



AP Environmental Science 2001 Free-Response Questions

The materials included in these files are intended for use by AP teachers for course and exam preparation in the classroom; permission for any other use must be sought from the Advanced Placement Program. Teachers may reproduce them, in whole or in part, in limited quantities, for face-to-face teaching purposes but may not mass distribute the materials, electronically or otherwise. These materials and any copies made of them may not be resold, and the copyright notices must be retained as they appear here. This permission does not apply to any third-party copyrights contained herein.

These materials were produced by Educational Testing Service (ETS), which develops and administers the examinations of the Advanced Placement Program for the College Board. The College Board and Educational Testing Service (ETS) are dedicated to the principle of equal opportunity, and their programs, services, and employment policies are guided by that principle.

The College Board is a national nonprofit membership association dedicated to preparing, inspiring, and connecting students to college and opportunity. Founded in 1900, the association is composed of more than 3,900 schools, colleges, universities, and other educational organizations. Each year, the College Board serves over three million students and their parents, 22,000 high schools, and 3,500 colleges, through major programs and services in college admission, guidance, assessment, financial aid, enrollment, and teaching and learning. Among its best-known programs are the SAT[®], the PSAT/NMSQT[™], the Advanced Placement Program[®] (AP[®]), and Pacesetter[®]. The College Board is committed to the principles of equity and excellence, and that commitment is embodied in all of its programs, services, activities, and concerns.

Copyright © 2001 by College Entrance Examination Board. All rights reserved. College Board, Advanced Placement Program, AP, and the acorn logo are registered trademarks of the College Entrance Examination Board.

2001 AP[®] ENVIRONMENTAL SCIENCE FREE-RESPONSE QUESTIONS

ENVIRONMENTAL SCIENCE

SECTION II

Time—90 minutes

NO CALCULATORS MAY BE USED ON THIS EXAMINATION

4 Questions

Directions: Answer all four questions, which are weighted equally; the suggested time is about 22 minutes for answering each question. Write all your answers on the pages following the questions in the pink booklet. Where calculations are required, clearly show how you arrived at your answer. Where explanation or discussion is required, support your answers with relevant information and/or specific examples.

1. Answer the questions below regarding the heating of a house in the Midwestern United States. Assume the following.
 - The house has 2,000 square feet of living space.
 - 80,000 BTUs of heat per square foot are required to heat the house for the winter.
 - Natural gas is available at a cost of \$5.00 per thousand cubic feet.
 - One cubic foot of natural gas supplies 1,000 BTUs of heat energy.
 - The furnace in the house is 80 percent efficient.
 - (a) Calculate the following, showing all the steps of your calculations, including units.
 - (i) The number of cubic feet of natural gas required to heat the house for one winter
 - (ii) The cost of heating the house for one winter
 - (b) Identify and describe three actions the residents of the house could take to conserve heat energy and lower the cost of heating the house.
 - (c) The residents decide to supplement the heating of the house by using a wood-burning stove. Discuss two environmental impacts, one positive and one negative, of using the wood-burning stove.

2001 AP® ENVIRONMENTAL SCIENCE FREE-RESPONSE QUESTIONS

2. After reading the following excerpt from an article about the interrelationships among organisms in an oak forest, answer parts (a), (b), and (c), which follow.

Chain Reactions Linking Acorns to Gypsy Moth Outbreaks and Lyme Disease Risk

Oak trees (*Quercus* spp.) produce large autumnal acorn crops every two to five years, and produce few or no acorns during intervening years. Acorns are a critical food for white-footed mice (*Peromyscus leucopus*). Mice are important predators of the pupal stage of the gypsy moth (*Lymantria dispar*). This introduced insect periodically undergoes outbreaks that defoliate millions of hectares of oak forests, decreasing tree growth, survival, and acorn crop production. An abundance of acorns provides food for white-tailed deer (*Odocoileus virginianus*). Mice and deer are the primary hosts of the black-legged tick (*Ixodes scapularis*), which carries Lyme disease.

