

2017 AP® ENVIRONMENTAL SCIENCE FREE-RESPONSE QUESTIONS

- (a) **Describe** TWO effects that ingesting microbeads has on aquatic organisms.
- (b) Dr. Ewoldsen states that nitrates pose different threats to aquatic ecosystems than microbeads do. **Describe** how nitrate levels can negatively affect water quality in some aquatic ecosystems.
- (c) While wastewater treatment plants are ineffective at removing microbeads, they are very effective at removing large pieces of plastic waste and other pollutants.
- Identify** one way large pieces of plastic are removed from wastewater during primary treatment.
 - Prior to discharge, wastewater is often disinfected. **Identify** one technique commonly used to disinfect wastewater.
 - Sludge or biosolids produced during the wastewater treatment process can be spread on agricultural fields. **Identify** one advantage and one disadvantage of this practice.
- (d) Coastal ecosystems are threatened by other human activities in addition to wastewater disposal. Mangrove swamps are one such threatened ecosystem.
- Provide** one reason why mangrove trees are being removed by humans.
 - Identify** one ecosystem service provided by intact mangrove ecosystems.

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3. Haiti shares a border with the Dominican Republic on the Caribbean island of Hispaniola.
- (a) The border between the two countries can be seen using satellite images because of the severe deforestation in Haiti.
- (i) **Provide** one reason why deforestation commonly occurs in a less developed country such as Haiti.
- (ii) **Describe** one realistic strategy to reduce deforestation in a less developed country.
- (b) Deforestation can affect water quality. **Identify** one change that can occur in the water quality of streams within a watershed that has been deforested. **Explain** how deforestation can lead to this change.
- (c) **Identify** TWO environmental benefits, other than those related to water quality, of maintaining forest ecosystems.

The table below contains demographic data for Haiti in 1995 and 2015.

DEMOGRAPHIC DATA FOR HAITI

Measure	1995	2015
Fertility rate (number of children per woman)	5.2	2.7
Life expectancy (years)	55	64
Infant mortality (deaths per 1,000)	85	48

- (d) **Identify** and **discuss** one factor in a less developed country that could contribute significantly to a change in life expectancy, similar to what occurred in Haiti from 1995 to 2015.
- (e) **Identify** and **discuss** one economic or cultural factor in a less developed country that could contribute significantly to a change in the fertility rate, similar to what occurred in Haiti from 1995 to 2015.

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Question 3

Haiti shares a border with the Dominican Republic on the Caribbean island of Hispaniola.

- (a) The border between the two countries can be seen using satellite images because of the severe deforestation in Haiti.

- (i) **Provide** one reason why deforestation commonly occurs in a less developed country such as Haiti.

(1 point for a correct reason why deforestation commonly occurs in a less developed country.)

- Converting forests into agricultural land, ranchland
- Using trees/charcoal for fuel or source of income
- Protecting forests through regulations is less common than in developed countries
- Harvesting timber for use as building materials
- Using forested land for commercial purposes by corporations/industrialized countries
- Clearing forested land to accommodate growing rural populations (e.g., roads, homes, schools)

- (ii) **Describe** one realistic strategy to reduce deforestation in a less developed country.

(1 point for a correct description of a realistic strategy to reduce deforestation in a less developed country.)

- Enact/enforce laws or regulations that restrict cutting of trees
- Encourage sustainable agriculture/forestry programs
- Introduce more efficient cooking methods that reduce use of wood as a fuel source
- Establish programs to promote alternate building materials that reduce the demand for wood
- Develop economic programs to increase individual incomes/decrease reliance on forest conversion
- Reduce population growth resulting in less demand for wood for fuel and income
- Promote ecotourism to protect natural areas and to discourage tree harvesting

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Question 3 (continued)

(b) Deforestation can affect water quality. **Identify** one change that can occur in the water quality of streams within a watershed that has been deforested. **Explain** how deforestation can lead to this change.

(2 points: 1 point for identifying a correct change in water quality and 1 point for correctly explaining the linkage to deforestation. The explanation point cannot be earned without correctly identifying a change in water quality.)

Change in Water Quality	Linkage to Deforestation
Increase in water temperature	Loss of shade; increased solar radiation reaching the stream
Increase in sediment/turbidity	Loss of root structure, leaf litter, canopy leads to increased soil erosion and runoff
Increase in nutrient concentration	Loss of vegetation results in less nutrient uptake and subsequent runoff into stream
Decrease in pH	Loss of root structure allows naturally-occurring acids to run off into streams
Decrease in dissolved oxygen	Loss of shade leads to warmer water, which holds less dissolved oxygen

(c) **Identify** TWO environmental benefits, other than those related to water quality, of maintaining forest ecosystems.

(2 points: 1 point for each correct environmental benefit identified. Only the first two benefits can earn a point.)

- Maintains habitat/biodiversity
- Releases oxygen
- Stores carbon
- Slows climate change/global warming
- Absorbs/reduces/filters air pollutants
- Regulates local temperatures/maintains microclimates and regional climates
- Reduces erosion, thus preserving soil quality/quantity
- Maintains nutrient cycles

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Question 3 (continued)

The table below contains demographic data for Haiti in 1995 and 2015.

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Measure	1995	2015
Fertility rate (number of children per woman)	5.2	2.7
Life expectancy (years)	55	64
Infant mortality (deaths per 1,000)	85	48

- (d) **Identify** and **discuss** one factor in a less developed country that could contribute significantly to a change in life expectancy, similar to what occurred in Haiti from 1995 to 2015.

(2 points: 1 point for correctly identifying a factor that increases life expectancy and 1 point for discussing how that factor contributes significantly to this increase. The discussion point may be earned without the identification point.)

Factor	Contribution to Increasing Life Expectancy
Increased access to health care	<ul style="list-style-type: none">• Fewer deaths from treatable diseases• Prevention of early death by giving vaccines
Improved food quality or quantity	<ul style="list-style-type: none">• Better health and general wellness resulting in less malnutrition or fewer early deaths• Decrease in food-borne diseases
Increased access to clean water (e.g., sanitation, sewage treatment, drinking water)	<ul style="list-style-type: none">• Fewer water-borne and communicable diseases
Fewer pregnancies	<ul style="list-style-type: none">• Fewer children resulting in fewer maternal deaths
Increased health-related education	<ul style="list-style-type: none">• Better sanitation, less disease transmission

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Question 3 (continued)

(e) **Identify** and **discuss** one economic or cultural factor in a less developed country that could contribute significantly to a change in the fertility rate, similar to what occurred in Haiti from 1995 to 2015.

(2 points: 1 point for correctly identifying one economic or cultural factor that decreases fertility rate and 1 point for discussing how that factor contributes significantly to this decrease. The contribution point may not be earned without earning the factor point.)

Factor	Contribution to significantly decreasing fertility rate
Increased education of women	<ul style="list-style-type: none">• Fewer children• Later age at first reproduction• Aware of choices for family planning
More economic opportunities for women	<ul style="list-style-type: none">• Fewer children• Later age at first reproduction• Less dependence on males
Later marriage age for women	<ul style="list-style-type: none">• Fewer children• Later age at first reproduction
Cultural acceptance of family planning strategies/increased access to family planning	<ul style="list-style-type: none">• Fewer children• Confidence that children will survive to adulthood
Increased women's rights/gender equality/empowerment of women	<ul style="list-style-type: none">• Access to family planning• Choices in reproduction• Financially less dependent on males
Increased industrialization/economic development	<ul style="list-style-type: none">• Children no longer an asset, but a financial liability
More social programs to support elderly citizens	<ul style="list-style-type: none">• Children no longer needed to support aging parents