Chief Reader Report on Student Responses:

2025 AP® Environmental Science Free-Response Questions

• Number of Students Scored	245,807		
• Number of Readers	848		
• Score Distribution	Exam Score	N	%At
	5	30,872	12.6%
	4	68,333	27.8%
	3	70,837	28.8%
	2	36,763	15.0%
	1	39,002	15.9%
• Global Mean	3.06		

The following comments on the 2025 free-response questions for AP® Environmental Science were written by the Chief Reader, Laura Hainsworth, Professor of Chemistry and Environmental Studies, Emory & Henry University. They give an overview of each free-response question and of how students performed on the question, including typical student errors. General comments regarding the skills and content that students frequently have the most problems with are included. Some suggestions for improving student preparation in these areas are also provided. Teachers are encouraged to attend a College Board workshop to learn strategies for improving student performance in specific areas.

Question 1

Task: Design an Investigation
Topic: Impact of Sea Level Change on Common Terns and Other Birds

	Max Points:	Mean Score:
Point 1	1	0.90
Point 2	1	0.92
Point 3	1	0.87
Point 4	1	0.52
Point 5	1	0.39
Point 6	1	0.41
Point 7	1	0.19
Point 8	1	0.41
Point 9	1	0.70
Point 10	1	0.24

Overall Mean Score: 5.55

What were the responses to this question expected to demonstrate?

The intent of this question was for students to demonstrate their ability to interpret a graph of sea level change and number of Common Tern breeding pairs over time. Students were asked to identify data trends and components of a scientific experiment. Students were also asked to explain concepts related to climate change's influence on sea level rise and to explain how adding a persistent organic pollutant to an aquatic environment would affect the results of a scientific study of wading birds. Students were expected to convey an understanding of the role of wetlands as providers of regulating ecosystem services and to describe an environmental problem that urbanization and development could create for wetlands.

In parts A, B, and C students were asked to demonstrate their ability to read and interpret information provided in a graph. In part A students were asked to identify the number of Common Tern breeding pairs in a specific year [Science Practice 5: Data Analysis and Topic 9.5: Global Climate Change]. In part B students were asked to describe the trend in number of bird pairs over a set range of years [Science Practice 5: Data Analysis and Topic 9.5 Global Climate Change]. In part C students were asked to describe how trends in the data refute a hypothesis [Science Practice 5: Data Analysis and Topic 9.10: Human Impacts on Biodiversity].

In part D students were asked to explain how climate change could lead to sea level rise [Science Practice 1: Concept Explanation and Topic 9.3: The Greenhouse Effect].

Parts E (i) and E (ii) asked students to identify a plausible hypothesis for a study involving wading bird species richness rise and to identify the study's dependent variable based on the information provided [Science Practice 4: Scientific Experiments and Topic 2.1 Introduction to Biodiversity].

In part F students were asked to explain how the addition of a persistent organic pollutant to the environment would affect the results of a study of wading bird species richness [Science Practice: 4 Scientific Experiments and Topic 8.7: Persistent Organic Pollutants (POPs)].

In part G students were asked to describe a regulating ecosystem service that wetlands can provide [Science Practice 1: Concept Explanation and Topic 2.2: Ecosystem Services].

In part H students were asked to explain how increased sediment could lead to a change in wading bird populations [Science Practice 7: Environmental Solutions and Topic 8.2: Human Impacts on Ecosystems].

In part I students were asked to describe an environmental problem that could occur in wetlands that is associated with increased urbanization and development [Science Practice 7: Environmental Solutions, Topic 5.10: Impacts of Urbanization and Topic 8.4: Human Impacts on Wetlands and Mangroves].

How well did the responses address the course content related to this question? How well did the responses integrate the skill(s) required on this question?

- In part A most students were able to apply Science Practice 5 Data Analysis and correctly identify 1,400 as the number of Common Tern breeding pairs in 1995.

- In part B most students correctly described the decrease in number of breeding pairs in the given time frame.

- In part C most students were able to describe that as sea level rose, there was a decrease in the number of bird breeding pairs, refuting the students' hypothesis.

