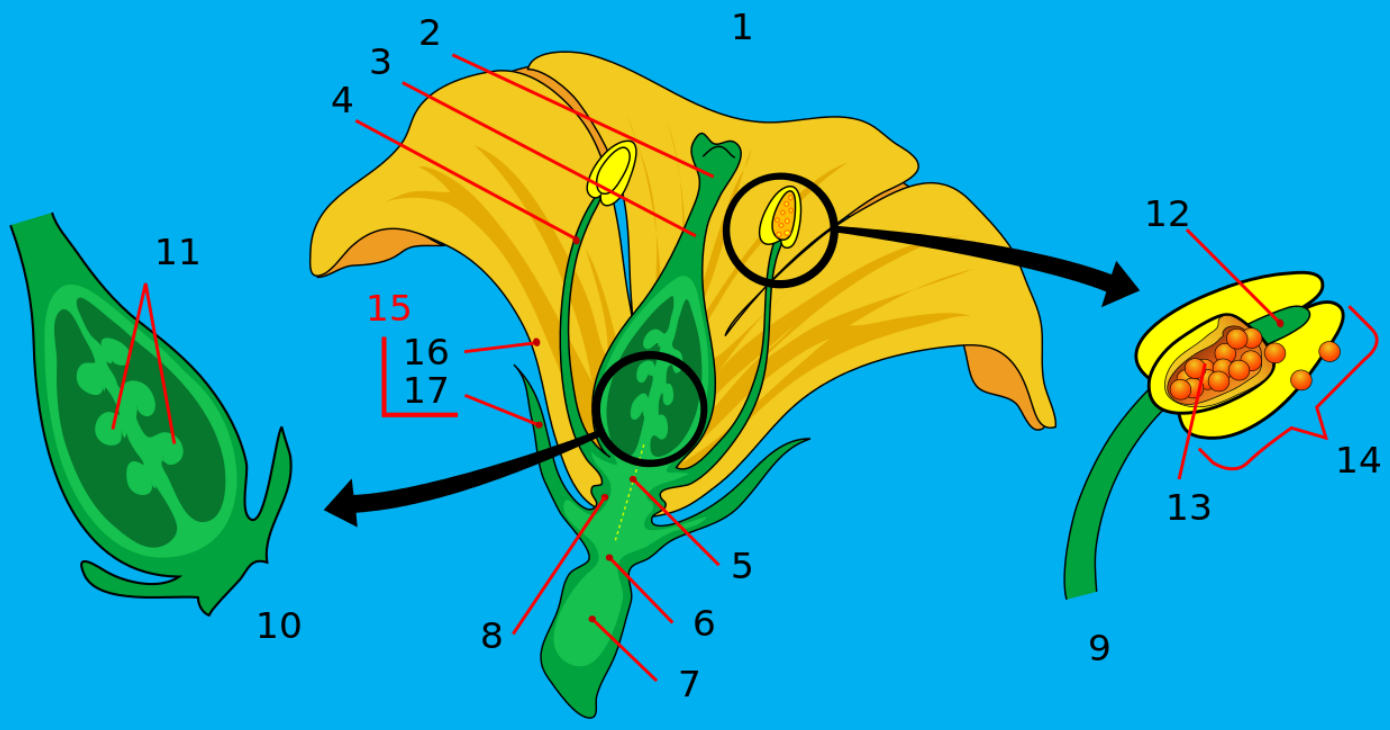
# 6. ANATOMY OF FLOWERING PLANTS




Biology Smart Booklet

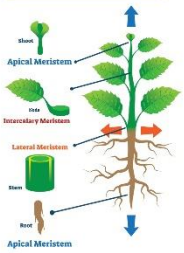
Theory + NCERT MCQs + NEET PYQs

# • Anatomy of flowerig plants •

## Plant Tissue

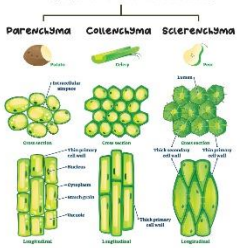
### Meristematic tissues
(Capable of cell division)

- Apical (Primary)
- Intercalary (Primary)
- Lateral (Secondary)

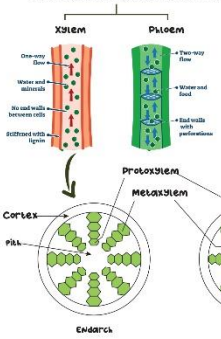



### Permanent tissues

**SIMPLE**
(Made up of only one cell type)




**COMPLEX**
(Made up of more than one cell types)

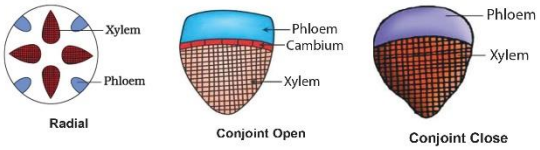


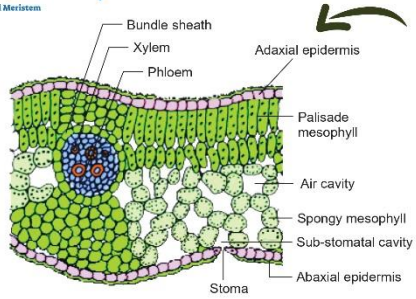

## TISSUE SYSTEM

### Epidermal Tissue System
- Epidermal cells
- Stomata
- Epidermal appendages

### Ground Tissue System
(All plants tissues except epidermis and vascular bundles for the ground tissues)

### Vascular Tissue System
(Xylem and Phloem together form vascular bundles)




## DICOTYLEDONOUS LEAF
(Dorsiventral)

**Epidermis (covers)**

- Adaxial epidermis (upper surface) — Less or may be absent stomata
- Abaxial epidermis (lower surface) — More stomata

**Mesophyll**

Tissue between upper and lower epidermis (Photosynthesis)
- (1) Palisade parenchyma.
- (2) Spongy Parenchyma

**Vascular System**

(i) Includes vascular bundles and seen in veins & midrib.
(ii) Bundle sheath cells surrounds the vascular bundles.

## MONOCOTYLEDONOUS LEAF

(Isobilateral) (Similar to dicot leaf)

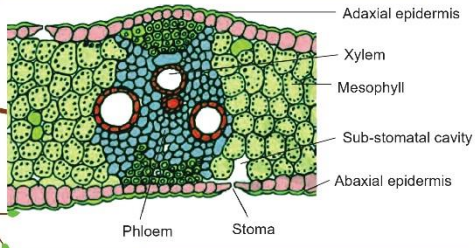
- **Stomata**
- **Bulliform cells**
  (Adaxial epidermis cells along veins in grasses transform into large, empty, colorless cells)
- **Mesophyll** (Not divided)
- Vascular bundle
  (two protoxylem and two metaxylem)
- Bundle Sheath (consist of Sclerenchyma)

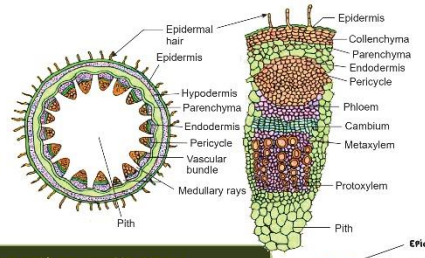
## VASCULAR CAMBLUM

(Meristematic layer responsible for cutting off xylem & Phloem tissues)

Formation of Cambial Ring - Intrafascicular cambium, Interfascicular cambium

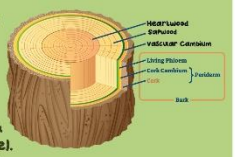
- Active Cambium – Cut off new cells towards 1.Pith - Secondary xylem 2.Periphery -Secondary Phloem
- Cambium Activity :-1) Active Cambium - Spring or early wood .2)Less Active Cambium - Autum or Late wood
- Old trees, Secondary xylem:- 1) Heart wood (Mechanical support) . 2) Sap wood (Conduction of water)



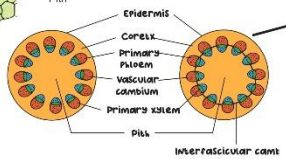

## CORK CAMBIUM

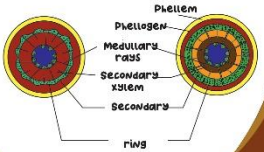
- Due to vascular cambium activity, the stem's girth increases resulting breking of outer cortical and epidermal layer replaced with protective cell layer called Phellogen or Cork cambium
  Cork Cambium:- (i) Lenticels.
  (ii) Bark:- (i) Soft/early Bark (Gas exchange).
  (ii) Hard/Late Bark




## DICOTYLEDONOUS STEM
(Secondary growth occurs)

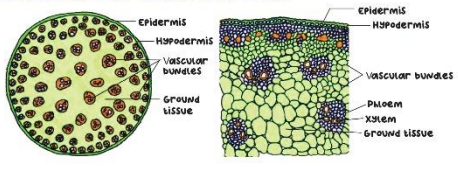
- Cortex zones :- (i) Hypodermis (Outermost, mechanical strength to young stem, Collenchymatous).
  (ii) Endodermis (Inner most, Starch sheath).
  (iii) Cortical ( Intracellular space)
- Pericycle (Above Phloem and inner side of endodermis)
- Vascular bundles (Conjoint, open and endarch protoxylem)
- Pith (round, Parenchymatous cells having intercellular space, center of stem)



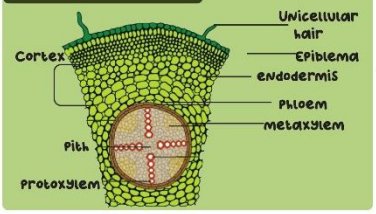




Secondary Growth in Stem

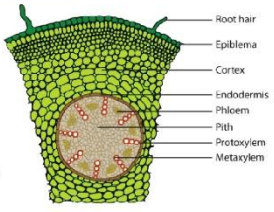
## MONOCOTYLEDONOUS STEM
(Secondary growth usually don't occur)




## DICOT ROOT




## MONOCOT ROOT
(Do not undergo secondary growth)




## Secondary Growth in Root

# ANATOMY OF FLOWERING PLANTS

## Anatomy

Anatomy is the study of internal structure of organisms. Plant anatomy includes organization and structure of tissues. Tissue is a group is cells having a common origin and usually performing a common function.

