



AP[®] Environmental Science 2002 Sample Student Responses

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ENVIRONMENTAL SCIENCE

SECTION II

Time—90 minutes

4 Questions

Directions: Answer all four questions, which are weighted equally; the suggested time is about 22 minutes for answering each question. Write all your answers on the pages following the questions in this booklet. Where calculations are required, clearly show how you arrived at your answer. Where explanation or discussion is required, support your answers with relevant information and/or specific examples.

1. Electric vehicles often have been proposed as an environmentally sound alternative to the gasoline engine for transportation. In response to state initiatives, several car manufacturers now include electric vehicles among their available models. In spite of these state initiatives, the penetration of electric vehicles into the transportation sector of the United States, as well as other countries, remains modest.
 - (a) Identify and describe two environmental benefits to using electric vehicles in place of gasoline-powered engines for transportation.
 - (b) Estimate the potential reduction in petroleum consumption (in gallons of gasoline per year) that could be achieved in the United States by introducing electric vehicles under the following assumptions:
 1. The mileage rate for the average car is 25 miles per gallon of gasoline.
 2. The average car is driven 10,000 miles per year.
 3. The United States has 150 million cars.
 4. 10 percent of United States cars could be replaced with electric vehicles.
 - (c) Some people have suggested that electric vehicles only shift the emission of air pollutants from dispersed sources to point sources. Explain and defend or refute this statement.
 - (d) Propose two potential new United States government policies that would encourage the widespread use of electric vehicles. Explain.

1) @ One environmental benefit is that using electricity to fuel cars in the place of gasoline would reduce the amount of CO₂ emissions from cars which contribute to global warming. Using electric cars would slow or stop global warming. Another environmental benefit of using electric cars is that electric cars do not require searching for fossil fuels. The search for fossil fuels has destroyed many

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habitats that were unique but could not survive when they were altered by drilling.

⑥ 150,000,000 cars in U.S. if 10% were electric then there would 15,000,000 cars powered by ~~electricity~~ electricity $(.10)(150,000,000) = 15,000,000$
 $150,000,000 - 15,000,000 = 135,000,000$ cars powered by fossil fuels

10,000 miles / 25 miles/gallon gas = 400 gallons per year

$$\begin{array}{r} 400 \\ 25 \overline{) 10000} \\ \underline{100} \\ 0000 \\ \underline{0000} \\ 0000 \\ \underline{0000} \\ 0000 \end{array}$$

$(1.5 \times 10^7 \text{ cars})(400 \text{ gallons/year}) = 600 \times 10^7 \text{ gallons} = 6.0 \times 10^9 \text{ gallons}$

$$\begin{array}{r} 400 \\ 1.5 \overline{) 6000} \\ \underline{6000} \\ 0000 \end{array}$$

We could reduce petroleum ~~consumption~~ consumption by 6.0×10^9 gallons per year or 6000 million gallons, or 6 billion gallons.

⑦ This statement means that using electric cars requires electricity rather than gasoline. Power plants needed to produce electricity are point sources for air pollution because though electricity is a clean source, making it requires the use of another energy source which is typically a fossil fuel. When gas powered cars are used, the cars all let off CO₂ and other air pollutants throughout the atmosphere because they are moving around making

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them dispersed sources. Though this statement may be true at this moment in time, if the power plants ~~using~~ making electricity were powered by solar, geothermal, or wind power the statement could be refuted. If power plants used solar power to make electricity to run cars, the power plants would no longer be point sources for air pollutants such as ~~carbon~~ sulfur dioxide (coal). Cars using electricity would not perform the incomplete combustion of fossil fuels that causes the production of many air pollutants such as CO which would be dispersed throughout the environment.

④ The United States government could offer ~~people incentives to purchase electric~~ auto producers a tax break if they produced a certain amount of electric cars which would make the auto manufacturers work harder to produce electric cars that people liked because of the tax break incentive to make less gas powered vehicles. Another ~~policy~~ policy that the government could implement would be to offer United States citizens subsidies to purchase electric cars.

