



## 2000 Advanced Placement Program® Free-Response Questions

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# 2000 AP® ENVIRONMENTAL SCIENCE FREE-RESPONSE QUESTIONS

## ENVIRONMENTAL SCIENCE

### SECTION II

Time—90 minutes

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 this booklet, NOT on the green insert. 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. A large, coal-fired electric power plant produces 12 million kilowatt-hours of electricity each day. Assume that an input of 10,000 BTU's of heat is required to produce an output of 1 kilowatt-hour of electricity.
  - (a) Showing all steps in your calculations, determine the number of
    - (i) BTU's of heat needed to generate the electricity produced by the power plant each day,
    - (ii) pounds of coal consumed by the power plant each day, assuming that one pound of coal yields 5,000 BTU's of heat,
    - (iii) pounds of sulfur released by the power plant each day, assuming that the coal contains one percent sulfur by weight.
  - (b) The Environmental Protection Agency (EPA) standard for power plants such as this one is that no more than 1.2 pounds of sulfur be emitted per million BTU's of heat generated. Using the results in part (a), determine whether the power plant meets the EPA standard.
  - (c) Describe two ways by which a fuel-burning electric power plant can reduce its sulfur emissions.
  - (d) Discuss why sulfur emissions from coal-fired power plants are considered an environmental problem and describe one negative effect on an ecosystem that has been associated with sulfur emissions.

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2. After reading the following editorial from *The Fremont Daily*, answer the questions that follow.

### IS RECYCLING SMART ECONOMICS?

Debates about recycling often become highly charged and passionate. Over the past decade some headlines have heralded that “trash is treasure” while others have proclaimed that “recycling is garbage.”

The antagonists in these debates are disagreeing over public policy and its role in shaping decisions about resource use. Both sides in these debates frequently have broad policy agendas that go far beyond choosing the most efficient way to manage solid waste. Both sides also promote their political agendas with unsupported assertions and incomplete information. Determining what amount of recycling will result in efficient resource use requires systematic analysis.

Proponents of recycling argue that recycling saves resources. For example, most manufacturers of aluminum cans currently depend on recycled aluminum for more than 50% of their needs. This recycled input reduces the economic and environmental costs associated with mining and landfills.

A common argument for the antirecycling side is that recycling wastes resources. It takes resources to recycle. For example, it takes human effort to sort aluminum cans from other trash and energy to move aluminum cans from the consumer back to the manufacturer.

It may not make economic sense to recycle all materials or all of any single material, but numerous studies have shown that there are net benefits to society at low or modest levels of recycling most materials. The question is, Which has the higher environmental cost: using recovered materials or using virgin materials? Do recovered or virgin materials cost more in resources? The answer is complex and changing.

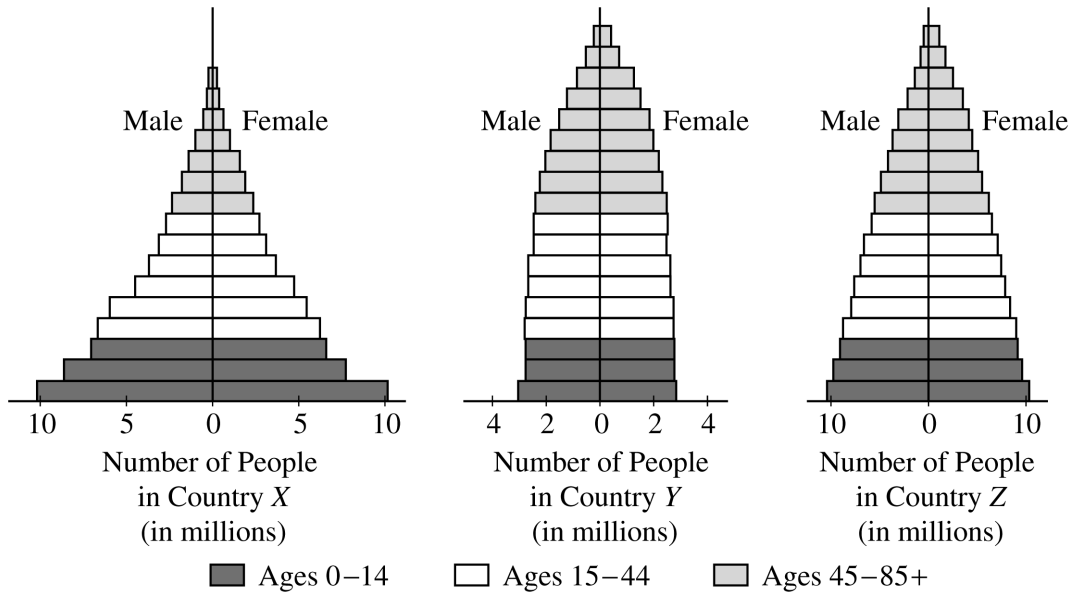
Your next environmental decision is fast approaching. Should you put this copy of *The Fremont Daily* in the recycling bin or should you put it in the trash?

- (a) Consider the arguments regarding aluminum presented in the editorial, then make
- (i) a similar argument in favor of recycling the newspaper, and
  - (ii) a similar argument against recycling the newspaper.
- (b) For each of the following, describe two pieces of scientific information that would be needed to evaluate
- (i) the environmental benefits of recycling the newspaper, and
  - (ii) the environmental costs of recycling the newspaper.
- (c) If a community can afford to begin a recycling program for either aluminum or newspaper, but not both, which one would you recommend to be recycled? Provide two reasons why your recommendation is better than the alternative.
- (d) Discuss two difficulties that the community might face in implementing the recycling program in part (c).

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3. Species such as the dusky seaside sparrow, the passenger pigeon, and the woolly mammoth are extinct. Populations of other species have declined to the point where they are designated as threatened or endangered.
- (a) Identify one threatened or endangered species and explain why its population has declined.
  - (b) Describe three characteristics of organisms that would make them particularly vulnerable to extinction.
  - (c) Present three arguments in favor of the maintenance of biodiversity.
  - (d) Name and describe one United States federal law or one international treaty that is intended to prevent the extinction of species.

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4. The figures above show the age structures of human populations in three countries, X, Y and Z.
- Which of the three countries has the largest rate of population growth? Which has the smallest rate? Explain.
  - Compare the infant mortality rates that are likely in Countries X and Y. Explain your reasoning.
  - Describe the changes in both the birth rate and the death rate for a country making the transition from a preindustrial society to an industrial society.
  - Describe one incentive that the government of a country could offer its citizens that would favor a reduction in the growth rate of its population. Explain how this incentive would work, and describe one possible drawback.

**END OF EXAMINATION**