

2025



AP[®] Environmental Science

Free-Response Questions Set 2

ENVIRONMENTAL SCIENCE
SECTION II
TIME – 1 HOUR AND 10 MINUTES

Directions:

Section II has 3 free-response questions and lasts 1 hour and 10 minutes.

If you are asked to explain, describe, or justify, respond in complete sentences and support your answers with relevant information and/or specific examples. Do not spend time restating the questions or providing more than the number of examples called for.

A calculator is available in this application and can be accessed throughout the exam.

For the parts of question 3 where calculations are required, clearly show how you arrived at your answer. You do not need to include units unless indicated. Use your keyboard for the following math expressions and symbols:

- Multiplication: use an “x” or asterisk (*)
Example: 4 x 5 or 4 * 5
- Division and Fractions: use a forward slash (/)
Example: 17 / 5
- Degrees: write “degrees”
Example: 25 degrees C
- Grouping: use parentheses
Example: (2+3) / (7-5)

Within the application, you can enter subscript or superscript, but the following methods are also acceptable:

- Subscript: use an underscore (_)
Example: CO₂
- Superscript: use a caret (^)
Example: 10¹²

You may pace yourself as you answer the questions in this section, or you may use these optional timing recommendations:

The suggested time is about 22 minutes for each question.

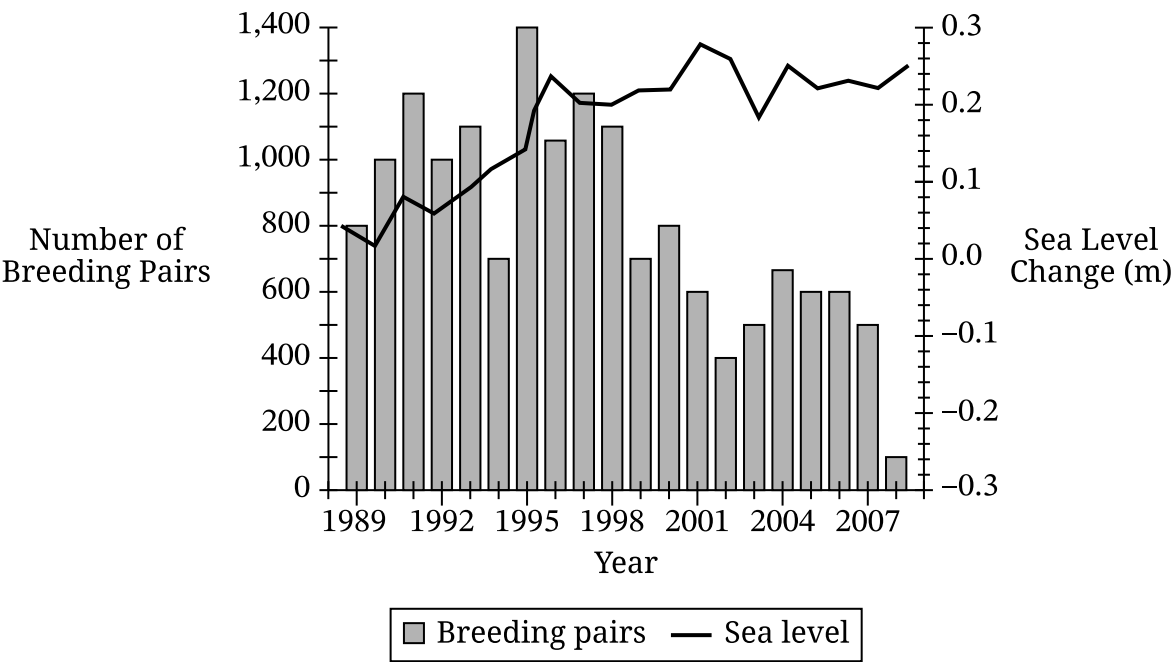
You may use the available paper for scratch work, but credit will only be given for responses entered in this application. Text you enter as an annotation will **not** be included as part of your answer. For questions that have sub-parts, be sure to label those clearly in your answer.