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ADDITIONAL PAGE FOR ANSWERING QUESTION 1

If citizens got back money for purchasing an electric car, this would make it more appealing to citizens because they would have to spend less on an electric car.

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 - (c) Some people have suggested that electric vehicles only shift the emission of air pollutants from dispersed sources to point sources. Explain and defend or refute this statement.
 - (d) Propose two potential new United States government policies that would encourage the widespread use of electric vehicles. Explain.

a One environmental benefit is that they do not release CO₂. CO₂ has been implicated as a greenhouse gas, contributing to global warming. These emissions of CO₂ are reduced by using electric cars instead of conventional gas powered cars which release ~~lots of~~ CO₂

b 10% of 150 million cars = 15 million electric cars

$$\frac{10,000 \text{ miles}}{\text{year}} \div \frac{25 \text{ miles}}{\text{gallon}} \times \frac{400 \text{ gallons}}{\text{years}} = \frac{400 \text{ gallons}}{\text{year car}}$$

~~$$\begin{array}{r} 4000 \\ \times 25 \\ \hline 20000 \\ 80000 \\ \hline 100000 \end{array}$$~~

$$\begin{array}{r} 400 \\ \times 25 \\ \hline 2000 \\ 8000 \\ \hline 10000 \end{array}$$

400 gallons x 15 million cars
6,000 million gallons =
6 Billion gallons gasoline/year

$$\begin{array}{r} 400 \times \\ \times 15 \\ \hline 2000 \\ 4000 \\ \hline 6000 \end{array}$$

c Cars are dispersed sources of air pollution emissions because they are mobile and widespread. This is true of conventional gas powered cars, but would not be true of electric cars. Still, the energy to run the cars has to come from somewhere. The electricity to run ^{electric} cars comes from power plants. These plants are point sources of ~~stationary~~ pollution. They are large, stationary, recognized sources of air pollution, at least in the case of coal burning plants. I agree that at present the use of electric cars will only shift emissions from ~~point~~ dispersed sources to point sources. Right now the majority of our electricity comes from coal and natural gas burning power plants. These plants are recognized point sources of air pollutants.

d To encourage electric car use, there are several things that the United States Government could do. First, it could offer tax credits or exemptions to individuals who purchase electric cars. This economic incentive would make people more likely to invest in an electric car, because they would see monetary benefits in addition to environmental ones.

A second policy to encourage use of electric cars would be for the government to fund research to make these cars more practical. Research funding could speed up the surmounting of problems such as limited range and limited speed that currently discourage people from purchasing and using electric cars.

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 - (d) Propose two potential new United States government policies that would encourage the widespread use of electric vehicles. Explain.

① One environmental benefit to using electric vehicles would be a decrease in the consumption of petroleum for fuel. This would mean less drilling for oil would be needed, and many wildlife areas that would otherwise be mined could be preserved. Another environmental benefit of using electric vehicles would be a decrease in the emission of air pollutants that occurs when gas is used for fuel. This would reduce smog in cities.

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raise overall air quality, and detract from the factors causing global warming.

(b) IF 10% of US cars could be replaced with electric vehicles, and the US has 150 million cars, then 15 million could be replaced. IF the average car is driven 10,000 miles per year, and every 25 miles requires 1 gallon of gas, then the average car uses 400 gallons of gas per year. IF 15 million cars that each would have used 400 gallons of gas are replaced, then a total of 6 billion gallons of gasoline per year could be saved.

(c) I disagree with this statement, because although electric vehicles might still cause some degree of localized air pollutants to be emitted, it will still be less pollution that results from the burning of gasoline. Therefore it is unfair to call it a simple shift, as there will be less.

(d) One potential new US government policy to encourage the widespread use of electric vehicles would be to offer tax breaks to those who own such vehicles.

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ADDITIONAL PAGE FOR ANSWERING QUESTION 1

in place of regular cars. Another possible policy would be to give preferential parking rights to those driving electric vehicles, in a similar fashion to handicapped parking.