

※ 本大題請於試卷內之「選擇題作答區」依序作答。

I. 選擇題: (2 points each)

1) Which type of general life cycle found in algae is basically the same type found in most animals?

- A. dibiontic and isomorphic
- B. dibiontic and heteromorphic
- C. monobiontic, where the diploid phase represents the individual
- D. monobiontic, where the haploid phase represents the individual
- E. there is no algal life cycle with an animal equivalent

2) Individuals in a desert are often evenly spaced from their neighbors. This would not be caused by

- A. Competition between roots for water
- B. Seed dispersal
- C. Herbivores living in the plants
- D. Germination inhibitors released by the plants
- E. Growth inhibitors released by the plants

3) Chemiosmotic generation of ATP is driven by

- A. a difference in  $H^+$  concentration on the two sides of the mitochondrial membrane.
- B. large quantities of ADP.
- C. osmosis of macromolecules.
- D.  $P_i$  transfer through the plasma membrane.
- E. the  $Na^+/K^+$  pump.

4) Which of the following statements concerning primitive cells is FALSE?

- A. They acquired the ability to grow.
- B. They acquired the ability to reproduce.
- C. They acquired the ability to pass on their characteristics to subsequent generations.
- D. They constructed new cells from organic molecules made via photosynthesis.
- E. They used organic molecules to satisfy their energy requirements.

5) In which of the following characteristics, prokaryotes and eukaryotes are similar?

- A. cell division
- B. contain ribosomes
- C. internal compartmentalization
- D. flagella
- E. enzymes localized in the plasma membrane

6) How do nastic movements differ from tropisms?

- A. Nastic movements are slower than tropisms.
- B. Nastic movements only occur in the dark.
- C. Tropisms are directional responses to directional stimuli; nastic movements are the same regardless of the direction of the stimulus.
- D. Nastic movements happen after a stimulus, tropisms happen during a stimulus.
- E. Nastic movements are not reversible.

7) The most comprehensive studies of seed plant phylogeny are based on differences among \_\_\_\_\_ sequences of \_\_\_\_\_.

- A. amino acid; cytochrome *c*
- B. amino acid; Rubisco
- C. nucleotide; mitochondrial genes
- D. nucleotide; ribosomal RNA
- E. nucleotide; the *rbcl* gene

8) Fertilization in angiosperms leads to the formation of a diploid zygote and the typically triploid primary

- A. endosperm nucleus.
- B. carpel.
- C. seed.
- D. ovule.
- E. ovary.

9) If humans had been present to build log structures during the Carboniferous period (they were not), which plant types would have been suitable sources of logs?

- A. charophytes (stoneworts), bryophytes, and gymnosperms
- B. ferns, horsetails, and lycophytes
- C. whisk ferns and epiphytes
- D. horsetails and bryophytes
- E. lycophytes and bryophytes

10) Arrange the following structures, which can be found on male pine trees, from the largest structure to the smallest structure (or from most inclusive to least inclusive).

1. sporophyte 2. microspores 3. microsporangia 4. pollen cone 5. pollen nuclei

- A. 1, 2, 3, 5, 4
- B. 1, 4, 2, 3, 5
- C. 1, 4, 3, 2, 5
- D. 4, 1, 2, 3, 5
- E. 4, 3, 2, 5, 1

11) To attach a particular amino acid to the tRNA molecule that will transport it, an enzyme, an aminoacyl-tRNA synthetase, is required, along with ATP. Initially, the enzyme has an active site for ATP and another for the amino acid, but it is not able to attach the tRNA. What must occur for the final attachment to occur?

- A. The ATP must first have to attach to the tRNA.
- B. The binding of the first two molecules must cause a 3-D change that opens another active site on the enzyme.
- C. The ATP must be hydrolyzed to allow the amino acid to bind to the synthetase.
- D. The tRNA molecule must alter its shape to be able to fit into the active site with the other two molecules.
- E. The 3' end of the tRNA must be cleaved before it can have an attached amino acid.

12) When electrons flow along the electron transport chains of mitochondria, which of the following changes occurs?

- A. The pH of the matrix increases.
- B. ATP synthase pumps protons by active transport.
- C. The electrons gain free energy.
- D. The cytochromes phosphorylate ADP to form ATP.
- E. NAD<sup>+</sup> is oxidized.

- 13) Why are mycorrhizal fungi superior to plants at acquiring mineral nutrition from the soil?
- Hyphae are one hundred to one thousand times larger than plant roots.
  - Hyphae have a smaller surface-area-to-volume ratio than do the hairs on a plant root.
  - Mycelia are able to grow in the direction of food.
  - Fungi secrete extracellular enzymes that can break down large molecules.
  - Hyphae have potential to inhabit almost all terrestrial habitats
- 14) Shoot elongation in a growing bud is due primarily to \_\_\_\_\_.
- cell division at the shoot apical meristem
  - cell division localized in each internode
  - cell elongation directly below the shoot apical meristem
  - cell elongation localized in each internode
  - cell division at the shoot apical meristem and cell elongation directly below the shoot apical meristem
- 15) Which of the following elements correctly pairs an essential element in plants with its function?
- magnesium — component of nucleic acids, phospholipids, ATP, several coenzymes
  - nitrogen — component of nucleic acids, proteins, hormones, coenzymes
  - phosphorus — cofactor functioning in protein synthesis
  - potassium — component of chlorophyll; activates many enzymes
  - sulfur — component of DNA; activates some enzymes
- 16) Which of the following characteristics, structures, or processes is common to bacteria and viruses?
- metabolism
  - ribosomes
  - genetic material composed of nucleic acid
  - cell division
  - independent existence
- 17) In analyzing the number of different bases in a DNA sample, which result would be consistent with the base-pairing rules?
- $A = G$
  - $A + G = C + T$
  - $A + T = G + T$
  - $A = C$
  - $G = T$
- 18) A recent study compared the *Homo sapiens* genome with that of Neanderthals. The results of the study indicated a mixing of the two genomes at some period in evolutionary history. Additional data consistent with this hypothesis could be the discovery of \_\_\_\_\_.
- some Neanderthal sequences not found in living humans
  - a few modern *H. sapiens* with some Neanderthal sequences
  - duplications of several Neanderthal genes on a Neanderthal chromosome
  - some Neanderthal chromosomes that are shorter than their counterparts in living humans
  - inversions in Neanderthal chromosome

