by epidermal cells.

337 (d) I, II and III (parenchyma tissue, collenchyma tissue and sclerenchyma tissue). All tissues except epidermis and vascular bundles constitutes ground tissues. It consists of simple tissue such as parenchyma, collenchyma and sclerenchyma

338 (d)

The main function of P-protein is sealing off damaged sieve elements by plugging up sieve plate pores.

339 (a)

The cylindrical meristem, *i.e.*, fascicular vascular cambium, interfascicular cambium and cork cambium are examples of secondary or lateral meristem and are responsible for producing secondary tissue

340 (a)

Mesophyll tissues occur between the two epidermal layers. In a dicot (dorsiventral) leaf, it is differentiated into palisade and spongy parenchyma. Both of these are rich in chloroplast.

341 (b)

Dicot root.

There are usually two to four xylem and phloem patches. Later, a cambium ring develops between the xylem and phloem. All tissues on the innerside of the endodermis such as pericycle, vascular bundles and pith constitutes the stele.

Pith is well developed in the monocots and is small, inconspicuous in dicots.

In monocot, is there is no secondary growth due to the absence of vascular cambium between the xylem and phloem. But secondary growth is the characteristic of dicotyledonous plants

342 (b)

Most angiosperms have vessels except a few (*e.g.*, *Drimys*, *Tetracentron*, *Trochodendron*). The gymnosperms lack vessels but these are found in the order-Gnetales. Vessels are the constituent of xylem complex tissue. They are composed of row of cells placed one above to other. Transverse wall of these cells is absent due to dissolution.

343 (b)

A -thin, B -thick

344 (a)

A-cortex, B-endodermins.

In dicotyledonous root, the cortex consists of several layer thin walled parenchyma cells. These parenchyma cells have intercellular space. The inner most layer of the cortex is called **endodermis**. It surrounds the vascular tissue. The innermost layer of cortex is called endodermis. It comprises a single layer of barrel-shaped cells without any intercellular spaces. The tangential as well as radial walls of the endodermal cells have a deposition of water

impermeable, waxy material called suberin in the form of casparian strips

345 (a)

In many cases of root apices, a cup-like region of cells called quiescent centre is present lying between the root cap and the active meristematic region. The quiescent centre is an inactive region of root apices and is often said as reserve meristem.

346 (d)

In winter, the cambium is less active and forms fewer xylary elements that have narrow vessels, and this wood is called autumn wood or late wood

347 (a)

**Sieve tube elements** are long, tube-like structures, arranged longitudinally and are associated with the companion cells. Their end walls are perforated in a sieve-like manner to form the sieve plates. A mature sieve elements possesses a peripheral cytoplasm and a large vacuole but lacks a nucleus. Functions of sieve tubes are controlled by the nucleus of companion cells

348 (c)

*Xylem is composed of four types of tissue*

(i) **Tracheids** Elongated or tube like cells with thick lignified walls and tapering ends. These are main water transporting elements

(ii) **Vessels** A long cylindrical tube with lignified walls and large central cavity. It is a characteristic feature of angiosperms

(iii) **Xylem fibres** have thickened walls and obliterated central lumen either septate or aseptate

(iv) **Xylem parenchyma** is a thin cellulose and used to store food in the form of starch or fat

349 (a)

Both apical meristems and intercalary meristems are called primary meristems because they appear early in life of a plant and contributes to the formation of primary plant body

351 (d)

**Xylem parenchyma** cells are living and thin-walled and their cell walls are made up of cellulose. They store food materials in the form of starch or fat and other substances like tannins. The radial conduction of water takes place by the ray parenchymatous cells

352 (c)



Bulliform cells in monocotyledons epidermis have bulliform cells, which regulate the surface area of leaves

353 (b)

Desert grasses often roll their leaves due to presence of bulliform cells. These are big-sized, thin-walled and large vacuolated cells frequently occur towards the lower epidermis.