- In part D students most often connected climate change with sea level rise by explaining that increased global temperature would cause land-based ice to melt. Alternately, many students answered with correct explanations of how increased water temperatures lead to water expansion in the ocean. Some students did not earn this point because they either incorrectly connected sea level rise to the melting of sea ice, or they incorrectly stated that increased carbon dioxide concentration in the ocean water leads to sea temperature rise.

- Responses in part E earned the first point by identifying a likely hypothesis with change in sea level as the independent variable and diversity of wading bird species as the dependent variable. Responses did not have to present a 'correct' hypothesis to earn a point. Students who did not earn this first point either stated a scientific question or were not specific about number of wading bird species as the dependent variable. Though articulating a hypothesis proved challenging, most students earned the second point in part E by identifying the dependent variable as the number of wading bird species [Science Practice 4: Scientific Experiments].

- In part F students were asked to explain how an increase in concentration of PCBs would affect the results of the study. Correct responses generally referred to a decrease in wading birds through bioaccumulation and/or biomagnification [Topic 8.7: Persistent Organic Pollutants (POPs)]. Students were challenged by this part of the question, with some students incorrectly focusing on the effect of the variable on the study instead of addressing the impact of the PCBs on the wading birds.

- In part G most students earned a point by describing improved water quality through filtration as a regulating ecosystem service of wetlands. Other common correct responses included describing that wetlands "provide protection from floods" and "sequester carbon" [Topic 8.4: Human Impacts on Wetlands and Mangroves].

- Students who earned a point in part H most often explained that increased sediment would decrease the ability of wading birds to see and find fish to eat.

- In part I students were asked to describe an environmental problem that can occur in wetlands that is associated with increased urbanization and development. Students provided a wide variety of correct responses. Many responses described the effects of a specific type of urban-associated runoff, such as "fertilizers," "pesticides," "heavy metals," "litter," or "wastewater effluent", on wetland habitats or organisms. Other correct answers addressed the effects of urbanization, including habitat loss and fragmentation due to building on the wetlands as well as noise and light pollution produced by urban areas.

What common student misconceptions or gaps in knowledge were seen in the responses to this question?

Common Misconceptions/Knowledge Gaps	*Responses that Demonstrate Understanding*
• In part (D) students incorrectly explained that sea level rise is caused by melting sea ice. Other students incorrectly described increased carbon dioxide levels in the water causing the thermal expansion of water.	• "Climate change can lead to sea level rise because increased temperature in the atmosphere leads to the melting of land ice. When land ice melts, it runs into the ocean. With the addition of this water, the sea level rises."
• In part (E) some students incorrectly wrote their hypothesis in the form of a scientific question.	• "As the sea level increases, the number of wading bird species in the coastal areas will increase."
• In part (F) students had difficulty explaining how an increase in PCBs in the ecosystem results in an increase of PCBs in wading birds through biomagnification and bioaccumulation.	• "PCBs are persistent organic pollutants, meaning that they accumulate in the fat of organisms and cannot be excreted. If there is an increase in PCBs, they will accumulate in the fat of the birds making it difficult for the birds to survive and will decrease their populations."

Based on your experience at the AP® Reading with student responses, what advice would you offer teachers to help them improve student performance on the exam?

- Provide ample opportunity for students to build their skills in designing and implementing their own experiments, preferably through laboratory exercises. This should include emphasizing key concepts such as developing scientific questions, hypotheses, identifying independent and dependent variables, and the function of a control in an experiment. Laboratory experiences are also a great way to reinforce course content.

- Introduce the task verbs used in the exam early in the school year, and then frequently use them in both formative and summative assessments. Task verbs for free-response questions can be found on page 227 of the *AP Environmental Science Course and Exam Description*. For example, the *describe* task verb asks students to provide the relevant characteristics of a specified topic. The *explain* task verb asks students to articulate the relationship between relevant variables and often takes the form of a cause-and-effect statement.

- Give students regular opportunities to interpret graphs during class activities and assessments to build their skill level in Science Practice 5: Data Analysis.

- Have students work with authentic data sets to build their skill level in Science Practice 4: Scientific Experiments and Science Practice 5: Data Analysis by using trends in the data to explain what changes could result from varying the parameters in an experiment's design.

What resources would you recommend to teachers to better prepare their students for the content and skill(s) required on this question?

