

Campbell's Biology, 9e (Reece et al.)
Chapter 35 Plant Structure, Growth, and Development

In previous chapters, students have been exposed to basic processes in life such as photosynthesis, respiration, and evolution. Chapter 35 provides key vocabulary on plant structure and development and introduces basic concepts and processes. This information is critical for understanding higher-order concepts introduced in subsequent chapters.

Multiple-Choice Questions

1) One major advantage of using *Arabidopsis thaliana* as a model system for studies of plant form and function is its

- A) fast generation time.
- B) exceptionally large genome.
- C) large seeds.
- D) high tolerance to stress.
- E) high mutation rate.

Answer: A

Topic: Concept 35.1

Skill: Application/Analysis

2) Studies using *Arabidopsis thaliana* have led to important advances in all of the following *except*

- A) gene mapping.
- B) impact of point mutations on gene function.
- C) gene expression during plant development.
- D) evolutionary history of plants.
- E) how genes potentially interact with other genes.

Answer: D

Topic: Concept 35.1

Skill: Application/Analysis

3) The total number of genes in a species' genome is not necessarily a good indicator of biological complexity because

- A) most genes are never turned on.
- B) many genes are repeats.
- C) this does not take into account the alternative splicing of pre-mRNA.
- D) this does not take into account mRNA-mRNA interactions.
- E) this does not take into account protein-mRNA interactions.

Answer: C

Topic: Concept 35.1

Skill: Knowledge/Comprehension

4) Choose the option that best describes the relationship between the cell wall thickness of parenchyma cells versus sclerenchyma cells.

- A) The cell walls of parenchyma cells are thinner than those of sclerenchyma cells.
- B) The cell walls of parenchyma cells are thicker than those of sclerenchyma cells.
- C) The cell walls of both types of cells are roughly equal.
- D) The thickness of the cell walls for both types of cells is too variable for a comparison to be made.

Answer: A

Topic: Concept 35.2

Skill: Knowledge/Comprehension

5) Which structure is *incorrectly* paired with its tissue system?

- A) root hair—dermal tissue
- B) palisade parenchyma—ground tissue
- C) guard cell—dermal tissue
- D) companion cell—ground tissue
- E) tracheid—vascular tissue

Answer: D

Topic: Concept 35.2

Skill: Knowledge/Comprehension

6) Which of the following is derived from the ground tissue system?

- A) root hair
- B) cuticle
- C) periderm
- D) pith
- E) phloem

Answer: D

Topic: Concept 35.2

Skill: Knowledge/Comprehension

7) Which part of a plant absorbs most of the water and minerals taken up from the soil?

- A) taproots
- B) root hairs
- C) the thick parts of the roots near the base of the stem
- D) storage roots
- E) sections of the root that have secondary xylem

Answer: B

Topic: Concept 35.2

Skill: Knowledge/Comprehension

8) Land plants are composed of all of the following tissue types *except*

- A) mesodermal.
- B) epidermal.
- C) meristematic.
- D) vascular.
- E) ground tissue.

Answer: A

Topic: Concept 35.2

Skill: Knowledge/Comprehension

9) Vascular plant tissue includes all of the following cell types *except*

- A) vessel elements.
- B) sieve cells.
- C) tracheids.
- D) companion cells.
- E) cambium cells.

Answer: E

Topic: Concept 35.2

Skill: Knowledge/Comprehension

10) When you eat Brussels sprouts, what are you eating?

- A) immature flowers
- B) large axillary buds
- C) petioles
- D) storage leaves
- E) storage roots

Answer: B

Topic: Concept 35.2

Skill: Application/Analysis

11) Which cells are no longer capable of carrying out the process of DNA transcription?

- A) tracheids
- B) mature mesophyll cells
- C) companion cells
- D) meristematic cells
- E) glandular cells

Answer: A

Topic: Concept 35.2

Skill: Application/Analysis

12) _____ is to xylem as _____ is to phloem.

- A) Sclerenchyma cell; collenchyma cell
- B) Apical meristem; vascular cambium
- C) Vessel element; sieve-tube member
- D) Cortex; pith
- E) Vascular cambium; cork cambium

Answer: C

Topic: Concept 35.2

Skill: Knowledge/Comprehension

13) CO₂ enters the inner spaces of the leaf through the

- A) cuticle.
- B) epidermal trichomes.
- C) stoma.
- D) phloem.
- E) walls of guard cells.