354 (b)

Xylem vessels are the tube-like structure. The walls of the xylem vessels are lignified. They lack the protoplasm. They are thick and variously-annular, spiral, reticulate, scalariform and pitted. The pitted condition is more common

355 (c)

At certain regions, the phellogen cuts off closely arranged parenchymatous cells on the outer side instead of cork cells. These parenchymatous cells soon rupture the epidermis, forming a lens-shaped openings called lenticels. Lenticels permit the exchange of gases between the outer atmosphere and the internal tissue of the stem. These occur in most woody trees

356 (d)

If the plants belongs to the tropical forest then the age of tree can't be determined by annual rings because the physiological and environmental factors remains the same throughout the year and due to this, the fluctuation of cambial activity does not take place

357 (d)

No reserve food materials like fats, proteins and sugars are present in meristematic cells.

358 (d)

Tyloses are balloon-like structures develop from xylem parenchyma. These tyloses block the passage of xylem vessels and ray parenchyma. So, these are also called tracheal plug. These tyloses block the continuity and flow of water, which leads to death of elements of heartwood.

359 (a)

The tissue derived from the procambium is called the vascular or fascicular tissue system. It consists of varying number of strands or bundles called the vascular bundles. Each vascular bundle is made up of xylem and phloem necessarily but the cambium may or may not be present.

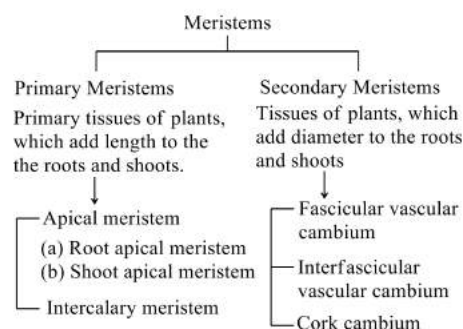
360 (b)

Medullary rays to intrafascicular cambium.

In dicot stems, the cells of cambium present between primary xylem and primary phloem are intrafascicular cambium. The cells of medullary cells, adjoining these intrafascicular cambium becomes meristematic and form the interfascicular cambium. Thus, a continuous ring of cambium is formed

361 (d)

**Meristems** are the specialised regions of active cell division



The division the of both primary and secondary meristems resulted in formation of functionally and structurally specialised cells/tissue which loose their ability to divide and thus are called permanent tissues

362 (c)

The number of vascular bundles in the leaf depends upon the size and venation of leaf

363 (d)

Interfascicular cambium is secondary meristem. It originates only at the time of secondary growth between the vascular bundles.

364 (a)

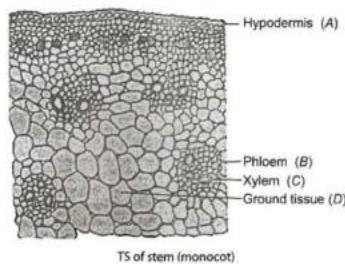
After certain years of growth, the xylem elements of the stems of a number of trees develop dark brown colouration, especially in the central or innermost layers. This region comprises dead element with highly lignified walls and is called heartwood or duramen. It is present in inner region of secondary wood.

365 (b)

In tropics, there is no sharp distinction between the seasons, hence, there is not much differences in the activity of cambium. In a diffused porous wood, the large-sized vessels are distributed through spring wood and autumn wood, eg, *Syzygium cumini*.

366 (b)

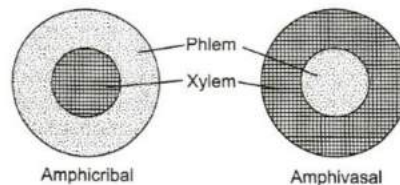
Scattered vascular bundles is the characteristic of monocot stem



TS of stem (monocot)

