2017

AP CollegeBoard

AP Environmental Science

Sample Student Responses and Scoring Commentary

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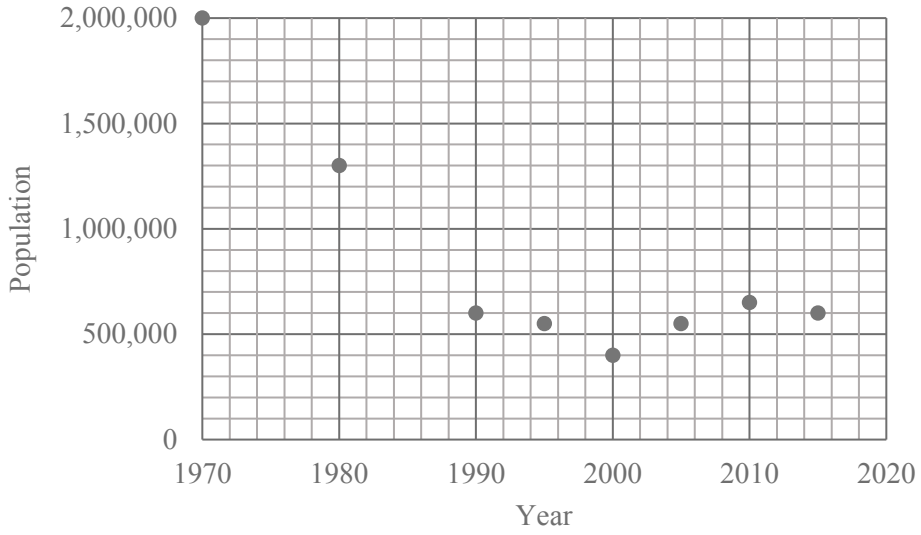
AP® ENVIRONMENTAL SCIENCE
2017 SCORING GUIDELINES

Question 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.

(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.

(2 points: 1 point for correctly labeled and scaled axes and 1 point for correct plotting of data with no more than one error.)



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

(2 points: 1 point for the correct setup and 1 point for the correct answer.)

$2{,}000{,}000 - 400{,}000 = 1{,}600{,}000$ $\qquad$ $1{,}600{,}000/2{,}000{,}000 \times 100 = 80\%$

$2 \times 10^6 - 4 \times 10^5 = 1.6 \times 10^6$ $\qquad$ $(1.6 \times 10^6 / 2 \times 10^6) \times 100 = 80\%$

(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**.

(2 points: 1 point for the correct setup and 1 point for the correct answer.)

$0.80 \times 600{,}000 = 480{,}000$ elephants $\quad 0.80 \times (6 \times 10^5) = 480{,}000$ elephants

OR

$(0.20 \times 600{,}000 = 120{,}000)$, then $600{,}000 - 120{,}000 = 480{,}000$ elephants

$(0.20 \times (6 \times 10^5) = 1.2 \times 10^5)$, then $6 \times 10^5 - 1.2 \times 10^5 = 4.8 \times 10^5$ elephants

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Question 2 (continued)

(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.

(*2 points: 1 point for a correct identification of a characteristic of a K-strategist and 1 point for an explanation of how this characteristic makes mammals prone to extinction*.)

Characteristic of a K-strategist	Explanation
Few offspring (per event/year/lifetime) OR Low reproductive rate	• Difficult recovery from population decline • Unable to adapt to changing environments or human-induced ecosystem changes • Fewer opportunities for reproduction to pass on genes
High parental care and protection of offspring	• Loss of parent = loss of offspring • Offspring vulnerable to predation
Long gestation period	• Fewer opportunities for reproduction
Late age for first reproduction/long maturation period	• Difficult recovery from population decline • Unable to adapt to changing environments or human-induced ecosystem changes • Fewer opportunities for reproduction to pass on genes

(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.

(2 points: 1 point for each correct discussion of a conservation strategy that was identified.)