Answer: C

Topic: Concept 35.2

Skill: Knowledge/Comprehension

14) Which of the following cells transport sugars over long distances?

- A) parenchyma cells
- B) collenchyma cells
- C) sclerenchyma cells
- D) tracheids and vessel elements
- E) sieve-tube elements

Answer: E

Topic: Concept 35.2

Skill: Knowledge/Comprehension

15) Which of the following have unevenly thickened primary walls that support young, growing parts of the plant?

- A) parenchyma cells
- B) collenchyma cells
- C) sclerenchyma cells
- D) tracheids and vessel elements
- E) sieve-tube elements

Answer: B

Topic: Concept 35.2

Skill: Knowledge/Comprehension

16) Which of the following are most responsible for supporting mature, nongrowing parts of the plant?

- A) parenchyma cells
- B) collenchyma cells
- C) trichomes
- D) tracheids and vessel elements
- E) sieve-tube elements

Answer: D

Topic: Concept 35.2

Skill: Application/Analysis

17) The vascular bundle in the shape of a single central cylinder in a root is called the

- A) cortex.
- B) stele.
- C) endodermis.
- D) periderm.
- E) pith.

Answer: B

Topic: Concept 35.2

Skill: Knowledge/Comprehension

18) One important difference between the anatomy of roots and the anatomy of leaves is that

- A) only leaves have phloem and only roots have xylem.
- B) root cells have cell walls and leaf cells do not.
- C) a waxy cuticle covers leaves but is absent from roots.
- D) vascular tissue is found in roots but is absent from leaves.
- E) leaves have epidermal tissue but roots do not.

Answer: C

Topic: Concept 35.2

Skill: Application/Analysis

19) A student examining leaf cross sections under a microscope finds many loosely packed cells with relatively thin cell walls. The cells have numerous chloroplasts. What type of cells are they?

- A) parenchyma
- B) xylem
- C) endodermis
- D) collenchyma
- E) sclerenchyma

Answer: A

Topic: Concept 35.2

Skill: Application/Analysis

20) Compared to most animals, the growth of most plants is best described as

- A) perennial.
- B) weedy.
- C) indeterminate.
- D) derivative.
- E) primary.

Answer: C

Topic: Concept 35.2

Skill: Application/Analysis

21) A vessel element would likely lose its protoplast in which section of a root?

- A) zone of cell division
- B) zone of elongation
- C) zone of maturation
- D) root cap
- E) apical meristem

Answer: C

Topic: Concept 35.2

Skill: Knowledge/Comprehension

22) Gas exchange, which is necessary for photosynthesis, can occur most easily in which leaf tissue?

- A) epidermis
- B) palisade mesophyll
- C) spongy mesophyll
- D) vascular tissue
- E) bundle sheath

Answer: C

Topic: Concept 35.2

Skill: Knowledge/Comprehension

23) Which of the following best describes advantages conferred by compound leaves versus simple leaves?

- A) There's a greater chance of capturing photons in intermittently shady areas.
- B) There is less chance of damage in high-wind areas.
- C) There's a reduced chance of herbivory.
- D) There is less surface area for water loss.
- E) There's a greater chance of capturing photons in intermittently shady areas and less chance of damage in high-wind areas.

Answer: E

Topic: Concept 35.2

Skill: Application/Analysis

24) Water is most likely to enter a mesophyll cell

- A) as a gas.
- B) as a liquid.
- C) covalently bound to sugars.
- D) coupled to ion transport.
- E) via endocytosis.

Answer: B

Topic: Concept 35.2

Skill: Synthesis/Evaluation

25) Plants contain meristems whose major function is to

- A) attract pollinators.
- B) absorb ions.
- C) photosynthesize.
- D) produce more cells.
- E) produce flowers.

Answer: D

Topic: Concept 35.3

Skill: Knowledge/Comprehension

26) A cell that is most likely to retain the ability to divide, perform metabolic functions, and store photosynthate would be a

- A) parenchyma cell in a leaf.
- B) vessel element in the vascular system.
- C) endodermal cell in a root.
- D) bark cell.
- E) fiber cell.

