



Student Performance Q&A:

2006 AP[®] Environmental Science Free-Response Questions

The following comments on the 2006 free-response questions for AP[®] Environmental Science were written by the Chief Reader, Susan Postawko of the University of Oklahoma in Norman. 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 document-based question required an understanding of passive and active solar energy systems and designs. The question also required the student to develop and support an argument in favor of either stand-alone or grid-connected photovoltaic systems utilizing information from the provided document.

How well did students perform on this question?

Compared with the document-based questions on previous AP Environmental Science Exams, students performed fairly well, with a mean score of 4.40 out of a possible 10 points. Almost all of the students attempted to answer this question, and most wrote several pages.

What were common student errors or omissions?

Students frequently tried to use only the information in the document from the Department of Energy (DOE) to answer the prompt in part (a), or they presented economic benefits and costs instead of environmental benefits and costs. In part (b) many focused on the DOE document without incorporating the rest of the information in the question with regard to the suburban location. In part (c) students occasionally ascribed taxing authority to industries, rather than to the government. In part (d) they frequently provided examples of active solar energy systems instead of passive systems, or they failed to sufficiently describe an appropriate example of a passive solar energy system or design. Students often substituted energy efficiency/conservation designs for passive solar energy designs.

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?

- Be sure that students engage in critical reading activities on a regular basis, utilizing case studies and news articles. Students should look at issues from a variety of perspectives and be able to support different positions. A number of points could have been earned on this question by simply extracting the relevant information given in the document and applying it to the appropriate section of the question.
- Make sure that your students are familiar with the issues surrounding the use of solar energy—the answers to this question indicated that many students have an inadequate understanding of this energy source. A very rudimentary level of understanding of the different types of solar energy systems, their respective benefits and costs, and their use and design would have been sufficient to earn many of the points on this question.

Question 2

What was the intent of this question?

This question was designed to assess students' ability to analyze data, make a prediction based on calculations using these data, and apply critical thinking skills to determine the validity of this prediction. Analysis, manipulation, and interpretation of these data provide a framework for students to view science as a process.

How well did students perform on this question?

Overall performance was fair. The mean score was 3.06 out of a possible 10 points.

What were common student errors or omissions?

In part (a) many students omitted calculations and simply provided answers. Quite a few of these responses were incorrect because students had not carefully analyzed the CO₂ and mean temperature time series. Others did not understand ratios, and this led to failed attempts at the dimensional analysis that was necessary to correctly compute the predicted global mean temperature change. In part (b) many students did not link the causes of increased CO₂ concentrations during the period 1950–2050 with *increased* fossil fuel consumption and/or the demands of a growing population. In part (c) some confused the greenhouse effect and the stratospheric ozone hole. Chlorofluorocarbons were frequently described as gases that destroy ozone, allowing more ultraviolet radiation to penetrate the atmosphere to heat the earth's surface.

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?

- Work with students on graph interpretation, dimensional analysis, and the application of quantitative analysis to environmental problems.
- Emphasize current climate change predictions so that students are better able to determine whether their calculation results are the correct order of magnitude.

Question 3

What was the intent of this question?

This question assessed knowledge of contemporary environmental issues related to brownfield reclamation. Given two possible options for reclamation, students were required to describe problems that might occur with each. Differentiating between advantages and disadvantages of using plants to reclaim the brownfield was expected. The difference between an environmental and a societal benefit of reclamation had to be addressed. Part (d) also required knowledge of legal methods related to hazardous waste disposal and current methods to reduce production of these wastes.

How well did students perform on this question?

Overall, students performed well on this question. The mean score was 5.40 out of a possible 10 points. Almost all students attempted each part of the question.

What were common student errors or omissions?