## The Tissue

A group of cells having a common origin and usually performing common function are called tissues.

There are two types of tissues (i) Meristematic (ii) Permanent.

**Meristematic Tissues:** The meristematic tissue is made up of the cells which have the capability to divide. Meristems in plants are restricted to a specialized regions and responsible to the growth of plants.

**Permanent Tissues:** The permanent tissues are derived from meristematic tissue, are composed of cells, which have lost the ability to divide and have become structurally and functionally specialised.

## Meristematic tissues:

**There are three types of Meristem:**

- Apical meristem
- Intercalary meristem
- Lateral meristem

**Apical meristem:** Meristematic tissue is a simple tissue composed of group of similar and immature cells which can divide and form new cells. The meristem which occurs at tips of roots and shoots are called apical meristem.

**Intercalary meristem:** Intercalary meristem occurs between mature tissues especially in grasses. Both apical meristems and intercalary meristems are primary meristems because they appear early in life of a plant and help to form the primary plant body.

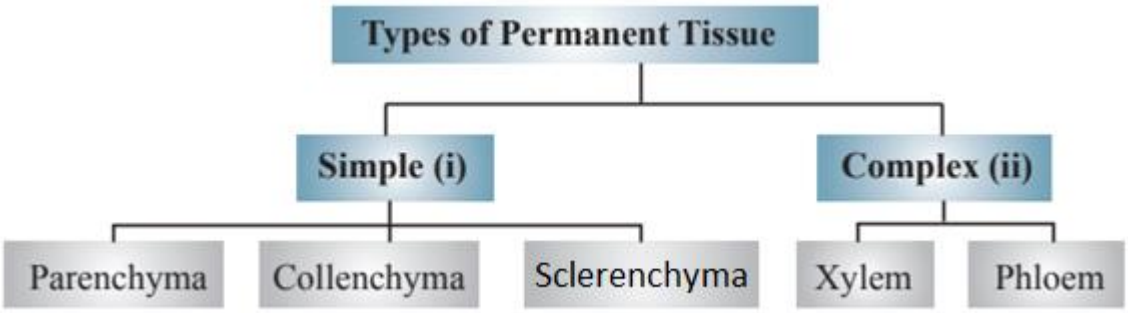
**Lateral meristem:** The meristem which occurs on the sides and takes part in increasing girth of the plants are called Lateral meristem. Intrafascicular cambium in the primary lateral meristem. Vascular cambium, cork cambium are secondary meristem.

**Axillary bud:** The buds which are present in the axils of leaves (Consist of cells left behind from shoot apical meristem) and are responsible for forming branches of flowers.

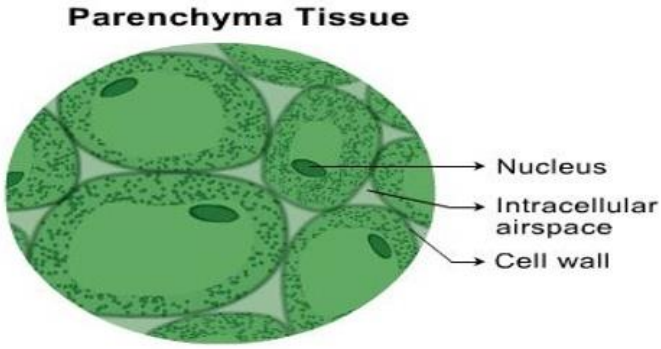
## Permanent tissues

The permanent tissues are derived from meristematic tissue, are composed of

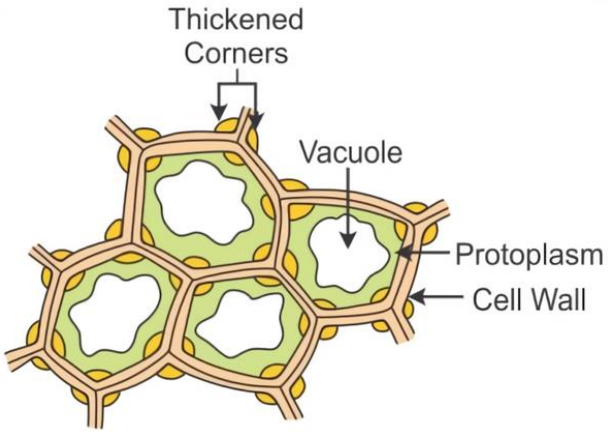
cells, which have lost the ability to divide and have become structurally and functionally specialized.



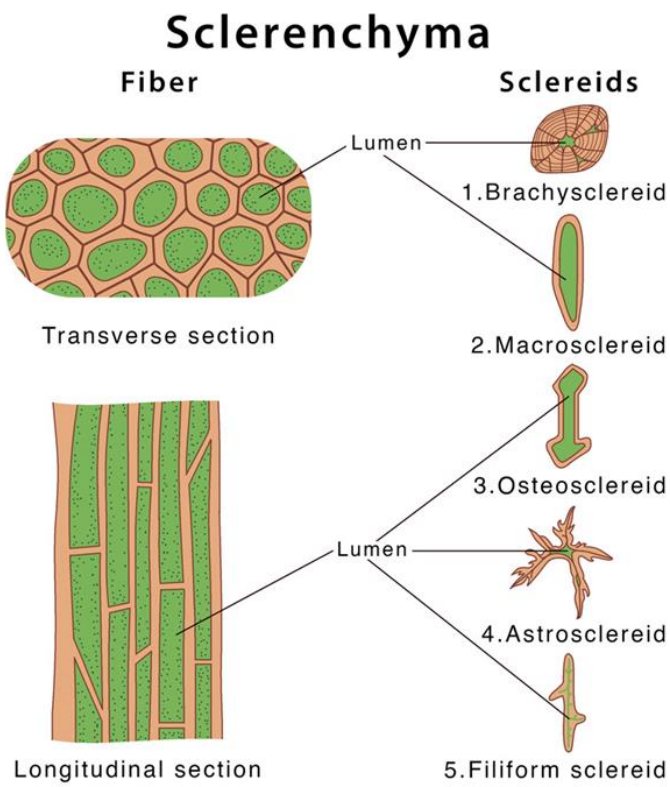

**Parenchyma:** Parenchyma is a simple permanent living tissue which is made up of thin-walled isodiametric cells. Each cell encloses a large central vacuole and peripheral cytoplasm containing nucleus. They are found in non-woody and soft areas of stem, root, leaves, fruits and flowers. They store the food and provide turgidity to softer parts of plant.




**Collenchyma:** Collenchyma consists of cells which are much thickened at corner due to cellulose, hemicellulose and pectin. Oval, spherical or polygonal often contain chlorophyll. They provide mechanical support to the growing parts of the plants like young stem.



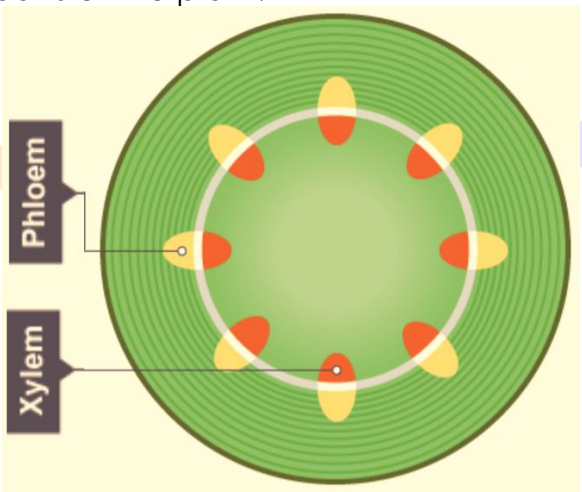

**Sclerenchyma:** Sclerenchyma are supportive tissue having highly thick-walled cells with little or no protoplasm due to deposition of cellulose or lignin. They are of two types: fibers and sclereids. They provide mechanical support to mature plant organs to tolerate bending, shearing, compression etc.




**Complex tissue:** Permanent tissues having all cells similar in structure and function are called simple permanent tissues and those having different kinds of cells are called complex tissue.

**Xylem:** Xylem consists of tracheid's vessels, xylem fibers and xylem parenchyma. It conducts water and minerals from roots to other parts of plant.

**Phloem:** Phloem consists of sieve tube elements, companion cells, phloem fibers and phloem parenchyma; Phloem transports the food material from leaves to various parts of the plant.




**Endarch:** Primary xylem is of two types- protoxylem and metaxylem. In stem, protoxylem lies in centre and metaxylem towards periphery. This type of primary xylem is called endarch.