Answer: A

Topic: Concept 35.3

Skill: Application/Analysis

27) Which of the following cell types is least likely to be capable of cell division?

- A) mesophyll cell in a developing leaf
- B) parenchyma cell 2 mm from the tip of a root
- C) parenchyma cell in a dormant axillary bud
- D) functional tracheid cell in a stem

Answer: D

Topic: Concept 35.3

Skill: Knowledge/Comprehension

28) The driving force that pushes the root tip through the soil is primarily

- A) continuous cell division in the root cap at the tip of the root.
- B) continuous cell division just behind the root cap in the center of the apical meristem.
- C) elongation of cells behind the root apical meristem.
- D) the elongation of root hairs.
- E) continuous cell division of root cap cells.

Answer: C

Topic: Concept 35.3

Skill: Knowledge/Comprehension

29) Shoot elongation in a growing bud is due primarily to

- A) cell division at the shoot apical meristem.
- B) cell elongation directly below the shoot apical meristem.
- C) cell division localized in each internode.
- D) cell elongation localized in each internode.
- E) cell division at the shoot apical meristem and cell elongation directly below the shoot apical meristem.

Answer: D

Topic: Concept 35.3

Skill: Knowledge/Comprehension

30) Axillary buds

- A) are initiated by the cork cambium.
- B) have dormant meristematic cells.
- C) are composed of a series of internodes lacking nodes.
- D) grow immediately into shoot branches.
- E) do not form a vascular connection with the primary shoot.

Answer: B

Topic: Concept 35.3

Skill: Application/Analysis

The following question is based on parts of a growing primary root.

- I. root cap
- II. zone of elongation
- III. zone of cell division
- IV. zone of cell maturation
- V. apical meristem

31) Which of the following is the correct sequence from the growing tips of the root upward?

- A) I, II, V, III, IV
- B) III, V, I, II, IV
- C) II, IV, I, V, III
- D) IV, II, III, I, V
- E) I, V, III, II, IV

Answer: E

Topic: Concept 35.3

Skill: Knowledge/Comprehension

32) Which of the following is *incorrectly* paired with its structure and function?

- A) sclerenchyma—supporting cells with thick secondary walls
- B) periderm—protective coat of woody stems and roots
- C) pericycle—waterproof ring of cells surrounding the central stele in roots
- D) mesophyll—parenchyma cells functioning in photosynthesis in leaves
- E) ground meristem—primary meristem that produces the ground tissue system

Answer: C

Topic: Concept 35.3

Skill: Knowledge/Comprehension

33) Which of the following root tissues gives rise to lateral roots?

- A) endodermis
- B) phloem
- C) cortex
- D) epidermis
- E) pericycle

Answer: E

Topic: Concept 35.3

Skill: Knowledge/Comprehension

34) A leaf primordium is initiated as a small mound of tissue on the flank of a dome-shaped shoot apical meristem. The earliest physical evidence of the site of a newly forming leaf primordium would be

- A) development of chloroplasts in a surface cell of the shoot apical meristem.
- B) cell division in the shoot apical meristem with the newly forming walls perpendicular to the surface of the meristem.
- C) preprophase bands parallel to the surface of the meristem in subsurface cells of the shoot apical meristem.
- D) elongation of epidermal cells perpendicular to the surface of the shoot apical meristem.
- E) formation of stomata in the epidermal layer of the shoot apical meristem.

Answer: C

Topic: Concept 35.3

Skill: Application/Analysis

35) Pores on the leaf surface that function in gas exchange are called

- A) hairs.
- B) xylem cells.
- C) phloem cells.
- D) stomata.
- E) sclereids.

Answer: D

Topic: Concept 35.3

Skill: Knowledge/Comprehension

36) Which of the following is a *true* statement about growth in plants?

- A) Only primary growth is localized at meristems.
- B) Some plants lack secondary growth.
- C) Only stems have secondary growth.
- D) Only secondary growth produces reproductive structures.
- E) Monocots have only primary growth, and eudicots have only secondary growth.

