Anatomy of Flowering Plants

1. Given below are two statements:
   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: **(2023)**
   (a) Statement I is incorrect but Statement II is true
   (b) Both Statement I and Statement II are true
   (c) Both Statement I and Statement II are false
   (d) Statement I is correct but Statement II is false
2. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R:
   Assertion A: Late wood has fewer xylary elements with narrow vessels.
   Reason R: Cambium is less active in winters.
   In the light of the above statements, choose the correct answer from the options given below: **(NEET2023)**
   (a) A is false but R is true
   (b) Both A and R are true and R is the correct explanation of A
   (c) Both A and R are true but R is NOT the correct explanation of A
   (d) A is true but R is false
3. Identify the correct statements:

   A. Lenticels are the lens-shaped openings permitting the exchange of gases.

   B. Bark formed early in the season is called hard bark.

   C. Bark is a technical term that refers to all tissues exterior to vascular cambium.

   D. Bark refers to periderm and secondary phloem.

   E. Phellogen is single-layered in thickness.

   Choose the correct answer from the options given below: **(2023)**
   (a) B and C only
   (b) B, C and E only
   (c) A and D only
   (d) A, B and D only
4. The transverse section of a plant part showed polyarch, radial and exarch xylem, with endodermis and pericycle. The plant part is identified as: **(2023)**
   (a) Monocot root
   (b) Dicot root
   (c) Dicot stem
   (d) Monocot stem
5. Consider the following tissues in the stelar region of a stem showing secondary growth.
   (A) Primary xylem
   (B) Secondary xylem
   (C) Primary phloem
   (D) Secondary phloem

   Arrange these in the correct sequence of their position from pith towards cortex. **(2023)**
   (a) (A) (B), (D), (C)
   (b) (B) (A), (C) (D)
   (c) (A) (B), (C), (D)
   (B) (A), (D), (C)
6. Consider the following plant tissues:
   (A) Axillary buds
   (B) Fascicular vascular cambium
   (C) Interfascicular cambium
   (D) Cork cambium
   (E) Intercalary meristem
   Identify the lateral meristems among the above. **(2023)**
   (a) (A), (C) and (D) only
   (b) (B), (C) and (D) only
   (c) (A) (B) (C) and (E) only
   (d) (A), (B) (D) and (E) only
7. Interfascicular cambium is present between **(NEET 2022 Phase 2)**
   (a) Secondary xylem and secondary phloem
   (b) Primary xylem and primary phloem
   (c) Pericycle and endodermis
   (d) Two vascular bundles
8. Initiation of lateral roots and vascular cambium during secondary growth takes place in cells of **(2022)**

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

9. "Girdling Experiment" was performed by Plant Physiologists to identify the plant tissue through which: **(2022)**
(a) A water is transported
(b) food is transported
(c) for both water and food transportation
(d) Dosmosis is observed

10. Read the following statements about the vascular bundles:
(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: **(2022)**
(a) (a), (b) and (d) only
(b) (b), (c), (d) and (e) only
(c) (a), (b), (c) and (d) only
(d) (a), (c), (d) and (e) only

11. In old trees the greater part of secondary xylem is dark brown and resistant to insect attack due to:
(a) secretion of secondary metabolities and their deposition in the lumen of vessels.
(b) deposition of organic compounds like tannins and resins in 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: **(2022 Phase 1)**
(a) (a) and (b) only
(b) (c) and (d) only
(c) (d) and (e) only
(d) (b) and (d) only

12. What is the role of large bundle sheath cells found around the vascular bundles in C. plants? **(2022)**
(a) To provide the site for photorespiratory pathway
(b) To increase the number of chloroplast for the operation of Calvin cycle
(c) To enable the plant to tolerate high temperature
(d) To protect the vascular tissue from high light intensity

13. The anatomy of springwood shows some peculiar features. Identify the correct set of statements about springwood.
(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: **(2022)**
(a) (a), (b), (d) and (e) only
(b) (a), (c), (d) and (e) only
(c) (a), (b) and (d) only
(d) (c), (d) and (e) only

14. Select the correct pair. **(2021)**

(a)	In dicot leaves, vascular bundles are surrounded by large thick-walled cells	Conjunctive tissue
(b)	Cells of medullary rays that form part of cambial rings	Interfasciculcambium
(c)	Loose parenchyma cells rupturing the epidermis and forming a lens-shaped opening in bark	Spongy parenchyma
(d)	Large colorless empty cells in the epidermis of grass leaves	Subsidiary cells

15. Identify the incorrect statement. **(2020)**
(a) Sapwood is involved in conduction of water and minerals from root to leaf.
(b) Sapwood is the innermost secondary xylem and is lighter in colour.
(c) Due to deposition of tannins, resins, oils etc., heart wood is dark in colour.
(d) Heart wood does not conduct water but gives mechanical support.

