# AP® Biology
# 2011 Free-Response Questions

## About the College Board

The College Board is a mission-driven not-for-profit organization that connects students to college success and opportunity. Founded in 1900, the College Board was created to expand access to higher education. Today, the membership association is made up of more than 5,900 of the world's leading educational institutions and is dedicated to promoting excellence and equity in education. Each year, the College Board helps more than seven million students prepare for a successful transition to college through programs and services in college readiness and college success — including the SAT® and the Advanced Placement Program®. The organization also serves the education community through research and advocacy on behalf of students, educators and schools.



**Visit the College Board on the Web: www.collegeboard.org.**
**AP Central is the official online home for the AP Program: apcentral.collegeboard.com.**

## 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 the pink booklet.

1. During an investigation of a freshwater lake, an AP Biology student discovers a previously unknown microscopic organism. Further study shows that the unicellular organism is eukaryotic.
   (a) **Identify** FOUR organelles that should be present in the eukaryotic organism and **describe** the function of each organelle.
   (b) Prokaryotic cells lack membrane-bound organelles found in eukaryotes. However, prokaryotes must perform many of the same functions as eukaryotes. For THREE of the organelles identified in part (a), **explain** how prokaryotic cells carry out the associated functions.
   (c) According to the endosymbiotic theory, some organelles are believed to have evolved through a symbiotic relationship between eukaryotic and prokaryotic cells. **Describe** THREE observations that support the endosymbiotic theory.

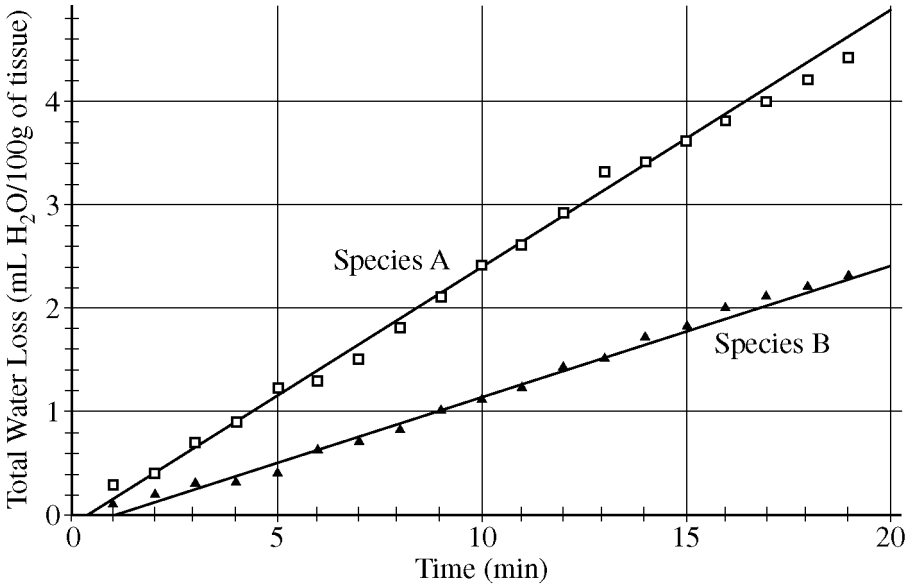
2. Organisms utilize a diversity of methods to obtain proper nutrition.
   (a) Some organisms digest food intracellularly, while others digest food extracellularly.
      - **Identify** ONE nonvertebrate organism that digests food intracellularly and **describe** the process.
      - **Identify** ONE nonvertebrate organism that digests food extracellularly and **describe** the process.
   (b) **Describe** TWO structural features of the human stomach and/or small intestine. For each, **explain** how the structure relates to the function.
   (c) Plants have a variety of mechanisms for obtaining nutrients. **Describe** TWO plant structures and **explain** how each structure is utilized in nutrient uptake.

3. Reproduction can be either asexual or sexual.
   (a) Using a specific example, **describe** how organisms can reproduce asexually. **Discuss** TWO evolutionary advantages of asexual reproduction.
   (b) **Identify** THREE ways that sexual reproduction increases genetic variability. For each, **explain** how it increases genetic diversity among the offspring.
   (c) **Discuss** TWO prezygotic isolating mechanisms that prevent hybridization between two species. Include in your discussion an example of each mechanism.

4. The regulation of transpiration is an important homeostatic mechanism in plants.

   (a) Under controlled conditions, a transpiration experiment was conducted using two plant species. The data collected are shown in the figure below. Using the data from the experiment, **calculate** the rate of transpiration for species A and species B between the times of 5 and 15 minutes (show your work). **Summarize** the difference between the two transpiration rates.

WATER LOSS VERSUS TIME FOR TWO PLANT SPECIES




   (b) **Identify** and **explain** THREE different structural or physiological adaptations that could account for the different transpiration rates of species A and B.

   (c) Water potential (Ψ) is described by the following formulas.

$$\Psi = \Psi_p + \Psi_s$$

$$\Psi = -iCRT$$

   **Discuss** the variables in both formulas and how they affect water potential.

**END OF EXAM**