Answer: B

Topic: Concept 35.3

Skill: Knowledge/Comprehension

37) All of the following cell types are correctly matched with their functions *except*

- A) mesophyll–photosynthesis.
- B) guard cell–regulation of transpiration.
- C) sieve-tube member–translocation.
- D) vessel element–water transport.
- E) companion cell–formation of secondary xylem and phloem.

Answer: E

Topic: Concept 35.3

Skill: Knowledge/Comprehension

38) What would be a plant adaptation that increases exposure of a plant to light in a dense forest?

- A) closing of the stomata
- B) lateral buds
- C) apical dominance
- D) absence of petioles
- E) intercalary meristems

Answer: C

Topic: Concept 35.4

Skill: Application/Analysis

39) A person working with plants may reduce the inhibition of apical dominance by auxin via which of the following?

- A) pruning shoot tips
- B) deep watering of the roots
- C) fertilizing
- D) treating the plants with auxins
- E) feeding the plants nutrients

Answer: A

Topic: Concept 35.4

Skill: Application/Analysis

40) What effect does "pinching back" have on a houseplant?

- A) increases apical dominance
- B) inhibits the growth of lateral buds
- C) produces a plant that will grow taller
- D) stimulates lateral buds to grow
- E) increases the flow of auxin down the shoot

Answer: D

Topic: Concept 35.4

Skill: Knowledge/Comprehension

41) Which of the following cells or tissues arise from lateral meristem activity?

- A) secondary xylem
- B) leaves
- C) trichomes
- D) tubers
- E) cortex

Answer: A

Topic: Concept 35.5

Skill: Knowledge/Comprehension

42) A plant has the following characteristics: a taproot system, several growth rings evident in a cross section of the stem, and a layer of bark around the outside. Which of the following best describes the plant?

- A) herbaceous eudicot
- B) woody eudicot
- C) woody monocot
- D) herbaceous monocot
- E) woody annual

Answer: B

Topic: Concept 35.5

Skill: Application/Analysis

43) Cells produced by lateral meristems are known as

- A) dermal and ground tissue.
- B) lateral tissues.
- C) pith.
- D) secondary tissues.
- E) shoots and roots.

Answer: D

Topic: Concept 35.5

Skill: Knowledge/Comprehension

44) Which of the following is a *true* statement?

- A) Flowers may have secondary growth.
- B) Secondary growth is a common feature of eudicot leaves.
- C) Secondary growth is produced by both the vascular cambium and the cork cambium.
- D) Primary growth and secondary growth alternate in the life cycle of a plant.
- E) Plants with secondary growth are typically the smallest ones in an ecosystem.

Answer: C

Topic: Concept 35.5

Skill: Knowledge/Comprehension

45) What tissue makes up most of the wood of a tree?

- A) primary xylem
- B) secondary xylem
- C) secondary phloem
- D) mesophyll cells
- E) vascular cambium

Answer: B

Topic: Concept 35.5

Skill: Knowledge/Comprehension

46) If you were able to walk into an opening cut into the center of a large redwood tree, when you exit from the middle of the trunk (stem) outward, you would cross, in order,

- A) the annual rings, new xylem, vascular cambium, phloem, and bark.
- B) the secondary xylem, cork cambium, phloem, and periderm.
- C) the vascular cambium, oldest xylem, and newest xylem.
- D) the secondary xylem, secondary phloem, and vascular cambium.
- E) the summer wood, bark, and phloem.

Answer: A

Topic: Concept 35.5

Skill: Application/Analysis

47) Additional vascular tissue produced as secondary growth in a root originates from which cells?

- A) vascular cambium
- B) apical meristem
- C) endodermis
- D) phloem
- E) xylem

Answer: A

Topic: Concept 35.5

Skill: Knowledge/Comprehension

48) According to the ABC model of floral development, which genes would be expressed in a showy ornamental flower with multiple sepals and petals but no stamens or carpels?

- A) *A* genes only
- B) *B* genes only
- C) *C* genes only
- D) *A* and *B* genes only
- E) *A* and *C* genes only

Answer: D

Topic: Concept 35.6

Skill: Knowledge/Comprehension

49) A mutation allows only *A* gene activity in a developing flower. Which flower part(s) will develop in this plant?