- More laws limiting hunting → less poaching, greater animal survival
- Better enforcement of animal or habitat protection laws → less poaching, greater animal survival
- Laws restricting or prohibiting trade of these species or their parts → no market, less poaching
- Establishment/expansion of preserves/parks → safe habitat in which to live and reproduce, reduce poaching
- Education about ecological value of animals → increased public support
- Development of ecotourism industry → creation of market for tourism, less poaching
- Tusk dyeing (elephants), horn removal (rhinos) → devalue animal parts, less poaching
- Captive breeding programs aimed at reintroduction → increased population or genetic diversity
- Armed protection (guards) for animals → less poaching
- Movement of threatened species to new location → greater survival, increased genetic diversity

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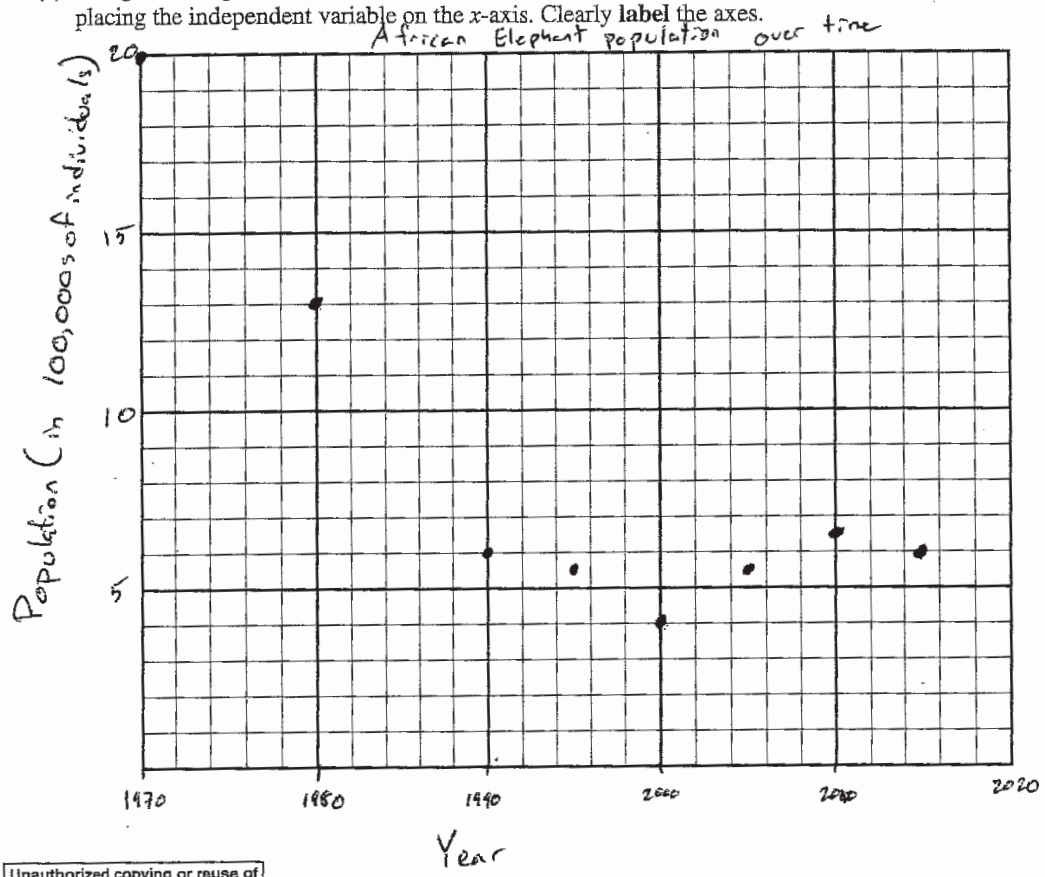
2. Populations of large terrestrial animals, such as African elephants and snow leopards, are in decline around the world. Many of these large animals are now on the verge of extinction.

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

(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.



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(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.

(b) $\frac{2,000,000 - 400,000}{2,000,000} = \frac{1,600,000}{2,000,000} = .8$

Thus the percentage of African Elephants lost is $.8 \times 100$ or **80%**

(c) $1 - .2 = .8$ which is the proportion of elephants remaining.

The population in 2015 is 600,000 individuals.

$$\begin{array}{r} 600,000 \\ \times \quad .8 \\ \hline 480000.0 \end{array}$$

Thus **480,000** African Elephants will be left in Africa in 2022

(d) One characteristic of a K-strategist is that they produce a small number of offspring. This makes them vulnerable to extinction because their population doesn't grow quickly, especially after a die-off, resulting from changing climate conditions, disease, or poaching. As a result their are fewer individuals and so more likely to go extinct.

