

Student Performance Q&A:

2005 AP[®] Environmental Science Free-Response Questions

The following comments on the 2005 free-response questions for AP[®] Environmental Science were written by the Chief Reader, Susan Postawko of the University of Oklahoma at 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?

The intent of this document-based question was to have students critically read an article on emerging and reemerging diseases and answer questions based on the article and their own knowledge and understanding.

How well did students perform on this question?

As a whole, students performed fairly well. The mean score was 4.52 out of a possible 10 points. The majority of points earned came from the correct explanation of the transmission and control of the disease in part (a), the identification of international travel in part (c), and the equation of HIV/AIDS with unsafe sexual activity or unsafe behavior in part (d).

What were common student errors or omissions?

In part (a) many answers were vague about the specific mode of transmission. Many answers also failed to identify the specific nature of water contamination (e.g., human fecal matter). Students frequently confused malaria with cholera.

In part (b) many students described an environmental characteristic that is important to the habitat of a disease vector or pathogen instead of an environmental characteristic that would contribute to increased numbers of humans becoming infected.

In part (c) many answers were too vague to earn credit. Students who did earn points described a mechanism by which pathogens entered the United States and then explained how an uninfected person could become infected with a specific disease.

In part (d) the most frequent error was choosing a disease that did not contribute significantly to the increased mortality shown on the graph.

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?

Teachers should encourage their students to complete their thoughts and to be as factual and specific as possible (e.g., answering such questions as “Infected with what?” “Contaminated with what?” “Transmitted how?”). Students also need to be reminded that when a question asks for an example, only the first example they provide will be scored. Topic sentences are not necessary, and restating the question does not earn points. Teachers are advised to incorporate relevant current events, as well as critical reading and discussion, into their courses.

Question 2

What was the intent of this question?

This question required students to demonstrate quantitative skills and understanding of the energy efficiency of grain production versus that of meat production. Also, students were required to demonstrate their understanding of the environmental consequences connected to each type of food production and the potential benefits and risks of a diet containing little meat.

How well did students perform on this question?

The mean score was 3.5 out of a possible 10 points. The highest possible score for students who did not attempt the calculation was 6 points. The fact that many students chose to address energy efficiency issues using the idea of embodied energy is to be applauded. These students thought about the additional energy, most often from fossil fuel inputs, that was required to process, transport, and manage crops and livestock.

What were common student errors or omissions?

In part (a) a number of students (about 10 to 15 percent) did not attempt the simple calculations, particularly the division involving a decimal ($52/2.6$).

In part (b) many students did not appear to understand the concept of percent change or the meaning of “per capita.” Students did not routinely use units or unit cancellation as a means to decode a problem.

In part (c) many students had trouble clearly demonstrating their understanding of the second law of thermodynamics as it applies to trophic relationships. Students also seemed to have trouble with the concept of efficiency, often confusing energy efficiency and land use efficiency with economic efficiency.

In part (d) many students stated that one environmental consequence was methane emissions from cattle, but they incorrectly linked those emissions to ozone depletion instead of to global warming.

In part (e), rather than considering the potential advantages or disadvantages of a diet with *little* meat, students often compared the advantages of a diet with meat to a diet without meat. Many students also seemed to think that meat is the only source of protein and that meat consumption is the root cause of obesity.

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?

It is essential that teachers help their students develop or refresh their number sense and improve their confidence by practicing simple arithmetic operations (especially division) and problem-solving skills throughout the year. In particular, teachers need to reinforce how to manipulate decimal numbers and how to handle large numbers, using scientific notation where applicable; and they need to teach students to pay attention to units (and unit cancellation). Teachers should provide students with practice working with relatively simple numbers *without calculators* and remind students to show all of their calculations.

The laws of thermodynamics have a great deal of relevance to many aspects of environmental science. While students seem to understand the need to capture solar energy, they need a much deeper understanding of what it means to lose useful energy when it is transferred from one trophic level to another.

Question 3

What was the intent of this question?

The primary purpose of this question was to assess students' knowledge of the contemporary environmental issue of mine land reclamation, acid mine drainage, and coal as an energy source.

How well did students perform on this question?

Overall, student performance was fair. The mean score was 3.09 out of a possible 10 points.

What were common student errors or omissions?

In part (a) many students did not seem to recognize that when the overburden is replaced, the land is not in its original condition. As a result, many students answered the question as if the soil and vegetation had already been restored, failing to address the need to recontour the land to approximate its original topography or to monitor the land during and after the reclamation process.

In part (b) many students answered the question by addressing why it is hard for plants to grow in arid regions, not why it is hard to restore land in arid regions. They rarely discussed erosion.

In part (c) some students demonstrated knowledge of acid mine drainage but did not suggest a remedy for the impact they identified. Many students suggested that sulfur (interpreted as element

sulfur) is the cause of acidification without linking it with oxygen or water. Many students also suggested that sulfur from coal leads to eutrophication.

In part (d) many students were able to identify two impacts, but they incorrectly connected CO₂ emissions and ozone depletion.

In part (e) many students did not demonstrate knowledge of the concept of per capita, implying that increased energy consumption results only from population growth.

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?

Teachers are encouraged to remind their students to read questions in their entirety and to address all parts of the question. Many students failed to earn points because they did not answer all parts of this question's subsections.

Question 4

What was the intent of this question?

The intent of this question was to determine whether students could connect a basic understanding of biomes to the environmental consequences resulting from alteration of a biome due to human activity, and describe how those adverse effects might be mitigated through a reduction in demand for the identified resource. The particular case in point was the development of petroleum resources within the Artic National Wildlife Refuge (ANWR), an issue that has attracted a significant amount of attention in the popular media during the last five years.

How well did students perform on this question?

Overall, student performance was fair. The mean score was 3.60 out of a possible 10 points.

What were common student errors or omissions?

In part (a) students were asked to perform a fairly simple mathematical problem (dividing the total amount of resource by the daily consumption to find the total number of days of resource). Common mistakes on this section involved errors in division that resulted in the wrong order of magnitude (e.g., 50 days or 5,000 days instead of the correct answer of 500 days). Students frequently did not show any setup of the calculation that resulted in a correctly identified answer of 500 days.

In part (b) students rarely had any difficulty in identifying characteristics of a tundra biome, but often they did not relate these characteristics to susceptibility to damage from human impacts. Students often simply restated the question and said the tundra was susceptible to damage because it was fragile.

In part (c) most students had no difficulty in identifying activities related to the development of petroleum resources in ANWR. Where some students experienced trouble was in describing a substantial environmental impact of the identified activity in ANWR. They often merely identified

an environmental effect (e.g., habitat loss, increased noise/air/light pollution, habitat fragmentation) without providing a sufficient description of any substantial environmental impact.

In part (d) the most common error was failing to specify a major end use of the petroleum or failing to list *two* major end uses. Most students did well in part (d).

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?

Teachers need to incorporate simple mathematical calculations (of large numbers) into their instruction on a regular basis. During the study of biomes, it would also be advantageous to relate the impact of human activities to specific characteristics of the various biomes. It is strongly suggested that current environmental topics and events be integrated into the instruction of the AP Environmental Science course.