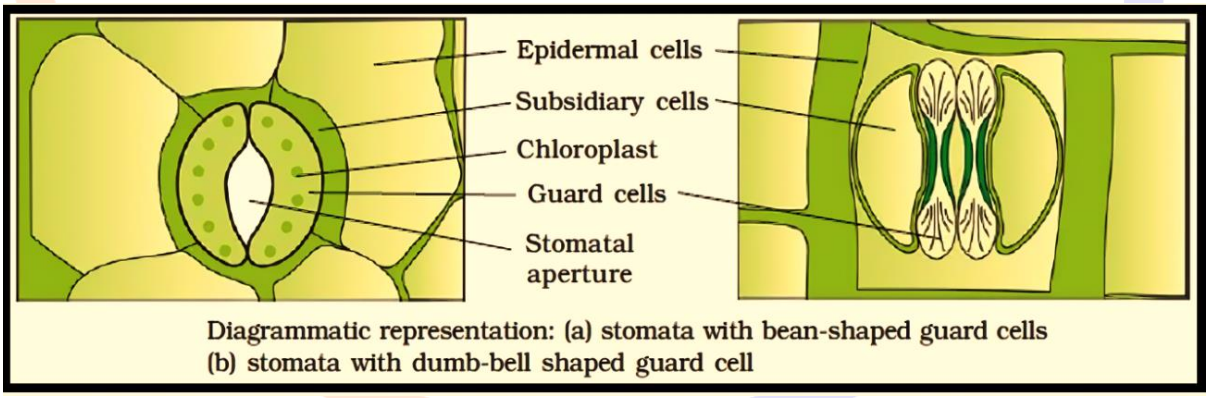
**Exarch:** In roots, protoxylem lies in periphery and metaxylem lies towards the center. This type of primary xylem is called exarch.

## Tissue System

The tissue system is divided into three categories based on a division of labor. Each system usually consists of a combination of tissue organizations that perform specific functions.

### Epidermal Tissue System

- It forms the outermost covering of whole plant body, which consists of epidermal cells, stomata, epidermal appendages (trichomes and hairs).
- Epidermis is single layered, parenchymatous with waxy thick layers of cuticle to prevent water loss.
- Stomata is present in epidermis of leaves. It regulates the transpiration and gaseous exchange. In dicots, stomata are bean-shaped having two guard cells closing the stomatal pore. In monocots, stoma is dumbbell shaped. Guard cells contain chloroplasts and help in opening and closing of stomata.
- Guard cells are surrounded by subsidiary cells. The stomatal aperture, guard cells and the surrounding subsidiary cells are together called stomatal apparatus.
- Epidermis also contains a number of hairs. Root hairs are unicellular elongation of epidermal cells. Trichomes are present on stems, which are multicellular, branched or un-branched preventing water loss due to transpiration.



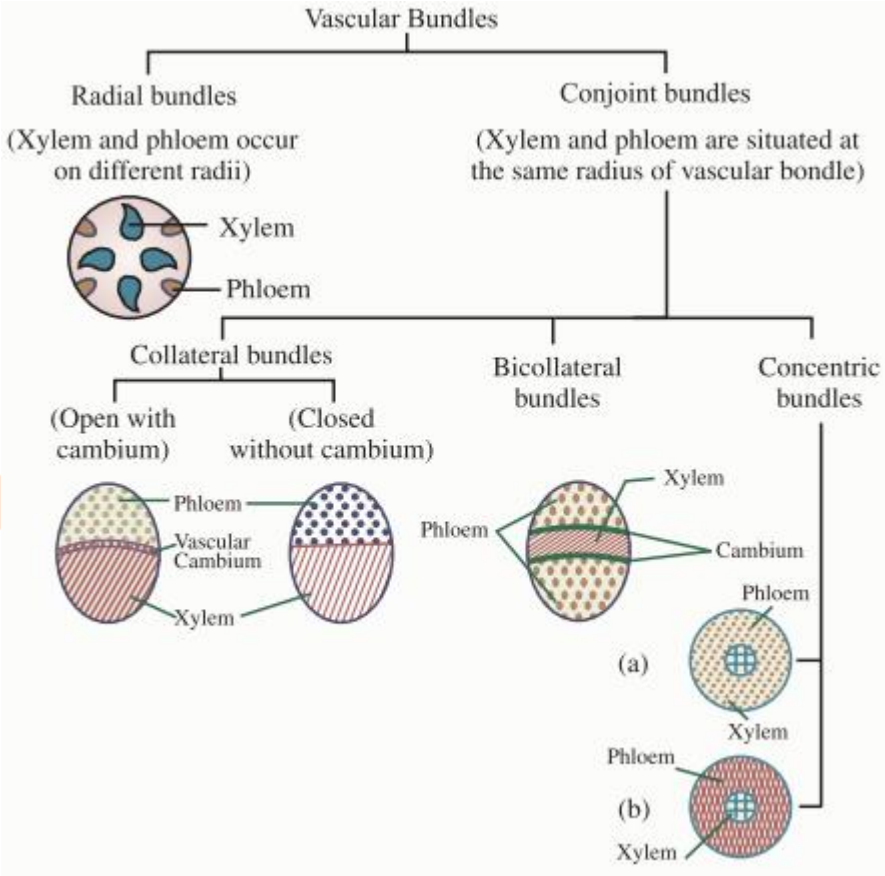

Diagrammatic representation: (a) stomata with bean-shaped guard cells (b) stomata with dumb-bell shaped guard cell

### The ground Tissue System

- All the tissue between epidermis and vascular bundle forms the ground tissues. It consists of simple permanent tissues. Parenchyma is present in pericycle, cortex, pith and medullary rays in stem and roots.
- In leaves the mesophyll, chloroplast containing cell, forms the ground tissues.

### The vascular tissue system

It includes vascular bundles which are made up of xylem and phloem.




## Anatomy of Root

| Dicot Root | Monocot Root |
|---|---|
| Cortex is comparatively narrow. | Cortex is very wide. |
| Endodermis is less thicknened casparian strips are more prominent. | Endodermal cells are highly thickened Casparian strips are visible only in young roots. |
| The xylem and phloem bundles varies from 2 to 5. | Xylem and phloem are more than 6 (polyarch). |
| Pith is absent or very small. | Well developed pith is present. |
| Secondary growth takes place. | Secondary growth is absent. |

## Casparian Strips

The tangential as well as radial walls of endodermal cells of dicot roots have deposition of water impermeable, waxy material, suberin in the form of casparian strips.

## Anatomy of Stem

| Dicot Stem | Monocot Stem |
|---|---|
| The ground tissue is differentiated into cortex, endodermis, pericycle and pitch. | The ground tissue is made up of similar cells |
| The vascular bundles are arranged in a ring. | The vascular bundles are scattered throughout the ground tissue. |

| | |
|---|---|
| Vascular bundles are open, without Surrounded bundle sheath and wedge-shaped outline. | Vascular bundles are closed, by sclerenchymatous bundle sheath, oval or rounded in shape. |
| The stem shows secondary growth due to presence of cambium between xylem and phloem. | Secondary growth is absent. |

## Secondary growth dicot stem

An increase in the girth (diameter) in plants. Vascular cambium and cork cambium (lateral meristems) are involved in secondary growth.

- Formation of cambial ring: Intrafascicular cambium + interfascicular cambium.
- Formation of secondary xylem and secondary phloem from cambial ring.
- Formation of spring wood and autumn wood.
- Development of cork cambium(phellogen).

## Secondary growth in dicot roots

Secondary growth in dicot roots occur with the activity of secondary meristems (vascular cambium). This cambium is produced in the stele and cortex, and results in increasing the girth of dicot roots.

## Spring wood

It is also called early wood in which cambium is active Vessels with wide cavities & Light in colour, low density presence of Xylary elements more.

## Autumn Wood

Also called late wood in which cambium is less active presence of Xylary elements is less Vessels are narrow & Dark, high density.

## Heartwood

Central or innermost region of stem which is hard, durable and resistant to attack of Microorganisms and insects & Not involved in conduction of water, gives mechanical support to stem.

## Sapwood

Peripheral region stem, light in colour Involved in conduction of water and mineral.

## Anatomy of Leaf

| Dorsiventral (Dicot) Leaf | Isobilateral (monocot) Leaf |
|---|---|
| Stomata are absent. | Stomata present on both sides. |
| Mesophyll is differentiated into two parts. | Mesophyll is undifferentiated. |
| Bundle sheath is single layered. | Bundle sheath is double layered |

| | |
|---|---|
| Hypodermis of the mid-rib region, is collenchymatous. | Hypodermis of the mid-rib region is sclerenchymatous. |
| Stomata have kidney shaped guard cells. | Stomata have kidney shaped dumb cells. |

## Cork Cambium

- Meristematic tissue which develops in the cortex region is called cork cambium or phellogen.
- The phellogen cuts off cells on both sides. The outer cells differentiate to form cork or phellem while the inner cells differentiate into secondary cortex or phelloderm.
- Phellogen, phellem and phelloderm are collectively called periderm.
- Due to activity of the cork cambium, pressure builds up on the remaining layers peripheral

## 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.

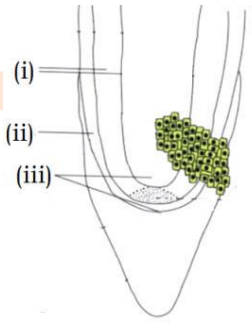
## Secondary Growth in Roots

- The vascular cambium of the dicot root originates from the tissue located just below the phloem bundles. A portion of pericycle tissue present above the protoxylem forms a continuous wavy ring. It gradually becomes circular. Rest of the steps are similar as in dicot stem.
- Secondary growth takes place in stems and roots of gymnosperms. No secondary growth occurs in monocots.