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ADDITIONAL PAGE FOR ANSWERING QUESTION 2

(e) One conservation method that could be implimented is ~~the~~ tighter protection from poachers through the use of guards. Poachers often kill animals such as elephants for a valuable material they posses, such as fur or ivory. If the number of deaths from poaching were decreased, by using armed rangers to ~~&~~ fight off the ~~poa~~ poachers, the number of endangered organisms would increase, preventing extinction.

Another conservation method would be ~~the~~ to designate the endangered species' habitat as a nature preserve. This would mean that no development could occur within the preserve, ~~not would~~ and people's access to the park would be restricted preventing possible harmful human interactions. The nature preserve would protect the animal and allow their population to increase without harmful human interference.

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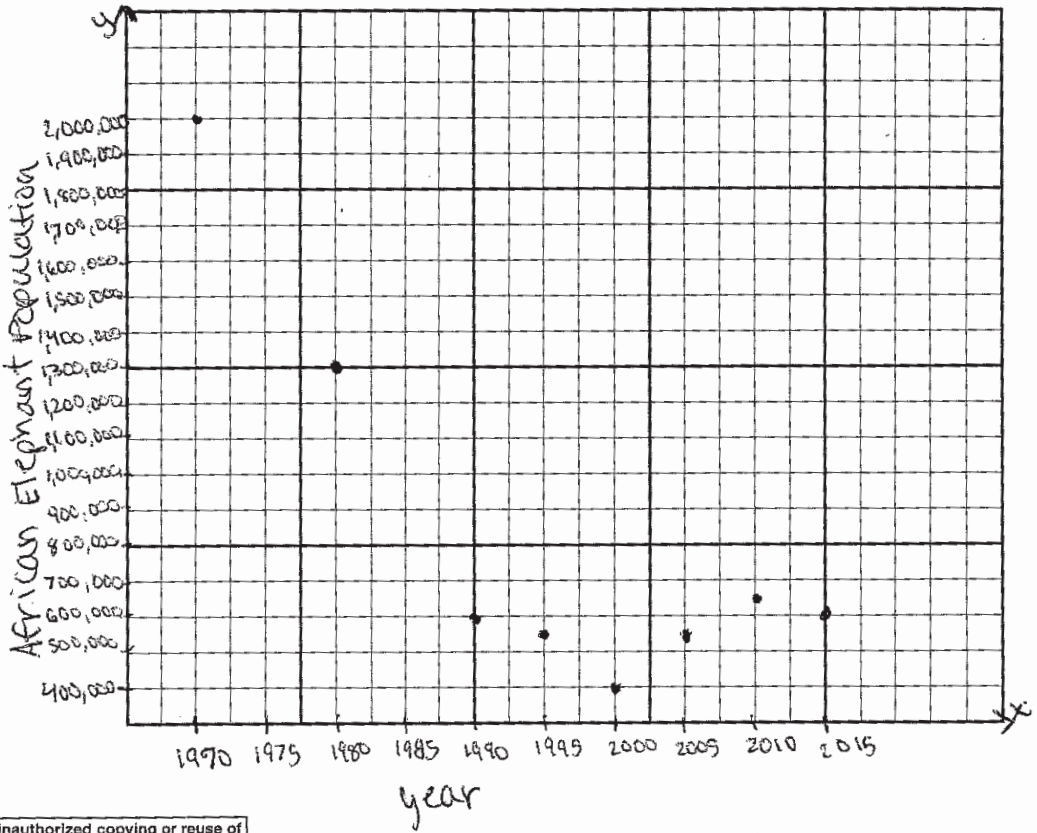

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(b) **Calculate** the percent loss of elephants in Africa from 1970 to 2000. Show all work.

