



## AP<sup>®</sup> Environmental Science 2002 Scoring Commentary

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**Question 1**

Sample 1R (Score 10 points)

This response shows an excellent, well-reasoned answer. Reduction of CO<sub>2</sub> emissions with a corresponding slowdown of global warming is given as one environmental benefit to using electric vehicles. Another benefit cited was the resulting decrease in habitat destruction arising from oil drilling, as the search for fossil fuels would be diminished with electric vehicle use. A total of 4 points are earned for part (a). The calculation shows a good setup that included units, with the correct answer being given for the potential reduction in petroleum use. The response demonstrates a clear understanding of the difference between a point source (electrical generating power plant) and a dispersed source (gasoline vehicles) of air pollution. The statement in part (c) is refuted with reference to having electricity generated by a non-air polluting energy source, such as solar. In part (d), two possible new government policies are identified and explained. The first involves tax incentives for the manufacturer, and the second suggests subsidies for the purchase of electric vehicles.

Sample 1S (Score 8)

This response earns 2 points for part (a) by identifying reduced CO<sub>2</sub> release, linked to global warming, as an environmental benefit of electric vehicles. The answer for the reduction in petroleum consumption is correctly obtained from the acceptable setup of an equation that includes units. The response also includes a good explanation of the difference between a point source (electrical generating power plant) and a dispersed source (gasoline vehicles) of air pollution. The statement in part (c) is defended by describing how electricity is produced from coal burning power plants that pollute the air. Offering tax credits for purchase and increased funding for research and development of electric vehicles are cited as new government policies that would encourage increased use of such vehicles.

Sample 1T (Score 6)

This response is representative of one that scores in the mid-range for this question. Two points are earned in part (a) for an explanation of how using electric vehicles would decrease consumption of petroleum and lead to less drilling for oil and the preservation of wildlife areas. Decreased emission of air pollutants is not specific enough to earn credit. Two points are earned in part (b), and no credit is earned in part (c). Part (d) earns 2 points for two acceptable new government policies that would lead to increased use of electric vehicles: tax breaks for ownership and preferential parking.

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**Question 2**

Sample 2R (Score 9)

In this response, part (a) earns 4 points for a description of a reduction of nutrients that are transported downstream, a discussion of the impact of this reduction, a description of a decrease in water levels as the river makes its way from the diversion area, and a discussion of the increase in erosion that could result from exposed soil along the waterway. In part (b), 2 points are earned for supporting an argument for “urban water consumption” by discussing water as an energy source in producing electricity and the necessary domestic use(s) of water. Another point is earned for describing water’s role in maintaining habitat areas, ecosystems, and biodiversity. In part (c), 1 point is earned for identifying the California Water Project, and 1 point is earned for discussing the impact of decreased water flow on plants, on the hydrologic cycle, and on animal populations.

Sample 2S (Score 8)

The response earns a total of 3 points for part (a): one for describing the accumulation of silt upstream when dams are used, and 2 more for describing the inability of fish to spawn in upstream areas when dams are present, with a resultant inability of such fish to reproduce. In part (b), the response earns 1 point for describing the intrinsic value of natural areas/organisms in ecosystems and another point for supporting water flow to natural areas by stating that nature should be preserved for the beauty and aesthetic value that it represents. In part (c), 3 points are earned: 1 point for identifying the Aswan High Dam as another large-scale water diversion project, 1 point for discussing the impact of flooding created by the artificial lake behind the dam, and 1 point for discussing the ecosystem destruction that may result downstream from the dam when large quantities of water are periodically released.

Sample 2U (Score 6)

In part (a), the response earns 1 point for describing the decreased water flow when water is diverted, 1 point for discussing increased water temperatures that can result from decreased water flow, and 1 point for discussing the decrease in nutrient flow and productivity in estuaries as a result of water diversion. No points are earned in part (b). In part (c), 1 point is earned for identifying Mono, another point is earned for discussing the decrease in aquatic habitat, and a third point is earned for discussing an increase in salts in the lake due to water diversion.