- 367 (d) Phellogen, phellem and phelloderm are collectively known as phloem
- 368 (b) In the upper epidermis of monocots (*e.g.*, wheat, maize cereals, grasses, etc), there are some large cells, found in groups, which are known as **motor cells** or **bulliform cells**. These cells help in rolling of leaves in dry climate.
- 369 (d) Characteristic feature of stem is **endarch** condition of xylem tissue. In endarch, protoxylem is present towards the centre of stem, while metaxylem towards the pericycle. Characteristic feature of root is **exarch** condition of xylem tissue. In exarch condition, protoxylem is present towards the pericycle and metaxylem towards the center of the root.
- 370 (c) Cotton is chiefly composed of epidermal hair of seed. Chemically it is cellulose.
- 371 (b) During the formation of leaves and elongation of stem, some cells 'left-behind' from shoot apical meristem. These constitute the axillary buds. Such buds are present in the axis of leaves and are capable of forming a branch of flower
- 373 (d) **Intercalary meristem** is present away from apical meristem in primary permanent tissue.
- 374 (b) **Cork cells** are dead cells and hence, do not respire.
- 375 (b) Epidermis.  
Epidermal cells are elongated compactly arranged and form continuous layer called epidermis. Stomata are present in epidermis of leaves and regulate process of transpiration and gaseous exchange. The epidermal hairs, *i.e.*, root hairs, unicellular elongations and trichomes, multicellular elongation of epidermis on root and shoot helps in absorbing water and preventing water loss, respectively

- 376 (d) The apical meristems are present in the apices of primary and secondary shoots and roots of the plant. The cells of apical meristem are in very active stage of division, have dense cytoplasm, thin cell wall and remain virus free.
- 377 (b) Parenchyma is the most abundant and common tissue of the plants. Parenchyma forms ground tissue in the non-woody or soft areas of the stem, leaves, roots, flowers, fruit, etc. The typical parenchyma is meant for storage of food. It is modified to performs special functions
- 378 (a) In root, growth occurs, just behind the apex as there is root cap at apex.
- 379 (d) **Sclerenchyma** consists of long, narrow cells with thick and lignified cell walls having a few or numerous pits. They are usually dead and without protoplasts. On the basis of variation in form, structure, origin and development, sclerenchyma may be either fibres or sclereids
- 380 (a) In amphicribal vascular bundle, the xylem is surrounded by phloem



- 381 (a) The companion cells are present in association with the sieve tube elements with the help of pit fields present between their walls. The companion cells help in maintaining pressure gradient in sieve tubes
- 382 (c) In monocot roots, xylem strands are exarch and polyarch.
- 383 (d) The tracheids are elongated, angular dead cells with hard lignified wide lumen and narrow end walls. The walls of tracheids possess different types of thickenings and the unthickened areas of its wall allow the rapid movement of water from one tracheid to another. Tracheids are the characteristic cell types of xylem tissues in gymnosperms and pteridophytes, where they are chief elements of water conduction.

384 (d)

**Medullary ray or pith rays** They are the radial strips of parenchyma cells present between the adjacent vascular bundles. The medullary rays connects the pith with pericycle and cortex. They ray cells make intimate connection with the conducting cells of both xylem and phloem through pits

The medullary rays help in the radial conduction of food and water. They also transport gases from pith to cortex and *vice-versa*

385 (a)

**Tracheids** are elongated or tube like cells with thick and lignified walls and tapering ends. These are dead and are without protoplasm. The inner layers of the cell walls have thickenings which vary in form. In flowering plants, tracheids and vessels are the main water transporting elements

386 (d)

The first formed primary phloem consists of narrow sieve tubes and is referred to as protophloem and later formed primary phloem is referred to as metaxylem

387 (b)

Parenchyma.

**Parenchyma** forms the major component within organs. The cells of the parenchyma are generally isodiametric. They may be spherical, oval, round, polygonal or elongated in shape. Their walls are thin and made up of cellulose. They may either be closely packed or have small intercellular spaces. The parenchyma performs various functions like photosynthesis, storage, secretion, etc.

388 (b)

Root.

The outside of the epidermis is often covered with waxy thick layer called cuticle, which prevents the loss of water. Cuticle is absent in roots

389 (b)

The wall of both vessel and sieve tube elements are perforated by large opening. Due to these adaptation, the cell to cell contact is possible. The vessels are nucleated, whereas the sieve tube elements are enucleated.

