AP® Biology
2007 Free-Response Questions

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BIOLOGY
SECTION II
Time—1 hour and 30 minutes

Directions: Answer all questions.

Answers must be in essay form. Outline form is not acceptable. Labeled diagrams may be used to supplement discussion, but in no case will a diagram alone suffice. It is important that you read each question completely before you begin to write. Write all your answers on the pages following the questions in this booklet.

1. Membranes are essential components of all cells.
   (a) **Identify** THREE macromolecules that are components of the plasma membrane in a eukaryotic cell and **discuss** the structure and function of each.
   (b) **Explain** how membranes participate in THREE of the following biological processes:
      - Muscle contraction
      - Fertilization of an egg
      - Chemiosmotic production of ATP
      - Intercellular signaling

2. Cephalization and the development of a brain were important steps in animal evolution.
   (a) **Discuss** the evolutionary origin and adaptive significance of cephalization in animal phyla.
   (b) **Describe** the development of the nervous system in the vertebrate embryo.
   (c) At the sound of shattering glass, people quickly turn their heads. **Discuss** how the human nervous system functions to produce this type of response to an external stimulus.

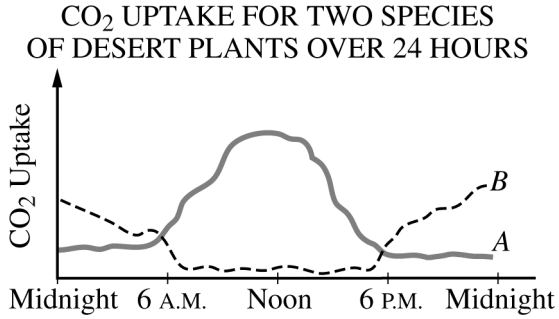
GO ON TO THE NEXT PAGE.

3. Compared with other terrestrial biomes, deserts have extremely low productivity.

   (a) **Discuss** how temperature, soil composition, and annual precipitation limit productivity in deserts.

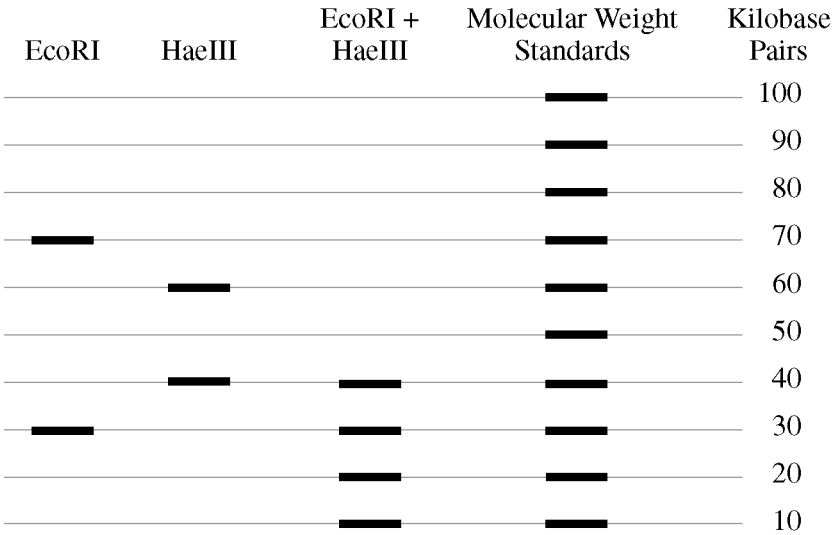
   (b) **Describe** a four-organism food chain that might characterize a desert community, and **identify** the trophic level of each organism.

   (c) **Describe** the results depicted in the graph. **Explain** one anatomical difference and one physiological difference between species *A* and *B* that account for the CO_2 uptake patterns shown. **Discuss** the evolutionary significance of each difference.



4. A bacterial plasmid is 100 kb in length. The plasmid DNA was digested to completion with two restriction enzymes in three separate treatments: EcoRI, HaeIII, and EcoRI + HaeIII (double digest). The fragments were then separated with electrophoresis, as shown.

RESULTS OF GEL ELECTROPHORESIS



(a) Using the circle provided, **construct** a labeled diagram of the restriction map of the plasmid. **Explain** how you developed your map.

(b) **Describe** how:

- recombinant DNA technology could be used to insert a gene of interest into a bacterium
- recombinant bacteria could be identified
- expression of the gene of interest could be ensured

(c) **Discuss** how a specific genetically modified organism might provide a benefit for humans and at the same time pose a threat to a population or ecosystem.