CHAPTER 6

ANATOMY OF FLOWERING PLANTS

Exercise 1 : NCERT Based Topic-wise MCQs

6.1 THE TISSUES

1. A tissue is a group of cells which are NCERT Page-84 / N-71
(a) similar in origin, but dissimilar in form and function.
(b) dissimilar in origin, form and function.
(c) dissimilar in origin, but similar in form and function.
(d) similar in origin, form and function.

2. Which meristem helps in increasing girth? NCERT Page-85
(a) Lateral meristem
(b) Intercalary meristem
(c) Primary meristem
(d) Apical meristem

3. Which of following helps bamboo and grasses to elongate? NCERT Page-85
(a) Apical merištems
(b) Lateral meristems
(c) Secondary meristems
(d) Intercalary meristems

4. Cells of permanent tissues are specialized NCERT Page-85 / N-77
(a) functionally.
(b) only structurally.
(c) both structurally and functionally.
(d) for mitosis.

5. Which is not correct about sclereids? NCERT Page-86
(a) These are parenchyma cells with thickened lignified walls.
(b) These are elongated and flexible with tapered ends.
(c) These are commonly found in the shells of nuts and in the pulp of guava, pear, etc.
(d) These are also called stone cells.

6. Lignin is the important constituent in the cell wall of NCERT Page-86
(a) phloem

(b) parenchyma
(c) xylem
(d) cambium

7. Meristematic tissue responsible for increase in girth of tree trunk is NCERT Page-85 / N-77
(a) Apical meristem
(b) Intercalary meristem
(c) Lateral meristem
(d) Phellogen

8. Sieve tubes are suited for translocation of food because they possess NCERT Page-88
(a) bordered pits.
(b) no ends walls.
(c) broader lumen and perforated cross walls.
(d) no protoplasm.

9. The vessel elements of angiosperms differ from other elements of xylem in having NCERT Page-87
(a) simple pits on their radial walls.
(b) bordered pits on their lateral walls.
(c) simple and bordered pits on their end walls.
(d) simple perforation on their end walls.

10. A common structural feature of vessel elements and sieve tube elements are NCERT Page-88
(a) pores on lateral walls.
(b) presence of p-protein.
(c) enucleate condition.
(d) thick secondary walls.

11. Apical, intercalary and lateral meristems are differentiated on the basis of NCERT-84 & 85/N-77
(a) origin
(b) function
(c) position
(d) development

12. During the formation of leaves and elongation of stem, some cells 'left behind' from the shoot apical meristem, constitute the NCERT Page-85 / N-77
(a) lateral meristem
(b) axillary bud
(c) cork cambium
(d) fascicular cambium

13. Which of the following is responsible for the formation of an embryonic shoot called axillary bud?
(a) Lateral meristem NCERT Page-85 / N-77
(b) Apical meristem
(c) Intercalary meristem
(d) Both (b) and (c)

14. A plant tissue when stained showed the presence of hemicellulose and pectin in cells wall of its cells. The tissue is called NCERT Page-86 / N-72
(a) collenchyma
(b) sclerenchyma
(c) xylem
(d) meristem

15. Various functions like photosynthesis, storage, excretion performed by NCERT Page-86 / N-72
(a) sclerenchyma
(c) collenchyma
(b) parenchyma
(d) aerenchyma

16. Sclerenchyma are usually protoplasts____and_____
(a) live, without
(b) dead, with
(c) live, with
(d) dead, without

17. The occurs in layers below the epidermis in dicotyledonous plants.
NCERTL Page-86 / N-72
(a) parenchyma
(b) sclerenchyma
(c) collenchyma
(d) aerenchyma

18. Xylem functions as a conducting tissue for water and minerals from to the and___
(a) roots, stems, leaves NCERT Page-87 / N – 73
(b) stems, roots, leaves
(c) leaves, stems, roots
(d) leaves, stems, leaves

19. Which one of the following have vessels as their characteristic feature?
NCERT/ Page-87
(a) Angiosperms
(b) Gymnosperms
(c) Pteridophytes
(d) Bryophytes

20. An organized & differentiated cellular structure having cytoplasm but no nucleus is called NCERT Page-88
(a) vessels
(b) xylem parenchyma
(c) sieve tubes
(d) tracheids

21. A vascular bundle in which the protoxylem is pointing to the periphery is called
NCERT Page-87 / N-74

(a) end arch
(b) exarch
(c) radial
(d) closed

22. In stems, the protoxylem lies towards the__and the metaxylem lies towards the__of the organ.
(a) center; periphery NCERT 87/N-74
(b) periphery; center
(c) periphery; periphery
(d) center; center

23. Which of the following statement is correct regarding simple permanent tissue?
NCERT Page-85, 86/ N-77

(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 specialized sclerenchyma Tous cells.

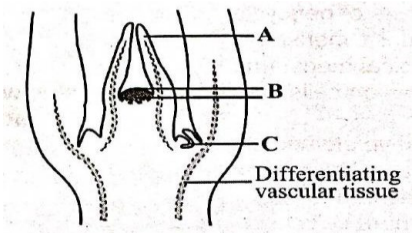
24. A student was given a tissue to observe under the microscope. He observes the tissue and concludes that the tissue is a type of simple plant tissue and provides mechanical support to young stem and petiole of leaf. Identify the tissue. NCERT Page-86 / N-72
(a) Parenchyma
(b) Collenchyma
(c) Sclerenchyma
(d) Xylem parenchyma

25. Apical and intercalary meristems are primary meristems because NCERT Page-85/N-77
(a) they occur in the mature region of roots and shoots of many plants.
(b) they made up of different kinds of tissues.
(c) they involved in secondary growth.
(d) they appear early in life of a plant and contribute to the formation of the primary plant body.

26. The length of different internodes in a culm of sugarcane is variable because of
NCERT Page-84, 85/N-77

(a) size of leaf lamina at the node below each internode
(b) intercalary meristem
(c) shoot apical meristem
(d) position of axillary buds

27. Identify A, B and C in the given figure of shoot apical meristem NCERT Page-85



(a) A - Leaf primordium, B - Shoot apical meristem, C - Axillary bud
(b) A - Leaf primordium, B - Shoot apical meristem, C - Apical bud
(c) A - Root hair primordium, B - Root apical meristem, C - Axillary bud
(d) A - Root hair primordium, B - Root apical meristem, C - Terminal bud

28. All the following statements regarding sieve tube elements are correct except that
(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.

