



AP[®] Environmental Science 2005 Scoring Commentary

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**AP® ENVIRONMENTAL SCIENCE
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Question 1

Overview

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 knowledge and understanding.

Sample: 1A

Score: 10

In part (a) 4 points were earned. The spread of West Nile Fever by infected mosquitoes transferring blood from human to human (1 point) and the spraying of insecticides as a method of control (1 point) are identified. The student identifies that cholera is spread via drinking water “contaminated with sewage” (1 point) and that “cleaning sewage” before returning it to the environment is a method of control (1 point). In part (b) 2 points were earned for explaining that the rise in temperature makes more niches in which mosquitoes can survive (1 point), thereby increasing the survival and dispersal of the mosquito population (1 point). Part (c) earned 2 points for discussing the role of global travel in spreading disease (1 point) and for explaining that if tuberculosis is discovered, then people who have been in contact with the infected person must be tested for the disease (1 point). Two points were earned for part (d) for identifying AIDS as the infectious disease responsible for increased mortality (1 point) and for explaining that AIDS can be passed from mothers to offspring at birth (1 point).

Sample: 1B

Score: 7

Three points were earned in part (a) for explaining that the bites of disease-carrying mosquitoes transmit the disease (1 point), people can control the disease by wearing “layers of clothing” (1 point), and more sanitary disposal of human waste can help control cholera (1 point). No points were earned in part (a) for transmission of cholera. In part (b) the student identifies the correlation between moist environments that result from global warming and favorable conditions for mosquitoes (1 point) and explains that mosquitoes multiply more in damp, warm areas (1 point). The response earned no points in part (c). Part (d) earned 2 points for naming HIV/AIDS as the cause for the increase in mortality (1 point) and for noting that HIV/AIDS can be “contracted through blood transfusions” (1 point).

Sample: 1C

Score: 5

Two points were earned for part (a) for explaining that cholera is caused by humans drinking water containing human waste (1 point) and for identifying “disinfect the water and make it drinkable” as a method of control (1 point). The essay earned no points for discussing the transmission of West Nile Fever, as biting by the mosquito is never mentioned. In part (b) the response received 2 points for mentioning the correct correlation between global warming and the changes in climate (1 point) and for explaining that the more hospitable environment affects mosquito reproduction (1 point). In part (d) 1 point was earned for correctly identifying the disease as HIV/AIDS.

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Question 2

Overview

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.

Sample: 2A

Score: 10

Two points were earned in part (a) for correctly showing the setup of the calculation and getting the correct answer in each of the calculations (1 point each). Two points were earned in part (b) for showing the setup of the calculation (1 point) and for calculating the correct percent change (1 point). Part (c) earned 2 points for describing that raising livestock requires land to grow feed as well as land for pasture (1 point) and for discussing the inefficiency of the transfer of energy up trophic levels (1 point). Part (d) earned 2 points for explaining that overgrazing is linked to desertification (1 point) and that the increased demand for water is connected to a reduction in surface water supply (1 point). In part (e) the response earned 1 point for identifying a disadvantage of a low-meat diet (meat is an excellent source of protein and vitamins) and 1 point for identifying an advantage (reduction of the consumption of fats that could lead to higher blood pressure).

Sample: 2B

Score: 8

Two points were earned in part (a) for correctly showing the setup of the calculation and getting the correct answer in each of the calculations (1 point each). Part (b) earned 2 points for showing the setup of the calculation (1 point) and for correctly calculating the percent change (1 point). One point was earned in part (c) for noting that cattle require additional land. This response did not receive the energy efficiency point because the explanation of energy transfer through trophic levels is not connected to the comparison of grain vs. meat consumption. Two points were earned in part (d) for describing some consequences of overgrazing (1 point) and deforestation (1 point). Only 1 point was earned in part (e) for identifying a disadvantage (could result in protein deficiency).

Sample: 2C

Score: 6

In part (a) no points were earned because, though the correct answers are present, the response shows no work. Only 1 point was earned in part (b) for the correct answer; no setup or calculation is shown. Part (c) earned 1 point for explaining that a given tract of land can produce “more calories” of grain than of meat. Two points were earned in part (d) for describing the connection between overgrazing and desertification (1 point) and for linking methane production to global warming (1 point). Two points were earned in part (e) for stating that a potential advantage of a low-meat diet is reduced risk of infectious disease (1 point) and for noting that a potential disadvantage is that one’s diet may be lacking in a specific essential nutrient (iron) (1 point).