You can go back and forth between questions in this section until time expires. The clock will turn red when 5 minutes remain—**the proctor will not give you any time updates or warnings.**

Note: This exam was originally administered digitally. It is presented here in a format optimized for teacher and student use in the classroom.

Common Terns are a species of shore bird that live along coasts and build nests on beaches above the high-tide line. From 1989 to 2008, researchers monitored a stretch of shoreline along a coast that contained a population of Common Terns. Each year they conducted nest surveys during the breeding season to estimate the number of breeding pairs. They also computed the change in sea level compared to the first year of the study. The graph shows the number of breeding pairs of Common Terns in the study area and relative change in sea level.

Common Tern Breeding Pairs and Increase in Sea Level, 1989–2008



1. Respond to parts A, B, C, D, E, F, G, H, and I, and all subparts.
- A. Based on the data in the graph, **identify** the number of Common Tern breeding pairs in 1995.
- B. Based on the data in the graph, **describe** the trend in the number of Common Tern breeding pairs from 1995 to 2008.
- C. A group of students hypothesized that sea level rise will lead to an increase in Common Tern populations. **Describe** one way that the data in the graph refute this hypothesis.
- D. **Explain** how climate change can lead to sea level rise.
- E. Wading birds are a group of large-bodied birds that inhabit coastal wetlands all over the world. Researchers monitored the number of wading bird species at four coastal locations experiencing rising sea levels over a 5-year period. The data are shown in the following table.

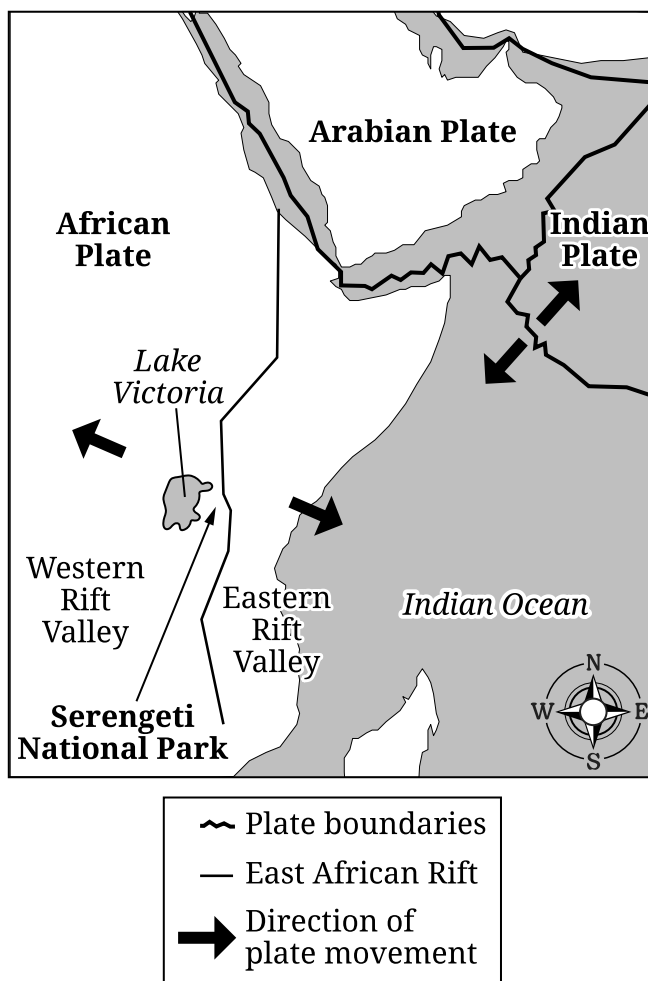
Sea Level Rise and Number of Wading Bird Species at Four Coastal Locations

Year	Increase in Sea Level (m)	Location A	Location B	Location C	Location D
1	0.05	1	5	3	4
2	0.08	2	4	3	6
3	0.10	6	7	5	5
4	0.12	5	7	7	7
5	0.15	7	8	9	8

