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: Nonnative Plants and the Chickadee Food Web

	Max Points:	Mean Score:
Point 1	1	0.62
Point 2	1	0.58
Point 3	1	0.88
Point 4	1	0.84
Point 5	1	0.45
Point 6	1	0.34
Point 7	1	0.48
Point 8	1	0.23
Point 9	1	0.28
Point 10	1	0.65

Overall Mean Score: 5.35

What were the responses to this question expected to demonstrate?

The intent of this question was for students to demonstrate their knowledge of reproductive strategies and food chain relationships using chickadees as an example. Students were asked to interpret graphical data from a scientific study relating chickadee, spider, and insect populations with the percentage of nonnative plants. A scientific experiment was introduced involving ant species' richness and habitat. Students were expected to identify components of the experiment and predict the results of a change in the experimental design by explaining the link between species richness and habitat disturbance. Finally, students were asked to apply the concept of habitat fragmentation by describing the effect of building roads on forest species, such as deer or bears.

In part A students were asked to describe a reproductive strategy used by K-selected species [Science Practice 1: Concept Explanation and Topic 3.2: K-Selected r-Selected Species].

In part B students were asked to interpret a food chain and use it to explain how the decrease in a predator species would affect the lower trophic levels shown in that food chain [Science Practice 1: Concept Explanation and Science Practice 2: Visual Representations; Topic 1.9: Trophic Levels and Topic 1.11: Food Chains and Food Webs].

In parts C, D, and E, students were asked to read two graphs, one showing how insect and spider populations varied in relation to the percentage of nonnative plants in the study sites, and one showing how chickadee reproduction rates varied in relation to the percentage of nonnative plants. In part C students had to read the graph and identify the number of spiders present at a certain percentage of nonnative plants. In part D they had to describe the inverse relationship between the number of insects and the percentage of nonnative plants on the graph [Science Practice 5: Data Analysis]. In part E students were expected to describe how the data supported a specific hypothesis about the relationship between the percentage of nonnative plants and chickadee population growth [Science Practice 5: Data Analysis and Topic 3.5: Population Growth and Resource Availability].

In parts F and G, students were provided with a description of a scientific experiment about ant biodiversity in two different sites—a frequently mowed urban park and an unmowed grassland. Part F asked students to identify the scientific research question (F (i)) and to identify the dependent variable (ant species richness) in the experiment (F (ii)) [Science Practice 4: Scientific Experiments and Topic 2.1: Introduction to Biodiversity].

Part G asked students to interpret the provided results and apply them to different scenarios. Part G (i) expected students to recognize that the grassland ant community was more diverse and explain why that made it more likely to recover from a disturbance [Science Practice 1: Concept Explanation and Science Practice 5 Data Analysis; Topic 2.1: Introduction to Biodiversity and Topic 2.6 Adaptations]. Part G (ii) asked students to explain how the results of the experiment would be different if the study had been conducted in a paved playground rather than an unmowed grassland [Science Practice 4: Scientific Experiments; Topic 2.1: Introduction to Biodiversity and Topic 9.10: Human Impacts on Biodiversity].

Part H asked students to consider habitat fragmentation and describe one effect a paved road in a forest can have on animal species [Science Practice 1: Concept Explanation and Topic 9.10: Human Impacts on Biodiversity].

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 describe reproductive strategies, such as providing considerable parental care or having few offspring, while some did not provide enough detail and others described nonreproductive traits.

- In part B responses that earned a point described the direction of change of a specific lower trophic level from the provided food chain diagram (e.g., “the insect population would decrease”) and explained why that change would occur. Students that described the expected change in a lower trophic level species but did not explain why that change would occur did not earn the point.

- In part C most students were able to correctly identify the number of spiders at 25% nonnative plants as 2.0.

- In part D most students were able to describe that as the percentage of nonnative plants increased, the number of insects decreased.

- In part E many students struggled to describe that below 25% nonnative plants, the chickadee population growth rate was at or above replacement level, which supports the hypothesis.

- Part F required students to employ Science Practice 4: Scientific Experiments. Many struggled to correctly identify the scientific question for the described investigation in part F (i). Some responses provided a hypothesis or misidentified the experimental variables in the question. In part F (ii) responses were more successful at earning the point. Students correctly identified the dependent variable as the number of ant species or ant species richness. Some students incorrectly referred to just the number of ants.