For reviewing task verbs and practicing responses:

- In AP Classroom, the Review section under the Course Guide contains numerous practice videos that walk students through the process of reading and responding to FRQs, including discussion of task verbs.

- Sample student responses for this question can be found on the exam information page on AP Central, along with commentary explaining why each point was or was not earned. Teachers can use these samples to better understand how each question was scored, including application of task verbs, and to work with students to practice writing correct responses.

- Scoring guidelines for this question can be found on the exam information page on AP Central. Teachers can use and adapt these scoring guidelines so that students become familiar with how their responses will be scored.

- Students can practice, score, and review examples of FRQ 1 on the released AP Environmental Science Exams. The most recent exams can be found on the exam information page on AP Central, while older exams can be found on AP Classroom. Student samples and scoring guidelines are also available for these questions.

Resources for enriching content knowledge and scientific skills (Science Practices 4 and 5):

- AP Daily videos in AP Classroom are available for every topic in AP Environmental Science. Teachers can use these to provide students with additional exposure to content throughout the course. To review human impacts on wetlands and persistent organic pollutants (POPs), teachers can assign Topic 8.4 and Topic 8.7 AP Daily videos.

- Teachers are strongly encouraged to incorporate the laboratory exercises that are available in AP Classroom. Each lab is designed to target specific science practice and skill development, including the articulation of hypotheses and interpreting data with respect to specific hypotheses.

- Teachers should consider a project based learning approach (PBL) to AP Environmental Science. Research indicates students who engage in project based AP coursework are more likely to earn a qualifying score of 3 or higher on the AP Exam. For instructors new to the PBL approach, the College Board has developed a yearlong sequence of PBL modules specifically designed for AP Environmental Science. For more information, visit https://apcentral.collegeboard.org/professional-learning or contact approjectbasedlearning@collegeboard.org.

- The AP Environmental Science Online Teacher Community offers many resources, discussions, tips, and activities that teachers have found helpful. It is easy to sign up, and teachers can search through discussion topics from previous years.

Training and additional instructional support:

- Teachers can sign up for an AP Summer Institute (APSI). This is a great way for instructors to gain in-depth knowledge about the AP Environmental Science curriculum and exam. It is also a great opportunity to network with colleagues from around the world.

- Teachers can apply to be an AP Reader. The AP Reading provides an outstanding professional development opportunity. In addition to providing in-depth, hands-on experience with how to accurately apply AP scoring guidelines, the AP Reading is a great way to share resources and network with colleagues.

Question 2

Task: Analyze an Environmental Problem and Propose a Solution
Topic: Wildebeest Migration in the Serengeti

	Max Points:	Mean Score:
Point 1	1	0.67
Point 2	1	0.27
Point 3	1	0.31
Point 4	1	0.80
Point 5	1	0.93
Point 6	1	0.60
Point 7	1	0.54
Point 8	1	0.55
Point 9	1	0.60
Point 10	1	0.73

Overall Mean Score: 6.00

What were the responses to this question expected to demonstrate?

The intent of this question was for students to demonstrate their ability to interpret information presented visually in an applied context. Students were asked to describe problems caused by the effects of human activity on natural ecosystems, in this case Serengeti National Park, and propose reasonable solutions to lessen those effects. Students were also asked about agricultural practices, the impacts of pesticide use, and alternatives to using pesticides.

In part A students were asked to use a diagram to identify a type of tectonic plate boundary underneath Serengeti National Park [Science Practice 2: Visual Representations and Topic 4.1: Plate Tectonics].

In part B students were asked to identify the dominant biome within the Serengeti [Science Practice 1: Concept Explanation and Topic 1.2: Terrestrial Biomes].

In part C students were asked to analyze information about the Serengeti given in the prompt and a map to identify where in Serengeti National Park the wildebeest are most likely to give birth [Science Practice 2: Visual Representations and Topic 1.2: Terrestrial Biomes].

In part D students were asked to explain why resource partitioning of food sources allows herbivore species to coexist [Science Practice 1: Concept Explanation and Topic 1.1: Introduction to Ecosystems].

Parts E and F asked students to describe how humans building a highway through Serengeti National Park would negatively affect the migrating wildebeest and then propose a reasonable solution [Science Practice 7: Environmental Solutions and Topic 9.10: Human Impacts on Biodiversity].