29. Which one of the following is well developed and present in hydrophytes?
(a) Aerenchyma
(b) Stomata
(c) Collenchyma
(d) Root system

30. Which of the following group of cells make up the Conjunctive tissue?
(a) Parenchymatous cells lying between xylem and phloem.
(b) Cells present between tight and gap junctions
(c) Cells of conjoint type of vascular bundles
(d) Meristematic cells present between two nodes

31. The chief water conducting elements of xylem in gymnosperms are: NCERT Page-87
(a) vessels
(b) fibers
(c) transfusion tissue
(d) tracheids

32. Which one of the following is not a lateral meristem? NCERT Page-84 & 85/N – 77
(a) Interfascicular cambium
(b) Interfascicular cambium
(c) Phellogen
(d) Intercalary meristem

33. Vessels are found in NCERT Page-87
(a) all angiosperms and some gymnosperms
(b) most of angiosperms and few gymnosperms
(c) all angiosperms, all gymnosperms and some pteridophyte
(d) all pteridophyte

34. Cork cambium and vascular cambium are NCERT Page-85 / N-77
(a) parts of secondary xylem and phloem
(b) parts of pericycle
(c) lateral meristems
(d) apical meristems

35. Companion cells are closely associated with: NCERT Page-88
(a) Sieve elements
(b) Vessel elements
(c) Trichomes
(d) Guard cells

6.2 THE TISSUE SYSTEM

36. Ground tissue includes NCERT Page-89 / N-72
(a) all tissues external to endodermis
(b) all tissues except epidermis and vascular bundles
(c) epidermis and cortex
(d) all tissues internal to endodermis

37. In land plants, the guard cells differ from other epidermal cells in having: NCERT Page-89 / N-72
(a) cytoskeleton
(b) mitochondria
(c) endoplasmic reticulum
(d) chloroplasts

38. One of the primary function of the ground tissue in a plant is NCERT Page-89 / N-72
(a) photosynthesis.
(b) to protect the plant.
(c) to anchor the plant.
(d) water and sugar conduction.

39. Some vascular bundles are described as open because these NCERT Page-73
(a) are surrounded by pericycle but not endodermis.
(b) are capable of producing secondary xylem and phloem.
(c) possess conjunctive tissue between xylem and phloem.
(d) are not surrounded by pericycle.

40. Which of the following statements is not correct for stomatal apparatus? NCERT Page-89 / N-72
(a) Inner walls of guard cells are thick and in elastic.
(b) Guard cells invariably possess chloroplasts and mitochondria.
(c) Guard cells does not possess subsidiary cells.
(d) Stomata are involved in gaseous exchange.

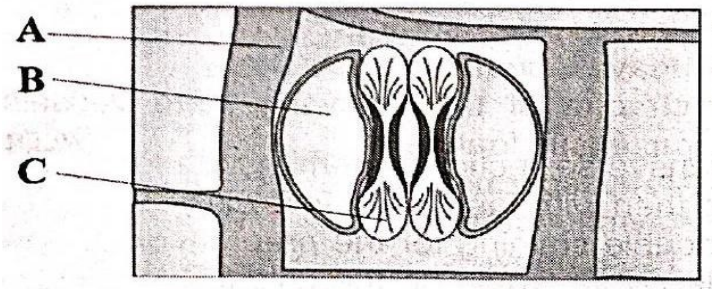
41. Which of the following statement(s) is/are correct about epidermal tissue system?

NCERT Page-88 / N-71

a) It forms the outer-most covering of the whole plant body and comprises epidermal cells, stomata and the epidermal appendages - the trichomes and hairs.
b) Epidermal cells are parenchymatous with a small amount of cytoplasm lining the cell wall and a large vacuole.
c) Epidermis is often covered with a waxy thick layer called the cuticle which prevents the loss of water.
d) All of the above

42. The given diagram show stomatal apparatus in monocots. Which one is correct option for A, B and C ?

NCERT Page-89 / N-72



(a) A - Epidermal cells; B - Subsidiary cells; C chloroplast
(b) A-Guard cells; B-Subsidiary cells; C - Stomatal pore
(c) A - Guard cells; B - Epidermal cells; C - Guard cells
(d) A - Epidermal cells; B - Subsidiary cells; C Guard cells

43. Which of the following types of cells is/are present in Gymnosperms? NCERT Page-88, 89

I. Sieve cells
II. Companion cells
III. Albuminous cells IV. Sieve tubes
Select the correct answer from the codes given below:
(a) I and III only
(b) I, II and III only
(c) II and IV only
(d) All of the above

6.3 Anatomy of Dicotyledonous and Monocotyledonous Plants

44. In dicot root NCERT Page-90 / N-74

(a) vascular bundles are scattered and with cambium
(b) vascular bundles are arranged in a ring and have cambium
(c) xylem and phloem radially arranged
(d) xylem is always endarch

45. Pericycle of roots produces NCERT Page-91 / N-74

(a) mechanical support
(b) lateral roots
(c) vascular bundles

(d) adventitious buds

46. Monocot leaves possess NCERT Page-93, 94/N-77
(a) intercalary meristem
(b) lateral meristem
(c) apical meristem
(d) mass meristem

47. What is true about a monocot leaf ? NCERT Page-93 & 94/N-76
(a) Reticulate venation
(b) Absence of bulliform cells from epidermis
(c) Mesophyll not differentiated into palisade and spongy tissues
(d) Well differentiated mesophyll

48. Anatomically fairly old dicotyledonous root is distinguished from the dicotyledonous stem by
(a) presence of cortex. NCERT Page-91, 92, 93 / N-73
(b) position of protoxylem.
(c) absence of secondary xylem.
(d) absence of secondary phloem.

