

Campbell's Biology, 9e (Reece et al.)

Chapter 38 Angiosperm Reproduction and Biotechnology

Chapter 38 is foundational, introducing critical vocabulary in flower morphology and concepts of both angiosperm sexual reproduction (gametophyte development, pollination, double fertilization, fruit production) and asexual reproduction (fragmentation, apomixis, vegetative reproduction). Proximal and ultimate evolutionary advantages and disadvantages are discussed. In a preview to later chapters, human influences on crop evolution and the environmental impacts of agriculture are introduced, developing the opportunity for higher-level skill discussions in the classroom.

Multiple-Choice Questions

1) The male wasp, *Campsoscolia ciliata*, transfers pollen from one orchid to another orchid of the same species. What "reward" does the male wasp receive from the orchid plants for helping with the orchid pollination?

- A) a supply of energy-rich nectar
- B) volatile chemical hormones that help the male wasp find a sexually receptive female
- C) no reward; the male wasp is deceived by the flower shape and odor
- D) successful copulation with the flower
- E) a store of nectar that the wasp can use in time of famine

Answer: C

Topic: Concept 38.1

Skill: Knowledge/Comprehension

2) Which of the following plant/animal interactions is not a mutually beneficial (mutualistic) relationship?

- A) honeybees gathering pollen from apple blossoms
- B) butterflies gathering nectar from lily blossoms
- C) beetles feeding on magnolia blossoms
- D) ants protecting and feeding from nectaries of Acacia
- E) wasps such as *Campsoscolia ciliata* transferring pollen in orchid flowers

Answer: E

Topic: Concept 38.1

Skill: Synthesis/Evaluation

3) Which of the following best describes the ploidy level of a fertilized embryo sac?

- A) All cells are diploid.
- B) All cells are triploid.
- C) All cells are polyploid.
- D) The ploidy level varies among species.
- E) There are haploid, diploid, and triploid cells.

Answer: E

Topic: Concept 38.1

Skill: Knowledge/Comprehension

4) A flowering plant with a deleterious mutation in microsporogenesis would most likely

- A) fail to produce sepals.
- B) fail to produce petals.
- C) fail to produce anthers.
- D) fail to produce pollen.
- E) fail to produce ovules.

Answer: D

Topic: Concept 38.1

Skill: Application/Analysis

5) When comparing the mature seeds of a pine tree to an apple tree, which of the following is a correct statement?

- A) The developmental sequences postfertilization are identical.
- B) Both contain triploid tissue.
- C) The nutritive tissues are both haploid.
- D) Only the apple seed has a diploid seed coat.
- E) Both contain haploid and diploid tissues.

Answer: E

Topic: Concept 38.1

Skill: Synthesis/Evaluation

6) A mature, unfertilized ovule in an angiosperm is the result of

- A) a single meiotic division.
- B) a single mitotic division.
- C) both meiotic and mitotic divisions.
- D) mitosis from the megaspore mother cell.
- E) differentiation from the suspensor tissues.

Answer: C

Topic: Concept 38.1

Skill: Application/Analysis

7) At the conclusion of meiosis in plants, the end products are always four haploid

- A) spores.
- B) eggs.
- C) sperm.
- D) seeds.
- E) gametes.

Answer: A

Topic: Concept 38.1

Skill: Knowledge/Comprehension

8) Which of the following is the correct sequence during the alternation of generations life cycle in a flowering plant?

- A) sporophyte → meiosis → gametophyte → gametes → fertilization → diploid zygote
- B) sporophyte → mitosis → gametophyte → meiosis → sporophyte
- C) haploid gametophyte → gametes → meiosis → fertilization → diploid sporophyte
- D) sporophyte → spores → meiosis → gametophyte → gametes
- E) haploid sporophyte → spores → fertilization → diploid gametophyte

Answer: A

Topic: Concept 38.1

Skill: Application/Analysis

9) Which of the following is *true* in plants?

- A) Mitosis occurs in gametophytes to produce gametes.
- B) Meiosis occurs in sporophytes to produce spores.
- C) The gametophyte is within the flower in angiosperms.
- D) Mitosis occurs in gametophytes to produce gametes, and meiosis occurs in sporophytes to produce spores.
- E) Mitosis occurs in gametophytes to produce gametes, meiosis occurs in sporophytes to produce spores, and the gametophyte is within the flower in angiosperms.