In part G students were asked to describe a characteristic of invasive species that gives them a competitive edge over native species [Science Practice 1: Concept Explanation and Topic 9.8: Invasive Species].

In part H students were asked to provide an additional benefit of crop rotation to justify its use to control pest populations [Science Practice 7: Environmental Solutions and Topic 5.15: Sustainable Agriculture].

In parts I and J students were asked to describe an environmental problem associated with using pesticides and propose a solution to control pests other than using pesticides or crop rotation [Science Practice 7: Environmental Solutions and Topic 5.14: Integrated Pest Management].

How well did the responses address the course content related to this question? How well did the responses integrate the skill(s) required on this question?

- In part A most students were able to correctly identify a divergent plate boundary.
- In part B most students identified the savanna or tropical grassland biome.
- In part C students who earned the point were able to use the provided information to determine that the wildebeest are likely to give birth after the rainy season of March–May and therefore identify the Grumeti Game Reserve.
- In part D students most frequently explained that competition between the wildebeest and gazelle for food resources is reduced due to resource partitioning.
- In part E most students were able to describe how building a highway through Serengeti National Park would fragment the wildebeest habitat or disrupt their migration route.
- Responses in part F proposed building wildlife corridors over or under the highway or building a highway overpass to allow migrating wildebeest to avoid the highway project as a reasonable solution.
- In part G correct responses described characteristics of invasive species as generalist species or r-selected species. Most frequently, students noted that r-selected species reproduce quickly or generate many offspring in each reproductive cycle, or that generalists are able to survive in conditions outside their normal habitat.
- In part H many students correctly justified the use of crop rotation by describing improved soil fertility, reduced soil erosion, and increased crop yield as additional benefits. Student responses that cited avoiding nutrient depletion in soil or maintaining nutrient levels in soil also earned a point.
- In part I correct responses most frequently described how spraying chemical pesticides can harm nontarget organisms, such as aquatic species.
- In part J students proposed solutions to controlling pests other than using pesticides or crop rotation. Many students described specific aspects of integrated pest management, such as examples of biological and mechanical controls.

What common student misconceptions or gaps in knowledge were seen in the responses to this question?

Common Misconceptions/Knowledge Gaps	*Responses that Demonstrate Understanding*
• In part B some students incorrectly identified the Serengeti as a grassland, desert, or shrubland.	• "Savanna" • "Tropical grassland"
• In part G some students incorrectly described the lack of natural predators as a characteristic of invasive species. While this factor may contribute to an introduced species' ability to become abundant, it is a characteristic of the ecosystem and not of the species itself.	• "Invasive species reproduce rapidly" • "It reproduces quickly and with many offspring" • "being a generalist species, having a wide range of tolerance"
• In part I some students demonstrated a misconception that pesticides cause nutrient pollution and eutrophication.	• "Pesticides can also kill or affect the health of non-targeted species"

Based on your experience at the AP® Reading with student responses, what advice would you offer teachers to help them improve student performance on the exam?

- Use maps and climate data when presenting terrestrial biomes and ensure that students are familiar with the biomes listed in Topic 1.2 of the *AP Environmental Science Course and Exam Description*. Comparing and contrasting biomes with photos and maps may help students understand the key differences between them. This information can then be reinforced when presenting Earth's climate zones (Topic 4.7).

- Give students regular opportunities to read information presented in prompts along with interpreting maps and diagrams during class activities (Science Practice 2). Requiring students to retrieve information directly from prompts and diagrams as an answer to a question posed in class or on a classroom assessment would reinforce this skill.

- Remind students that repeating the given information from the prompt in their response to *describe* or *explain* questions is not sufficient to earn a point. Have students practice identifying the new information provided in their responses to be sure they are not simply repeating the question prompt or stem.

- Have students practice describing solutions to environmental problems (Skill 7.B) while being as specific as possible to show their understanding of both the problem and its solution. Similarly, have students evaluate or discuss what makes a solution to an environmental problem realistic, as well as their additional advantages and unintended consequences (Skill 7.C).

- When presenting the characteristics of species, for example, invasive species (Topic 9.8), be sure students understand the distinction between a characteristic of a species and a characteristic of the ecosystem that may influence the success of that species.