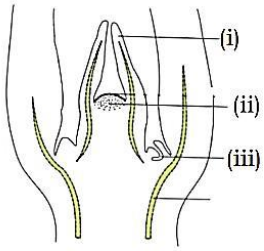
# NCERT LINE BY LINE QUESTIONS

## Paragraph 6.1 The Tissues
## Paragraph 6.1.1 Meristematic tissues:

1. Apical meristems **(Pg. 84, E)**
   A) Occur at root tip
   B) Produce primary tissues
   C) Regenerate parts of plant
   D) Both A & B
2. During leaf formation and stem elongation, some cells of apical meristem left behind form- **(Pg. 84, E)**
   A) Primary cell.
   B) Intercalary meristem
   C) Axillary bud
   D) Interfascicular cambium
3. Intercalary meristem **(Pg. 85, E)**
   A) Occur in grasses
   B) Occur between mature tissue
   C) Both A & B
   D) None
4. Primary meristem **(Pg. 85, E)**
   A) Appear later in life of plant
   B) Appear early in life of plant
   C) Regenerates parts of plant
   D) Both B & C
5. Primary body of plant is formed by- **(Pg. 85, E)**
   A) Meristem
   B) Vascular cambium
   C) Both A & B
   D) None
6. Lateral meristem are- **(Pg. 85, E)**
   A) Type of primary meristem
   B) Appearing early in life of plant
   C) Responsible for producing secondary tissues
   D) Both A & B
7. Secondary meristem include- **(Pg. 85, E)**
   A) Fascicular vascular cambium
   B) Cork cambium
   C) Secondary phloem
   D) Both A and B
8. Meristem that occur in mature region of root and shoot of plant- **(Pg. 85, E)**
   A) Apical meristem
   B) Intercalary meristem
   C) Lateral meristem
   D) None of these
9. Identify the correct labels- **(Pg. 85, E)**




   A) (i) – cortex, (ii) – Protoderm, (iii) –initial of central cylinder & cortex
   B) (i) – Protoderm, (ii) – cortex, (iii) – central cylinder
   C) (i) – central cylinder, (ii) – cortex, (iii) – Protoderm
   D) (i) – central cylinder, (ii) – Protodrem, (iii) – cortex
10. Identify the axillary bud in given figure – **(Pg. 85, E)**




A) (i) B) (ii) C) (iii) D) Both (ii) and (iii)

## Paragraph – 6.1.2 Permanent Tissue

11. Cell of permanent tissue **(Pg. 86, E)**
A) Divide regularly to repair damage B) Divide occasionally
C) Do not divide generally D) Both (B) and (C)

12. Simple tissue are – **(Pg. 86, E)**
A) Meristematic tissues having all cells similar in structure and function
B) Meristematic tissues having different types of cells
C) Permanent tissues having all cells similar in structure and function
D) Permanent tissues having many different type of cells

13. Complex tissues are – **(Pg. 86, E)**
A) Meristematic tissues having all cells similar in structure and function
B) Permanent tissues having all cells similar in structure and function
C) Meristematic tissues having different types of cells
D) Permanent tissues having different types of cells.

## Paragraph – 6.1.2.1 Simple tissue

14. Simple tissues are made of **(Pg. 86, E)**
A) Some types of cells of similar origin
B) Only one type cells
C) Different types of cells of same origin
D) Different types of cells of different origin

15. Major component within organs is formed by – **(Pg. 86, E)**
A) Collenchyma B) Sclerenchyma
C) Parenchyma D) All of these

16. Walls of parenchyma are made of– **(Pg. 86, E)**
A) Proteose B) Cellulose C) Keratin D) Pectin

17. Parenchyma performs functions – **(Pg. 86, E)**
A) Photosynthesis B) Storage
C) Secretion D) All of the above

18. Parenchyma cells are generally – **(Pg. 86, E)**
A) Of varying diameters, with no intercellular space
B) Of similar diameters, with no intercellular space
C) Of similar diameters, with small intercellular space
D) Both B and C

19. Where does collenchyma occur? **(Pg. 86, E)**
A) Below endodermis in most monocots
B) Below epidermis in most monocots
C) Below epidermis in most dicots
D) Below endodermis in most dicots

20. Cell of collenchyma are thickened at corners due to deposition of **(Pg. 86, E)**
A) Cellulose B) Hemicellulose
C) Pectin D) All of these

21. Collenchyma cells – **(Pg. 86, E)**
A) May be polygonal and never contain chloroplasts.
B) May be polygonal and often contain chloroplasts
C) May be oval and contain chloroplasts
D) Both B and C

22. Collenchyma cells **(Pg. 86, E)**
A) Have no intercellular spaces
B) Have large intercellular spaces
C) May or may not have intercellular spaces
D) None of these

23. Mechanical support in plants is provides by **(Pg. 86, E)**
A) Parenchyma B) Collenchyma
C) Sclerenchyma D) Both B and C

24. Choose the best option **(Pg. 86, M)**
A) All collenchymatous cells Assimilate food
B) No collenchymatous cells assimilate food
C) Some collenchymatous cells do not assimilate food
D) All collenchymatous cells do not assimilate food

25. Collenchyma provide mechanical support to – **(Pg. 86, E)**
A) Young stem B) Petiole of leaf organs only
C) Organs only D) All of these

26. Identify the given figure **(Pg. 86, E)**


A) (i) – parenchyma, (ii) – fibre, (iii) – sclereid, (iv) – collenchyma
B) (i) – sclereids, (ii) – fibre, (iii) – parenchyma, (iv) collenchyma
C) (i) – collenchyma, (ii) – sclerids, (iii) – fobres, (iv) – parenchyma
D) (i) – collenchyma, (ii) fibre, (iii) – sclereids, (iv) – parenchyma

27. Sclenenchyma cells are – **(Pg. 86, E)**
A) Usually dead with protoplast B) Usually dead without protoplast
C) Usually living with protoplast D) Usually living without protoplast

28. Read the given statements – **(Pg. 86, M)**
(i) Sclereids are found in leaves of tea.
(ii) Fibres generally occur single in various plant parts.
(iii) Sclerenchyma provides mechanical support to young stems.
(iv) Parenchyma cells have thick walls.
(v) Collenchyma cells are thickened at corners.
How many are correct
A) 2 B) 3 C) 4 D) 1

29. Pulp of pear has which type of sclerenchyma cells- **(Pg. 87, E)**
A) Sclereids B) Fibres C) Tracheids D) Trichomes

## Paragraph – 6.1.2.2
## Complex Tissues

30. Complex tissues are – **(Pg. 87, E)**
A) Made of one of cells, working as unit
B) Made of many types of cells, working as a unit
C) Made of one type of cells, working separately

D) Made of many types of cells, working separately

31. Xylem has following functions except– **(Pg. 87, E)**
A) Conducting water from roots to upper plant part
B) Conducting minerals from leaves to roots
C) Providing mechanical strength to plant parts
D) Conducting sap from roots to leaves

32. Xylem tissue consists of- **(Pg. 87, E)**
A) Sieve tube, companion cells, fibres, parenchyma
B) Sieve cells, vessels, fibres, parenchyma
C) Vessels, tracheids, sieve tube, fibres
D) Vessels, tracheid, fibres, parenchyma

33. Gymnosperms lack- **(Pg. 87, E)**
A) Xylem vessels B) Companion cells
C) Sieve tubes and companion cells D) All of the above

34. Phloem of gymnosperms possess- **(Pg. 87, E)**
A) Albuminous cells B) Companion cells
C) Sieve tube D) Both (B) and (C)

35. Xylem has all dead cells except- **(Pg. 87, E)**
A) Xylem parenchyma B) Xylem fibres
C) Xylem vessels D) Xylem tracheids

36. Ray parenchymatous cells help in – **(Pg. 87, E)**
A) Radial conduction of food B) Axial conduction of water
C) Axial conduction of food D) Radial conduction of water

37. Food materials can be stored in xylem parenchyma in all of these forms except – **(Pg. 87, E)**
A) Starch B) Fat C) Tannin D) None

38. In stems, **(Pg. 87, E)**
A) Protoxylem lies towards centre and metaxylem towards periphery, called endarch
B) Protoxylem lies towards centre and metaxylem towards periphery, called exarch
C) Metaxylem lies towards centre and protoxylem towards periphery called endarch
D) Metaxylem lies towards centre and protoxylem towards periphery called exarch

39. In roots – **(Pg. 87, E)**
A) Protoxylem lies towards centre and metaxylem towards periphery, called endarch
B) Protoxylem lies towards centre and metaxylem towards periphery, called exarch
C) Metaxylem lies towards centre and protoxylem towards periphery called endarch
D) Metaxylem lies towards centre and protoxylem towards periphery called exarch

40. A maturāe sieve elements – **(Pg. 88, E)**
A) Have peripheral nucleus
B) Have peripheral cytoplasm and no nucleus
C) Have no vacuole and no nucleus
D) Have large vacuole and peripheral nucleus

41. Phloem fibres – **(Pg. 88, E)**
A) Are made of parenchyma B) Are made of collenchyma
C) Present in primary phloem D) Present in secondary phloem

42. Which of the statements about Phloem is correct? **(Pg. 88, M)**
A) Protoploem consists of narrow sieve tube
B) Metaphloem consists of narrow sieve tubes
C) Protopholem consists of bigger sieve tubes
D) Both protophloem and metaphloem have bigger sieve tubes.