Answer: E

Topic: Concept 38.1

Skill: Knowledge/Comprehension

10) Which of the following are *true* of most angiosperms?

- A) They have a triploid endosperm within the seed.
- B) They have an ovary that becomes a fruit.
- C) They have a small (reduced) sporophyte.
- D) They have a triploid endosperm within the seed and an ovary that becomes a fruit.
- E) They have a triploid endosperm within the seed, an ovary that becomes a fruit, and a small (reduced) sporophyte.

Answer: D

Topic: Concept 38.1

Skill: Knowledge/Comprehension

11) Based on studies of plant evolution and anatomy, which flower part is least likely to have evolved from a leaf?

- A) stamen
- B) carpel
- C) petals
- D) sepals
- E) receptacle

Answer: E

Topic: Concept 38.1

Skill: Application/Analysis

12) All of the following floral parts are involved in pollination or fertilization *except* the

- A) stamen.
- B) carpel.
- C) petals.
- D) sepals.
- E) receptacle.

Answer: D

Topic: Concept 38.1

Skill: Knowledge/Comprehension

13) The ovary is most often located on/in the

- A) stamen.
- B) carpel.
- C) petals.
- D) sepals.
- E) receptacle.

Answer: B

Topic: Concept 38.1

Skill: Application/Analysis

14) Microsporangia in flowering plants are located in the

- A) stamen.
- B) carpel.
- C) petals.
- D) sepals.
- E) receptacle.

Answer: A

Topic: Concept 38.1

Skill: Application/Analysis

15) Which of the following is the correct order of floral organs from the outside to the inside of a complete flower?

- A) petals → sepals → stamens → carpels
- B) sepals → stamens → petals → carpels
- C) spores → gametes → zygote → embryo
- D) sepals → petals → stamens → carpels
- E) male gametophyte → female gametophyte → sepals → petals

Answer: D

Topic: Concept 38.1

Skill: Application/Analysis

16) In some angiosperms, other floral parts contribute to what is commonly called the fruit. Which of the following fruits is derived mostly from an enlarged receptacle?

- A) pea
- B) raspberry
- C) apple
- D) pineapple
- E) peach

Answer: C

Topic: Concept 38.1

Skill: Application/Analysis

17) All of the following are primary functions of flowers *except*

- A) pollen production.
- B) photosynthesis.
- C) meiosis.
- D) egg production.
- E) sexual reproduction.

Answer: B

Topic: Concept 38.1

Skill: Knowledge/Comprehension

18) Meiosis occurs within all of the following flower parts *except* the

- A) ovule.
- B) style.
- C) megasporangium.
- D) anther.
- E) ovary.

Answer: B

Topic: Concept 38.1

Skill: Application/Analysis

19) A perfect flower is fertile, but may be either complete or incomplete. Which of the following correctly describes a perfect flower?

- A) It has no sepals.
- B) It has fused carpels.
- C) It is on a dioecious plant.
- D) It has no endosperm.
- E) It has both stamens and carpels.

Answer: E

Topic: Concept 38.1

Skill: Application/Analysis

20) Carpellate flowers

- A) are perfect.
- B) are complete.
- C) produce pollen.
- D) are found only on dioecious plants.
- E) develop into fruits.

Answer: E

Topic: Concept 38.1

Skill: Application/Analysis

21) Which of the following statements regarding flowering plants is false?

- A) The sporophyte is the dominant generation.
- B) Female gametophytes develop from megaspores within the anthers.
- C) Pollination is the placing of pollen on the stigma of a carpel.
- D) The food-storing endosperm is derived from the cell that contains two polar nuclei and one sperm nucleus.
- E) Flowers produce fruits within the ovules.

Answer: B

Topic: Concept 38.1

Skill: Synthesis/Evaluation

22) Which of the following types of plants are incapable of self-pollination?

- A) dioecious
- B) monoecious
- C) complete
- D) wind-pollinated
- E) insect-pollinated

Answer: A

Topic: Concept 38.1

Skill: Knowledge/Comprehension

23) In flowering plants, pollen is released from the

- A) anther.
- B) stigma.
- C) carpel.
- D) filament.
- E) pollen tube.