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19) Meristematic tissue cells in plants are most similar to which kind of cells in animals?

- A. somite cells
- B. ectodermal cells
- C. embryonic stem cells
- D. mesodermal cells
- E. epithelial cells

20) During metamorphosis, a tadpole's tail is reduced in size by the process of \_\_\_\_\_.

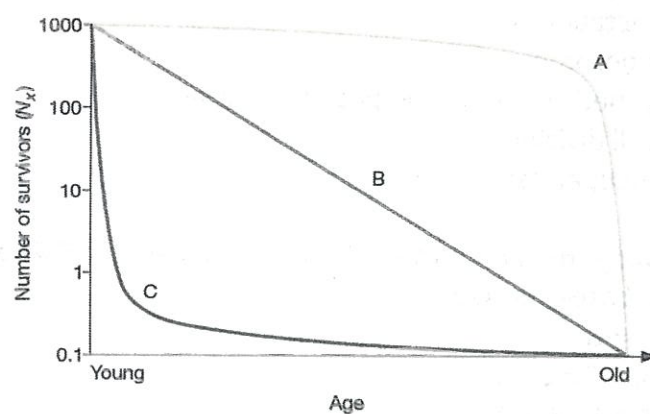
- A. regeneration
- B. apoptosis
- C. meiosis
- D. oxidative phosphorylation
- E. re-differentiation

21) Your professor wants you to construct a phylogenetic tree of orchids. She gives you tissue from seven orchid species and one lily. What is the most likely reason she gave you the lily?

- A. to serve as an outgroup
- B. to see if the lily is a cryptic orchid species
- C. to see if the lily and the orchids show all the same shared derived characters (synapomorphies)
- D. to demonstrate likely homoplasies
- E. to see if you can tell the differences between lily and orchids

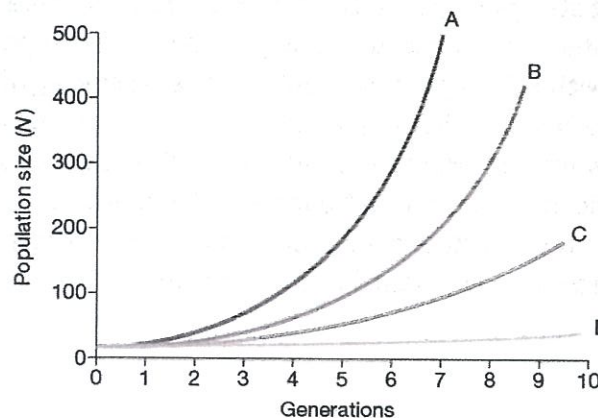
22) In the following figure, which of the following survivorship curves implies that an animal may lay many eggs with the same probability of dying each year of life?

- A. curve A
- B. curve B
- C. curve C
- D. both A and B
- E. both B and C



23) In the accompanying figure, which of the lines represents the highest per capita rate increase ( $r$ )?

- A. line A
- B. line B
- C. line C
- D. line D
- E. not enough information



24) Most of the absorption surfaces of multicellular animals are lined with \_\_\_\_\_.

- A. connective tissue
- B. smooth muscle cells
- C. neural tissue
- D. epithelial tissue
- E. adipose tissue

25) Suppose researchers marked 800 turtles and later were able to trap a total of 300 individuals in that population, of which 150 were marked. What is the estimate for total population size?

- A. 200
- B. 1050
- C. 1600
- D. 2100
- E. 3000

II. 簡答題 (5 points each)

1) Choose the letter of the best match from the following:

- A. abscisic acid    B. artemisinin    C. auxin    D. brassinosteroids  
E. cytokinin    F. ethylene    G. gibberellin    H. systemin

- \_\_\_\_\_ (1) A chemical derivative of adenine.  
\_\_\_\_\_ (2) Discovered because of a relationship to a disease of rice.  
\_\_\_\_\_ (3) First plant hormone to be discovered.  
\_\_\_\_\_ (4) Influential in the opening and closing of stomata.  
\_\_\_\_\_ (5) Its defoliant effects were first noticed when it leaked from gas lights; later found to be produced by plants themselves.

- 2) Describe how do the apical meristems produce the primary plant body and the lateral meristems produce the secondary plant body.
- 3) Compare and contrast how  $C_4$  plants and CAM plants separate the acquisition of  $CO_2$  from the production of sugar in the Calvin cycle.
- 4) Explain the differences between the apoplastic, symplastic, and transcellular pathways for water movement across a root.
- 5) What are the major differences between mitosis and meiosis?
- 6) Explain homeotic mutations and how scientists understand body plan diversity through Hox genes.
- 7) Describe five major types of animal behaviors and provide an example for each.
- 8) Why is biodiversity important?
- 9) Compare the differences between adaptation and acclimatization.
- 10) Explain Neutral Theory and why it is important in evolution.