## Paragraph – 6.2

## The tissue system

43. The three types of tissue systems – epidermal ground and vascular systems are classified based on their- **(Pg. 88, E)**
A) Function B) Location C) Structure D) Both (B) and (C)

## Paragraph – 6.2.1
## Epidermal tissue system

44. Outer layer of primary plant body is – **(Pg. 88, E)**
A) Epiblema B) Epidermis C) Epicarp D) Ectodermis

45. Waxy layer on epidermis- **(Pg. 89, E)**
A) is called trichome B) is called epiblema
C) is absent in roots D) help in exchange of gases

46. Consider the following statements – **(Pg. 89, E)**
i) Epidermal cells are parenchymatous.
ii) Epidermis is usually two – layered.
iii) Stomata are usually present in epidermis of stem.
iv) Outer walls of guard cells are thick and inner walls are thin.
v) Subsidiary cells are epidermal cells.
How many of these statements are incorrect?
A) 2 B) 1 C) 3 D) 4

47. Stomatal apparatus consists of – **(Pg. 89, E)**
A) Stomatal aperture only B) Stomatal aperture and guard cells
C) Subsidiary cells D) Both (B) and (C)

48. Epidermal cells modify to form **(Pg. 89, E)**
A) Trichomes only B) Trichomes, Root hairs, Stomata
C) Trichomes, Root hair, Subsidiary cells D) Root hairs only

49. Trichomes – **(Pg. 89, E)**
A) Present on stem and are multicellular
B) Present on root and are multicellular
C) Present on stem and are unicellular
D) Present on root and are unicellular

## Paragraph – 6.2.2
## The ground Tissue System

50. All tissues are included in ground tissue except – **(Pg. 89, E)**
A) Cortex B) Pith C) Pericycle D) Epidermis

51. In leaves, mesophyll is present in – **(Pg. 89, E)**
A) Epidermal tissue system B) Ground tissue system
C) Vascular tissue system D) Both (A) & (B)

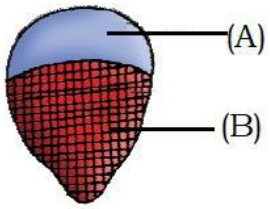
## Paragraph – 6.2.3
## The Vascular Tissue System

52. In dicots stem, which condition is present **(Pg. 90, E)**
A) Cambium present between xylem & phloem, known as closed type vascular bundle
B) Cambium absent between xylem & phloem, known as closed type vascular bundle.
C) Cambium present outside xylem & phloem, known as open type vascular bundle
D) Cambium present between xylem & phloem, known as open type vascular bundle.

53. A : Monocot have closed type of vascular bundles
R : monocots do not show secondary growth **(Pg. 90, H)**
A) Both A and R are correct and R is correct explanation of A
B) Both A & R are correct and R is not the explanation of A
C) A is correct and R is incorrect

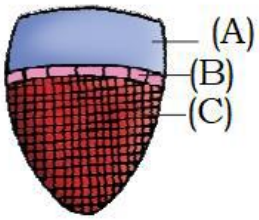
D) Both A & R are incorrect

54. Read given statements in context of given figure **(Pg. 90, E)**




i) A is xylem and B is phloem
ii) A is phloem and B is xylem
iii) Primary xylem in figure is endarch type.
iv) Primary in figure is exarch type.
Choose the correct statements
A) (i) and (iii) B) (i) and (iv) C) (ii) and (iii) D) (ii) and (iv)

55. The given figure can be vascular bundle of **(Pg. 90, E)**




A) Shoot of sunflower B) Shoot of grass
C) Root of sunflower D) Root of grass

## Paragraph – 6.3
## Anatomy of Dicot & Monocot Plants

56. For understand the tissue organization of roots, stems and leaves better, it is convenient to study– **(Pg. 90, E)**
A) Longitudinal section of young and growing zones of organs
B) Transverse section of young & growing zones of organs
C) Longitudinal section of mature zones of organs
D) Transverse section of mature zones of organs

## Paragraph – 6.3.1
## Dicotyledonous Root

57. Choose correct order of cells from outside to inside in a sunflower root- **(Pg. 90, E)**
A) Epidermis – endodermis – cortex – pericycle
B) Epiblema – cortex – endodermis – pericycle
C) Epiblema – cortex – pericycle – endodermis
D) Epidermis – endodermis – pericycle – cortex

58. Suberin is deposited on – **(Pg. 90, E)**
A) Tangential walls of epidermal cells
B) Radial walls of cortical cells
C) Tangential walls of endodermal cells
D) radial walls of epidermal cells

59. The substance that casparian strips is made up of is – **(Pg. 91, E)**
A) waxy B) water – impermeable
C) suberin D) all of these

60. Initiation of lateral roots in dicot during secondary growth occurs in – **(Pg. 91, E)**
A) Endodermal cells B) Pericycle
C) Medullary ray D) Conjunctive tissue

61. Initiation of vascular cambium in dicot root during secondary growth occurs from –

**(Pg. 91, E)**

A) Thin walled parenchymatous cells
B) Thick walled collenchyma cells
C) Thinn walled endodermal cells
D) Thick walled parenchyma cells

62. Which of the following is true about
A) Parenchymatous and lie outside phloem
B) Parenchymatous and lie outside endodermis
C) Collenchymatous and lie between xylem and phloem
D) Parenchymatous and lie between xylem & phloem

63. Endodermis is present in dicot root in **(Pg. 91, E)**
A) Two layer with little intercellular spaces
B) Two layer without any intercellular spaces
C) Single layer with little intercellular spaces
D) Single layer without any intercellular spaces

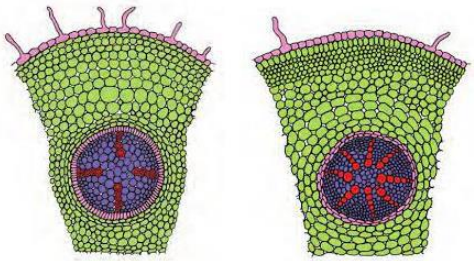
64. Cortex of dicot root consists of – **(Pg. 91, E)**
A) Multi layers of thick walled parenchyma
B) Multi layers of thin walled parenchyma
C) Single layer of thick walled parenchyma
D) Single layer of thin walled parenchyma

65. Innermost layer of cortex in dicot root is – **(Pg. 91, E)**
A) Pericycle B) Hypodermis C) Endodermis D) Pith

66. Parenchyma cells are generally thin walled. An example of thick-walled parenchyma in dicot root is **(Pg. 91, E)**
A) Pith B) Pericycle C) Endodermis D) Hypodermis

67. Stele includes **(Pg. 91, E)**
A) Endodermis, pericycle, pith
B) Endodermis, pericycle, vascular bundles
C) Pericycle, vascular bundle, pith
D) Endodermis, vascular bundle, pith

68. Identify the figure (i) & (ii) **(Pg. 91, E)**




A) (i)– T.S of dicot root (ii) – T.S of monocot root
B) (i) – T.S of dicot stem (ii) – T.S of monocot stem
C) (i) – T.S of monocot root (ii) – T.S of dicot root
D) (i) – L.S of monocot stem (ii) – L.S of dicot root

69. Identify the correct labels of monocot root T.S **(Pg. 91, E)**
A) (i)- cortex, (ii)- endodermis, (iii)- pericycle
B) (ii)- cortex, (i)- endodermis, (iii)- pericycle
C) (iii)- cortex, (ii)- endodermis, (i)- pericycle
D) (i)- cortex, (iii)- endodermis, (ii)- pericycle

## Paragraph – 6.3.2

## Monocotyledonous Root

70. Xylem bundles in monocot root- **(Pg. 91, E)**
A) Are fewer than dicot root B) Are less than six
C) Are polyarchy D) All of the above

71. Secondary growth in monocot roots occur- **(Pg. 91, E)**
A) By vascular cambium B) By interfascicular cambium
C) Both A & B D) None of these

## Paragraph – 6.3.3
## Dicotyledonous Stem

72. Epidermis of dicot stem- **(Pg. 91, E)**
A) Is called epiblema B) Lacks stomata
C) Has a thin layer of cuticle D) Lacks trichomes

73. Cortex in dicot stem is found between- **(Pg. 92, E)**
A) Epidermis and endodermis B) Endodermis and pericycle
C) Pericycle and pith D) Endodermis and pith

74. Hypodermis of dicot stem is made of- **(Pg. 92, E)**
A) Parenchyma B) Collenchyma
C) Sclerenchyma D) All of these

75. Starch sheath is found in dicot stem in- - **(Pg. 92, E)**
A) Endodermis B) Cortex C) Pericycle D) Pith

76. Cortical cells dicot stem has- **(Pg. 92, E)**
A) No intercellular spaces
B) Inconspicuous intercellular spaces
C) Conspicuous intercellular spaces
D) Very large intercellular spaces

77. Pericycle of dicot stem is present in the form of- **(Pg. 92, E)**
A) Semi – square patches of collenchyma
B) Semi – lunar patches of sclerenchyma
C) Semi – lunar patches of collenchyma
D) Semi – lunar patches of parenchyma