Answer: A

Topic: Concept 38.1

Skill: Knowledge/Comprehension

24) In the life cycle of an angiosperm, which of the following stages is diploid?

- A) megaspore
- B) generative nucleus of a pollen grain
- C) polar nuclei of the embryo sac
- D) microsporocyte
- E) both megaspore and polar nuclei

Answer: D

Topic: Concept 38.1

Skill: Application/Analysis

25) Where does meiosis occur in flowering plants?

- A) megasporocyte
- B) microsporocyte
- C) endosperm
- D) pollen tube
- E) megasporocyte and microsporocyte

Answer: E

Topic: Concept 38.1

Skill: Application/Analysis

26) Which of the following is a correct sequence of processes that takes place when a flowering plant reproduces?

- A) meiosis → fertilization → ovulation → germination
- B) fertilization → meiosis → nuclear fusion → formation of embryo and endosperm
- C) meiosis → pollination → nuclear fusion → formation of embryo and endosperm
- D) growth of pollen tube → pollination → germination → fertilization
- E) meiosis → mitosis → nuclear fusion → pollen

Answer: C

Topic: Concept 38.1

Skill: Application/Analysis

27) Which of the following is *incorrectly* paired with its life-cycle generation?

- A) anther—gametophyte
- B) pollen—gametophyte
- C) embryo sac—gametophyte
- D) stamen—sporophyte
- E) embryo—sporophyte

Answer: A

Topic: Concept 38.1

Skill: Knowledge/Comprehension

28) Which of the following is the correct sequence of events in a pollen sac?

- A) sporangia → meiosis → two haploid cells → meiosis → two pollen grains per cell
- B) pollen grain → meiosis → two generative cells → two tube cells per pollen grain
- C) two haploid cells → meiosis → generative cell → tube cell-fertilization → pollen grain
- D) pollen grain → mitosis → microspores → meiosis → generative cell plus tube cell
- E) microsporocyte → meiosis → microspores → mitosis → two haploid cells per pollen grain

Answer: E

Topic: Concept 38.1

Skill: Application/Analysis

29) Which of the following occurs in an angiosperm ovule?

- A) An antheridium forms from the megasporophyte.
- B) A megaspore mother cell undergoes meiosis.
- C) The egg nucleus is usually diploid.
- D) A pollen tube emerges to accept pollen after pollination.
- E) The endosperm surrounds the megaspore mother cell.

Answer: B

Topic: Concept 38.1

Skill: Knowledge/Comprehension

30) Where and by which process are sperm cells formed in plants?

- A) meiosis in pollen grains
- B) meiosis in anthers
- C) mitosis in male gametophyte pollen tube
- D) mitosis in the micropyle
- E) mitosis in the embryo sac

Answer: C

Topic: Concept 38.1

Skill: Knowledge/Comprehension

31) In which of the following pairs are the two terms equivalent?

- A) ovule~egg
- B) embryo sac~female gametophyte
- C) endosperm~male gametophyte
- D) seed~zygote
- E) microspore~pollen grain

Answer: B

Topic: Concept 38.1

Skill: Application/Analysis

32) Which of the following is the male gametophyte of a flowering plant?

- A) ovule
- B) microsporocyte
- C) pollen grain
- D) embryo sac
- E) stamen

Answer: C

Topic: Concept 38.1

Skill: Knowledge/Comprehension

33) Which of the following would be considered a multiple fruit?

- A) apple
- B) strawberry
- C) raspberry
- D) pineapple
- E) corn on the cob

Answer: D

Topic: Concept 38.1

Skill: Knowledge/Comprehension

34) In flowering plants, a mature male gametophyte contains

- A) two haploid gametes and a diploid pollen grain.
- B) a generative cell and a tube cell.
- C) two sperm nuclei and one tube cell nucleus.
- D) two haploid microspores.
- E) a haploid nucleus and a diploid pollen wall.

Answer: C

Topic: Concept 38.1

Skill: Knowledge/Comprehension

35) Three mitotic divisions within the female gametophyte of the megaspore produce

- A) three antipodal cells, two polar nuclei, one egg, and two synergids.
- B) the triple fusion nucleus.
- C) three pollen grains.
- D) two antipodal cells, two polar nuclei, two eggs, and two synergids.
- E) a tube nucleus, a generative cell, and a sperm cell.

