

Sample Exam

Cauliflower is nothing but a
cabbage with a college education.

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General Instructions: Answer the multiple choice questions on the computerized sheet in pencil. Be sure to code in your ID number correctly and write your name on the answer sheet. Non-multiple choice questions should be answered directly on the pages provided. Please make sure your name is on each sheet before handing it in. Please sign the pledge at the end of the exam if you have complied with its terms (*i.e.*, do your own work). Have fun, and we hope that you're feeling more like a cauliflower than a cabbage!

Multiple choice questions: *Darken the single, best choice in the appropriate place on the answer sheet. There are no "known" tricks! (1 point each)*

1. Vascular plant tissue includes all of the following cell types EXCEPT
 - a. vessels.
 - b. sieve cells.
 - c. tracheids.
 - d. companion cells.
 - e. cambium cells.

2. The photosynthetic cells in the interior of a leaf are what kind of cells?
 - a. parenchyma
 - b. collenchyma
 - c. sclerenchyma
 - d. phloem
 - e. endodermis

3. Which functional plant cells lack a nucleus?
 - a. xylem only
 - b. sieve tube cells only
 - c. companion cells only
 - d. both companion and parenchyma cells
 - e. both xylem and sieve tube cells

4. The fiber cells of plants are a type of
 - a. parenchyma.
 - b. sclerenchyma.
 - c. collenchyma.
 - d. meristematic cell.
 - e. phloem cell.

5. 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. the cells of roots have cell walls that are lacking in leaf cells.
 - c. a waxy cuticle covers leaves but is absent in roots.
 - d. vascular tissue is found in roots but it is absent from leaves.
 - e. leaves have epidermis, while such tissue is absent from roots.

6. 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
7. 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 of sugars.
 - d. vessel element/water transport.
 - e. companion cell/formation of secondary xylem and phloem.
8. Which of the following root tissues gives rise to secondary roots?
- a. endodermis
 - b. phloem
 - c. cortex
 - d. epidermis
 - e. pericycle
9. Additional vascular tissue produced as secondary growth in a root or stem originates from which cells?
- a. vascular cambium
 - b. apical meristem
 - c. endodermis
 - d. phloem
 - e. xylem
10. 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 cells are these?
- a. parenchyma
 - b. xylem
 - c. endodermis
 - d. collenchyma
 - e. sclerenchyma
11. Pores on the leaf surface that function in gas exchange are called
- a. hairs.
 - b. xylem cells.
 - c. phloem cells.
 - d. stomata.
 - e. sclereids.
12. Bark
- a. is composed of phloem plus periderm.
 - b. is associated with annuals but not perennials.
 - c. is formed by apical meristems.
 - d. has no identifiable function in trees.
 - e. forms annual rings.
13. The opening of stomates is thought to involve
- a. an increase in the osmotic concentration of the guard cells.
 - b. a decrease in the osmotic concentration of the stoma.
 - c. active transport of water into the guard cells.
 - d. decreased turgor pressure in guard cells.
 - e. movement of K⁺ out of guard cells.

14. The water within xylem vessels moves toward the top of a tree (long distances) as a result of
- active transport of ions into the vascular bundle.
 - atmospheric pressure on roots.
 - evaporation of water through stoma.
 - the force of root pressure.
 - osmosis in the root.
15. According to the pressure-flow hypothesis of phloem transport,
- solute moves from a high concentration in the "source" to a lower concentration in the "sink."
 - water is actively transported into the "source" region of the phloem to create the turgor pressure needed.
 - the combination of a high turgor pressure in the "source" and transpiration water loss from the "sink" moves solutes through phloem conduits.
 - the formation of starch from sugar in the "sink" increases the osmotic concentration.
 - the pressure in the phloem of a root is normally greater than the pressure in the phloem of a leaf.
16. Water entering the vascular bundle of the root from the cortex must pass through the
- Casparian strip.
 - phloem.
 - endodermal cytoplasm.
 - epidermis.
 - xylem.
17. George Washington completely removed the bark from around a cherry tree but was stopped by his father before cutting the tree down. It was noticed that the leaves retained their normal appearance for several weeks, but that the tree eventually died. The tissue(s) that George left functional was (were) the
- phloem.
 - xylem.
 - cork cambium.
 - cortex.
 - companion and sieve cells.
18. Arrange the following five events in an order that explains the mass flow of materials in the phloem.
- Water diffuses into the sieve elements.
 - Leaf cells produce sugar by photosynthesis.
 - Solutes are actively transported into sieve elements.
 - Sugar is transported from cell to cell in the leaf.
 - Sugar moves down the stem.
- 2, 1, 4, 3, 5
 - 1, 2, 3, 4, 5
 - 2, 4, 3, 1, 5
 - 4, 2, 1, 3, 5
 - 2, 4, 1, 3, 5
19. Photosynthesis begins to decline when leaves wilt because
- flaccid cells are incapable of photosynthesis.
 - CO₂ accumulates in the leaves and inhibits photosynthesis.
 - there is insufficient water for photolysis during light reactions.
 - stomata close, preventing CO₂ entry into the leaf.
 - the chlorophyll of flaccid cells cannot absorb light.

