

Name:

Section I. Multiple choice. Check any and all correct items; this means: there may be no correct response for you to check, or there might be more than one correct item that must be checked for full credit, in a given question. Total points: 48; each question worth 4 points.

1. *Prunus avium* is the scientific name given to the cherry tree. Here, *avium* represents
 - the genus all cherries belong to
 - the family that cherries belong to
 - a specific cherry variety
 - the specific epithet, not shared by other species of cherries
2. The protista emerged towards the end of the precambrian period, some 500 million years ago. The evolutionary innovations that distinguish the protista from all life forms that precede them in the fossil record include
 - a diploid phase in the life cycle
 - a membrane-bound nucleus
 - oxygen-evolving photosynthesis
 - presence of cell walls
3. Plant cells are similar to other eukaryotic cells in most respects. However, the following features are unique to plant cells
 - chloroplasts
 - endoplasmic reticulum
 - plasmodesmata
 - lysosomes
4. In bygone days, fungi were often lumped with plants because of alleged similarities between the two groups. Which of the following are characteristics of the fungi that are NOT seen in plants?
 - food reserve consists of glycogen
 - cell wall contains chitin
 - organism is eukaryotic
 - absorptive heterotrophy is chief mode of nutrition
5. The green, brown, and red algae are considered plant-like protista. As a group, which characteristic(s) do they share with plants that other photosynthetic organisms do not exhibit?
 - are exclusively heterotrophic
 - are complex, multicellular organisms
 - possess cell walls
 - have chlorophyll a
6. Red algae are capable of growing to greater depths than brown and green algae because they possess

- carotenoids, pigments that absorb in the blue portion of the visible spectrum
- phycobilins, pigments that absorb green light
- chlorophyll b, pigments that supplement light energy harvested by chlorophyll a
- laminarins, a storage reserve that resembles starch

7. Spores and gametes are different in that
- spores are multicelled, while gametes are always single-celled
 - spores are diploid, while gametes are haploid
 - gametes are always direct products of meiosis, whereas spore production is not immediately preceded by meiosis
 - gametes directly participate in fertilization, while spores produce a haploid multicelled organism first
8. Seedless vascular plants such as giant horsetails and giant lycopods came to dominate the landscape of the carboniferous and permian periods of the Paleozoic era. Which of the following features, lacking in the bryophytes, directly contributed to the tree-size stature of many seedless vascular plants of this time?
- synthesis of lignin in cell walls
 - presence of rhizoids
 - absence of motile sperm
 - presence of a central stele, made up of xylem and phloem
9. Speciation, the process of species formation from an ancestral population, is hastened when
- the ancestral population remains genetically uniform
 - the ancestral population is genetically diverse
 - when gene flow between two descendent populations is blocked
 - when the two descendent populations continue to interbreed
10. The evolutionary innovations that first appeared among the gymnosperms (i.e. not seen in bryophytes and seedless vascular plants) include
- heterospory
 - true roots
 - retention of the female gametophyte on the maternal sporophyte
 - presence of xylem elements
11. The entire ovule represents (or, is equivalent to)
- a highly specialized megasporangium
 - a highly reduced female gametophyte
 - the embryo
 - a microsporangium

Part II. Short answers and essays. Variable points, as noted.

1. Examine the characteristics in the lefthand column and decide if they hold true for *any member* of the groups listed above the columns on the right (indicate your response with check marks). 8 points.

Fungi Algae Bryophytes Seedless vascular plants

- a. exclusively heterotrophic
- b. dominant phase of lifecycle is haploid
- c. dependent on water for fertilization
- d. use xylem and phloem to conduct food and water
- e. exhibit zygotic meiosis
- f. exhibit alternation of generations
- g. produce spores
- h. produce a sporophyte that is not dependent on the gametophyte

3. Indicate whether the statements below are true or false. 5 points.

- A. In all organisms, gamete formation is directly preceded by meiotic division.
 - B. The deuteromycota produce sexual spores in a sac-like structure called the ascus.
 - C. Oogamy, the retention of the female gamete on the mother plant, is evolutionarily more advanced than isogamy, when the gametes involved in mating are identical and both types are released from the mother plant.
 - D. 'Class' represents a more general (more inclusive) taxonomic category than 'Order'.
 - E. Most bryophytes have a thick waxy cuticle and regulated air pores called stomata.
4. Compare the paired character states in the list below, and circle the one that represents an evolutionary advance. Give a one or two sentence explanation for your choice (i.e., explain why the selected characteristic confers greater adaptive value). 9 points.

a. Gametophyte as dominant generation vs Sporophyte as dominant generation

Adaptive value:

b. Homospory vs Heterospory

Adaptive value:

c. A single-celled organism vs Multicelled organism

Adaptive value:

5. Describe the morphological concept of species. What type of traits are preferred in making species designations, and which traits must be avoided? How is this concept different from the biological concept of species? What is the main drawback or disadvantage of the morphological concept of species? Which definition of species is most widely used by botanists, and why? 10 points.

6. How do stomata open and close? Describe the structural features, the cellular mechanism, and the changes in water status, that allow stomatal guard cells to open. 8 points.

7. Examine the paired items below. From each of these pairs, choose the environmental parameter that would promote a higher rate of transpiration from the leaf surface than the other item in the pair, in a normal mesophytic C3 plant; indicate your choice by circling the appropriate parameter. 6 points.

higher leaf temperature (35°C)	versus	lower leaf temperature (25°C)
high relative humidity (85% RH)	versus	low relative humidity (10% RH)
low tissue [CO ₂]	versus	high tissue [CO ₂]
night time	versus	day time
water stress	versus	adequate water supply
windy conditions	versus	still air

8. Compare xylem and phloem structure and function by checking the appropriate columns in the right for each characteristic listed in the left-hand column. 6 points.

	Xylem elements	Phloem elements
--transport fluids in both directions (basipetally and acropetally) in a plant		
--lack nuclei		
--contents under hydrostatic pressure		
--transport inorganic anions and cations (any kind)		
--in all cases, transport not inhibited by metabolic poisons		
--rate of transport declines under serious water stress (plant shows signs of wilting)		