- In part G, many students struggled to explain how greater biodiversity in the grassland ant community would cause the community to be more likely to recover from a disturbance in part G (i). Simply stating the grassland was more diverse without providing a mechanism for recovery was not sufficient to earn the point. In part G (ii) most correct responses explained that there would be fewer ant species on the paved playground because impermeable pavement is not a suitable habitat. Students that earned the point articulated a clear link between a directional change in the number of species ("there would be fewer ant species") and the cause of that change ("because impermeable pavement is not a suitable habitat"). Responses that did not earn the point contained a causal variable but did not articulate the relationship between that variable and the expected impact on ant species diversity. Some incorrect responses also conflated the number of species with the number of individuals, or population size.

- In part H most students successfully described that animals would get hit by cars or that the road could prevent animals from accessing either resources or other populations of their species.

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 E students frequently provided either a single data point at 25% nonnative plants or described the chickadee negative population growth rate with more than 25% nonnative plants.	• "One way that the data supports this is that the chickadee population growth rate was above replacement level when the amount of nonnative plants was below 25%. If the population is above replacement level then the population would be stable or growing."
• In part F (i) students often misunderstood the relationship between variables in the described experiment or only referred to them in very vauge terminology, like "human interference."	• "How is ant biodiversity affected by the frequent mowing of grassy fields?"
• In parts F (ii) and G (ii) students frequently conflated number of ant species with number of ants (ant population size).	• "The results of the investigacion could have been different as a paved playground would likely have even less species richness. This would be due to the fact that there is less vegetation and shelters for the different species of ants to survive any distruption like rain, predators, and humans running around."

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 for the relevant characteristics of a specified topic. The *explain* task verb asks that students articulate the relationship between relevant variables, often in the form of a cause-and-effect statement.

- Often population reproduction strategies such as K- and r-strategies are taught at the same time as population survivorship curves. Clearly distinguish between these two sets of characteristics, so that students understand the nuances of each.

- The skills in Science Practice 4: Scientific Experiments should be practiced often in class. Students should have the opportunity to practice developing their own experiments with clearly identified independent variables, dependent variables, and controls. They also should practice identifying these concepts from written descriptions of experiments to prepare them for this portion of the question.

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

- Students should be reminded to avoid using vague terms such as "human interaction." Similarly, descriptions of changes should be accompanied by direction of change whenever possible. In many contexts, "ant species richness will be altered" is an incomplete response. More specific responses such as "ant species richness will decrease" are more likely to earn the point.

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.

- Examples of FRQ 1 from recent Environmental Science Exams are available for students to practice, score, and review. The most recent exams can be found on the exam information page on AP Central, while FRQs from older exams can be found in AP Classroom. Student samples and scoring guidelines are also available for exams posted on AP Central.

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 videos to provide students with additional exposure to content throughout the course. To review concepts of biodiversity and resilience, teachers can reference Unit 2 AP Daily videos, such as 2.1, 2.2, and 2.3.

- 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. For example, Lab 2: An Investigation of Species Diversity engages students in a hands-on study of the concept and importance of biodiversity.

- Teachers can 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 topics of discussion 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 an 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: Precipitation Patterns Under La Niña

	Max Points:	Mean Score:
Point 1	1	0.51
Point 2	1	0.27
Point 3	1	0.61
Point 4	1	0.52
Point 5	1	0.61
Point 6	1	0.42
Point 7	1	0.17
Point 8	1	0.36
Point 9	1	0.59
Point 10	1	0.27

Overall Mean Score: 4.34

What were the responses to this question expected to demonstrate?

This question focused broadly on global climate patterns, including La Niña. Students were also asked about related environmental problems, including flooding, drought, and forest fires.

In parts A and B students were asked to identify that the sea surface condition was cooler than average from the given figure [Science Practice 2: Visual Representations]. In addition, students were asked to identify the climate phenomenon that was associated with the stronger than normal trade winds and cooler than average sea surface conditions [Science Practice 2: Visual Representations and Topic 4.9: El Niño and La Niña].

In part C students were asked to use a second labeled figure to describe differences in climate patterns on two specific locations on the figure [Science Practice 2: Visual Representations].