Answer: A

Topic: Concept 38.1

Skill: Knowledge/Comprehension

36) What is the difference between pollination and fertilization in flowering plants?

- A) Fertilization precedes pollination.
- B) Pollination easily occurs between plants of different species, whereas fertilization is within a species.
- C) Pollen is formed within megasporangia so that male and female gametes are near each other.
- D) Pollination is the transfer of pollen from an anther to a stigma. Fertilization is the fusion of haploid nuclei.
- E) If fertilization occurs, pollination is unnecessary.

Answer: D

Topic: Concept 38.1

Skill: Application/Analysis

37) Recent research has shown that pollination requires that carpels recognize pollen grains as "self or nonself." For self-incompatibility, the system requires

- A) the rejection of nonself cells.
- B) the rejection of self cells.
- C) carpel incompatibility with the egg cells.
- D) that the flowers be incomplete.
- E) the union of genetically identical sperm and egg cells.

Answer: B

Topic: Concept 38.1

Skill: Application/Analysis

38) Genetic incompatibility does *not* affect the

- A) attraction of a suitable insect pollinator.
- B) germination of the pollen on the stigma.
- C) growth of the pollen tube in the style.
- D) membrane permeability of cells.
- E) different individuals of the same species.

Answer: A

Topic: Concept 38.1

Skill: Application/Analysis

39) What effects would occur in a mutant of *Arabidopsis* that cannot synthesize GABA within its flowers?

- A) Pollen tube growth would not be directed toward the egg, and fertilization would not occur.
- B) The seeds from the flowers would be unable to break dormancy.
- C) The pollen grain would not form a pollen tube due to incompatibility with the pollen tube.
- D) The length of the style would be increased to the point where the growing pollen tube would be unable to reach the synergids.

Answer: A

Topic: Concept 38.1

Skill: Synthesis/Evaluation

40) As a flower develops, which transition is most likely to occur?

- A) The microspores become pollen grains.
- B) The ovule becomes a fruit.
- C) The petals are retained.
- D) The vegetative nucleus becomes a sperm nucleus.
- E) The ovules become ovaries.

Answer: A

Topic: Concept 38.2

Skill: Application/Analysis

41) The primary function of the integument of an ovule is to

- A) protect against animal predation.
- B) ensure double fertilization.
- C) form a seed coat.
- D) direct development of the endosperm.
- E) produce hormones that ensure successful pollination.

Answer: C

Topic: Concept 38.2

Skill: Application/Analysis

42) Which of the following events suggests there is a change in the egg cell membrane after penetration by a sperm?

- A) The pollen tube grows away from the egg toward the polar nuclei.
- B) Ca^{2+} builds up in the cytoplasm of the egg.
- C) The egg cell plasmolyzes.
- D) Double fertilization occurs.
- E) There is a spike in membrane transport activity.

Answer: B

Topic: Concept 38.2

Skill: Application/Analysis

43) The structure of a mature, functional fruit always includes

- A) one or more seeds.
- B) extensive vascular connections to the parent plant.
- C) fleshy cells rich in sugars.
- D) brightly colored pigments to attract animal dispersers.
- E) subtending bracts to protect against predators.

Answer: A

Topic: Concept 38.2

Skill: Application/Analysis

44) Which of the following statements argues for an advantage for flowering plants to maintain an extended gametophyte generation?

- A) The protection of female gametophytes within ovules keeps them from drying out.
- B) Sperm with flagella can reach the egg faster.
- C) It provides sufficient time for the integument to develop into a seed coat.
- D) It allows for a complex nucleus to develop.
- E) It allows more time for potential pollination.

Answer: A

Topic: Concept 38.2

Skill: Application/Analysis

45) What is typically the result of double fertilization in angiosperms?

- A) The endosperm develops into a diploid nutrient tissue.
- B) A triploid zygote is formed.
- C) Both a diploid embryo and triploid endosperm are formed.
- D) Two embryos develop in every seed.
- E) The antipodal cells develop into the seed coat.

Answer: C

Topic: Concept 38.2

Skill: Application/Analysis

46) Which of the following statements applies to the endosperm in angiosperms?