20. Root hairs are most important to a plant because they
- anchor a plant into the soil.
 - store starches.
 - increase the surface area for absorption.
 - provide a habitat for nitrogen-fixing bacteria.
 - contain xylem tissue.
21. In plant roots, the Casparian strip is correctly described by which of the following?
- It is located in the walls between endodermal cells and cortex cells.
 - It provides energy for the active transport of minerals into the vascular bundle from the cortex.
 - It ensures that all minerals are absorbed from the soil in equal amounts.
 - It ensures that all water and dissolved substances must pass through a cell before entering the vascular bundle.
 - It provides increased surface area for the absorption of mineral nutrients.
22. Which of the following best describes the general role of micronutrients in plants?
- They are cofactors in enzyme reactions.
 - They are necessary for essential regulatory functions.
 - They prevent chlorosis.
 - They are components of nucleic acids.
 - They are necessary for the formation of cell walls.
22. All of the following are elements that plants need in very small amounts (micronutrients) EXCEPT
- hydrogen
 - iron.
 - chlorine.
 - copper.
 - zinc.
23. In the nutrition of a plant, which element is classified as a macronutrient?
- zinc
 - chlorine
 - calcium
 - molybdenum
 - manganese
24. Which of the following is the major role of potassium in plants?
- osmotic regulation
 - photosynthesis
 - ATP synthesis
 - reproduction
 - lipid metabolism
25. Which of the following are botanically classified as a fruit?
- asparagus
 - celery
 - green beans
 - carrot
 - potato
28. Which of the following processes occurs in an anaerobic environment?
- glycolysis
 - Kreb's cycle
 - mitochondrial electron transport
 - both a and c will occur in an anaerobic environment

29. Carbon dioxide is produced during:
- glycolysis
 - the Krebs's cycle
 - the mitochondrial electron transport chain
 - substrate level phosphorylation reactions
 - all of the reactions above produce carbon dioxide
30. The electron transport chain in the mitochondrion pumps protons from the _____ to the _____.
- matrix; intermembrane space
 - matrix; stroma
 - intermembrane space; matrix
 - matrix; cytoplasm
31. During the complete breakdown of glucose into carbon dioxide and water, approximately _____ net ATP are produced via substrate level phosphorylations and approximately _____ net ATP are produced via oxidative phosphorylation.
- 0, 32
 - 4, 32
 - 8, 28
 - 16, 16
 - 32, 4
32. Given the general equation for respiration, $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$, which of the following is true?
- glucose is reduced to water
 - oxygen is reduced to carbon dioxide
 - glucose is oxidized to carbon dioxide
 - oxygen is oxidized to water
 - glucose and oxygen are both oxidized to carbon dioxide
33. Approximately how many different redox reactions occur during glycolysis?
- 1
 - 2
 - 5
 - 10
 - none of the reactions are redox reactions
34. The first biochemical pathway to evolve in living things was most likely:
- fermentation
 - glycolysis
 - the Krebs's cycle
 - the mitochondrial electron transport chain
35. Which of the following statements about glycolysis is TRUE?
- no ATP are made during glycolysis
 - Glycolysis requires 32 ATP to work
 - One redox reaction occurs during glycolysis
 - Glycolysis occurs only under anaerobic conditions
 - There are two oxidative phosphorylation reactions during glycolysis
36. The fruit of a tomato develops directly from the:
- anther
 - ovary
 - ovule
 - receptacle
 - stigma