In part D students were asked to describe why urban areas were more prone to flooding during extended precipitation events [Science Practice 1: Concept Explanation and Topic 5.10: Impacts of Urbanization].

In parts E and F students were asked to propose a realistic solution that the city could implement to decrease the risk of flooding in urban areas and then to justify the solution that they proposed in part E with an additional advantage other than reduction in the risk of flooding [Scientific Practice 7: Environmental Solutions and Topic 5.13: Methods to Reduce Urban Runoff].

In part G students were asked to describe one difference between the climate of a temperate seasonal forest and that of a savanna [Science Practice 1: Concept Explanation and Topic 1.2: Terrestrial Biomes].

In part H students were asked to identify the ecological process that occurs following a forest fire [Science Practice 1: Concept Explanation and Topic 2.7: Ecological Succession].

In part I students were asked to describe one way that burning forests contributes to atmospheric pollution [Science Practice 7: Environmental Solutions and Topic 6.7: Energy from Biomass].

In part J students were asked to describe one sustainable forestry practice that could be used to reduce the occurrence or severity of forest fires [Science Practice 7: Environmental Solutions and Topic 5.17: Sustainable Forestry].

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 from the figure that the ocean water was cooler than average.

- In part B responses that earned a point identified La Niña as the climate phenomenon shown in the figure. Many students incorrectly identified El Niño instead of La Niña.

- Responses in part C correctly interpreted information on the map, describing that Region A had an increased chance of precipitation and that Region B had a decreased chance of precipitation. Responses needed to include both regions in the comparison to earn this point.

- Responses that earned a point in part D described that permeable surfaces increased runoff/decreased absorption. Many students only identified permeable surfaces without describing how the surface type impacted flooding, thus not earning this point.

- In part E most students proposed the use of permeable pavement or building green roofs. Students were challenged by this question in that their solution needed to be realistic. For example, many responses that did not earn this point proposed gravel, which is not realistic road-building material in cities, to replace impermeable surfaces.

- In part F students were asked to justify the solution they proposed in part D with an additional benefit. Students who earned this point most often stated that permeable pavement would increase groundwater recharge or that vegetation on the green roof stored carbon dioxide/produced oxygen.

- Students who earned a point in part G most often described the temperate seasonal forests as having a cooler climate than savannas. Students were challenged by this question because many responses described savannas as areas with no precipitation/extremely dry.

- In part H students earned the point by by correctly identifying secondary succession as the ecological process that occurred after a forest fire.

- Most students were able to correctly describe an atmospheric pollutant, such as carbon dioxide or particulate matter, that is associated with burning trees in part I. Many students who did not earn this point contradicted their understanding of carbon dioxide by stating that carbon dioxide destroys the ozone layer.

- In part J most students correctly described how prescribed burns removed dead leaves and brush, which helpes reduce the severity of forest fires. Stating that prescribed burns reduce the severity of forest fires without articulating why did not earn a point.

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 students struggled to identify the correct climate phenomenon. Students most frequently answered El Niño.	• "La Niña"
• In part D many students only identified impermeable surfaces without describing how the surface related to the increased risk of flooding.	• "Urban areas have a lot lower infliltration rate due to there being many concrete roads/sidewalks that don't allow water to go through and into the ground."
• In part E some students proposed unrealistic solutions to the risk of flooding, such as replacing pavement/surfaces with gravel or sand. Some students also suggested making buildings themselves more permeable.	• "A realistic solution a city could implement to decrease the risk of flooding in urban areas is replacing paved roads with more permeable roads."
• In part G students had difficulty correctly recalling the precipitation characteristics of the savanna and the temperature seasonal forest in order to describe a difference.	• "A temperate seasonal forest recieves more consistent rainfall yearound as opposed to a savanna which experiences a wet and a dry season."

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?

- Students should frequently be presented with environmental issues in which they can practice providing realistic environmental solutions (Science Practice 7). It is also important for students to evaluate if their solutions are realistic within the parameters of the setting provided.

- Give students regular opportunities to interpret diagrams and graphs during class activities and assessments to build their skill level in analyzing visual representations (Science Practice 2). Students should be evaluated based on the information provided in the visual representation—not content knowledge they may have.