- When discussing various agricultural practices, emphasize the differences between pesticides and fertilizers (Topics 5.4 and 5.6). This can then be reinforced when presenting eutrophication (Topic 8.5) and endocrine disruptors (Topic 8.3).

What resources would you recommend to teachers to better prepare their students for the content and skill(s) required on this question?

Resources for enriching content knowledge:

- AP Daily videos in AP Classroom are available for every topic in AP Environmental Science. Teachers can use these to provide students with additional exposure to content throughout the course.
    - To review characteristics of terrestrial biomes, teachers can assign AP Daily videos for Topic 1.2.
    - To review characteristics of invasive species, teachers can assign AP Daily videos for Topic 9.8.
    - To review the distinction between pesticides and fertilizers, teachers can assign AP Daily videos for Topic 5.4.

- Teachers can consider a project based learning approach (PBL). For instructors new to the PBL approach, the College Board has developed a yearlong sequence of PBL modules specifically designed for AP Environmental Science. For more information, visit https://apcentral.collegeboard.org/professional-learning or contact approjectbasedlearning@collegeboard.org.

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Question 3

Task: Analyze an Environmental Problem and Propose a Solution Doing Calculations
Topic: Energy Production and Its Environmental Impacts

	Max Points:	Mean Score:
Point 1	1	0.44
Point 2	1	0.36
Point 3	1	0.38
Point 4	1	0.20
Point 5	1	0.53
Point 6	1	0.53
Point 7	1	0.38
Point 8	1	0.48
Point 9	1	0.23
Point 10	1	0.32

Overall Mean Score: 3.84

What were the responses to this question expected to demonstrate?

The intent of this question was for students to demonstrate an understanding of concepts related to the environmental impacts of surface mining and the use of coal to generate electricity. Students were asked to propose a solution to reduce coal use and to calculate the total amount of coal that would be needed to generate enough electricity for the town in a year.

In part A students were asked to demonstrate an understanding of different mining practices [Science Practice 1: Concept Explanation and Topic 5.9: Impacts of Mining].

In Part B students were asked to describe one environmental impact of surface mining [Science Practice 7: Environmental Solutions and Topic 5.9: Impacts of Mining].

In part C students were asked to demonstrate an understanding of the environmental impacts of burning fossil fuels for electricity [Science Practice 7: Environmental Solutions and Topic 6.5: Fossil Fuels and Topic 7.1: Introduction to Air Pollution].

In part D students were asked to propose a realistic solution that the local government could enact to reduce the environmental impacts caused by using coal to generate electricity [Science Practice 7: Environmental Solutions and Topic 7.6: Reduction of Air Pollutants].

In part E students were asked to calculate the total amount of coal that would need to be burned to provide electricity for the houses in the town for a year [Science Practice 6: Mathematical Routines and Topic 6.2: Global Energy Consumption].

In part F students were asked to calculate the percentage change in bird species richness in a forest near the power plant [Science Practice 6: Mathematical Routines and Topic 7.8: Noise Pollution].

In part G students were asked to calculate the year in which the population of the town would double given a constant growth rate [Science Practice 6: Mathematical Routines and Topic 3.8: Human Population Dynamics].

How well did the responses address the course content related to this question? How well did the responses integrate the skill(s) required on this question?

- In part A most students were able to identify strip mining, open pit mining, or mountaintop removal as types of surface mining.

- In part B students that earned the point described surface mining as causing the loss of habitat due to the removal of the overlying plants, soil, and rock to access the coal.

- In part C most students described how various air pollutants released from the combustion of coal can cause environmental problems in the town, such as lower air quality and acid rain. Because the prompt referred to the "town," which is a human habitat, human health impacts such as respiratory problems related to the air pollutants also earned the point.

- In part D correct responses proposed that the local government could require that the coal power plant install wet scrubbers to reduce air pollutants or that the local government provide incentives for residents to install solar panels on their houses to reduce demand for electricity from the coal power plant.

- In part E many students correctly utilized scientific notation and dimensional analysis with unit cancellation to get the correct setup and answer. Some students calculated the correct answer and setup without using units.