390 (b)

Velamen is a layer of dead cells acting as water-absorbing spongy material found on the outside of aerial roots of **epiphytic** plants.

391 (a)

**Phloem parenchyma** is made up of elongated, tapering cylindrical cells which have dense cytoplasm and nucleus. The cell wall is composed of cellulose and has pits through which plasmodesmata connections exist between the cells. The phloem parenchyma stores food material and other substances like resins, latex and mucilage. Phloem parenchyma is absent in most of the monocotyledons

392 (c)

In maize leaf (monocot), the undifferentiated mesophyll occurs in the concentric layers around the vascular bundles having large centrifugal chloroplasts in its large bundle sheath cells. Such an arrangement is called Kranz anatomy

393 (d)

The phloem fibre of jute, flax and hemp are used for commercial purpose because of its characteristic to lose protoplasm and become dead at maturity

394 (b)

In dicot root, during the secondary growth, the cork is formed. This cork is inner to the endodermis and external to the primary phloem

396 (c)

On the basis of variation in form, structure origin development sclerenchyma may be fibre, *i.e.*, thick the elongated and pointed cells or sclereids, *i.e.*, spherical oval or cylindrical

397 (a)

Each stoma is composed of two bean-shaped cells known as **guard cells**. These are modified ground tissue. They have the chlorophylls and performs photosynthesis. The outer walls of guard cells (away from the stomatal pore) are thin and inner wall (toward the stomatal pore) are highly thickened

398 (d)

The fibres bound associated with the phloem, pericycle and cortex are referred to as stem, bast or soft fibres. Fibres of this category are derived mostly from the dicotyledonous plant.

399 (c)

In a dicot root, the vascular bundles are collateral and exarch. The innermost layer of cortex in roots is endodermis. It is made up of closely packed living cells characterized by presence of Casparian strips.

In vascular bundle of dicot roots, xylem and phloem patches are separated from each other by



- intervening thin-walled parenchyma cells called conjunctive or complementary tissue.
- 400 **(b)**  
Primary xylem is of two types. First, formed primary xylem is called protoxylem and later formed is called metaxylem. The position of protoxylem and metaxylem is towards pith and periphery, respectively in case of stem and *vice versa* in roots
- 401 **(c)**  
Periderm includes-phellem, phellogen and phelloderm.
- 402 **(b)**  
Gymnosperm lacks vessels in their xylem tissue. Vessels are also absent in pteridophytes. Their tracheary element comprise only tracheids. Flowering plants possesses, both vessel and tracheids but later are comparatively fewer and moreover vessels are the characteristic features of angiosperms
- 403 **(c)**  
Apical meristem.  
During the formation of leaves and elongation of stem, some cells 'left-behind' from shoot apical meristem. These constitute the axillary buds. Such buds are present in the axis of leaves and are capable of forming a branch of flower
- 404 **(d)**  
Phellogen cuts off the cells on both sides and form an outer imprevous layer, cork and an inner parenchymatous layer, phelloderm
- 405 **(c)**  
A-Vascular, B-Midrib, C-Veins, D-Dicot
- 406 **(c)**  
Counting the annual rings.  
The spring wood is lighter in colour and has a lower density whereas the autumn wood is darker and has higher density. The two kinds of woods that appear as alternate concentric rings, constitutes an annual ring. Annual rings seen in a cutted stem give an estimate of the age of the tree
- 407 **(d)**  
Meristematic cells have thin cell wall without intercellular spaces.
- 408 **(a)**  
Mechanical strength of hypocotyls of seedling is provided by epidermis and collenchyma tissue.
- 409 **(d)**  
All except IV.
- On the basis of variation in form, structure, origin and development, sclerenchyma may be fibres or sclereids. The fibres are thick walled, elongated and pointed cells, generally occurring in groups, in various parts of the plant. The sclereids are spherical oval or cylindrical, highly thickened dead cells with very narrow cavity (lumen). These are commonly found in the fruit wall of nuts, pulp of fruit like guava, pear and sapota, seed coats of legumes and leaves of tea. Sclerenchyma provides the mechanical support to organs
- 410 **(d)**  
The innermost layer of the cortex is called **endodermis**. The cells of the endodermis are rich in starch grains and the layer is referred to as the starch sheath
- 411 **(a)**  
Collenchyma cells are elongated and polygonal with tapering ends, found in outer region of cortex, *e.g.*, angles of stems, midrib of leaves, etc. The cell wall of collenchyma consists of cellulose, pectins and hemicellulose.
- 412 **(d)**  
Tracheids and vessels are the characteristic of xylem vascular bundle and the A, B and C are tracheid, vessels and vessels, respectively
- 413 **(a)**  
Cells of meristematic tissue are living and thin walled. They contain dense protoplasm and conspicuous nuclei and are without intercellular spaces.
- 414 **(c)**  
The increase in the height of plant is due to apical meristem. Therefore, the height of the board remains the same after ten years
- 415 **(b)**  
Cell wall in a plant cell is found in both the phases, *i.e.*, sporophytic and gametophytic phase of life cycle
- 416 **(b)**  
Motor cells or bulliform cells are found in epidermis of monocot leaf, *e.g.*, grasses. Epidermal cells situated in ling furrows are larger with thin flexible walls. These cells help in the rolling of leaves in dry weather.
- 417 **(a)**  
The cambium lies in vascular bundles of dicot and gymnosperm stem in between phloem and xylem
- 418 **(c)**