16. The transverse section of a plant shows following anatomical features: **(2020)**
1. Large number of scattered vascular bundles surrounded by bundle sheath.
2. Large conspicuous parenchymatous ground tissue.
3. Vascular bundles conjoint and closed.
4. Phloem parenchyma absent.
Identify the category of plant and its part:
(a) Monocotyledonous root
(b) Dicotyledonous stem
(c) Dicotyledonous root
(d) Monocotyledonous stem

17. Large, empty colourless cells of the adaxial epidermis along the veins of grass leaves are **(2020 Covid Re-NEET)**
(a) Guard cells
(b) Bundle sheath cells
(c) Bulliform cells
(d) Lenticels

18. Which of the following statements about cork cambium is incorrect? **(2020 Covid Re-NEET)**
(a) It forms a part of periderm
(b) It is responsible for the formation of lenticels
(c) It is a couple of layers thick
(d) It forms secondary cortex on its Outerside

19. Grass leaves curl inwards during very dry weather. Select the most appropriate reason from the following **(2019)**
(a) Closure of stomata
(b) Flaccidity of bulliform cells
(c) Shrinkage of air spaces in spongy mesophyll
(d) Tyloses in vessels

20. Phloem in gymnosperms lacks **(2019)**
(a) Albuminous cells and sieve cells
(b) Sieve tubes only
(c) Companion cells only
(d) Both sieve tubes and companion cells

21. Which of the statements given below is not true about formation of annual rings in trees? **(2019)**
(a) Annual ring is a combination of spring wood and autumn wood produced in a year
(b) Differential activity of cambium causes light and dark bands of tissue-early and late wood respectively.
(c) Activity of cambium depends upon variation in climate.
(d) Annual rings are not prominent in trees of temperate region.

22. Secondary xylem and phloem in dicot stem are produced by **(2018)**
(a) Apical meristem
(b) Vascular cambium
(c) Phellogen
(d) Axillary meristems

23. Casparian strips occur in **(2018)**
(a) Epidermis
(b) Pericycle
(c) Cortex
(d) Endodermis

24. Plants having little or no secondary growth are **(2018)**
(a) Grasses
(b) Deciduous angiosperms
(c) Conifers
(d) Cycads

25. Stomata in grass leaf are: **(2018)**
(a) Dumb-bell shaped
(b) Kidney shaped
(c) Rectangular
(d) Barrel shaped

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

27. The vascular cambium normally gives rise to: **(2017)**
(a) Phelloderm
(b) Primary phloem
(c) Secondary xylem
(d) Periderm

28. Identify the wrong statement in context of heartwood: **(2017)**
(a) Organic compounds are deposited in it
(b) It is highly durable
(c) It conducts water and minerals efficiently

(d) It comprises dead elements with highly lignified wall

29. Which of the following statements is true for phloem in plants? **(2017)**
(a) Phloem fibres are made up of collenchymatous cells
(b) Sieve tube elements are multicellular with wide lumen and rich cytoplasm
(c) Companion cells help in maintaining the pressure gradient in sieve tubes
(d) Phloem parenchyma is a abundantly present in monocots

30. The chief function of vessels in the plant body is to: **(2017)**
(a) Eliminate excess of water
(b) Transport food materials manufactured in the leaves to other parts of the plant
(c) Store food material in the form of starch or fat
(d) Conduct water and mineral salts

31. The balloon-shaped structures called tyloses: **(2016 - II)**
(a) Are extensions of xylem parenchyma cells into vessels
(b) Are linked to the ascent of sap through xylem vessels
(c) Originate in the lumen of vessels
(d) Characterise the sapwood

32. Cortex is the region found between: **(2016 - II)**
(a) Endodermis and pith
(b) Endodermis and vascular bundle
(c) Epidermis and stele
(d) Pericycle and endodermis

33. Specialised epidermal cells surrounding the guard cells are called **(2016 - I)**
(a) Complementary cells
(b) Subsidiary cells
(c) Bulliform cells
(d) Lenticels

34. Vascular bundles in monocotyledons are considered closed because: **(2015)**
(a) There are no vessels with perforations
(b) Xylem is surrounded all around by phloem
(c) A bundle sheath surrounds each bundle
(d) Cambium is absent

35. A major characteristic of the monocot root is the presence of: **(2015)**
(a) Vasculature without cambium
(b) Cambium sandwiched between phloem and xylem along the radius
(c) Open vascular bundles
(d) Scattered vascular bundles

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

37. 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) Cortical cells
(b) Secondary xylem
(c) Secondary phloem
(d) Protoxylem

38. Tracheids differ from other tracheary elements in: **(2014)**
(a) Being lignified
(b) Having casparian strips
(c) Being imperforate
(d) Lacking nucleus