(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.

b. $\frac{400,000}{2,000,000} = \frac{4}{20} = \frac{1}{5} = 20\%$ left $\rightarrow 100\% - 20\% =$ **80% loss**

c. $\frac{x}{600,000} \times \frac{1}{5}$

$5x = 600,000$

$x = 120,000 \Rightarrow 600,000 - 120,000 =$ **480,000 elephants in 2022**

d. Elephants, K-strategists, produce few offspring with an extended period of parental care. By producing very few offspring, a population can die in just a single generation because the offspring have a much lower survival rate than r-selected species (such as dandilions) that produce many offspring with the idea that some will die but the ones that live will carry on the species.

e. In the case of large terrestrial mammals, many are endangered due to human overuse / poaching. If the value of the fur / tusk / etc. was eliminated, poaching would possibly stop. For example, if an african elephant's tusk was discolored, it would have no value and the elephant would not be killed.

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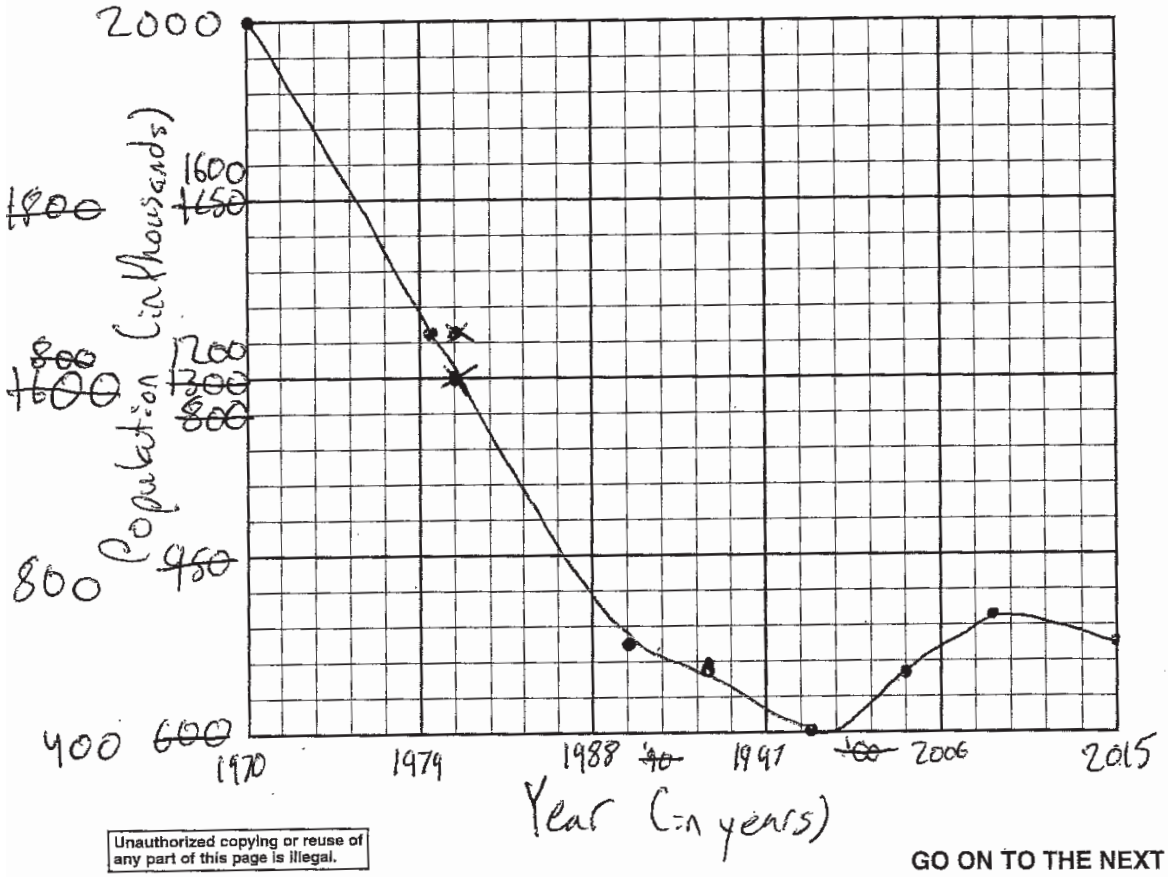

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(c) The International Union for Conservation of Nature (IUCN) estimates that the elephant population will decline by 20 percent between 2015 and 2022. Use this estimate to **calculate** how many elephants will be left in Africa in 2022. Show all work.