49. Which one of the following option is correct about bulliform/motor cell ? NCERT Page-94 / N-72
(a) It is seen in grasses.
(b) It is large-sized, thin-walled colorless, vacuolate cells on the adaxial surface.
(c) It helps in rolling of leaf to minimize water loss when it is flaccid.
(d) All of the above

50. Which of the following are present in monocot root? NCERT Page-91 / N-74
(a) conjoint, collateral, open polyarch vascular bundle.
(b) exodermis, endarch, tetrarch closed vascular bundles.
(c) suberized exodermis, casparian strip, passage cells, cambium.
(d) suberized exodermis, polyarch xylem, pith.

51. Where do the casparian bands occur? NCERT Page-91 / N-74
(a) Epidermis
(b) Endodermis
(c) Pericycle
(d) Phloem

52. In an experiment, a student cut a transverse section of young stem of a plant which he has taken from his school garden. After observing it under the microscope how would he ascertain whether it is a monocot stem or a dicot stem? NCERT Page-92, 93/N-76
(a) With the help of bulliform cells.
(b) With the help of casparian strips.
(c) With the help of vascular bundles.
(d) With the help of stomatal apparatus.

53. A conjoint and open vascular bundle will be observed in the transverse section of NCERT Page-92, 93/N-73

(a) monocot root
(b) monocot stem
(c) dicot root
(d) dicot stem

54. In stems, the protoxylem lies towards the and the metaxylem lies towards the of the organ. NCERT Page-92, 93/N-74
(a) centre; periphery
(b) periphery; centre
(c) periphery; periphery
(d) centre; centre

55. In a vertical section of a dorsiventral leaf, the protoxylem in its midrib bundle NCERT Page-93 / N-76
(a) faces the dorsal epidermis of the leaf
(b) faces the ventral epidermis of the leaf
(c) is not distinct
(d) is surrounded by metaxylem

Exercise 2 : NCERT Exemplar & NEET

NCERT EXEMPLAR QUESTIONS

1. A transverse section of stem is stained first with safranin and then with fast green following the usual schedule of double staining for the preparation of a permanent slide. What would be the color of the stained xylem and phloem?
(a) Red and green
(b) Green and red
(c) Orange and yellow
(d) Purple and orange

2. Match the followings and choose the correct option from below. NCERT Page-86, 85/N-71

A. Meristem	(i) photosynthesis, storage
B. Parenchyma	(ii) mechanical support
C. Collenchyma	(iii) actively dividing cells
D. Sclerenchyma	(iv) stomata
E. Epidermal tissue	(v) sclereids

Options:
(a) A-(i), B-(iii), C-(v), D-(ii), E-(iv)
(b) A-(iii), B-(i), C-(ii), D-(v), E-(iv)
(c) *A*-(ii), *B*-(iv), *C*-(v), *D* —-(i), E-(iii)
(d) A-(v), B-(iv), C-(iii), D-(ii), E-(i)

3. Match the following and choose the correct option from below. NCERT Page-94, 95/N-72

A. Cuticle	(i) guard cells

B. Bulliform cells (ii) single layer
C. Stomata (iii) waxy layer
D. Epidermis (iv) empty colourless cell
Options:
(a) A-(iii), B-(iv), C-(i), D-(ii)
(b) *A*-(i), *B*-(ii), *C*-(iii), *D*-(iv)
(c) A-(iii), B-(ii), C-(iv), D-(i)
(d) *A*-(iii), *B*-(ii), *C*-(i), *D*-(iv)

4. Identify the simple tissue from among the following. NCERT Page-86 / N-72
(a) Parenchyma
(b) Xylem
(c) Epidermis
(d) Phloem

5. Cells of this tissue are living and show angular wall thickening. They also provide mechanical support. The tissue is NCERT Page-86 / N-77
(a) *xylem*
(b) sclerenchyma
(c) collenchyma
(d) epidermis.

6. Epiblema of roots is equivalent to NCERT Page-90 / N-73
(a) pericycle
(c) epidermis
(b) endodermis
(d) stele

7. A conjoint and open vascular bundle will be observed in the transverse section of NCERT Page-91/ N-73
(a) monocot root
(b) monocot stem
(c) dicot root
(d) dicot stem

8. In which of the following pairs of parts of a flowering plant is epidermis absent?
(a) Root tip and shoot tip
(b) Shoot bud and floral bud
(c) Ovule and seed
(d) Petiole and pedicel

9. How many shoots apical meritsems are likely to be present in a twig of a plant possessing, 4 branches and 26 leaves?
(a) 26
(b) 1
(c) 5
(d) 30

10. In conifers fibers are likely to be absent in
    (a) secondary phloem
    (b) secondary xylem
    (c) primary phloem
    (d) leaves

11. When we peel the skin of a potato tuber, we remove
    (a) periderm
    (b) epidermis
    (c) cuticle
    (d) sapwood

12. A vessel less piece of stem possessing prominent sieve tubes would belong to
    (a) Pinus
    (b) Eucalyptus
    (c) Grass
    (d) Trochodendron

13. Which one of the following cell types always divides by anticlinal cell division?
    (a) Fusiform initial cells
    (b) Root cap
    (c) Protoderm
    (d) Phellogen

NEET QUESTIONS

14. Specialized epidermal cells surrounding the guard cells are called NCERT Page-89 / N-72 /
    (a) Complementary cells
    (b) Subsidiary cells
    (c) Bulliform cells
    (d) Lenticels

15. Root hairs develop from the region of NCERT Page-89 / N-72 /
    (a) Elongation
    (b) Root cap
    (c) Meristematic activity
    (d) Maturation

16. Which of the following is made up of dead cells? NCERT Page-86 / N-72 |
    (a) Collenchyma
    (c) Phloem
    (b) Phellem
    (d) Xylem parenchyma

17. Which of the following facilitates opening of stomatal aperture?
(a) Decrease in turgidity of guard cells
(b) Radial orientation of cellulose microfibrils in the cell wall of guard cells
(c) Longitudinal orientation of cellulose microfibrils in the cell wall of guard cells
(d) Contraction of outer wall of guard cells