- i. **Identify** a hypothesis that researchers are likely investigating in the wading bird study.
- ii. **Identify** the dependent variable in this study.
- F. One year after the completion of the study of wading bird species described in Part E, locations A and B experienced an increase in the concentration of PCBs, known to be a persistent organic pollutant, running off into the water.
- If the researchers repeated their study, **explain** how this environmental change could affect the results of the study.
- G. **Describe** a regulating ecosystem service that can be provided by wetlands.
- H. Since 1990, there has been an increase in urbanization around the coastal wetlands that wading bird communities inhabit. Most of these bird species eat fish and locate prey visually while walking through shallow water. An increase in sediment was discovered in a wetland located near an urban area.
- Explain** how increased sediment might lead to a change in the size of the wading bird populations.
- I. **Describe** an environmental problem, other than an increase in sediment, that can occur in wetlands that is associated with increased urbanization and development.

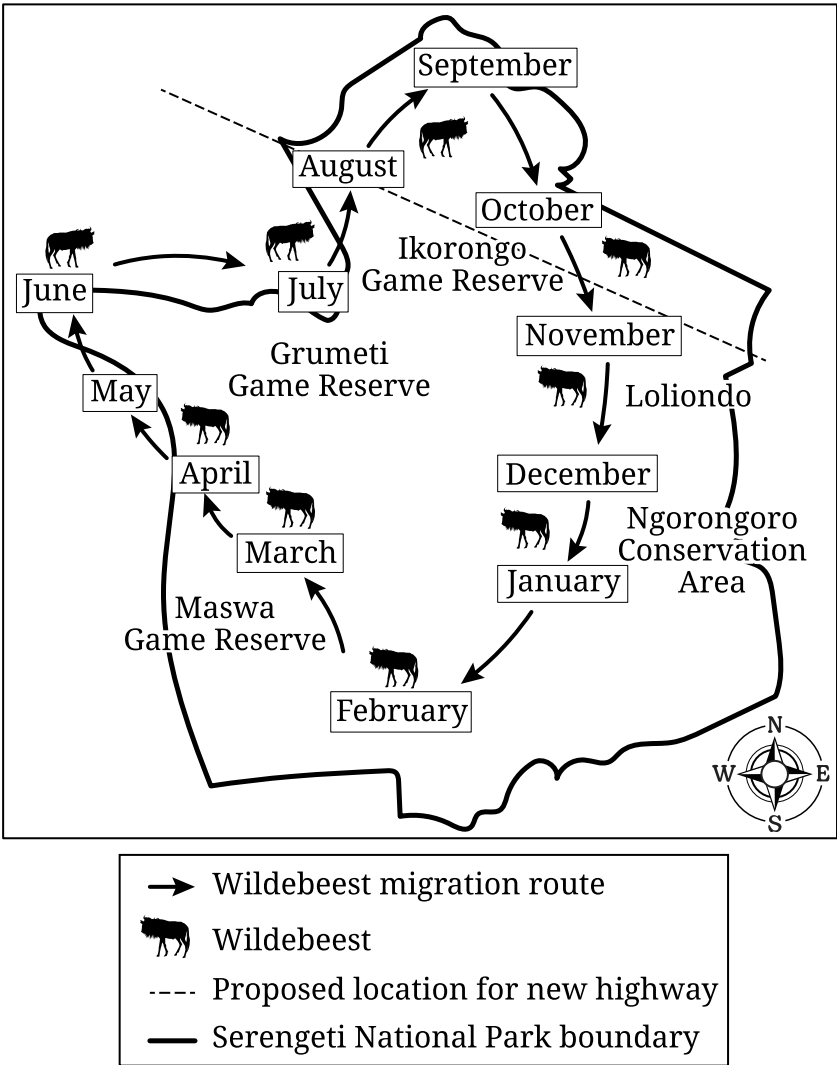
Serengeti National Park is located in Tanzania, Africa. The park is located in a valley along a tectonic plate boundary called the East African Rift. Figure 1 shows the East African Rift and other plate boundaries near the east coast of Africa.