(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.

b $2000000 - 400000 = 160000$

$1600000 \div 2000000 = 0.8$

$2000000 \overline{)16000000.0}$

$.8 \cdot 100 =$ **80% loss**

c $.2 \times 600000$ elephants $= 120000$ dead elephants

$600000 - 120000 =$ **480000 elephants**

d One characteristic is higher age till sexual maturity which leaves them prone to extinction since they can't produce as much offspring as quickly as r-strategists.

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ADDITIONAL PAGE FOR ANSWERING QUESTION 2

e One would be to put a hunting ban on the elephants to make poaching them for ivory illegal. Another would be to make breeding programs for them to maximise offspring and parental efficiency.

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2017 SCORING COMMENTARY

Question 2

Overview

This question was intended to have students analyze a data table of the estimated population size of elephants on the African continent. Additionally, students were asked to explain how reproductive strategies could lead to the extinction of a species and how conservation strategies could be implemented to prevent the extinction of a species.

Students were asked to correctly plot the data in the table on the axes provided, with the direction that the independent variable be placed on the x-axis. Students were then asked to use the data in the table to calculate the percent loss of elephants in Africa from 1970 to 2000 and to calculate (predict) the size of the African elephant herd in 2022, based on a 20 percent decline in the herd size from 2015 to 2022. These concepts were associated with science practices 5.1 – 5.3 (The student can perform data analysis and evaluation of evidence) for the graphing task and science practices 2.1 – 2.1 (The student can use mathematics appropriately) for the calculations.

In the next part of the question, students were asked to demonstrate their knowledge of reproductive and conservation strategies in large mammals prone to extinction. Students were asked to identify a characteristic of a K-strategist and explain how that characteristic could make the species prone to extinction. In the final part of the question, students were asked to identify and discuss two conservation strategies that could be implemented to prevent the extinction of large terrestrial mammals. These concepts were drawn from III. Population, A. Population Biology Concepts and VII. Global Change, subtopic C. Loss of Biodiversity in the topic outline.

Sample: 2A
Score: 10

The student earned 2 points in part (a) for proper preparation and creation of the graph: 1 point for correctly labeling and scaling the axes and 1 point for correctly plotting the data. The student earned 2 points in part (b): 1 point for correctly setting up the calculation and 1 point for the correct answer. The student earned 2 points in part (c): 1 point for correctly setting up of the calculation and 1 point for the correct answer. The student earned 2 points in part (d): 1 point for correctly identifying that K-strategists "produce a small number of offspring" and 1 point for explaining that recovery after a population decline is slow; "their population doesn't grow quickly, especially after a die-off, resulting from … disease or poaching." The student earned 2 points in part (e): 1 point for discussing "protection from poachers through the use of guards" would result in fewer deaths from poaching. The student earned 1 point for discussing that designating nature preserves would "protect the animal and allow their population to increase."

Sample: 2B
Score: 8

The student earned 2 points in part (a) for proper preparation and creation of the graph: 1 point was earned for correctly labeling and scaling the axes and 1 point was earned for correctly plotting the data. The student earned 2 points in part (b): 1 point for correctly setting up of the calculation and subtracting the percentage remaining from 100 percent and 1 point for the correct answer. The student earned 2 points in part (c): 1 point for correctly using a ratio method to calculate how many elephants will be left in 2022 and 1 point for the correct answer. The student earned 1 point in part (d) for correctly identifying the K-strategist characteristic of producing "few offspring." No point was earned for the explanation. The student earned 1 point in part (e) for correctly identifying that discoloring elephant tusks will negatively affect their value and for discussing how the strategy could prevent extinction by stating, "If the value of the fur/tusk/etc. was eliminated, poaching would possibly stop."

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Question 2 (continued)

Sample: 2C
Score: 6

The student earned 1 point in part (a) for labeling and scaling the axes. No additional point was earned for plotting the data as several points are inaccurately plotted on the graph. The student's choice of intervals on the x-axis make it difficult to accurately plot the data on the grid provided. The student earned 2 points in part (b): 1 point for correctly setting up the calculation and 1 point for the correct answer. The student earned 2 points in part (c): 1point for correctly setting up the calculation and 1 point for the correct answer. The student earned 1 point in part (d) for correctly identifying that a K-strategist has a "higher age till [*sic*] sexual maturity." No point was earned for the explanation.

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