- A) Its nutrients may be absorbed by the cotyledons in the seeds of eudicots.
- B) It develops from a haploid cell.
- C) Its nutrients are digested before embryo development.
- D) It develops from the fertilized egg.
- E) It is only fully developed in monocot seeds.

Answer: A

Topic: Concept 38.2

Skill: Application/Analysis

47) Which of the following metabolic processes is most likely to still be occurring at low levels in a fully mature, viable, dry seed?

- A) photosynthesis
- B) respiration
- C) fatty acid synthesis
- D) protein synthesis
- E) DNA replication

Answer: B

Topic: Concept 38.2

Skill: Synthesis/Evaluation

48) Which of the following is a potential advantage of introducing apomixis into hybrid crop species?

- A) Cultivars would be better able to cope with a rapidly changing environment.
- B) They would have a larger potential genome than inbred crops.
- C) All of the desirable traits of the cultivar would be passed on to offspring.
- D) They would benefit from positive mutations in their DNA.
- E) It would be easier to introduce novel genes.

Answer: C

Topic: Concept 38.2

Skill: Application/Analysis

49) Which of the following developmental processes in a seed is the most evolutionarily advantageous for the initial establishment of a viable seedling?

- A) The emergence of the radical.
- B) The coleoptiles in monocots.
- C) The protective layer of cutin outside of the seed coat.
- D) The emergence of the first photosynthetically active leaves.
- E) The development of a nutrient-rich hypocotyl.

Answer: A

Topic: Concept 38.2

Skill: Synthesis/Evaluation

50) Which of the following "vegetables" is botanically a fruit?

- A) potato
- B) lettuce
- C) radish
- D) celery
- E) green beans

Answer: E

Topic: Concept 38.2

Skill: Application/Analysis

51) The embryo of a grass seed is enclosed by two protective sheaths, a(n) _____, which covers the young shoot, and a(n) _____, which covers the young root.

- A) cotyledon; radicle
- B) hypocotyl; epicotyl
- C) coleoptile; coleorhiza
- D) scutellum; coleoptile
- E) epicotyl; radicle

Answer: C

Topic: Concept 38.2

Skill: Knowledge/Comprehension

52) Which of the following statements is true about fruits?

- A) Fruits form from megasporangia and integuments.
- B) All fruits contain seeds.
- C) Green beans, corn, tomatoes, and wheat are all vegetables.
- D) Pollination is always required for fruit maturation.
- E) During fruit development, the wall of the ovary becomes the integument.

Answer: A

Topic: Concept 38.2

Skill: Application/Analysis

53) Fruits develop from

- A) microsporangia.
- B) receptacles.
- C) fertilized eggs.
- D) ovaries.
- E) ovules.

Answer: D

Topic: Concept 38.2

Skill: Knowledge/Comprehension

54) What is the first step in the germination of a seed?

- A) pollination
- B) fertilization
- C) imbibition
- D) hydrolysis of starch and other food reserves
- E) emergence of the radicle

Answer: C

Topic: Concept 38.2

Skill: Knowledge/Comprehension

55) Garden beans and many other eudicots have a hooked hypocotyl during germination. Which of the following is true concerning hypocotyls and/or the hypocotyl hook?

- A) It is the first structure to emerge from a eudicot seed.
- B) It pushes the cotyledons up through the soil.
- C) It straightens when exposed to sufficient water.
- D) It is stunted in an etiolated seedling.
- E) It emerges after the successful establishment of the radicle.

Answer: E

Topic: Concept 38.2

Skill: Knowledge/Comprehension

56) Which of the following is an advantage of sexual reproduction as opposed to asexual reproduction?

- A) increased genetic variation in progeny
- B) enhanced mitosis
- C) more stable populations
- D) rapid increases in population due to high seed production
- E) higher reproductive success

Answer: A

Topic: Concept 38.2

Skill: Application/Analysis

57) Which of the following is *true* about vegetative reproduction?

- A) It involves both meiosis and mitosis to produce haploid and diploid cells.
- B) It produces vegetables and not fruits.
- C) It involves meiosis only.
- D) It can lead to genetically altered forms of the species.
- E) It produces clones of the parent plant.

Answer: E

Topic: Concept 38.2

Skill: Knowledge/Comprehension

58) Which of the following is a *true* statement about clonal reproduction in plants?