18. Stomata in grass leaf are
(a) Dumb-bell shaped
(b) Kidney shaped
(c) Barrel shaped
(d) Rectangular

19. Casparian strips occur in NCERT Page-91/N-74/
(a) Epidermis
(c) Endodermis
(b) Pericycle
(d) Cortex

20. Xylem trans locates: NCERT Page-87 / N-73 |
(a) Water only
(b) Water and mineral salts only
(c) Water, mineral salts and some organic nitrogen only
(d) Water, mineral salts, some organic nitrogen and hormones

21. Regeneration of damaged growing grass following grazing is largely due to: NCERT Page-85 / N-77 |
(a) Secondary meristem
(b) Lateral meristem
(c) Apical meristem
(d) Intercalary meristem

22. Phloem in gymnosperms lacks: NCERT Page-88 / N-73 |
(a) Albuminous cells and sieve cells
(b) Sieve tubes only
(c) Companion cells only
(d) Both sieve tubes and companion cells

23. Match List-I with List-II. NCERT Page-84,85, 87 / N-77 |

List-I		List-II	
A	Cells with active cell division capacity	I	Vascular tissues
B	Tissue having all cells similar in structure and function	II	Meristematic tissue
C	Tissue having different types of cells	III	Sclereids
D	Dead cells with highly thickened walls and narrow lumen	IV	Simple tissue

Select the correct answer from the options given below.
(A) (B) (C) (D)
(a) III II IV I

(b) II IV I III
(c) IV III II I
(d) I II III IV

24. Read the following statements about the vascular bundles : NCERT Page-90 / N-73 |
i. In roots, xylem and phloem in a vascular bundle are arranged in an alternate manner along the different radii.
ii. Conjoint closed vascular bundles do not possess cambium
iii. In open vascular bundles, cambium is present in between xylem and phloem
iv. The vascular bundles of dicotyledonous stem possess endarch protoxylem
v. In monocotyledonous root, usually there are more than six xylem bundles present
Choose the correct answer from the options given below :
(a) (ii), (iii), (iv) and (v) only
(b) (i), (ii), (iii) and (iv) only
(c) (i), (ii), (iv) and (v) only
(d) (i), (ii) and (iv) only

25. Given below are two statements : NCERT Page-87 |
Statement I: Endarch and exarch are the terms often used for describing the position of secondary xylem in the plant body.
Statement II : Exarch condition is the most common feature of the root system.
In the light of the above statements, choose the correct answer from the options given below:
(a) Both Statement I and Statement II are true (b) Both Statement I and Statement II are false
(c) Statement I is correct but Statement II is false (d) Statement I is incorrect but Statement II is true

Exercise 3 : Matching, Statement & Assertion Reason

MATCH THE FOLLOWING

1. Match the elements of xylem given in column I with their character given in the column II and choose the correct option. NCERT Page-87

Column I	Column II
A. Xylem vessels	I. Store food materials
B. Xylem tracheids	II. Obliterated lumen
C. Xylem fibres	III. Perforated plates
D. Xylem parenchyma	IV. Chisel-like ends

(a) $A-IV, B-III, C-II, D-I$ (b) $A-III, B-II, C-I, D-IV$
(c) $A-II, B-I, C-IV, D-III$ (d) A-III, B - IV, C - II, D – I

2. Match the terms given in column I with their features given in column II and choose the correct option.

NCERT Page-87

Column I (Terms)		Column II (Features)	
A.	Fibres	I.	Cells are living and thin walled with cellulosic cell wall, store food materials in the form of starch or fat.
B.	Sclereids	II.	Main water conductive cells of the pteridophytes and the gymnosperms
C.	Tracheids	III.	Thick walled, elongated and pointed cells, generally occurring in groups
D.	Vessels	IV.	Long cylindrical tube like structure and cells are devoid of protoplasm. Characteristic feature of angiosperms
		V.	Reduced form of sclerenchyma cells with highly thickened lignified cellular walls that form small bundles of durable layers of tissue in most plants.

(a) $A-I, B-II, C-III, D-IV$
(b) $A-III, B-V, C-II, D-IV$
(c) $A-III, B-I, C-V, D-II$
(d) $A-V, B-IV, C-III, D-I$

3. Match column-I with column-II and choose the correct option.

NCERT Page-87, 94/N-73

Column I		Column II	
A.	Bulliform cells	I.	Initiation of lateral roots
B.	Pericycle	II.	Conduct food material
C.	Xylem	III.	Grasses
D.	Phloem	IV.	Dicot leaf
		V.	Conduct water and mineral

(a) $A-III, B-V, C-IV, D-I$
(b) $A-II, B-V, C-I, D-III$
(c) $A-II, B-IV, C-I, D-III$
(d) A - III, B - I, C - V, D – II

4. Match the names of the structures given in column-I with the functions given in column-II, choose the answer which gives the correct combination of the two columns :

NCERT Page-89, 96/N-72

Column I (Structure)		Column II (Function)	
A.	Stomata	I.	Protection of stem
B.	Bark	II.	Plant movement
C.	Cambium	III.	Secondary growth

D.	Cuticle	IV.	Transpiration
		V.	Prevent the loss of water

(a) $A-V, B-III, C-I, D-IV$
(b) $A-I, B-IV, C-V, D-III$
(c) $A-II, B-IV, C-I, D-III$
(d) $A-IV, B-I, C-III, D-V$

5. Match column-I with column-II & select the correct option from the codes given below .NCERT-91, 97/N-74

Column I		Column II	
A.	Stele	I.	Innermost layer of cortex
B.	Endodermis	II.	Suberin
C.	Casparian strips	III.	All the tissues exterior to vascular cambium
D.	Bark	IV.	All the tissues inner to endodermis

(a) $A-IV, B-I, C-II, D-III$
(b) $A-III, B-II, C-I, D-IV$
(c) $A-I, B-II, C-III, D-IV$
(d) $A-IV, B-II, C-I, D-III$

6. In the given columns, column I contain structures of female reproductive system and column II contain its feature. Select the correct match.
NCERT Page-85, 86/N-77

Column I		Column II	
A.	Lateral meristem	I.	Fascicular vascular cambium, interfascicular cambium and cork cambium.
B.	Apical meristem	II.	Tips of shoots and roots.
C.	Bast fibres	III.	Generally absent in primary phloem but found in secondary phloem.