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Question 3

Overview

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

Sample: 3A

Score: 10

Two points were earned in part (a): 1 point for indicating that soil layers must be restored and 1 point for writing that "trees and new vegetation [*sic*] need to be planted." Part (b) earned 2 points for indicating that without water, reestablishing vegetation will be slow (1 point), and without plants, the soil will erode (1 point). Two points were earned in part (c): 1 point for indicating that sulfur combines chemically to form acid rain, which lowers pH in areas leading to disruption of plant/animal growth, and 1 point for indicating calcium carbonate may be used to neutralize the acid. In part (d) 2 points were earned for indicating that emissions from coal combustion include greenhouse gases that contribute to global warming (1 point) and that photochemical smog, which is harmful to people, is a secondary effect of these emissions (1 point). Two points were earned in part (e) for indicating that "the energy consumption of Americans is increasing" (1 point) and that coal is an inexpensive source of energy (1 point).

Sample: 3B

Score: 8

Two points were earned in part (a): 1 point for identifying that "topsoil must be restored" and 1 point for indicating that new vegetation will be "necessary to hold the soil." Part (b) earned 1 point for indicating that a limited supply of water will make revegetation difficult. Two points were earned in part (c): 1 point for indicating that "when water seeps through" the tailings it could combine with sulfur to form an acid, which would then seep into the soil and adversely affect plant growth, and 1 point for indicating that the acid could be neutralized with limestone. Two points were earned in part (d) for indicating that burning coal releases carbon dioxide, which contributes to global warming (1 point), and sulfur released during combustion of coal may combine with water to form acid rain, which can harm plants (1 point). One point was earned in part (e) for indicating that the United States will use coal to meet its increasing energy demand because it is inexpensive.

Sample: 3C

Score: 6

One point was earned in part (a) for indicating that revegetation is a step in reclamation. In part (b) 1 point was earned for identifying that rain is necessary for revegetation to be successful. No points were earned in part (c). Part (d) earned 2 points for explaining that the combustion of coal results in the release of "CO₂ into the atmosphere," which leads to global warming (1 point), and for indicating that the combustion of coal leads to the formation of "SO₂ and H₂SO₄, which contribute to acid deposition" (1 point). Two points were earned in part (e): 1 point for indicating that energy consumption per capita will increase "as Americans buy more appliances" and 1 point for identifying that coal use is likely to increase because it is a suitable substitute for alternate energy sources.

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Question 4

Overview

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

Sample: 4A

Score: 10

Two points were earned in part (a): 1 point for setting up the calculation and 1 point for the correct answer. Part (b) earned 2 points. The essay identifies the climatological characteristic (cold and dry) linked to slow regrowth of vegetation (1 point). The student earned 1 point for explaining that the specialized diet of the caribou and the simplified food web would be highly susceptible to human disturbances, resulting in a major alteration in the lifestyle of the caribou and associated wolf populations. Four points were earned in part (c) for the identification of road construction as the activity leading to a loss of food resources and alteration of migration pathways (2 points) and pipeline construction as the activity that could inhibit the caribou's ability to migrate to food resources (2 points). Part (d) earned 2 points: 1 point for the identification of transportation as an end use of petroleum that is connected to the conservation measure of substitution of hydrogen fuels and higher efficiency, and 1 point for the identification of home heating as an end use of petroleum and the conservation measure of substituting solar energy for petroleum fuel.

Sample: 4B

Score: 8

Two points were earned in part (a) for the correct setup of the calculation (1 point) and for the correct answer of 500 days (1 point). The identification of low biodiversity as a characteristic associated with delicate equilibrium within the food web earned 1 point in part (b). While permafrost is an acceptable characteristic of the tundra, in this response the explanation of how permafrost leads to particular susceptibility of the biome to damage from human impact is too vague to have earned a point. Part (c) earned 3 points. The student identifies road construction as the activity leading to "habitat fragmentation," causing population displacement and increased competition for resources (2 points). The identification of pipeline construction as an activity associated with the development of petroleum resources in ANWR earned 1 point. Two points were earned in part (d). One point was earned for the identification of transportation as an end use and improved efficiency as a conservation measure. A second point was earned for identifying plastic manufacturing as an end product and the substitution of glass and cardboard as a conservation measure.

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Question 4 (continued)

Sample: 4C

Score: 6

Two points were earned in part (a) for the correct setup of the calculation (1 point) and for the correct answer of 500 days (1 point). No points were earned in part (b). While a small number of species (low biodiversity) is acceptable as a biological characteristic, a “small number of organisms” (low population) is not acceptable. Two points were earned in part (c) for identifying the construction of roads (1 point) and drilling (1 point) as activities associated with the development of ANWR. Neither activity was linked to an acceptable description of substantial environmental impact. Environmental effects such as habitat destruction/fragmentation and soil damage must be linked to a substantial environmental impact in ANWR. Two points were earned in part (d): 1 point for identifying transportation as an end use of petroleum and improved efficiency as a conservation measure, and 1 point for identifying electrical power generation as an end use and the substitution of solar or wind power as a conservation measure.