2017

AP CollegeBoard

AP Environmental Science

Free-Response Questions

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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 book. 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. Read the following article from the *Fremont Daily Times* and answer the questions that follow.

Fremont Daily Times

Scientists Discuss Threats from Plastic Pollution

In testimony before the United States Senate Committee on Environment and Public Works, Dr. Duke Ewoldsen, an eminent toxicologist, discussed a new water pollutant that threatens aquatic life: microbeads. Ewoldsen noted that while posing a different threat than more conventional water pollutants such as nitrates, phosphates and PCBs, tiny beads of plastic contained in many products, especially cosmetics, now threaten plankton and small fish that ingest the particles because they mistake them for food. The microbeads cannot be digested and can fill or block the digestive tracts of the fish, leading to starvation. In addition, surfaces of these small spheres can adsorb organic pollutants such as PCBs and dioxin.

When asked about steps to reduce this threat, Ewoldsen noted that the beads are so small that they are not easily removed by wastewater treatment plants and thus often enter aquatic ecosystems in wastewater discharges.

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(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.

(i) **Identify** one way large pieces of plastic are removed from wastewater during primary treatment.

(ii) Prior to discharge, wastewater is often disinfected. **Identify** one technique commonly used to disinfect wastewater.

(iii) 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.

(i) **Provide** one reason why mangrove trees are being removed by humans.

(ii) **Identify** one ecosystem service provided by intact mangrove ecosystems.

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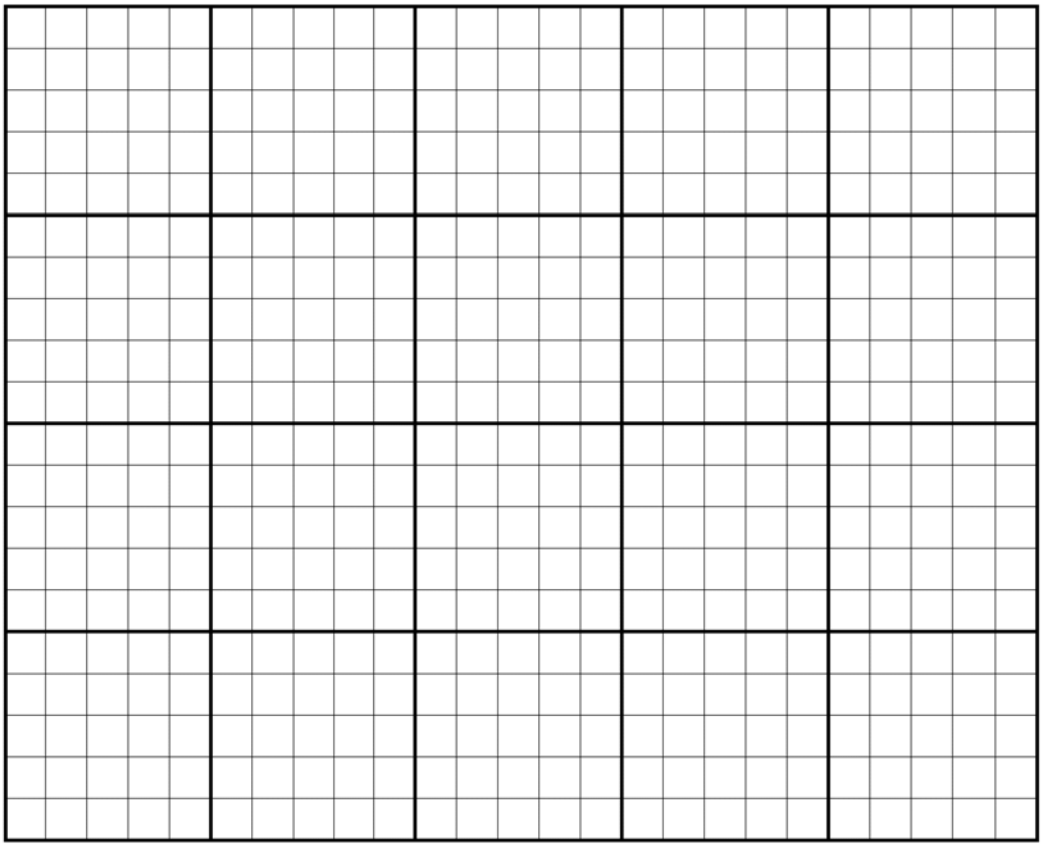
2. Populations of large terrestrial animals, such as African elephants and snow leopards, are in decline around the world. Many of these large animals are now on the verge of extinction.

ESTIMATED AFRICAN ELEPHANT POPULATION ON THE AFRICAN CONTINENT

Year	Population
1970	2,000,000
1980	1,300,000
1990	600,000
1995	550,000
2000	400,000
2005	550,000
2010	650,000
2015	600,000

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(a) Using the data provided in the table above, **plot** the elephant population data as points on the grid below, placing the independent variable on the *x*-axis. Clearly **label** the axes.



(b) **Calculate** the percent loss of elephants in Africa from 1970 to 2000. Show all work.

(c) The International Union for Conservation of Nature (IUCN) estimates that the elephant population will decline by 20 percent between 2015 and 2022. Use this estimate to **calculate** how many elephants will be left in Africa in 2022. Show all work.

(d) Most large terrestrial mammals are K-strategists. **Identify** one characteristic of a K-strategist and **explain** how the characteristic you identified can make these mammals prone to extinction.

(e) **Identify** and **discuss** TWO conservation strategies that could be implemented to prevent the extinction of large terrestrial mammals, such as the African elephant or snow leopard.

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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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4. Dams are built by humans for various purposes including hydroelectric power generation and control of downstream flooding.

   (a) **Explain** how electricity is generated at a hydroelectric dam.

   (b) **Identify** TWO economic benefits, other than hydroelectric power generation and control of downstream flooding, associated with dams.

   (c) **Describe** one ecological benefit of seasonal flooding of the floodplain of a free-flowing river.

   (d) Some dams have been removed from rivers.

      (i) **Explain** how removal of a dam can benefit fish populations.

      (ii) **Describe** one negative environmental consequence of removing a dam from a river (other than effects on fish populations).

   (e) Dams are also built by beavers, a keystone species in some North American ecosystems.

      (i) **Define** keystone species.

      (ii) **Describe** how dams built by beavers can make beavers a keystone species in some ecosystems.

STOP

END OF EXAM

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