- A) Clones of plants do *not* occur naturally.
- B) Cloning, although achieved in animals, has not been demonstrated in plants.
- C) Making cuttings of ornamental plants is a form of fragmentation.
- D) Reproduction of plants by cloning may be either sexual or asexual.
- E) Viable seeds can result from sexual reproduction only.

Answer: C

Topic: Concept 38.2

Skill: Application/Analysis

59) Which of the following statements is true for a species that produces seeds by apomixis?

- A) The seed coat is made of diploid cells derived from the ovule of a flower.
- B) The embryo consists of diploid cells derived from fertilization of a haploid egg by a haploid sperm.
- C) The scutellum is the primary food storage tissue of the embryo.
- D) A haploid embryo is contained within the seed.
- E) The embryo of the seed is genetically distinct from the parent plant.

Answer: A

Topic: Concept 38.2

Skill: Application/Analysis

60) Which of the following could be considered an evolutionary advantage of asexual reproduction in plants?

- A) increased success of progeny in a stable environment.
- B) increased agricultural productivity in a rapidly changing environment.
- C) maintenance and expansion of a large genome.
- D) production of numerous progeny.
- E) increased ability to adapt to a change in the environment.

Answer: A

Topic: Concept 38.2

Skill: Application/Analysis

61) Under which conditions would asexual plants have the greatest advantage over sexual plants?

- A) an environment that varies on a regular, predictable basis
- B) an environment with irregular fluctuations of conditions
- C) a relatively constant environment with infrequent disturbances
- D) a fire-maintained ecosystem
- E) an environment with many seed predators

Answer: C

Topic: Concept 38.2

Skill: Knowledge/Comprehension

62) Which of the following statements is *true* of protoplast fusion?

- A) It occurs when the second sperm nucleus fuses with the polar nuclei in the embryo sac.
- B) It can be used to form new plant varieties by combining genomes from two plants.
- C) It is used to develop gene banks to preserve genetic variability.
- D) It is the method of test-tube cloning that produces whole plants from callus.
- E) It occurs within a callus that is developing in tissue culture.

Answer: B

Topic: Concept 38.2

Skill: Knowledge/Comprehension

63) One major potential benefit resulting from protoplast fusion experiments in agriculturally relevant species is

- A) there is an increased potential of hopeful mutants.
- B) species that are normally sexually incompatible can sometimes be successfully fused, producing offspring with traits of both parent species.
- C) many new species can be produced in a short period of time.
- D) deleterious traits are often removed by this process.
- E) genetically unrelated species can be successfully combined to produce new species with much larger genomes and adaptive potentials.

Answer: B

Topic: Concept 38.2

Skill: Application/Analysis

- 64) The most immediate potential benefits of introducing genetically modified crops include
- A) increasing the amount of land suitable for agriculture.
 - B) overcoming genetic incompatibility.
 - C) increasing the frequency of self-pollination.
 - D) increasing crop yield.
 - E) decreasing the mutation rate of certain genes.

Answer: D

Topic: Concept 38.2

Skill: Knowledge/Comprehension

- 65) A parent with an S_1S_2 genotype exhibiting sporophytic self-incompatibility can potentially fertilize which of the following plant genotypes of the same species with pollen grains?

- A) S_1S_3
- B) S_2S_3
- C) S_3S_4
- D) S_1S_4
- E) Half of all the pollen grains could be successful.

Answer: C

Topic: Concept 38.2

Skill: Application/Analysis

- 66) A parent with an S_1S_2 genotype exhibiting gametophytic self-incompatibility could potentially fertilize which of the following plant genotypes of the same species with pollen grains?

- A) S_1S_3
- B) S_2S_3
- C) S_1S_4
- D) S_2S_4
- E) Half of all the pollen grains could be successful.

Answer: E

Topic: Concept 38.2

Skill: Application/Analysis

- 67) Biofuels are mainly produced by

- A) the breakdown of cell wall biopolymers into sugars that can be fermented.
- B) plants that convert hemicellulose into gasoline.
- C) the genetic engineering of ethanol-generating genes into plants.
- D) transgenic crops that have cell walls containing ethylene.
- E) plants that are easy to grow in arid environments.