37. Tomato seeds were once:

- a. an ovary
- b. ovules
- c. pollen grains
- d. sperms

38. Fertilization occurs in the:

- a. anther
- b. ovule
- c. petal
- d. root
- e. style

39. During double fertilization, two sperms fuse with female cells to produce:

- a. seed and fruit
- b. embryo and zygote
- c. ovule and ovary
- d. endosperm and zygote

40. The function of the sepals is to:

- a. produce the pollen
- b. attract pollinators
- c. protect the other floral structures
- d. serve as the receptive landing surface for the pollen

For each of the following cells, indicate if the structure is: a. haploid b. diploid c. triploid d. hexaploid

41. _____ flower petal cells

42. _____ root cell

43. _____ endosperm cells

44. _____ cell in a pollen grain

45. Following pollination, indicate the sequence of tissues the pollen tube would pass through as it grows toward its rendezvous with the egg.

- a. micropyle → ovary → style → stigma → ovule → egg
- b. ovule → ovary → micropyle → stigma → style → egg
- c. stigma → style → ovary → ovule → micropyle → egg
- d. style → ovary → ovule → stigma → micropyle → egg
- e. style → stigma → ovary → ovule → micropyle → egg

46. Wind-pollinated flowers are typically:

- a. large
- b. very colorful
- c. sweet scented
- d. produce copious pollen

Matching: Match each of the following with the appropriate cell/tissue

- a. chains of cells that transport food materials
- b. tapered xylem cells with lignified walls
- c. protective coat of woody stems and roots
- d. cell layer in root, which regulates movement into the central vascular cylinder
- e. supporting cells with thickened primary walls (often located just under epidermal surface)
- f. bundles of long sclerenchyma cells
- g. supporting cells with thick secondary walls (usually are lignified)
- h. unspecialized cells functioning in food storage or photosynthesis
- i. parenchyma cells inside vascular ring in stem

- 1. _____ sclerenchyma
- 2. _____ collenchyma
- 3. _____ tracheids
- 4. _____ fibers
- 5. _____ periderm
- 6. _____ endodermis
- 7. _____ pith
- 8. _____ phloem

Short answer: Using complete sentences, answer the following question.

- 1. Describe, with as much detail as possible, how guard cells are regulated.

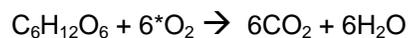
POD QUESTION: Use the Rembrandt-like sketch (not included) of a pea pod with seeds to answer the following questions

- 1. Structure #1 is _____ (1 pt)
- 2. Structure #2 is _____ (1 pt)

The formation of this pod required:

- 3. _____ pollen grain(s)
- 4. _____ egg(s)
- 5. _____ sperm(s)
- 6. _____ ovary(s)
- 7. _____ ovule(s)
- 8. _____ pistil(s)

RADIOACTIVE QUESTION: Indicate with an asterisk where the starred (*) atom appears on the right side of the equation.



FLORAL QUESTION: Label the parts of the flower below.

diagram not inserted

SHORT ANSWER QUESTION: *Using complete sentences characteristic of the smartest of cabbages answer BOTH OF the following questions.*

1. What is asexual reproduction. Give an example. What are some advantages and disadvantages of asexual reproduction?
2. Describe the typical sexual life cycle of a plant. Include terms such as alternation of generations, sporophyte, gametophyte, gamete, sperm, egg, fertilization, meiosis, megaspore, microspore, pollen, embryo, haploid, zygote, diploid. You may use a diagram, but you must explain it.

Pledge: I have neither given nor received help when taking this exam.

Signature _____ Date _____

CONGRATULATIONS, YOU MADE IT!

BONUS QUESTIONS: *Earn a bonus point for each correct response. No points are deducted for incorrect responses.*

GENIUS QUESTION: *Automatic "A" on the exam and an all expense date with the celebrity of your choice. No partial credit.*

Diagram all the reactions of glucose catabolism. Include chemical structures, all possible isomers, chemical names, and enzyme names (please use the official Enzyme Commission name format).

TRIVIA QUESTION: *Aren't they all? (For fun only)*

How many seeds does an average watermelon contain?

DUMB QUESTION: *A real specialty (For fun only)*

Where on the planet Venus do the flytraps grow?

TRICK QUESTION: *Can I fool you? (For fun only)*

How many coleoptiles does a bean seed have?

COCKTAIL PARTY QUESTION: Discuss the following statement, "*Plants are smarter than you think*".

OBVIOUS ANSWER QUESTION: Win a sticker!