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**Question 3**

Sample 3R (Score 10)

This response shows clearly plotted data points connected with a smooth, sigmoid curve, earning both points for part (a). In part (b), 1 point is earned for a clear definition for LD50, and since it is clearly indicated that the graph was used to determine the LD50 and that the value is within the acceptable range, the second point is earned. In part (c), 2 points are earned: 1 point for the clear, complete definition of threshold level of toxicity, and a second point for the correct answer for the threshold level (also marked on the graph). In part (d), a complete argument is developed “for extending these results,” suggesting that brine shrimp and humans might respond in similar ways to  $\text{CuSO}_4$  and that the results could be used to estimate the LD50 for humans. The response also indicates that testing on humans is unsafe, unethical, and time-consuming. Although 3 valid points are made within the argument, this subpart earns the maximum of 2 points. Then, 1 point is earned for the argument against extending the results, and the suggestion that the brine shrimp live in a different environment than humans. The next statement contradicts the “for” argument — it is stated previously that the results could be used to estimate the effects on humans, but the “against” argument states that it is difficult to predict the LD50 for humans from the results. No credit is earned for this contradictory statement. The response goes on to earn a final point with a discussion indicating that the results may not transfer from one species to another.

Sample 3S (Score 8)

This response earns 2 points each for part (a) and part (b). However, no points are earned for part (c) because of a misunderstanding about threshold level of toxicity. In part (d), a complete argument is presented for extending the results, indicating that since  $\text{CuSO}_4$  is toxic to brine shrimp, it also may be toxic and lethal to humans. This argument is further developed in stating that brine shrimp die at a certain level and a similar level may exist for humans (since a dose effect is evident in brine shrimp, there may also be a dose effect in humans). A complete argument is presented against extending the results, indicating that humans would not be immersed in the solution (lab conditions do not necessarily reflect actual conditions) and that humans are different than brine shrimp with respect to body size. All 4 points are earned for part (d).

Sample 3T (Score 6)

Part (a) earns 2 points, and the definition of LD50 earns a third point. However, there is no identification of LD50 on the graph, and the answer “about .1%” is too vague, so the second point is not earned for part (b). Both points are earned for part (c). In part (d), because there is no valid argument developed for extending the results, no points are earned. However, an incomplete argument against extending the results (stating that the LD50 for shrimp could be different for humans — one of the factors that may affect dose-response results may be the use of different species) earned one point for part (d).

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## Question 4

### Sample 4R (Score 8)

In part (a), the response earns 2 clear “description” points, but no point is earned for the location (“equator” is too vague). A total of 3 out of a possible 4 points are earned in part (b); the fourth point was not earned because it was not clear in the response that there was a complete understanding of the difference in modes of transmission between cholera and yellow fever (e.g., the reference to them both as “diseases that have vectors”.) The point in part (c) was earned because it is qualified in the first sentence with an explanation of why these areas would most likely be affected (if the response only stated that Africa, South America, and parts of Asia would be most likely to be affected, no point would be earned). Two points are earned in part (d) for the clear linking of specific climate changes with likely environmental problems that may result from these climate changes.

### Sample 4S (Score 6)

This response shows an outstanding job done in part (a). The complete description of El Niño easily earns the 2 description points. The combination of “the Eastern Pacific” and “Intertropical Convergence Zone” earns the location point. In part (b), an interesting link is made between flooding due to El Niño and unsanitary conditions that would lead to the spread of diseases (this earns 1 point). Unfortunately, the second part of the question in part (b) is not addressed. One point is earned for part (c). In part (d), a single point is earned for the connection between lack of precipitation, forest fires, and destruction of natural habitats.

### Sample 4T (Score 5)

Parts (a), (c), and (d) are addressed quite well in this response. The only point not earned for these three parts is for the location of El Niño — the “west coast of South America” is too broad a description (it implies that El Niño occurs all along the west coast of South America, which isn’t quite true.) The response is weak for part (b), and no points are earned. Although the answer starts out promising, with the statement that El Niño keeps many areas warmer and more humid than normal, there is a misunderstanding that both cholera and yellow fever are waterborne diseases, which is incorrect.