D.		Sap wood	IV.	Involved in the conduction of water and minerals from the root to leaf.

(a) $A-I, B-II, C-III, D-IV$
(b) $A-III, B-I, C-II, D-IV$
(c) $A-I, B-IV, C-III, D-II$
(d) $A-$ II, $B-$ IV, C - III, D – I

TWO STATEMENT TYPE QUESTIONS

DIRECTION: Read the statements carefully and answer the question on the basis of following options.
(a) Both Statement I' and Statement II are incorrect
(b) Statement I is correct but Statement II is incorrect
(c) Statement I is incorrect but Statement II is correct
(d) Both Statement I and Statement II are correct

7. Statement I: The regeneration of parts, grazed by the herbivores in grasses is by the activity of apical meristem. NCERT Page-85 / N-77
Statement II: The cells of parenchyma are generally isodiametric.

8. Statement I: Vessels are interconnected through perforations is their common walls.
Statement II: The presence of vessels is a characteristic feature of angiosperms.
NCERT Page-87

9. Statement I: A mature sieve element does not have cytoplasm
Statement II: The nucleus and vacuole are absent in mature sieve element NCERT Page-88

10. Statement I: Companion cells maintain the pressure gradient in the sieve tubes.
Statement II: The functions of sieve tubes are controlled by the nucleus of companion cells.
NCERT Page-88

11. Statement I: All tissues except epidermis and vascular bundles constitute the ground tissue.
Statement II: It consists of xylem and phloem. NCERT Page-89/N-73

12. Statement I: The adaxial (upper surface) bears more stomata than the abaxial (lower surface) epidermis.
Statement II: Mesophyll, which possesses chloroplasts and carry out photosynthesis, is made up of parenchyma. NCERT Page-93 / N-76

Four/Five Statement Type Questions

13. Read the following statements and select the correct one(s). NCERT Page-87 / N-73
(i) In flowering plants, tracheids and vessels are the main water transporting elements.
(ii) The presence of vessels is a characteristic feature of angiosperms.
(iii) Xylem fibres have highly thinned walls and their cell walls are made up of cellulose.
(iv) Xylem parenchyma store food materials in the form of starch or fat and other substances like tannins.
(v) Primary xylem is of three types.
Which of the above statement(s) is/are correct?
(a) Only (i) and (v)
(b) only (ii), (iii) and (v)
(c) Both (iii) and (iv) only
(d) Only (i), (ii) and (iv)

14. Which of the following statements are correct about phloem? NCERT Page-88 / N-73
(i) Phloem transports food materials, usually from leaves to the other parts of the plant.
(ii) It is composed of sieve tube elements, companion cells, phloem parenchyma and phloem fibres.
(iii) The companion cells are specialized parenchymatous cells which are closely associated with phloem parenchyma.
(iv) The first formed primary phloem consists of narrow. sieve tubes and referred to as protophloem and the later formed phloem has bigger sieve tubes and referred to as metaphloem.
(v) Angiosperms have albuminous cells.
(a) (i), (ii) and (iv)
(b) Both (ii) and (v)
(c) Both (ii) and (iv)
(d) All of these

15. Which of the following statements are correct ? NCERT Page-87, 88/N-73
(i) Xylem transports water and minerals.
(ii) Gymnosperms lack sieve tubes and companion cells in phloem.
(iii) The first formed primary xylem is called metaxylem.
(iv) Phloem fibres (bast fibres) are made up of collenchymatous cells.
(v) Root hairs help absorb water and glucose.
(a) (i) and (iii)
(b) (i) and (ii)
(c) (iii) and (iv)
(d) (i) and (iv)

16. Which type of plant tissue is being described by the given statements? NCERT Page-86 / N-72
(i) It consists of long, narrow cells with thick and lignified cell walls having a few or numerous pits.
(ii) They are dead and without protoplasts.
(iii) On the basis of variation in form, structure, origin and development, it may be either fibers or sclereids.
(iv) It provides mechanical support to organs.
(a) Parenchyma
(b) Sclerenchyma

(c) Collenchyma
(d) Chlorenchyma

17. Read the following statements and answer the question. NCERT Page-88 / N-72
(i) They are present on the stem as epidermal hairs.
(ii) They are usually multicellular. (iii) They may be branched or unbranched and soft or stiff.
(iv) They help in preventing water loss due to transpiration.
Which part of epidermal tissue system is being described by the above statements?
(a) Stomata
(b) Guard cells
(c) Epidermis
(d) Trichomes

18. Which of the following statements is correct? NCERT Page-90, 94/N-72
(a) Lenticels occur in most woody trees.
(b) Sclerenchymatous cells are usually present in cortex.
(c) The vascular tissue system is divided into three main zones- cortex, pericycle and pith.
(d) The conjoint vascular bundles usually have the xylem located only on the outer side of the phloem.

19. Which anatomy of plants is being described by the statements given below? NCERT Page-91 / N-72
(i) The cortex consists of several layers of thin-walled parenchyma cells with intercellular spaces.
(ii) The tangential as well as radial walls of the endodermal cells have a deposition of water impermeable, waxy material -suberin- in form of casparian strips.
(iii) Secondary growth takes place.
(iv) Pith is small or inconspicuous.
(a) Dicotyledonous root
(b) Monocotyledonous root
(c) Dicotyledonous stem
(d) Monocotyledonous stem

20. Read the following statements and answer the question. NCERT Page-93 / N-72
(i) It has a sclerenchyma Tous hypodermis, a large number of scattered vascular bundles and a large parenchymatous ground tissue.
(ii) Vascular bundles are conjoint and closed.
(iii) Peripheral vascular bundles are generally smaller than the centrally located ones.
(iv) Phloem parenchyma is absent, and water containing cavities are present within the vascular bundles.
Which plant anatomy is being described by the above statements?
(a) Dicotyledonous root
(b) Monocotyledonous root
(c) Dicotyledonous stem
(d) Monocotyledonous stem

Assertion & Reason Questions

DIRECTION: These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following four responses.
(a) Both (*A*) and (*R*) are correct but (*R*) is not the correct explanation of (*A*)
(b) (A) is correct but (R) is not correct
(c) (A) is not correct but (R) is correct
(d) Both (A) and (R) are correct and (R) is the correct explanation of (*A*)

21. Assertion: In open vascular bundles, cambium is present.
Reason: In monocot stem, cambium is present.

22. Assertion: In angiosperms, the conduction of water is more efficient because their xylem has vessels.
Reason: Conduction of water by vessel elements is an active process with energy supplied by xylem parenchyma, rich in mitochondria.