- A) sepals
- B) petals
- C) stamens
- D) carpels
- E) both sepals and petals

Answer: A

Topic: Concept 35.6

Skill: Knowledge/Comprehension

50) While studying the plant *Arabidopsis*, a botanist finds that an RNA probe produces colored spots in the sepals of the plant. From this information, what can be inferred?

- A) The differently colored plants will attract different pollinating insects.
- B) The RNA probe is transported only to certain tissues.
- C) The colored regions were caused by mutations that occurred in the sepals.
- D) The RNA probe is specific to a gene active in sepals.
- E) More research needs to be done on the sepals of *Arabidopsis*.

Answer: D

Topic: Concept 35.6

Skill: Application/Analysis

51) Before differentiation can begin during the processes of plant cell and tissue culture, parenchyma cells from the source tissue must

- A) differentiate into procambium.
- B) undergo dedifferentiation.
- C) increase the number of chromosomes in their nuclei.
- D) enzymatically digest their primary cell walls.
- E) establish a new polarity in their cytoplasm.

Answer: B

Topic: Concept 35.6

Skill: Knowledge/Comprehension

- 52) The polarity of a plant is established when
- A) the zygote divides.
 - B) cotyledons form at the shoot end of the embryo.
 - C) the shoot-root axis is established in the embryo.
 - D) the primary root breaks through the seed coat.
 - E) the shoot first breaks through the soil into the light as the seed germinates.

Answer: A

Topic: Concept 35.6

Skill: Knowledge/Comprehension

53) *Totipotency* is a term used to describe a cell's ability to give rise to a complete new organism. In plants, this means that

- A) plant development is *not* under genetic control.
- B) the cells of shoots and the cells of roots have different genes.
- C) cell differentiation depends largely on the control of gene expression.
- D) a cell's environment has no effect on its differentiation.
- E) sexual reproduction is *not* necessary in plants.

Answer: C

Topic: Concept 35.6

Skill: Application/Analysis

54) Which of the following statements is false?

- A) A preprophase band determines where a cell plate will form in a dividing cell.
- B) The way in which a plant cell differentiates is determined by the cell's position in the developing plant body.
- C) Homeotic genes often control morphogenesis.
- D) Plant cells differentiate because the cytoskeleton determines which genes will be turned "on" and "off."
- E) *Arabidopsis* was the first plant to have its genome sequenced.

Answer: D

Topic: Concept 35.6

Skill: Synthesis/Evaluation

Art Questions

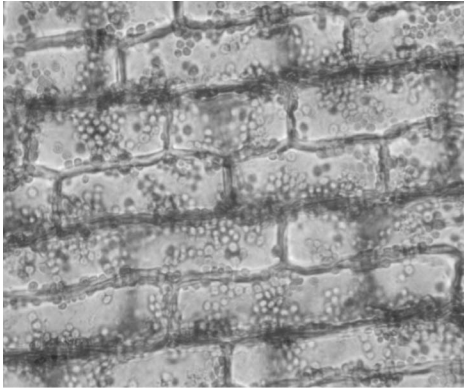


Figure 35.1

55) Which of the following are true statements about the cells shown in the photograph in Figure 35.1 above?

- A) They are parenchyma cells.
- B) They are photosynthetic.
- C) They are usually found in roots.
- D) They are phloem cells.
- E) They are parenchyma cells and photosynthetic.

Answer: E

Topic: Concept 35.2

Skill: Knowledge/Comprehension

The following questions are based on the drawing of root or stem cross sections shown in Figure 35.2.

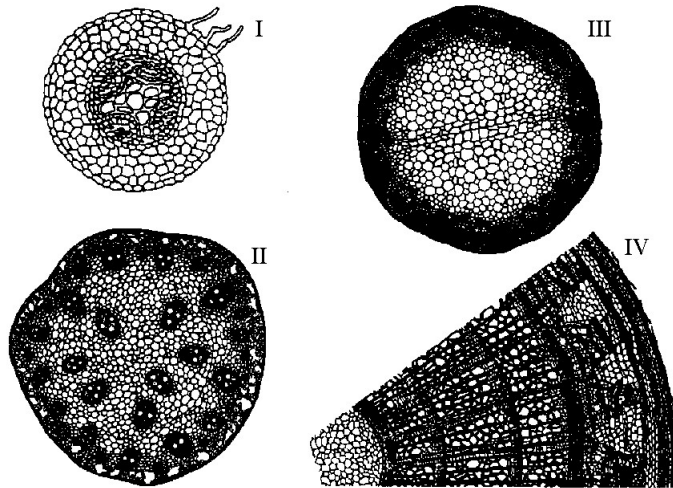


Figure 35.2

56) A monocot stem is represented by

- A) I only.
- B) II only.
- C) III only.
- D) IV only.
- E) both I and III.