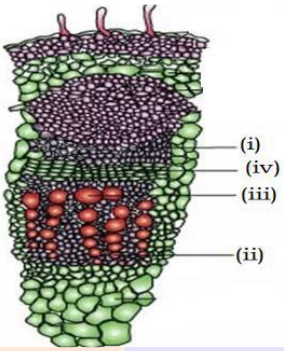
78. Medullary rays are – **(Pg. 92, E)**
A) Axially placed, parenchymatous
B) Axially placed, collenchymatous
C) Radially placed, parenchymatous
D) Radially placed, collenchymatous

79. Location of medullary rays – **(Pg. 92, E)**
A) Above endodermis
B) Between endodermis and pericycle
C) Between pericycle and cortex
D) Between vascular bundles

80. In sunflower stem, vascular bundle is- **(Pg. 93 E)**
A) Conjoint, closed, exarch protoxylem
B) radial, open, endarch protoxylem
C) conjoint, open, exarch protoxylem
D) conjoint, open, endarch protoxylem

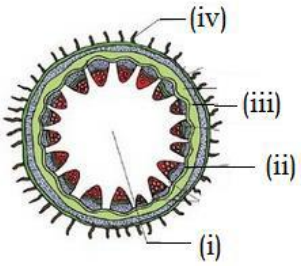
81. which of these is incorrect about pith of dicot stem? **(Pg. 93, E)**
A) Parenchymatous cells B) No intercellular space
C) Central portion of stem D) Large intercellular space

82. Identify the correct labels **(Pg. 92, E)**




A) (i)- protoxylem, (ii)- cambium, (iii)-phloem, (iv)- metaxylem
B) (ii)- protoxylem, (iv)- cambium, (i)-phloem, (iii)- metaxylem
C) (iv)- protoxylem, (i)- cambium, (ii)- phloem, (iii)- metaxylem
D) (iii)- protoxylem, (iv)- cambium, (i)- phloem, (ii)- metaxylem

83. Identify endodermis in the given figure- **(Pg. 92, E)**




A) (i) B) (ii) C) (iv) D) (iii)

## Paragraph – 6.3.4
## Monocot Stem

84. Select the correct match of columns A & B **(Pg. 93, M)**

| **Column A** | **Column B** |
|---|---|
| i Hypodermis of grasses stem | 1) parenchyma |
| ii Hypodermis of sunflower stem | 2) Collenchyma |
| iii Bundle sheath of grasses stem | 3) Sclerenchyma |
| iv Ground tissue of grasses stem | |

A) (i)- 2, (ii)- 3 B) (iv)- 1, (iii)- 1 C) (iii)- 3, (i)- 3 D) (ii)- 1, (iv)- 3

85. In monocot stem, **(Pg. 93, E)**
A) Peripheral vascular bundles are generally smaller than central ones
B) Central vascular bundles are generally smaller than peripheral ones
C) Both peripheral and central are almost same sized
D) None of these

86. Phloem parenchyma is absent in- **(Pg. 93, E)**
A) Gymnosperms B) Monocots C) Both D) None

87. The given figure is **(Pg. 92, E)**

A) Monocot root B) Dicot root C) Monocot stem D) Dicot stem

## Paragraph – 6.3.5
## Dorsiventral leaf (Dicot)

88. Read the given statements and choose the number of correct statements **(Pg. 93, M)**

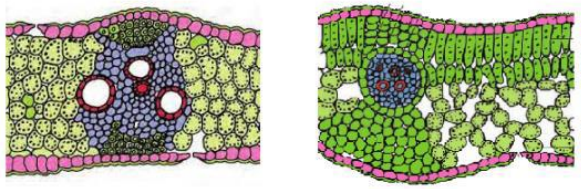
(i) Leaf of dicot lack cuticle
(ii) Stomata on adaxial side of epidermis is more in number than abaxial side
(iii) Mesophyll is the ground tissue in dicot leaf
(iv) The adaxial epidermis may lack stomata
A) 1 B) 2 C) 3 D) 4

89. In the leaf of sunflower, mesophyll lies- **(Pg. 93, E)**
A) Between epidermis and cortex
B) Between adaxial epidermis and abaxial epidermis
C) Between endodermis and pericycle
D) Between pericycle and vascular bundles

90. Which of the given statements about dicot leaf is incorrect? **(Pg. 93, M)**
A) The abaxial palisade parenchyma is made of elongated cells
B) Spongy parenchyma is oval or round
C) The spongy parenchyma has large spaces between cells
D) The parenchyma on adaxial side of leaf are arranged vertically & parallel to each other

91. Consider the statements given below- **(Pg. 93, M)**
a) Size of vascular bundle in leaf depend upon size veins
b) Vascular bundles in leaf are surrounded by bundle sheath cells
A) (a) is correct & (b) is incorrect B) (a) is incorrect & (b) is correct
C) Both are correct D) Both ate incorrect

92. Identify the correct option in context of given figures **(Pg. 93, E)**



(i) (ii)

A) (i)- dicot stem, (ii)- monocot stem
B) (i)- dicot leaf, (ii)- monocot leaf
C) (i)- monocot stem, (ii)- dicot stem
D) (i)- monocot leaf, (ii)- dicot leaf

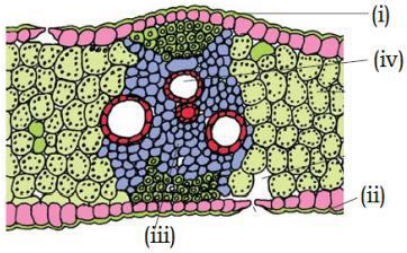
## Paragraph – 6.3.6
## Isobilateral Leaf (Monocot)

93. Which of the following is correct for isobilateral leaves? **(Pg. 94, E)**
A) Present in all angiosperms
B) Two different types of mesophyll are found
C) Stomata on both surfaces of mesophyll
D) Has similar sizes of vascular bundles

94. In grasses, large, empty, colourless cells are called- **(Pg. 94, E)**
A) Subsidiary cells B) Complementary cells
C) Cortical cells D) None of these

95. Identify the incorrect statement in regards to bulliform cells- **(Pg. 94, E)**
A) Present on abaxial side B) Empty cells
C) Makes leaf curl inward when flaccid
D) Helps to minimize water loss

96. Identify correct labels for given figure. **(Pg. 94, E)**




A) (i)- adaxial epidermis (ii)- abaxial epidermis, (iii)- xylem (iv)- phloem
B) (ii)- adaxial epidermis (i)- abaxial epidermis, (iii)- xylem (iv)- phloem
C) (i)- adaxial epidermis (ii)- abaxial epidermis, (iv)- xylem (iii)- phloem
D) (ii)- adaxial epidermis (i)- abaxial epidermis, (iv)- xylem (iii)- phloem

## Paragraph – 6.4
## Secondary growth

97. Increase in girth of plant- **(Pg. 94, E)**
A) Involves lateral meristem
B) Involves intercalary meristem
C) Involves apical meristem
D) All of these

## Paragraph – 6.4.1
## Vascular Cambium

98. Vascular cambium- **(Pg. 94, E)**
i) Is meristematic
ii) Present in patches between xylem and phloem in young stem
iii) Present as a single layer between xylem and phloem in young stem
iv) Forms complete ring later How many of the above statements are correct-
A) 1 B) 2 C) 3 D) 4

## Paragraph – 6.4.1.1
## Formation of cambial ring

99. In dicot stem, cambium cells present between xylem & phloem is- **(Pg. 94, E)**
A) Intrafasicular cambium
B) Interfascicular cambium
C) Cork cambium
D) Cortical cambium

100. Interfasicular cambium is formed by- **(Pg. 94, E)**
A) Pericycle cells
B) Endodermal cells
C) Medullary cells
D) Complementary cells

## Paragraph – 6.4.1.2
## Activity of Cambial Ring

101. Cambial ring cuts off new cells- **(Pg. 95, E)**
A) Towards inner side only
B) Towards outer side only
C) Towards inner and outer side both
D) Along its own axis

102. Cambial ring cuts off new cells – **(Pg. 95, E)**
A) Towards pith, called secondary phloem
B) Towards pith, called secondary cambium
C) Towards pith, called secondary medullary rays
D) Towards pith, called secondary xylem

103. Cambial ring cut off – **(Pg. 95, E)**
A) More cells on outer side
B) More cells on inner side
C) Equal cells on both sides
D) Cells randomly

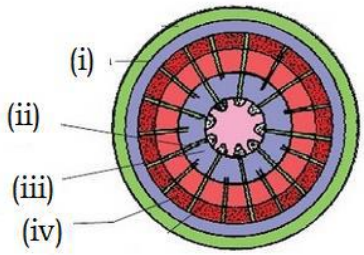
104. **Assertion:** secondary xylem form a compact mass.
**Reason:** cambium is lesser active on outer side comparatively.
Choose the best option- **(Pg. 95, H)**
A) Assertion & Reason both are correct and Reason is correct explanation for Assertion.