NCERT Page-87

23. Assertion: Vessels are more efficient for water conduction as compared to tracheids.
Reason: Vessels are dead lignified.

NCERT Page-87

ANSWER KEYS

Exercise-1 (NCERT Based Topic-wise MCQs)

1	(d)	9	(d)	17	(c)	25	(d)	33	(b)	41	(d)	49	(d)
2	(a)	10	(c)	18	(a)	26	(b)	34	(c)	42	(d)	50	(d)
3	(d)	11	(c)	19	(a)	27	(a)	35	(a)	43	(a)	51	(b)
4	(c)	12	(b)	20	(c)	28	(a)	36	(b)	44	(c)	52	(c)
5	(a)	13	(b)	21	(b)	29	(a)	37	(d)	45	(b)	53	(d)
6	(c)	14	(a)	22	(a)	30	(a)	38	(a)	46	(a)	54	(a)
7	(c)	15	(b)	23	(b)	31	(d)	39	(b)	47	(c)	55	(b)
8	(c)	16	(d)	24	(b)	32	(d)	40	(c)	48	(b)		

Exercise-2 (NCERT Exemplar & NEET)

1	(a)	5	(c)	9	(c)	13	(c)	17	(b)	21	(d)	25	(d)
2	(b)	6	(c)	10	(b)	14	(b)	18	(a)	22	(d)		

3	(a)	7	(d)	11	(a)	15	(d)	19	(c)	23	(b)		
4	(a)	8	(a)	12	(d)	16	(b)	20	(d)	24	(*)		

Exercise-3 (Matching, Statement & Assertion Reason Type)

1	(d)	4	(d)	7	(c)	10	(d)	13	(d)	16	(b)	19	(a)	22
2	(b)	5	(a)	8	(d)	11	(b)	14	(a)	17	(d)	20	(d)	23
3	(d)	6	(a)	9	(a)	12	(c)	15	(b)	18	(a)	21	(b)	

HINTS & SOLUTIONS

EXERCISE – 1

1. (d) A group of structurally similar or dissimilar cells that perform a common function and have a common origin is called a tissue. A plant is made up of different kinds of tissues.
2. (a) Lateral meristem divides only periclinally or radially and is responsible for increase in girth or diameter. It includes vascular cambium and cork-cambium.
3. (d) Intercalary meristem develops between regions of mature or permanent tissue (at the base of the grass leaf). The cells of this tissue possess the ability to divide and produce new cells, as do apical and lateral meristems. Intercalary meristem helps the bamboo and grasses to elongate.
4. (c) Divisions of cells in both primary as well as secondary meristems, the newly formed cells become structurally and functionally specialized and lose the ability to divide. Such cells are termed as permanent or mature cells and constitute the permanent tissues.
5. (a) Sclereids (stone cells) are sclerenchymatous cells which are lignified, extremely thick walled so that the lumen of the cells is almost obliterated. Sclereids are most abundant in soft tissues like cortex, phloem, medulla, fleshy fruits, seed coats and fruit walls.
6. (c) Lignin is the important constituent in the cell wall of xylem. Xylem consists of four different types of elements- tracheids, vessels, and xylem parenchyma and xylem fibres. Wall of tracheids are highly thickened by the deposition of lignin, except at certain points called as pits.
7. (c)
8. (c)
9. (d)
10. (c) In plant conducting tissue xylem has an important integral cell as xylem vessel which is without nucleus. The phloem on other hand has a row of sieve tubes which are also without nucleus at maturity.
11. (c) Apical, intercalary and lateral meristems are differentiated on the basis of position. Apical meristem is situated at the shoot apex and the root apex. Intercalary meristem is present at the base of internodes, e.g., in grasses or at the base of leaves e.g., in Pinus or at the base of nodes, e.g., mint. Lateral meristems are present along the lateral sides of stem and roots.
12. (b) Axillary buds are present in the axils of leaves and are capable of forming a branch or a flower.
13. (b)

14. (a) Collenchyma is living mechanical tissue, found beneath the epidermis (i.e., hypodermis) of herbaceous dicot stem.
    The intercellular spaces in this tissue are absent because in intercellular spaces at the corner of cells thickenings of cellulose and pectin develop due to which the cell wall become rigid and thick at corners.
15. (b) Parenchyma is the common simple tissue. This is the most primitive tissues from which other tissues are evolved and hence also called as fundamental tissue. The main function of parenchyma is storage of food.
    Photosynthesis, respiration, secretion, assimilation, etc. are some of the important processes which occur in parenchymatous cells.
16. (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. They are simple dead mechanical tissue occuring in mature organs of plants body. They are chiefly distributed in cortex, pericycle, xylem and phloem region.
17. (c) The collenchyma occurs in layers below the epidermis or outer layer of cells in young stems and in leaf veins in dicotyledonous plants. Collenchyma cells are elongated cells with irregularly thick cell walls that provide support and structure. Their thick cell walls are composed of the compounds cellulose and pectin.
18. (a) Xylem is a complex permanent tissue mainly responsible for conduction of water and minerals from the roots to the top of plants (unidirectional).
19. (a) The presence of vessels is a characteristic feature of angiosperms. Vessels help in conduction of water and dissolved salts form roots to the different parts of the shoot and provides mechanical support.
20. (c) A mature sieve element possess a peripheral cytoplasm and a large vacuole but lacks nucleus. Sieve tube consists of row of cells arranged one above the other to form long pipes. Sieve tube occurs in angiosperms. The functions of sieve tubes are controlled by the nucleus of companion cells.
21. (b) In roots, the protoxylem lies towards periphery and metaxylem lies towards the centre. Such arrangement of primary xylem is called exarch.
22. (a) The first formed primary xylum elements are called protoxylem and the later formed primary xylem is called metaxylem. In stems, the protoxylem lies towards the centre (pith) and the metaxylem lies towards the periphery of the organ. This type of primary xylem is
    called endarch.
23. (b)
24. (b)
25. (d) Primary meristems are those meristems which originate from the embryonic meristem. They are located at the tips of stems, roots and appendages. Apical and intercalary meristems are primary meristem because they appear early in life of a plant and contribute to the
26. (b) Intercalary meristem occurs between mature tissues and is the separated region of apical meristem. It is found in between the plant organs. By the activity of this meristem, length of the plant organs increases.
27. (a) In the given figure of shoot apical meristem, the parts marked as A, B and C are respectively leaf primordium; shoot apical meristem and axillary bud (present in the axils of leaf and are capable of forming a branch or a flower). The shoot apical meristem is a population of cells located at the tip of the shoot axis. It produces lateral organs, stems tissues and regenerates itself.
28. (a) The end walls of sieve tube elements are perforated in a sieve like manner to form the sieve plates. A mature sieve element possesses a peripheral cytoplasm and a large vacuole but lacks a nucleus.
29. (a)
30. (a) Conjuctive tissue- Parenchymatous cells lying between xylem and phloem.
31. (d) Tracheids are chief water conducting elements of xylem in gymnosperms. They are devoid of protoplasm and hence dead. The wall constituting the tracheids is hard, thick and lignified. These are elongated cells with tapering ends.