Figure 1. Tectonic Plate Movement near East Coast of Africa



Serengeti National Park contains a variety of tropical habitats but is dominated by wideopen lands that include a variety of grass species with scattered trees and shrubs. Most grass growth occurs after the March through May rainy season. Many of the park’s herbivores, such as wildebeest and zebra, migrate through the park in an annual cycle following the growth of new grass (Figure 2).

Figure 2. Annual Migration of Wildebeest in Serengeti National Park



2. Respond to parts A, B, C, D, E, F, G, H, I, and J.

- A. Based on the information in Figure 1, **identify** the type of plate boundary that runs beneath Serengeti National Park.
- B. Based on the information provided, **identify** the dominant biome within the Serengeti.
- C. Wildebeest give birth to their young when new grasses are growing. Based on the information in Figure 2, **identify** the location in the Serengeti where wildebeest are most likely to give birth.
- D. The Serengeti has two primary types of grasses: long and short. The two grass types provide similar levels of nutrition for animals. Wildebeest primarily consume long grasses, while other herbivores such as gazelle consume the short grasses. These two similar species coexist in Serengeti National Park.
Explain why resource partitioning allows for the coexistence of the wildebeest and the gazelle in the Serengeti.
- E. The Tanzanian government plans to build a highway across the northern portion of the Serengeti, as shown in Figure 2.
Describe one way the planned highway shown in Figure 2 could negatively affect the wildebeest population in the Serengeti.
- F. **Propose** a solution to the negative effect created by the planned highway described in part E.
- G. Many organisms live in grasslands. One weed species, the spotted knapweed, was introduced at one location in North America in the 1890s and is currently found throughout the rangelands of the western United States. The spotted knapweed poses several environmental problems in North America. Farmers often use crop rotation to control populations of pests like the spotted knapweed. A more traditional method of controlling pests involves spraying pesticides.
Describe a characteristic of an invasive species, such as the spotted knapweed, that allows them to outcompete native species.
- H. **Justify** the use of crop rotation as an environmental solution by providing an additional advantage, other than controlling pest populations.
- I. **Describe** an environmental problem associated with controlling pest populations with large amounts of pesticide.
- J. **Propose** a solution to controlling pests, other than pesticides or crop rotation.

The local government of a newly built town has contracted with an electrical company to provide energy to the town. The company generates electricity primarily through the burning of coal and has built a new power plant for the town. A nearby deposit of coal was discovered close to the surface. To access the coal, the company decides to remove the overburden and vegetation over the deposit.

3. Respond to parts A, B, C, D, E, F, and G.

A. Identify a type of surface mining the company could use to access the coal.

B. Describe an environmental problem associated with surface mining.

C. The town is located downwind of the new coal-burning power plant.

Describe an environmental problem the town could experience as a result of the electricity generation at the coal-burning power plant.

D. The local government is concerned about the environmental consequences of using coal to generate electricity for the town.

Propose a realistic solution the local government could enact that would reduce the negative environmental consequences of using coal to generate electricity.

E. Burning one pound of coal produces an average of 0.88 kilowatt-hours (kWh) of electricity. An average household in the United States uses 1.064×10^4 kWh of electricity each year.

Calculate how many pounds of coal would need to be burned to generate enough electricity to power a town with 11,000 houses for a year. **Show** your work.

F. Researchers are concerned about the impact of noise pollution on songbirds in a forest near the power plant. Since the power plant was installed, bird species richness has declined from 7.5 species per hectare to 6.0 species per hectare.

Calculate the percent change in bird species per hectare since the power plant was installed. **Show** your work.

G. The town has been growing since it was built and had a growth rate of 5.38% in 2022, with a population of 26,250.

Assuming that the growth rate remains constant, **calculate** the year in which the population will reach 52,500. **Show** your work.

STOP
END OF EXAM