Growth in plants is largely restricted to specialised regions of active cell division called meristem. (*Gk meristos-divide*). Plants have different kind of meristems. The meristems, which occur at the tips of roots and shoots and produce primary tissues are called apical meristems

419 (b)

During the secondary growth, the continuous ring of cambium is formed by joining of intrafascicular cambium and interfascicular cambium not by vascular cambium. Vascular cambium form xylem on the its inside and phloem on outside due to differential action of for more

420 (d)

By the deposition of resins, oils, gums, etc, in the xylem cell wall, 'formation of tylosis' in xylem vessels and by degeneration of protoplast of living cell 'sapwood' is converted into 'heartwood'.

421 (c)

Sequence of cellular layers from the periphery towards the cortex in an old dicot stem is epidermis, hypodermis, cortex, endodermis, pericycle and vascular bundles.

422 (d)

Dicotyledon leaf is also called dorsiventral leaf. Monocotyledon leaf is also called isobilateral leaf

423 (a)

Cork cambium is also called **phellogen**. Cork is also called **phellem**. Secondary cortex is also called **phelloderm**.  
Cork cambium, cork and secondary cortex are collectively called **periderm** or secondary ground tissue.

424 (c)

Ground tissue system occupies the whole of the interior of plant organs with the exclusion of

vascular system. Ground tissue system of leaves is called mesophyll. Mesophyll is made up of two types of photosynthetic cells, palisade and spongy

425 (a)

**Sieve tubes** are cylindrical tube-like cells with perforated cross walls called sieve plates. Sieve tubes are responsible for movement of food material and sealing of pores after wounding.

426 (d)

Interfascicular and intrafascicular both cambium join each other and form a continuous ring of cambium for the secondary growth of dicots

427 (a)

All tissues except epidermis and vascular bundles constitutes ground tissues. It consists of simple tissue such as parenchyma, collenchyma and sclerenchyma

428 (c)

Phellem is a group of tissue formed due to activity of **phellogen** (cork cambium) towards the outer side, while towards the inner side, phellogen cuts another group of cells called phelloderm or secondary cortex. Below secondary cortex is occurred **secondary phloem**, it is formed due to activity of vascular cambium, which cuts secondary xylem towards inner side. This newly formed secondary xylem is called autumn wood.

429 (d)

In datepalm (*Phoenix* sp), there is no secondary growth, differentiation of wood into bark, sapwood and heartwood is not present.

430 (a)

Stomata are present in the epidermis of leaves. Their main function is regulation of transpiration and gaseous exchange with the help of two bean shaped cells known as guard cells