B) Assertion & Reason both are correct and Reason is not the correct explanation for Assertion
C) Assertion is correct but Reason is incorrect
D) Assertion is incorrect but Reason is correct

105. Secondary medullary rays are- **(Pg. 95, E)**
A) Narrow bands of parenchyma
B) Narrow bands of meristem
C) Wide bands of parenchyma
D) Wide bands of meristem

106. Which of these is correct about activity of cambial ring? **(Pg. 95, E)**
A) Secondary xylem crushes primary xylem
B) Secondary xylem crushes primary phloem
C) Secondary xylem crushes secondary phloem
D) Both B & C

107. Identify the secondary xylem in the figure- **(Pg. 95, E)**




A) (i) B) (ii) C) (iii) D) (iv)

## Paragraph – 6.4.1.3
## Spring wood and autumn wood

108. Activity of cambium is under control of- **(Pg. 96, E)**
A) Physiological factors B) Environmental factors
C) Both A & B D) Depend on season only

109. In spring, cambium produce **(Pg. 96, E)**
A) Less xylary elements, having vessels with wider cavities
B) More xylary elements, having vessels with wider cavities
C) Less xylary elements, having vessels with narrow cavities
D) More xylary elements, having vessels with narrow cavities

110. Select the characters of autumn wood from the list- **(Pg. 96, E)**
i) Light in colour ii) Dark in colour
iii) Low density iv) High density
v) Wider vessels vi) Narrow vessels
A) i, iii, v B) i, iv, vi C) ii, iv, vi D) ii, iii, v

111. Annual rings are constituted by- **(Pg. 96, E)**
A) Alternate concentric rings of 3 types of woods
B) continuous concentric rings of 3 types of woods
C) Alternate concentric rings of 2 types of woods
D) continuous concentric rings of 2 types of woods.

## Paragraph – 6.4.1.4
## Heartwood & Sapwood

112. Heartwood is- **(Pg. 96, E)**
A) Light in colour B) Dark in colour
C) Alternately light & dark in colour D) None of these

113. Consider the following statements about heartwood- **(Pg. 96, E)**
i) Lighter in colour
ii) Comprises dead elements

iii) Suberized walls
iv) Resistant to attack of micro-organisms
v) Conducts water and provide mechanical support to plant
How many of the statements are correct?
A) 2 B) 3 C) 4 D) 5

## Paragraph – 6.4.2
## Cork Cambium

114. **Assertion:** Cork cambium is needed due to activity of vascular cambium
**Reason:** Phellogen is present below endodermis
Select the appropriate answer- **(Pg. 96, E)**
A) Both Assertion & Reason are correct
B) Assertion is correct and Reason is wrong
C) Assertion is wrong and Reason is correct
D) Both Assertion and Reason are wrong

115. Phellogen is made of- **(Pg. 96, E)**
A) Narrow, thick-walled, meristematic cells
B) Narrow, thin-walled, parenchyma
C) Narrow, thick-walled, parenchyma
D) Narrow, thin-walled, meristem

116. Phellogens cuts- **(Pg. 96, E)**
A) Cork on inner side and phelloderm on outside
B) Phellem on inner and secondary cortex on outside
C) Bark on outside and secondary cortex on inside
D) Phellem on outside and phelloderm on inside

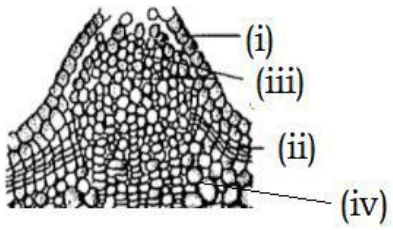
117. Cork is impervious to water due to **(Pg. 96, E)**
A) Lignin B) Suberin C) Keratin D) Cellulose

118. Bark includes – **(Pg. 97, E)**
A) Secondary xylem and periderm
B) Secondary phloem and periderm
C) Pericycle and vascular cambium
D) Pith and stele

119. Phlloderm is – **(Pg. 97, E)**
A) Parenchymatous B) Collenchymatous
C) Sclerenchymatous D) Meristematic

120. Lenticles are **(Pg. 97, E)**
A) Circle – shaped B) Rectangular
C) Lens – shaped D) Polygonal shaped

121. Select the correct labels – **(Pg. 97, E)**




A) (i) – complimentary cells B) (ii) – cork cambium
C) (iii) – secondary cortex D) (iv) – epidermis

## Paragraph – 6.4.3
## Secondary Growth in Roots

122. In sunflower root. Vascular cambium is originated from tissues – **(Pg. 97, E)**
A) Below phloem bundle B) Of pericycle

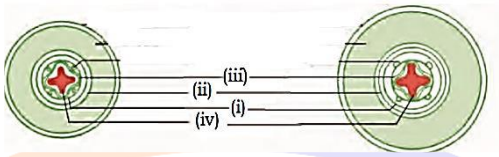
C) Of interfascicular cambium D) Both (A) & (B)

123. Secondary growth does not occur in – **(Pg. 98, E)**

A) Gymnosperm stem B) Gymnosperm root

C) Monocot D) All of these

124. Identify the cambial ring – **(Pg. 98, E)**




A) (i) B) (iii) C) (iv) D) (ii)

## NEET PREVIOUS YEARS QUESTIONS

**1.** Secondary xylem and phloem in dicot stem are produced by_____. **[2018]**
(a) apical meristems (b) vascular cambium (c) axillary meristems (d) phellogen

**2.** Casparian strips occur in: **[2018]**
(a) Epidermis (b) Pericycle (c) Endodermis (d) Cortex

**3.** Plants having little or no secondary growth are_____. **[2018]**
(a) grasses (b) deciduous angiosperms (c) cycads (d) conifers

**4.** Stomata in grass leaf are _____. **[2018]**
(a) dumb-bell shaped (b) kidney shaped (c) barrel shaped (d) rectangular

**5.** Identify the wrong statement in context of heartwood. **[2017]**
(a) It is highly durable.
(b) It conducts water and minerals efficiently.
(c) It comprises dead elements with highly lignified walls.
(d) Organic compounds are deposited in it.

**6.** The vascular cambium normally gives rise to _____. **[2017]**
(a) primary phloem (b) secondary xylem
(c) periderm (d) phelloderm

**7.** Which of the following facilitates opening of stomatal aperture? **[2017]**
(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.

**8.** Which of the following is made up of dead cells? **[2017]**
(a) Collenchyma (b) Phellem(c) Phloem (d) Xylem parenchyma

**9.** Root hairs develop from the region of _____. **[2017]**
(a) elongation (b) root cap (c) meristematic activity (d) maturation

**10.** Specialised epidermal cells surrounding the guard cells are called _____. **[2016]**
(a) complementary cells (b) subsidiary cells
(c) bulliform cells (d) lenticels

**11.** Vascular bundles in monocotyledons are considered closed because **[2015]**
(a) cambium is absent. (b) there are no vessels with perforations.
(c) xylem is surrounded all around by phloem.
(d) a bundle sheath surrounds each bundle.

**12.** A major characteristic of the monocot root is the presence of **[2015]**
(a) scattered vascular bundles.
(b) vasculature without cambium.
(c) cambium sandwiched between phloem and xylem along the radius.
(d) open vascular bundles.

**13.** Read the different components from (A) to (D) in the list given below and identify the correct order of the components with reference to their arrangement from outer side to inner side in a woody dicot stem**[2015]**
(A) Secondary cortex (B) Wood (C) Secondary phloem (D) Phellem
(a) A, B, D, C (b) D, A, C, B (c) D, C, A, B (d) C, D, B, A

**14.** In a ring girdled plant
**[2015]**
(a) the root dies first. (b) the shoot and root die together.
(c) neither root nor shoot will die. (d) the shoot dies first.

**15.** Transmission tissue is characteristic feature of _____.
**[2015]**
(a) solid style (b) dry stigma (c) wet stigma (d) hollow style

**16.** You are given a fairly old piece of dicot stem and a dicot root. Which of the following anatomical structures will you use to distinguish between the two?
**[2014]**
(a) Secondary xylem (b) Secondary phloem (c) Protoxylem (d) Cortical cells

**17.** Tracheids differ from other tracheary elements in
**[2014]**
(a) having casparian strips. (b) being imperforate.
(c) lacking nucleus. (d) being lignified.

18. Grass leaves curl inwards during very dry weather. Select the most appropriate reason from the following:
**(NEET-2019)**
(1) Closure of stomata (2) Flaccidity of bulliform cells
(3) Shrinkage of air spaces in spongy mesophyll (4) Tyloses in vessels

19. Which of the statements given below is not trueabout formation of Annual Rings in trees?
**(NEET-2019)**
(1) Annual ring is a combination of spring wood and autumn wood produced in a year.
(2) Differential activity of cambium causes light and dark bands of tissue - early and late wood respectively
(3) Activity of cambium depends upon variation in climate.
(4) Annual rings are not prominent in trees of temperate region.

20. In the dicot root the vascular cambium originates from :- **(NEET-2019 ODISSA)**
(1) Tissue located below the phloem bundles and a portion of pericycle tissue above protoxylem.
(2) Cortical region.
(3) Parenchyma between endodermis and pericycle.
(4) Intrafascicular and interfascicular tissue in a ring.

