



Student Performance Q&A:

2008 AP[®] Environmental Science Free-Response Questions

The following comments on the 2008 free-response questions for AP[®] Environmental Science were written by the Chief Reader, Art Samel of Bowling Green State University in Bowling Green, Ohio. They give an overview of each free-response question and of how students performed on the question, including typical student errors. General comments regarding the skills and content that students frequently have the most problems with are included. Some suggestions for improving student performance in these areas are also provided. Teachers are encouraged to attend a College Board workshop to learn strategies for improving student performance in specific areas.

Question 1

What was the intent of this question?

This was the document-based question. After reading a newspaper article, students were asked a series of questions related to the subject of the article, biodiesel fuel. The questions required students to demonstrate knowledge of alternative energy sources, the carbon cycle, and the issues surrounding the use of food products to produce energy.

How well did students perform on this question?

Students performed fairly well on this question. The mean score was 4.1 out of a possible 10 points. Most students attempted to answer part (a) and calculated the correct areas. In parts (b) and (e) many students provided descriptions that were not sufficiently thorough, and in part (d) many students did not include two complete discussions. Few students earned the point in part (c).

What were common student errors or omissions?

Students had difficulty with part (c). Only a few indicated an understanding of the difference between the impact of biodiesel fuel and fossil fuels on atmospheric CO₂ concentrations. Students commonly wrote that biodiesel fuel releases no CO₂ when burned or that biodiesel fuel reduces the atmospheric CO₂ concentration. Students also confused photosynthesis and respiration in their explanations.

In part (e) many students did not demonstrate an understanding of the problems of using a food commodity (corn) as fuel.

Based on your experience of student responses at the AP Reading, what message would you like to send to teachers that might help them to improve the performance of their students on the exam?

- Remind students that when calculations are required on the exam, they must clearly show how they arrived at their answers.
- Encourage students to provide complete descriptions and discussions.
- Remind students to answer the questions that have been asked. For example, when asked to describe an *environmental* advantage, students did not earn points for descriptions of nonenvironmental advantages.
- Provide students opportunities to extemporaneously write explanations of environmental concepts—when answering this question, they were largely unable to explain the difference between old and new carbon.
- Give students the opportunity to discuss and write explanations of environmental issues currently in the news. Exam questions occasionally cover subject matter that is similar to recent world events.

Question 2

What was the intent of this question?

The question assessed students' abilities to analyze environmental information from a schematic diagram as well as from text. The outcome of these analyses should have been a correct computation of landfill values for infiltrated water, cadmium containing leachate, cadmium released into surrounding soil, and the annual costs associated with treating the leachate. The question also measured students' abilities to recognize viable methods of waste stream reduction for cadmium and the inherent shortcomings associated with the implementation of these methods.

How well did students perform on this question?

Students performed fairly well on this question. The mean score was 2.26 out of a possible 10 points.

What were common student errors or omissions?

Many students chose not to answer this question. Integrating the prompts with the schematic and descriptive text appeared difficult for those students who attempted to answer.

In parts (a), (b), and (c) students often omitted calculations or had difficulty with the calculations. Students struggled with setting up the equations that were based on the schematic and text; showing correct dimensional analysis; and carrying correct units through the problem(s). They also had difficulty with metric units and the final computation. When students elected to answer the computational parts of the question (parts [a], [b], and [c]) with prose, the prose did not indicate a clear understanding of the setup.

In part (d) many students confused reducing municipal waste *input* with treating cadmium-bearing leachate already in the waste stream, and they inappropriately suggested filtering as a method. Many students were vague in their descriptions of methods (e.g., screening waste).

Based on your experience of student responses at the AP Reading, what message would you like to send to teachers that might help them to improve the performance of their students on the exam?