39. Lenticels are involved in: **(2013)**
(a) Photosynthesis
(b) Transpiration
(c) Gaseous exchange
(d) Food transport

40. Interfascicular cambium develops from the cells of: **(2013)**
(a) Pericycle
(b) Medullary rays
(c) Xylem parenchyma
(d) Endodermis

41. Age of a tree can be estimated by: **(2013)**
(a) Diameter of its heartwood
(b) Its height and girth
(c) Biomass
(d) Number of annual rings

Answer Key

S1. Ans. (a)

S2. Ans. (b)

S3. Ans. (c)

S4. Ans. (a)

S5. Ans. (a)

S6. Ans. (b)

S7. Ans. (d)

S8. Ans. (a)

S9. Ans. (b)

S10. Ans. (a)

S11. Ans. (a)

S12. Ans. (b)

S13. Ans. (b)

S14. Ans. (b)

S15. Ans. (b)

S16. Ans. (d)

S17. Ans. (c)

S18. Ans. (d)

S19. Ans. (b)

S20. Ans. (d)

S21. Ans. (d)

S22. Ans. (b)

S23. Ans. (d)

S24. Ans. (a)

S25. Ans. (a)

S26. Ans. (c)

S27. Ans. (c)

S28. Ans. (c)

S29. Ans. (c)

S30. Ans. (d)

S31. Ans. (a)

S32. Ans. (c)

S33. Ans. (b)

S34. Ans. (d)

S35. Ans. (a)

S36. Ans. (b)

S37. Ans. (d)

S38. Ans. (c)

S39. Ans. (c)

S40. Ans. (b)

S41. Ans. (d)

Solutions

S1. Ans.(a)

Endarch and exarch are the terms often used for describing the position of primary xylem in the plant body.

S2. Ans.(b)

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

S3. Ans.(c)

Lenticels are lens shaped opening permitting exchange of gases between the outer atmosphere and internal tissue of the stem.

Bark that is formed early in the season is called early or soft bark. Towards the end of the season late or hard bark is formed.

S4. Ans.(a)

Radial vascular bundles are present in roots. Monocot roots have polyarch and exarch condition of xylem.

S5. Ans.(a)

Explanation The correct sequence of tissues in the stelar region of the stem showing secondary growth from pith towards cortex is:

Primary Xylem → Secondary Xylem Secondary Phloem → Primary Phloem

S6. Ans.(b)

Lateral meristems are the meristems that add to the width or girth in a process known as secondary growth. They are responsible for the secondary growth in plants and are found parallel to the sides of the plants.

S7. Ans.(d)

During secondary growth in dicot stem, the cells of medullary rays lie between the vascular bundles become dedifferentiated and give rise to new cambium called interfascicular cambium.

S8. Ans.(a)

Initiation of lateral roots and vascular cambium during secondary growth takes place in pericycle cells of dicot roots. Epiblema, endodermis and cortex do not dedifferentiate.

S9. Ans.(b)

The girdling experiment shows that phloem is the tissue responsible for translocation of food; and that transport takes place in one direction i.e. towards the root.

S10. Ans.(a)

All the statements are correct regarding vascular bundles but none of the options with such combination is given.

S11. Ans.(a)

In old trees, the greater part of secondary xylem is dark brown due to deposition of organic compounds like tannins, resins, oils, gums, aromatic substances and essential oils in the central or innermost layers of the stem. These substances make it hard, durable and resistant to the attacks. of micro-organisms and insects.

S12. Ans.(b)

The large cells around the vascular bundles of C. plants form bundle sheath. These cells have large number of chloroplasts to perform calvin cycle.

S13. Ans.(b)

Spring wood is also called early wood. It is lighter in colour and has a lower

density. The vessels are produced with the wider lumens to transport more water to meet the requirement by increased transpiring surface in spring season.

The spring and autumn wood appear as alternate concentric rings of light and dark colour forming annual rings.

S14. Ans.(b)

S15. Ans.(b)

Due to the deposition of organic compounds such as tannins, resins, oils, gums, aromatic chemicals, and essential oils, the middle or innermost part of secondary xylem in old trees is dark brown. The heartwood region consists of dead elements with strongly lignified walls. Sapwood refers to the lighter-colored peripheral area (outermost) of the secondary xylem.

S16. Ans.(d)

A sclerenchymatous hypodermis, a large number of distributed vascular bundles, each surrounded by a sclerenchymatous bundle sheath, and a vast, visible parenchymatous ground tissue characterise the monocotyledonous stem. The vascular bundles are joined and closed together.

S17. Ans.(c)

Certain adaxial epidermal cells along veins in grasses transform into huge, empty, colourless cells. Bulliform cells are what they're termed.