Answer: B

Topic: Concept 35.3

Skill: Knowledge/Comprehension

57) A plant that is at least 3 years old is represented by

- A) I only.
- B) II only.
- C) III only.
- D) IV only.
- E) both I and III.

Answer: D

Topic: Concept 35.3

Skill: Knowledge/Comprehension

58) A woody eudicot is represented by

- A) I only.
- B) II only.
- C) III only.
- D) IV only.
- E) both I and III.

Answer: D

Topic: Concept 35.3

Skill: Knowledge/Comprehension

Scenario Questions

59) As a youngster, you drive a nail in the trunk of a young tree that is 3 meters tall. The nail is about 1.5 meters from the ground. Fifteen years later, you return and discover that the tree has grown to a height of 30 meters. About how many meters above the ground is the nail?

- A) 0.5
- B) 1.5
- C) 3.0
- D) 15.0
- E) 28.5

Answer: B

Topic: Concept 35.5

Skill: Application/Analysis

60) Suppose George Washington completely removed the bark from around the base of a cherry tree but was stopped by his father before cutting the tree down. The leaves retained their normal appearance for several weeks, but the tree eventually died. The tissue(s) that George left functional was/were the

- A) phloem.
- B) xylem.
- C) cork cambium.
- D) cortex.
- E) companion and sieve-tube members.

Answer: B

Topic: Concept 35.5

Skill: Application/Analysis

End-of-Chapter Questions

The following questions are from the end-of-chapter “Test Your Understanding” section in Chapter 35 of the textbook.

61) Most of the growth of a plant body is the result of

- A) cell differentiation.
- B) morphogenesis.
- C) cell division.
- D) cell elongation.
- E) reproduction.

Answer: D

Topic: End-of-Chapter Questions

Skill: Knowledge/Comprehension

62) The innermost layer of the root cortex is the

- A) core.
- B) pericycle.
- C) endodermis.
- D) pith.
- E) vascular cambium.

Answer: C

Topic: End-of-Chapter Questions

Skill: Knowledge/Comprehension

63) Heartwood and sapwood consist of

- A) bark.
- B) periderm.
- C) secondary xylem.
- D) secondary phloem.
- E) cork.

Answer: C

Topic: End-of-Chapter Questions

Skill: Knowledge/Comprehension

64) The phase change of an apical meristem from the juvenile to the mature vegetative phase is often revealed by

- A) a change in the morphology of the leaves produced.
- B) the initiation of secondary growth.
- C) the formation of lateral roots.
- D) a change in the orientation of preprophase bands and cytoplasmic microtubules in lateral meristems.
- E) the activation of floral meristem identity genes.

Answer: A

Topic: End-of-Chapter Questions

Skill: Knowledge/Comprehension

65) Based on the ABC hypothesis, what would be the structure of a flower from the outermost whorl that had normal expression of genes *A* and *C* and expression of gene *B* in all four whorls?

- A) carpel-petal-petal-carpel
- B) petal-petal-stamen-stamen
- C) sepal-carpel-carpel-sepal
- D) sepal-sepal-carpel-carpel
- E) carpel-carpel-carpel-carpel

Answer: B

Topic: End-of-Chapter Questions

Skill: Application/Analysis

66) Which of the following arise, directly or indirectly, from meristematic activity?

- A) secondary xylem
- B) leaves
- C) dermal tissue
- D) tubers
- E) secondary xylem, leaves, dermal tissue, and tubers

Answer: E

Topic: End-of-Chapter Questions

Skill: Application/Analysis

67) Which of the following would not be seen in a cross-section through the woody part of a root?

- A) sclerenchyma cells
- B) parenchyma cells
- C) sieve-tube elements
- D) root hairs
- E) vessel elements

Answer: D

Topic: End-of-Chapter Questions

Skill: Application/Analysis