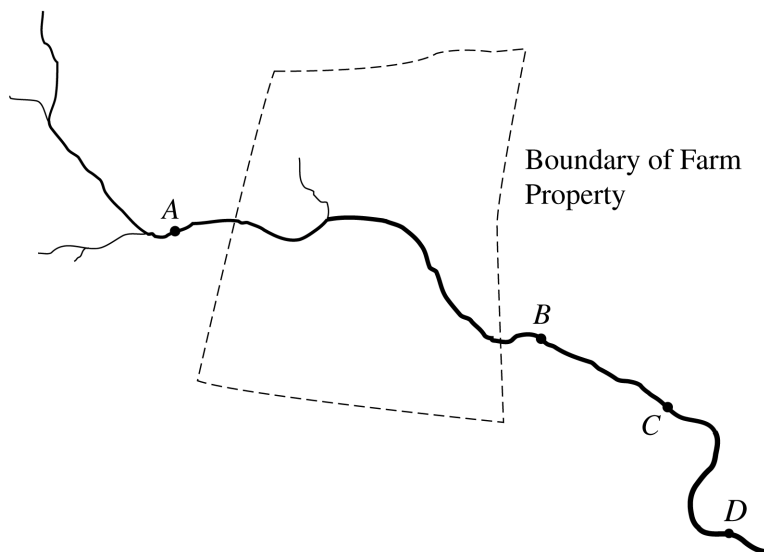
- (a) In the space provided below, diagram a food web based on the interrelationships of the organisms identified in the excerpt.
- (b) Design a controlled experiment that tests the relationship between acorn production and gypsy moth population. Include the hypothesis that the experiment tests.
- (c) Briefly describe a strategy that uses integrated pest management for the control of the black-legged tick population.

2001 AP[®] ENVIRONMENTAL SCIENCE FREE-RESPONSE QUESTIONS

3. In recent years, results from scientific studies have increased public awareness of the possible damage to human health from exposure to indoor air pollution.
- (a) Identify two specific indoor air pollutants and, for each, discuss the following.
- (i) The type of building most affected by the pollutant
 - (ii) Source(s) of the pollutant
 - (iii) The pollutant's effects on human health
 - (iv) The method(s) of prevention or cleanup of the pollutant
- (b) According to the Environmental Protection Agency, at least 17 percent of the four million commercial buildings in the United States can be considered "sick buildings."
- (i) Explain what is meant by the term "sick building."
 - (ii) Describe the criteria used for determining whether a building is "sick."

2001 AP® ENVIRONMENTAL SCIENCE FREE-RESPONSE QUESTIONS

4. Students in an environmental science class at Fremont High School tested the water quality in a stream near their school. They were concerned about the possible pollution of the stream, which flows through a farm on which hogs are raised. Shown below are a diagram that indicates the sites where the students collected water samples (labeled *A* through *D*, upstream to downstream) and a table of the results of the students' water tests.



Results of Water Tests

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
Dissolved Oxygen (ppm)	6.4 ± 0.3	2.5 ± 0.1	3.0 ± 0.2	5.8 ± 0.2
Phosphate (ppm)	0.9 ± 0.05	1.2 ± 0.09	1.1 ± 0.08	1.0 ± 0.09
Nitrate (ppm)	0.9 ± 0.3	19.3 ± 1.1	12.5 ± 1.0	6.2 ± 0.5
pH	5.5	5.4	5.6	5.4

- (a) Assess the likelihood that animal waste is contaminating the water. Discuss the scientific basis of your assessment.
- (b) Describe two additional tests that could be used in monitoring the quality of the water in the stream. For each test, describe the patterns you would expect from sites *A* through *D*.
- (c) Describe a sequence of ecological changes that might result from the discharge of animal waste into a body of water.
- (d) The Clean Water Act was first passed in the United States in 1972 and has been amended several times since then. Describe two specific provisions of this legislation that would be likely to apply to the quality of the stream water.

END OF EXAMINATION