S18. Ans.(d)

Cells on both sides are cut off by cork cambium or phellogen. Inner cells differentiate into secondary cortex or phelloderm, whereas exterior cells

differentiate into cork or phellem. On the inside, it produces secondary cortex.

S19. Ans.(b)

Water stress causes bulliform cells to become flaccid. This causes the leaves to curl inward, reducing water loss.

S20. Ans.(d)

Gymnosperm phloem is devoid of both sieve tubes and companion cells.

Albuminous cells and sieve cells are seen in gymosperms.

S21. Ans.(d)

The cyclical activity of cambium produces annual rings. Climate conditions in temperate zones are

rarely consistent throughout the year. The climatic conditions in the tropics, on the other hand, are consistent throughout the year. As a result, in

temperate plants, cambium is more active in the spring and less active in the autumn.

S22. Ans.(b)

In the stem and root of a vascular plant, vascular cambium is found between the xylem and phloem. It is the source of both secondary xylem (inwards,

towards pith) and secondary phloem (outwards, away from pith) growth (outwards).

S23. Ans.(d)

The casparian strip is a band of cell wall material deposited in the endodermis' radial and transverse walls. Suberin and lignin make up this substance.

S24. Ans.(a)

Monocots have either no secondary growth or abnormal secondary development, as seen in grass.

In monocots, this occurs due to the lack of cambium between the xylem and the phloem.

S25. Ans.(a)

Guard cells in broad-leaved plants are kidney- shaped, whereas those on grasses' leaf blades, such as wheat and bamboo, are dumb-bell shaped.

S26. Ans.(C)

Both sides of the cell are cut off by phellogen. The cork (phellem) differentiates from the outer cells,

whereas the secondary cortex develops from the inner cells (phelloderm). Secondary cortical cells are parenchymatous. Phellem is made up of cells that have died.

S27. Ans.(c)

The vascular cambium produces secondary xylem and secondary phloem during secondary growth.

Cork cambium produces phelloderm.

S28. Ans.(c)

Heartwood is the non-functional middle section of the secondary xylem of old trees that is hard, lifeless, dark brown in colour, and heavily lignified.

Deposition of organic molecules is responsible for the dark colour (tannins, resins, oils, gums, aromatic

substances, essential oils, etc). These ingredients make it tough, long-lasting, and resistant to bacteria

and insects. The stem is supported mechanically by the heartwood, which does not conduct water.

S29. Ans.(c)

Sieve tube elements are long, tube-like structures that are coupled with companion cells and are oriented longitudinally. The sieve plates are formed by perforating their end walls. A developed sieve element has a big vacuole and peripheral cytoplasm

but no nucleus. The nucleus of companion cells controls the actions of sieve tubes.

S30. Ans.(d)

Tracheids and vessels are the principal water transportation elements in flowering plants. Vessel is a long cylindrical tube-like structure composed of multiple vessel parts, each with lignified walls and a huge central chamber.

S31. Ans.(a)

Tyloses are balloon-shaped structures that extend from xylem parenchyma cells into vessels.

S32. Ans.(c)

Between the epidermis and the stele is the cortex. The stele is made up of all tissues on the inner side of the endodermis, such as the pericycle, vascular bundles, and pith.

S33. Ans.(b)

In the area of the guard cells, a few epidermal cells become specialised in their shape and size and are known as subsidiary cells. Stomatal apparatus refers to the stomatal orifice, guard cells, and auxiliary cells that surround it.

S34. Ans.(d)

The vascular bundles of monocotyledonous plants are devoid of cambium.

S35. Ans.(a)

The vascular bundles of monocotylednous plants are

devoid of cambium. As a result, they are referred to as closed since they do not generate additional tissues. The monocot stem, not the root, has scatter

vascular bundles.

S36. Ans.(b)

The correct order from the outer to the inner side

of the dicot stem is phellem-secondary cortex- secondary phloem-wood.

S37. Ans.(d)

The stem of a dicot is endarch, while the root of a dicot is exarch. Protoxylem distinguished them anatomically.

S38. Ans.(c)

Tracheids are imperforate, while the rest of the trachea is perforated.

S39. Ans.(c)

The exchange of gases between the outer atmosphere and the inside tissue of the stem is enabled through

lenticels, which are lens-shaped openings. Most woody trees have these.

S40. Ans.(b)

The intrafasicular cambium is the cambium present between primary xylem and primary phloem in dicot

stems. Adjacent to these are the cells of medullary rays.

The interfascicular cambium is formed when the intrafascicular cambium becomes meristematic.

Xylem parenchyma is a live, thin-walled organ with cellulose-based cell walls.

Endodermis is the innermost layer of the cortex in dicot roots.

The pericycle is a layer of thin-walled parenchymatous cells that is next to the endodermis.

S41. Ans.(d)

The number of annual rings equals the number of years.