Answer: A

Topic: Concept 38.3

Skill: Synthesis/Evaluation

- 68) One disadvantage of monoculture is that
- A) the whole crop ripens at the same time.
 - B) genetic uniformity makes a crop more vulnerable to a new pest or disease.
 - C) it predominantly uses vegetative propagation.
 - D) most grain crops self-pollinate.
 - E) it allows for the cultivation of large areas of land.

Answer: B

Topic: Concept 38.3

Skill: Application/Analysis

- 69) Which of the following is a scientific concern related to creating genetically modified crops?
- A) Herbicide resistance may spread to weedy species.
 - B) Beneficial insects may be harmed by eating pest species.
 - C) Their adaptive advantages would allow them to overpower natural ecosystems.
 - D) The monetary costs of growing genetically modified plants are significantly greater than traditional breeding techniques.
 - E) Genetically modified plants are less stable and may revert back to parental genotypes.

Answer: A

Topic: Concept 38.3

Skill: Application/Analysis

- 70) All of the following strategies are being pursued with the goal of preventing transgene escape from genetically modified crops *except*
- A) the engineering of male sterility into plants.
 - B) the genetic engineering of apomixis into transgenic crops.
 - C) the genetic engineering of transgenes into the chloroplast DNA.
 - D) the genetic engineering of flowers that develop normally, but fail to open.
 - E) hybridization of transgenic crop genes with related wild weeds.

Answer: E

Topic: Concept 38.3

Skill: Synthesis/Evaluation

- 71) Which of the following is proving to be the most difficult task for plant breeders regardless of the techniques they use for crop improvement due to the complexity of the metabolic pathways involved?
- A) insect resistance
 - B) nitrogen fixation
 - C) herbicide resistance
 - D) improved nutritional quality
 - E) virus resistance

Answer: B

Topic: Concept 38.3

Skill: Application/Analysis

72) Which of the following is a successful example of the commercial use of transgenic crops?

- A) inserting *Bt* toxin genes into cotton, maize, and potato
- B) developing plants that are resistant to ultraviolet light mutations
- C) producing plants that resist attack by large herbivores
- D) developing plants that produce all the essential amino acids for humans
- E) producing plants that contain genes for making human insulin

Answer: A

Topic: Concept 38.3

Skill: Application/Analysis

Art Questions

The following questions refer to the diagram of an embryo sac of an angiosperm shown in Figure 38.1.

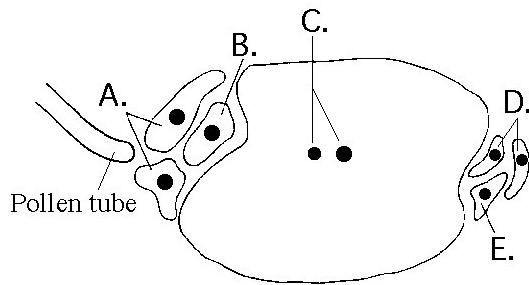


Figure 38.1

73) Based on Figure 38.1, which cell(s), after fertilization, give(s) rise to the embryo plant?

- A) A
- B) B
- C) C
- D) D
- E) E

Answer: B

Topic: Concept 38.1

Skill: Knowledge/Comprehension

74) Based on Figure 38.1, which cell(s) become(s) the triploid endosperm?

- A) A
- B) B
- C) C
- D) D
- E) E

Answer: C

Topic: Concept 38.1

Skill: Knowledge/Comprehension

75) Based on Figure 38.1, which cell(s) guide(s) the pollen tube to the egg cell?

- A) A
- B) B
- C) C
- D) D
- E) E

Answer: A

Topic: Concept 38.1

Skill: Knowledge/Comprehension

Scenario Questions

76) You are studying a plant from the Amazon rain forest that shows strong self-incompatibility. To characterize this reproductive mechanism, you would look for

- A) ribonuclease (RNAase) activity in stigma cells.
- B) RNA in the plants.
- C) pollen grains with very thick walls.
- D) carpels that cannot produce eggs by meiosis.
- E) systems of wind, but not insect, pollination.