32. (d) Meristem is divided on the basis of position in plant bodies into apical meristem, lateral meristem and intercalary meristem. Lateral meristem is present on the lateral sides, that is fascicular and interfascicular cambium and cork cambium (phellogen).
33. (b) Generally gymnosperms do not have vessels but a few gymnosperms with vessels are Ephedra, Smilax etc. Most of angiosperms have vessels except of few e.g., Trochodendron.
34. (c) Cork cambium and vascular cambium are responsible for secondary growth which increases the girth of the stem. Therefore, they are considered as lateral meristems .
35. (a) Companion cells are narrow, elongated and thin walled living cells. They lie on the sides of the sieve tubes and are closely associated with them through compound plasmodesmata.
36. (b) Ground tissue includes all tissues except epidermis and vascular bundles. The ground tissue comprises the bulk of the primary plant body. Parenchyma, collenchyma and sclerenchyma cells are common in the ground tissue.
37. (d) Guard cells differ from epidermal cells in having chloroplast. The cell wall of guard cells are not uniform, inner walls are thicker than the outer walls, epidermal cells are uniformly thin.
38. (a) All tissues except epidermis and vascular bundles constitute the ground tissue. In leaves the ground tissue consists of thin-walled chloroplast containing cells called mesophyll cells that actively involve in the process of photosynthesis.
39. (b) Open means presence of cambium during secondary growth. Vascular cambium divides to form secondary xylem towards inner side while secondary phloem towards outside.
40. (c)
41. (d)
42. (d) Stomata are tiny pores, and composed of two bean shaped epidermal cells called guard cells which enclose stomatal pore.
    Stomata are mostly present in epidermal layers of leaves and in other aerial parts like young stems, floral parts etc. Guard cells in dicots are kidney shaped and in monocots are dumb bell shaped. The guard cells may be surrounded by varying number of specialized epidermal cells called subsidiary cells or accessory cells.
43. (a) Gymnosperms have albuminous cells and sieve cells. They lack sieve tubes and companion cells.
44. (c) The xylem and phloem strands alternate with each other separated by parenchymatous cells. Such kinds of vascular bundles are called radial and found mainly in roots.
45. (b) Pericycle in roots is active in the formation of root branches or lateral roots.
46. (a) Intercalary meristems are derived from apical meristems and separated from the same by permanent cells. They are responsible for localised growth.
47. (c) In monocot leaves, the mesophyll cells are undifferentiated.
48. (b) Anatomically fairly old dicotyledonous root is distinguished from the dicotyledonous stem by position of cortex. Protoxylem is the first-formed xylem developing from procambium and consisting of narrow cells with annular, spiral, or scalariform wall thickenings.
49. (d) All the statements are correct regarding Bulliform or motor cells. They are large, bubble-shaped, empty colourless epidermal cells that occur in groups on the upper surface of the leaves of many grasses. Loss of turgor pressure in these cells causes leaves to "roll up" during water stress.
50. (d) The internal structure of a typical monocotyledon root is similar to dicotyledon root. Number of xylem bundles are more than six (polyarch) in monocotyledon root (exceptionally the number of xylem bundles are two to six in onion). Pith is well developed in monocotyledon root. Monocot roots do not undergo secondary growth.
51. (b) Endodermis or innermost layer of cortex has casparian strips in roots. It is called starch sheath in dicot stems. It separates cortex from stele. The cell walls are thickened at the corners in angular collenchyma.

52. (c) By observing the arrangements of vascular bundles, the student will discover the nature of stem. If the vascular bundles are arranged in a ring then it is a dicot stem and if the vascular bundles are scattered, then it is a monocot stem.
53. (d)
54. (a) The first formed primary xylem elements are called protoxylem and the later formed primary xylem is called metaxylem. In stems, the protoxylem lies towards the centre (pith) and the metaxylem lies towards the periphery of the organ. This type of primary of the organ. This type of primary xylem is called endarch.
55. (b)