21. Regeneration of damaged growing grass following grazing is largely due to :- **(NEET-2019 ODISSA)**
(1) Lateral meristem (2) Apical meristem (3) Intercalary meristem (4) Secondary meristem

22. Large, empty colourless cells of the adaxial epidermis along the veins of grass leaves are **(NEET-2020 COVID)**

(1) Lenticels (2) Guard cells (3) Bundle sheath cells (4) Bulliform cells

23. Which of the following statements about cork cambium is incorrect? **(NEET-2020 COVID)**

(1) It forms secondary cortex on its outerside (2) It forms a part of periderm
(3) It is responsible for the formation of lenticels (4) It is a couple of layers thick

24. The transverse section of a plant shows following anatomical features. **(NEET-2020)**

a) large number of scattered vascular bundles surrounded by bundle sheath.
b) Large conspicuous parenchynchymatous ground tissue,
c) Vascular bundles conjoint and closed
d) Phloem parenchyma absent.
Identify the category of plant and its part.
1) Dicotyledonous root 2) Monocotyledonous stem
3) Monocotyledonous root 4) Dicotyledonous stem

25. Identify the incorrect statement **(NEET-2020)**

1) Due to deposition of tannins resins, oils etc., heart wood is dark in colour
2) Hart wood does not conduct water but gives mechanical support
3) Sapwood is involved in conduction of water and minerals from root leaf.
4) Sapwood is the innermost secondary xylem and is lighter in colour.

26. Match List-I with List – II **[NEET-2021]**

| List-I | | List-II | |
|---|---|---|---|
| (a) | Lenticels | (i) | Phellogen |
| (b) | Cork cambium | (ii) | Suberin deposition |
| (c) | Secondary cortex | (ii) | Exchange of gases |
| (d) | Cork | (iv) | Phelloderm |

Choose the correct answer from the options given below

| | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| (1) | (iii) | (i) | (iv) | (ii) |
| (2) | (ii) | (iii) | (iv) | (i) |
| (3) | (iv) | (ii) | (i) | (iii) |
| (4) | (iv) | (i) | (iii) | (ii) |

27. Match list- 1 with list-II **[NEET-2021]**

| **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
1) a-iv, b-iii, c-ii, d-i 2) a-i, b-ii, c-iii,d-iv 3) a-iii, b-ii, c-iv, d-i 4) a-ii, b-iv, c-I, d-iii

28. Select the correct pair **[NEET-2021]**

| | | |
|---|---|---|
| 1) | In dicto leaves, vascular bundles are surrounded by large thick-walled cells | Conjunctive tissue |
| 2) | Cells of medullary rays that form part of cambial ring | Interfascicular cambium |
| 3) | Loose parenchyma cells rupturing the epidermis and forming a lens – shaped opening in bark | Spongy parenchyma |
| 4) | Large colorless empty cells in the epidermis of grass leaves | Subsidiary cells |

29. In old trees the greater part of secondary xylem is dark brown and resistant to insect attack due to: **[NEET-2022]**

(a) secretion of secondary metabolites and their deposition in the lumen of vessels
(b) deposition of organic compounds like tannins and resins the central layers of stem
(c) deposition of suberin and aromatic substances in the outer layer of stem
(d) deposition of tannins, gum, resin and aromatic substances in the peripheral layers of stem
(e) presence of parenchyma cells, functionally active xylem elements and essential oils

Choose the correct answer from the options given below:

1) (a) and (b) only
2) (c) and (d) only
3) (d) and (e) only
4) (b) and (d) only

30. Read the following statements about the vascular bundles: **[NEET-2022]**

a) In roots, xylem and phloem in a vascular bundle are arranged in an alternate manner along the different radii
b) Conjoint closed vascular bundles do not possess cambium
c) In open vascular bundles, cambium is present in between xylem and phloem
d) The vascular bundles of dicotyledonous stem possess endarch protoxylem
e) In monocotyledonous root, usually there are more than six xylem bundles present

Choose the correct answer from the options given below:

1) a, b and d only
2) b, c, d, and e only
3) a, b, c and d only
4) a, b, c, d and e only

31. The anatomy of springwood shows some peculiar features. Identify the correct set of statements about springwood. **[NEET-2022]**

a) It is also called as the earlywood
b) In spring season cambium produces xylem elements with narrow vessels
c) It is lighter in colour
d) The springwood along with autumn wood shows alternate concentric rings forming annual rings
e) It has lower density

Choose the correct answer from the options given below:

1) a, b, d and e only
2) a, c, d and e only
3) a, b and d only
4) c, d and e only

## NCERT LINE BY LINE QUESTIONS – ANSWERS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1) D | 2) C | 3) C | 4) D | 5) A | 6) C | 7) D | 8) C | 9) A | 10) C |
| 11) D | 12) C | 13) D | 14) B | 15) C | 16) B | 17) D | 18) D | 19) C | 20) D |
| 21) D | 22) A | 23) D | 24) C | 25) A | 26) D | 27) B | 28) A | 29) A | 30) B |
| 31) B | 32) D | 33) A | 34) A | 35) A | 36) D | 37) D | 38) A | 39) D | 40) B |
| 41) D | 42) A | 43) D | 44) B | 45) C | 46) C | 47) D | 48) C | 49) A | 50) D |
| 51) B | 52) D | 53) B | 54) C | 55) A | 56) D | 57) B | 58) C | 59) D | 60) B |
| 61) D | 62) D | 63) D | 64) B | 65) C | 66) B | 67) C | 68) C | 69) B | 70) C |
| 71) D | 72) C | 73) A | 74) B | 75) A | 76) C | 77) B | 78) C | 79) D | 80) D |
| 81) B | 82) B | 83) D | 84) C | 85) A | 86) B | 87) C | 88) B | 89) B | 90) A |
| 91) C | 92) D | 93) D | 94) D | 95) A | 96) C | 97) A | 98) D | 99) A | 100) C |
| 101) C | 102) D | 103) B | 104) A | 105) A | 106) D | 107) C | 108) C | 109) B | 110) C |
| 111) C | 112) B | 113) A | 114) B | 115) D | 116) D | 117) B | 118) B | 119) A | 120) C |
| 121) B | 122) D | 123) C | 124) B | | | | | | |

## NEET PREVIOUS YEARS QUESTIONS-ANSWERS

**1** (b) **2** (c) **3** (a) **4** (a) **5** (b) **6** (b) **7** (b) **8** (b) **9** (d) **10** (b)
**11** (a) **12** (b) **13** (b) **14** (a) **15** (a) **16** (c) **17** (b) **18** (2) **19** (4) **20** (1)
**21** (3) **22** (4) **23** (1) **24** (2) **25** (4) **26** (1) **27** (4) **28** (2) 29 (1) 30 (4) 31 (2)

## NEET PREVIOUS YEARS QUESTIONS-EXPLANATIONS

**1. (b)** Secondary tissues are generated from the growth of a cambium. Vascular cambium gives rise to secondary xylem to the inside, and to secondary phloem to the outside.

**2. (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.

**3. (a)** Grasses are monocots and monocots usually do not have secondary growth. Palm like monocots have anomalous secondary growth.

**4. (a)** Grass being a monocot, has dumb-bell shaped stomata in their leaves.

**5. (b)** Heartwood is inactive physiologically due to deposition of organic compounds and formation of tyloses, so it will not conduct water and minerals.

**6. (b)** During secondary growth in plants, vascular cambium gives rise to secondary xylem and secondary phloem. Phelloderm is formed by cork cambium. Periderm is the corky outer layer formed in secondary thickening.

**7. (b)** Cellulose microfibrils are arranged radially rather than longitudinally which makes it easy for the stomata to open.

**8. (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.

**9. (d)** In roots, the root hairs develop from the zone of maturation. This zone is differentiated zone thus, bearing root hairs.

**10. (b)** Specialised epidermal cells surrounding the guard cells are known as subsidiary or accessory cell.

**11. (a)** Vascular bundles in monocotyledons are considered closed due to absence of cambium.

**12. (b)** Monocot root shows radial and closed vascular bundle (xylem & phloem).

**13. (b)** The correct sequence from outerside to inner side in a woody dicot stem is as follows:

Phellem - Secondary cortex - Secondary phloem- Wood

**14. (a)** In a ring girdled plant, roots die first due to damage of phloem causing inhibition of translocation of food.

**15. (a)** A solid style has transmission tissue which has large intercellular spaces. It allows growth of pollen tube in pistil.

**16. (c)** Anatomically fairly old dicotyledonous root is distinguished from the dicotyledonous stem by position of protoxylem. In dicot roots, the protoxylem is located near the periphery of the vascular cylinder while in dicot stem, the protoxylem is located near the centre of vascular bundle *i.e.*, the xylem is endarch.

17. (b) The walls of vessels (tracheary elements) are lignified and less thicker than tracheids. The lumen is wider. Vessels differ from tracheids in having cell fusions arising through the dissolution of end walls.

24. All anatomical features related to monocotyledonous stem

25. Sapwood is the outermost secondary xylem and is lighter in colour

26 Lenticels are meant for exchange of gases.
Phellogen is also known as cork cambium.
Phelloderm is also called secondary cortex because it is the cortex that develops during secondary growth. Cork has deposition of suberin in their cell walls when they get mature.

27. ii-iv-i-iv

28. • When the cells of medullary rays differentiated, they give rise to the new cambium called interfascicular cambium.
• Loose parenchyma cells rupturing the epidermis and forming a lens-shaped opening in bark are called complementary cells.
• Large colourless empty cells in the epidermis of grass leaves are called bulliform cells.
• In dicot leave, vascular bundles are surrounded by large thick walled cells called bundle sheath cells.

29: a & b are correct
deposition of suberin and aromatic substances in the inner layer of stem
deposition of tannins, gum, resin and aromatic substances in the central layers of stem
secondary xylem does not have presence of parenchyma cells, functionally active xylem elements

30. all are correct

31. 'b' is false. The spring wood is lighter in colour and has a lower density whereas the autumn wood is darker and has a higher density