Answer: A

Topic: Concept 38.1

Skill: Application/Analysis

77) Regardless of where in the world a vineyard is located, in order for the winery to produce a Burgundy, it must use varietal grapes that originated in Burgundy, France. The most effective way for a new California grower to plant a vineyard to produce Burgundy is to

- A) plant seeds obtained from French varietal Burgundy grapes.
- B) transplant varietal Burgundy plants from France.
- C) acquire a tissue culture of varietal Burgundy grapes from France.
- D) cross French Burgundy grapes with native American grapes.
- E) graft varietal Burgundy grape scions onto native (Californian) root stocks.

Answer: E

Topic: Concept 38.3

Skill: Application/Analysis

End-of-Chapter Questions

The following questions are from the end-of-chapter “Test Your Understanding” section in Chapter 38 of the textbook.

78) A seed develops from

- A) an ovum.
- B) a pollen grain.
- C) an ovule.
- D) an ovary.
- E) an embryo.

Answer: C

Topic: End-of-Chapter Questions

Skill: Knowledge/Comprehension

- 79) A fruit is
A) a mature ovary.
B) a mature ovule.
C) a seed plus its integuments.
D) a fused carpel.
E) an enlarged embryo sac.

Answer: A

Topic: End-of-Chapter Questions

Skill: Knowledge/Comprehension

- 80) Double fertilization means that
A) flowers must be pollinated twice to yield fruits and seeds.
B) every egg must receive two sperm to produce an embryo.
C) one sperm is needed to fertilize the egg, and a second sperm is needed to fertilize the polar nuclei.
D) the egg of the embryo sac is diploid.
E) every sperm has two nuclei.

Answer: C

Topic: End-of-Chapter Questions

Skill: Knowledge/Comprehension

- 81) "Golden Rice"
A) is resistant to various herbicides, making it practical to weed rice fields with those herbicides.
B) is resistant to a virus that commonly attacks rice fields.
C) includes bacterial genes that produce a toxin that reduces damage from insect pests.
D) produces larger, golden grains that increase crop yields.
E) contains daffodil genes that increase vitamin A content.

Answer: E

Topic: End-of-Chapter Questions

Skill: Knowledge/Comprehension

- 82) Which statement concerning grafting is correct?
A) Stocks and scions refer to twigs of different species.
B) Stocks come from vines, but scions come from trees.
C) Stocks provide root systems for grafting.
D) Grafting creates new species.
E) Stocks and scions must come from unrelated species.

Answer: C

Topic: End-of-Chapter Questions

Skill: Knowledge/Comprehension

- 83) Some dioecious species have the XY genotype for male and XX for female. After double fertilization, what would be the genotypes of the embryos and endosperm nuclei?
A) embryo X/endosperm XX or embryo Y/endosperm XY
B) embryo XX/endosperm XX or embryo XY/endosperm XY
C) embryo XX/endosperm XXX or embryo XY/endosperm XYY
D) embryo XX/endosperm XXX or embryo XY/endosperm XXY
E) embryo XY/endosperm XXX or embryo XX/endosperm XXY

Answer: C

Topic: End-of-Chapter Questions

Skill: Application/Analysis

84) A small flower with green petals is most likely

- A) bee-pollinated.
- B) bird-pollinated.
- C) bat-pollinated.
- D) wind-pollinated.
- E) moth-pollinated.

Answer: D

Topic: End-of-Chapter Questions

Skill: Application/Analysis

85) The pollen produced by wind-pollinated plants is often smaller than the pollen produced by animal-pollinated plants. A reason for this might be that

- A) wind-pollinated plants, in general, are smaller than animal-pollinated plants.
- B) wind-pollinated plants release pollen in the spring, before the plant has stored enough energy to make large pollen grains.
- C) small pollen grains can be carried farther by the wind.
- D) animal pollinators are more facile at picking up large pollen grains.
- E) wind-pollinated flowers don't need large pollen grains because they don't have to attract animal pollinators.

Answer: C

Topic: End-of-Chapter Questions

Skill: Application/Analysis

86) The black dots that cover strawberries are actually individual fruits. The fleshy and tasty portion of a strawberry derives from the receptacle of a flower with many separate carpels. Therefore, a strawberry is

- A) both a multiple fruit and an aggregate fruit.
- B) both a multiple fruit and an accessory fruit.
- C) both a simple fruit and an aggregate fruit.
- D) both an aggregate fruit and an accessory fruit.
- E) a simple fruit with many seeds.

Answer: D

Topic: End-of-Chapter Questions

Skill: Application/Analysis