- Encourage students to understand what the question is asking before they start writing answers.
- Encourage students to show all computational work. Work with students to organize computational problems that use dimensional analysis.
- Encourage students to complete all computational sets, so that they can earn points where possible.
- Encourage development of analytical skills: work with students on data analysis and the application of quantitative analysis to environmental problems.
- Encourage students to review their answers to determine whether the computations produce realistic results, with the right order of magnitude. If a computation produces an unrealistic result, then it is likely incorrect.

Question 3

What was the intent of this question?

The intent of this question was to determine the level of students' understanding of fire-suppressed forests, the impact of the Healthy Forests Initiative upon forests, ecosystem services provided by forests, and the effect of clear-cutting upon those services. In addition, students were asked to identify another plant community or biome maintained by fire, other than forests.

How well did students perform on this question?

Students performed well on this question. The mean score was of 4.6 out of a possible 10 points. Almost all students attempted to answer the question.

What were common student errors or omissions?

In part (a) many students indicated "dry" as a condition of suppressed forests. Fire-suppressed forests are not dry but have an accumulation of combustible materials, an increase in understory growth, stored turpines in older trees, and other conditions that cause the fire risk to increase. Dryness is due to local climate, not forest conditions. Other students thought fire suppression followed a forest fire or the act of putting out a forest fire.

In part (b) students did not earn points for responding with fire-reduction methods.

Students who did not receive full credit in part (c) failed to identify an ecosystem service benefiting humans. A number of students who indicated clear-cutting the forest did not link it to an ecosystem service. Students also had difficulty explaining the carbon/oxygen cycle and omitted the human service of carbon dioxide reduction reducing climate change impacts. Many students incorrectly stated that oxygen is released from carbon dioxide during photosynthesis.

In part (d) some students did not know a specific plant community, other than forests, that is maintained by fire.

Based on your experience of student responses at the AP Reading, what message would you like to send to teachers that might help them to improve the performance of their students on the exam?

- Students should read questions carefully and note where linkages and exclusions are specified within the questions (e.g., “[e]xcluding fire reduction” in part [b]). When students miss this subtlety, they may earn no points on one or more parts of a question.
- Students should be familiar with the ecological services provided by ecosystems and the impact of humans on ecosystems.
- Students should take sample exams in class and focus on providing responses that answer the specific questions that have been asked.

Question 4

What was the intent of this question?

The aim of this question was to assess students’ knowledge of contemporary issues related to human population growth and its impact on the environment. Students were required to graph and analyze Total Fertility Rate (TFR) data, which should have shown a decreasing trend, and then to give two causes for this decrease over the past fifty years. Students were then asked to compare the TFR for a developed country (the United States) and a less-developed country (Kenya) and to discuss two factors that would account for the difference. Lastly, students were required to relate two effects of rapid human population growth on the biodiversity of the Earth.

How well did students perform on this question?

Students performed fairly well on this question. The mean score was 5.81 out of a possible 10 points.

What were common student errors or omissions?

In part (b) students often did not specify the role played by increased educational opportunities for *women* in reducing the TFR. Instead, they simply gave “increased education” as a cause. Another common error was to link the end of the baby boom with the end of wars in Korea, Vietnam, and Iraq to explain decreased worldwide TFR after 1950.

In part (c) students sometimes did not qualify their statements by stating which country they were describing and therefore did not earn points.

In part (d) students had difficulty identifying how human population growth impacts biodiversity. Many students gave answers that related to human health and human biodiversity, rather than to the biodiversity of nonhuman species. Many students erroneously mentioned marriage between people of two different races as a factor that would increase biodiversity, or they used answers that would have been appropriate for parts (b) or (c).

Based on your experience of student responses at the AP Reading, what message would you like to send to teachers that might help them to improve the performance of their students on the exam?

- Encourage students to fully discuss or describe their ideas, even when it may seem that the discussion point is an obvious outcome of the cause or factor being discussed. A list is not the same thing as a discussion or a description.
- Work with students to accurately plot data on a graph. Be sure that they know how to plot points and bars and how to draw pie charts. Stress attention to detail. It is also important to focus on the interpretation of drawn graphs.