- In part F many students correctly utilized the formula for percent change to calculate the percent decrease in bird species per hectare in a forest near the coal power plant. Answers needed to indicate that a decrease in the percentage had occurred.

- Most correct responses in part G used the "Rule of 70" formula to calculate the amount of time it takes for a population to double when the growth rate is constant. Correct responses then included adding the time to double to the initial year to calculate the correct year. Due to the availability of calculators, some students utilized logarithmic population growth formulas to calculate the answer.

What common student misconceptions or gaps in knowledge were seen in the responses to this question?

Common Misconceptions/Knowledge Gaps	*Responses that Demonstrate Understanding*
• In part D students struggled with proposing a solution that the local government could enact that was phrased as a realistic government policy. For example, many students said that the use of scrubbers in the power plant would reduce air pollution but did not put this in the context of a policy statement, such as passing an ordinance that requires that the power plant install a wet scrubber.	• "The local governments could produce legislation that would require coal powered plants to use a wet scrubber to catch pollutants that would otherwise enter the atmosphere."
• In part F many students did not use parentheses to clearly show the correct order of operations in their percent change setup. Students arrived at the correct answer but didn't use parentheses to show that they subtracted 7.5 from 6 before they divided by 7.5. Some students did not show that they multiplied by 100 to convert the decimal to a percentage for the setup, which must show complete work.	• "((6-7.5)/ (7.5)) x 100 = -20% There was a 20% decrease in bird species per hectare since the power plant was installed."
• In part G some did not show the complete setup of adding the doubling time to the base year to arrive at the answer.	• "26250 x 2 = 52500, Dt: 70/%growth=years to double population, 70/5.38 = 13.01115242, about 13 years, 2022 + 13, Population will reach 52,500 by 2035."

Based on your experience at the AP® Reading with student responses, what advice would you offer teachers to help them improve student performance on the exam?

- Introduce the task verbs used in the exam early in the school year, and then frequently use them in both formative and summative assessments. Task verbs for free response questions can be found on page 227 of the *AP Environmental Science Course and Exam Description*. For example, the *describe* task verb asks students to provide the relevant characteristics of a specified topic. The *explain* task verb asks students to articulate the relationship between relevant variables and often takes the form of a cause-and-effect statement.

- Give students ample opportunity to practice articulating realistic policy options for governments to address environmental problems. Ensure that students understand the tools available to governments to encourage behavior change through incentives such as subsidies or tax credits, or to discourage certain activities through appropriate laws and regulations.

- Provide ample opportunity for students to practice the various math skills detailed in Science Practice 6: Mathematical Routines. Ensure that students practice entering the work into a computer and that they use parentheses correctly to illustrate the proper order of operations. Instruct students to show all their work, even if it is math that they can perform in their head. Remind students that there is no penalty for showing more work than they need to, but sometimes students do not earn the setup point because they have not clearly shown how they arrived at a numerical answer.

What resources would you recommend to teachers to better prepare their students for the content and skill(s) required on this question?

For practicing mathematical operations in the digital environment:

- Have students complete the test preview available in the Bluebook app. Teachers and students can also use practice questions on AP Classroom for a Bluebook-type experience. A guide to digital entry of mathematical operations for AP Environmental Science is available on AP Central.

- Sample student responses for FRQ 3 can be found on the exam information page on AP Central, along with commentary explaining why each point was or was not earned. Teachers can use these samples to better understand how mathematical operations were scored and to work with students to practice typing mathematical operations.

- Have students practice typing examples of mathematical operations from FRQ 3 on the released AP Environmental Science Exams. Students can then review and score each other's responses to learn best practices. The most recent exam questions can be found on the exam information page on AP Central, while older exams can be found on AP Classroom. Student samples and scoring guidelines are also available for these questions.

Resources for enriching content knowledge:

- AP Daily videos in AP Classroom are available for every topic in AP Environmental Science. Teachers can use these to provide students with additional exposure to content throughout the course.

- To coach students in identifying and articulating realistic solutions to environmental problems, teachers might consider a project based learning approach (PBL). For instructors new to the PBL approach, the College Board has developed a yearlong sequence of PBL modules specifically designed for AP Environmental Science. For more information, visit https://apcentral.collegeboard.org/professional-learning or contact approjectbasedlearning@collegeboard.org.

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