NCERT Exemplar Questions

1. (a)
2. (b) A meristem is a simple tissue made of a group of similar and immature cells (meristematic cells) which can divide and form new cells.
   Parenchyma cells having chloroplasts are termed as chlorenchyma. It helps in the manufacture of food (photosynthesis). Storage parenchyma is made of large sized vacuolated cells which are used to store water, mucilage and food, e.g., Aloe, Opuntia, potato tuber.
   Collenchyma gives mechanical strength to young dicot stems, petioles and leaves.
   Sclerenchyma is of two types, sclerenchyma fibres and sclereids.
   Epidermal tissue system make the outermost covering of plant body. It mainly consists of epidermis and epidermal appendages. Epidermis is made of epidermal cells and stomata.
3. (a)
4. (a) Simple permanent tissue found in plants is Parenchyma and, xylem and phloem are complex permanent tissues. Epidermis is a part of epidermal tissue system.
5. (c)
6. (c) Epiblema (rhizodermis) is the outermost layer of young root which has thin-walled cells. Some of the cells give rise to root hairs which take part in the absorption of water and mineral salts. Epidermis is also outer most layer. Therefore epiblema of root is equivalent to epidermis.
7. (d)
8. (a)
9. (c) The shoot apical meristems are present at the tips of the stem, and its branches. They produce growth in length. As the twig possesses 4 branches, number of shoot apical meristems are likely to be 5 including one of the twig itself.
10. (b) Fibres occur in all those parts of plants where mechanical strength is required i.e., leaves, petioles, cortex, xylem, phloem, etc. In conifers, they are likely to be absent in secondary xylem.
11. (a) Periderm is a tissue of secondary origin that replaces damaged epidermis. It can be found in underground plant organs. In potato, a model for periderm studies, periderm replaces the epidermis early in tuber development and suberized phellems constitute tuber's skin. Thus when we peel off a potato tuber we will remove periderm.
12. (d)
13. (c)

NEET

14. (b) Specialized epidermal cells surrounding the guard cells are known as subsidiary or accessory cell.
15. (d) In roots, the root hairs develop from the zone of maturation. This zone is differentiated zone thus, bearing root hairs.
16. (b) Cork cambium undergoes periclinal division and cuts off thick walled suberised dead cells towards outside i.e., phellem (cork) and it cuts off thin walled living cells i.e., phelloderm on inner side.
17. (b) Cellulose microfibrils are arranged radially rather than longitudinally which makes it easy for the stomata to open.
18. (a) Grass being a monocot, has Dumb-bell shaped stomata in their leaves.
19. (c) Casparian strip is a band of cell wall material deposited in the radial and transverse walls of the endodermis. Casparian strip is made of suberin and sometimes lignin.
20. (d) Xylem is a type of complex tissue. It translocates water, mineral salts, organic nitrogen and hormones.
21. (d) Intercalary meristems are capable of cell division and they allow for rapid growth and regrowth of many monocots. Intercalary meristem, found in grasses, help to regenerate the parts removed by the grazing herbivores.
22. (d) Phloem in gymnosperms lacks both sieve tube and companion cells. They only certain sieve cells for conduction of food material and also have albuminous cells that have function similar to that of companion cells.
23. (b) Meristematic tissues are those tissues which have cells with active cell division capacity.
    Simple tissues are those tissues which have all the cells similar in structure and function.
    Vascular tissues are complex permanent tissues hence they have different types of cells.
    Sclereids are sclerenchymatous cells which are dead with highly thickened walls and narrow lumen.
24. (*) All the statements are correct about vascular bundles.
25. (d) Statement I is incorrect because endarch and exarch are the terms often used for describing the position of primary xylem in the plant body. Exarch condition is the most common feature of the root system. Hence, statement I is incorrect and II is correct.

EXERCISE -3

1. (d) $A-III, B-IV, C-II, D-I$
2. (b) $A-III, B-V, C-II, D-IV$
3. (d) $A-III, B-I, C-V, D-II$
4. (d) $A-IV, B-I, C-III, D-V$
5. (a) $A-IV, B-I, C-II, D-III$
6. (a) $A-I, B-II, C-III, D-IV$
7. (c) Intercalary meristem-Occurs in grasses and regenerate parts removed by the grazing herbivores.
   Parenchyma cells are generally isodiametric.
8. (d) Vessel- Long cylindrical tube-like structure, with lignified walls and a large central cavity, devoid of protoplasm. Interconnected through perforations in their common walls.
   The presence of vessels is a characteristic feature of angiosperms.
9. (a)
10. (d) The functions of sieve tubes-controlled by the nucleus of companion cells.
    Companion cells maintain the pressure gradient in the sieve tubes.
11. (b) It consists of simple tissues such as parenchyma, collenchyma and sclerenchyma.

12. (c) The abaxial epidermis bears more stomata than the adaxial epidermis. Mesophyll has two types of cells- the palisade parenchyma and the spongy parenchyma.
13. (d) Xylem fibres have highly thickened walls and obliterated central lumens whereas xylem parenchyma are thinned wall and their cell walls are made up of cellulose.
14. (a) Phloem transports food materials, usually from leaves to the other parts of the plant. The companion cells are specialised parenchymatous cells which are closely associated with sieve tube elements.
15. (b) The first formed primary xylem elements are called protoxylem and the later formed primary xylem is called metaxylem. Phloem fibres (bast fibres) are made up of sclerenchymatous cells.
16. (b)
17. (d)
18. (a) Lenticels are raised pores in the stem of a woody plant that allows gas exchange between the atmosphere and the internal tissues. Parenchymatous cells are usually present in cortex. The ground tissue system is divided into three main zones- cortex, pericycle and pith. The conjoint vascular bundles usually have the phloem located only on the outer side of the xylem.
19. (a) All the statements describe the anatomy of dicotyledonous root. Dicot root consists of a single layer of epiblema which bears unicellular root hairs. Endodermis is followed by one or more layers of pericycle. Inner to pericycle lies radially arranged vascular bundles. This arrangement keeps the xylem bundles in direct contact with the outer tissue of the roots which conduct water absorbed by root hairs to the inside. Xylem is exarch.
20. (d) All the given statements represent the anatomical features of monocotyledonous stem. Monocot stem is characterised by epidermis (2-3layered), hypodermis and undifferentiated ground tissue stem. Vascular strand is numerous and scattered. Vascular bundles are conjoint, collateral and closed.
21. (b) Collateral vascular bundles have the xylem pointing towards the inner side of the phloem. In the same way in monocots, cambium is absent. Collateral vascular bundles are present in stems and leaves of angiosperms and gymnosperms.
22. (b) Xylem is the water conducting tissue. It consists of living cells like parenchyma and dead cells like tracheary elements.
23. (a) Vessels are more efficient for water conduction as compared to tracheids. Vessels resemble tracheids very much in structure and function. But unlike tracheids these are like long tubes arranged in vertical row formed of cylindrical cells arranged to end with their end walls completely dissolved. These are also dead and lignified.