In part (a) some students incorrectly described erosion. They were also confused about the nutrients that might be disrupted in the soil. In part (b) most students stated that the plants decontaminated the soil, but some failed to describe the mechanism of how this was accomplished. Another common error was to cite the advantage of not having to remove the soil. Because this is merely a restatement of the first part of the question, it did not earn points. The belief that plants somehow release substances to decontaminate the soil was another mistake. In part (c) many answers were nebulous—for instance, references to making the area “safer” or “cleaner” or removing contaminants were considered too vague to earn points. A few students misunderstood the term *environmental*.

In part (d) a number of misconceptions were noted. The term *reduce* was used many times in section (i). Again, this was a restatement of the question. Many students did not understand that the question concerned reducing the production of hazardous wastes, not reducing wastes after they have been created. “Banning nuclear power plants” or shutting down these plants was a popular but unacceptable response that lacked a clean alternative energy source. Many students misread the question in section (ii) and thought it was asking for *illegal* methods of disposing of hazardous waste. Dumping into rivers and oceans was a popular example of the illegal methods described. Students were often unspecific in their answers—referring to “dumps” or “burying the wastes” are examples of responses that were too vague to earn points. Advocating the placement of wastes in a legal area just restated the question and did not earn a point.

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 complete their thoughts and to be as factual and specific as possible.
- Remind students to reread their answers and make sure they are not just restating the question.
- Make it clear that if a question asks for two examples, students should list only two; additional examples will not receive credit.
- Review the difference between environmental and economic benefits or effects.

Question 4

What was the intent of this question?

This question required data interpretation, knowledge of specific content (commercial fishing methods, impacts, and regulations), and understanding of the “commons” concept. In part (a) students were asked to demonstrate graph-reading skills and to use the information given on a graph to calculate the rate of decline in fish stocks over a five-year period. Part (b) asked students to demonstrate specific knowledge of some commonly employed commercial fishing methods and show how commercial fishing relates to the depletion of marine organisms. Part (c) required knowledge about the regulation and management of marine resources. Part (d) tested students’ understanding of commonly held resources and their management.

How well did students perform on this question?

The mean score on this question was 3.90 out of a possible 10 points. Despite its being the fourth question, most students attempted to answer it.

What were common student errors or omissions?

In part (a) the most common error was not reading the y-axis carefully, resulting in students’ reporting the answer in metric tons rather than 10^3 metric tons. Many did not divide the decline in catch by the years. A less widespread, though frequent, omission was not clearly showing how the final answer was determined.

In part (b) the most common mistakes related to specific misunderstandings about the various methods of commercial fishing. In particular, students were confused about how sonar works (directed sound waves and echoes) and how it is used in the fishing industry. Many confused the fishing industry uses of sonar (for locating fish and reading bottom topography) with military uses.

In part (c) a large number of students were unable to name any specific and relevant United States federal law or international regulation. Many were unable to differentiate between state and federal laws or regulations, and many who did identify a law or regulation were unable to explain how it contributed to the management of a marine resource. This part was left unanswered by a substantial number of students.

In part (d) it was evident that quite a few students do not understand the concept of commonly held pools of resources, or “the commons.” Most often, students identified some resource (e.g., rainforest, forest, land) in very general terms. They then typically described simple overuse of the resource and subsequent environmental damage rather than addressing the central notion that a commons is a public resource being exploited, and potentially degraded, for private gain.

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?

- In general, remind students to read the questions carefully and answer them with more specificity.
- Continue to work with students on graphing and help them to develop critical thinking skills related to graphs. For example, students must understand the source of data in a

graph, and they need greater understanding of what the graph may mean. Remind them to look carefully at axes and units.

- Give students practice in carrying out simple mathematical operations without the use of a calculator, and remind them to show their work.
- Provide opportunities for students to recognize and manipulate numbers in scientific notation.
- Include discussion of regulations and laws within the context of particular environmental issues or problems. Students should study environmental concerns not just as cause-and-effect issues—they should learn methods of problem solving, with an aim toward finding specific solutions and appropriate ways to manage conflicts.