- Provide students with ample opportunities to use vocabulary. In many instances students attempted to use vocabulary they thought might be interchangeable for another term (e.g., watershed and aquifer). Scientific terminology is exact, and students should understand and be able to articulate differences between terms used in the course framework.

- Advise students to carefully proofread their responses before submitting. While some misspellings might not affect scoring, others can potentially change the meaning of a response, rendering it incorrect. For example, using the word "admit" in place of "emit" can reverse the meaning of a sentence.

- Because this year was the first year of digital testing for AP Environmental Science, many students wrote responses in "textspeak"; for example, typing "bc" in place of "because." As a result, their responses were often incomplete or incoherent. Remind students that a more formal writing style will ensure that their answers are clear and coherent.

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 El Niño and La Niña, teachers can reference AP Daily videos for Topic 4.9.
    - To review characteristics of terrestrial biomes, teachers can reference AP Daily videos for Topic 1.2.

- To coach students in identifying and articulating realistic solutions to environmental problems, 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.

- 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 topics of discussion 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 an 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 3

Task: Analyze an Environmental Problem and Propose a Solution Using Calculations
Topic: Air Pollution and Motor Vehicles

	Max Points:	Mean Score:
Point 1	1	0.54
Point 2	1	0.09
Point 3	1	0.19
Point 4	1	0.41
Point 5	1	0.45
Point 6	1	0.65
Point 7	1	0.68
Point 8	1	0.34
Point 9	1	0.56
Point 10	1	0.55

Overall Mean Score: 4.47

What were the responses to this question expected to demonstrate?

The intent of this question was for students to apply mathematical skills to analyzing and proposing solutions for environmental problems. Students were expected to demonstrate an understanding of air pollution associated with motor vehicles, and energy use in a school building. The question also included mathematical routines, as students were asked to calculate differences in gas mileage between hybrid and gasoline-powered vehicles, and energy savings in a school switching to LED bulbs.

In part A students were asked to identify an anthropogenic source of particulate matter (PM) air pollution other than from motor vehicles [Science Practice 1: Concept Explanation and Topic 7.4: Atmospheric CO_2 and Particulates].

In part B students were asked to describe how a vapor recovery nozzle reduces atmospheric pollution [Science Practice 7: Environmental Solutions and Topic 7.6: Reduction of Air Pollutants].

In part C students were asked to explain how an increase in people working from home and fewer people commuting to work in personal vehicles could lead to a reduction in acid rain [Science Practice 1: Concept Explanation and Topic 7.7: Acid Rain].

Part D asked students to calculate the percentage change in gas mileage if a commuter sold a gasoline-powered vehicle and replaced it with a hybrid SUV [Science Practice 6: Mathematical Routines and Topic 6.3: Fuel Types and Uses].

In part E students were asked to calculate how many more miles the commuter can drive in the hybrid SUV in the city than they could have driven in the gasoline-powered car [Science Practice 6: Mathematical Routines and Topic 6.3: Fuel Types and Uses].

In part F students were asked to propose a realistic solution that schools could implement to decrease energy use for heating or cooling, other than reducing the amount of time the school building is occupied [Science Practice 7: Environmental Solutions and Topics 5.10: Impacts of Urbanization and 6.3: Fuel Types and Uses].

In part G students calculated the energy use in the school building in kilowatts per year using LED light bulbs [Science Practice 6: Mathematical Routines and Topics 6.2: Global Energy Consumption, 6.8: Solar Energy, 6.10: Geothermal Energy, and 6.13: Energy Conservation].

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 an anthropogenic source of particulate matter (PM) including "combustion of coal/fossil fuels," "construction," and "industrial exhaust."
- Some students in part B earned the point by describing that vapor recovery nozzle traps/captures vapor, fumes, or VOCs from gasoline "when pumping gas into a car." Some students incorrectly indicated that the vapor recovery nozzle traps/captures fumes "from vehicle emissions."
- In part C some students were able to explain that more people working from home would "reduce NOx and/SOx in the atmosphere," which reduces acid rain. Some students indicated that more people working from home reduces VOC or PM, which is true, but did not earn a point because these pollutants do not contribute to acid rain.
- In part D most students were able to correctly calculate the percent change in mileage when switching from a gasoline-powered SUV to a hybrid SUV.
- In part E most students were able to correctly calculate how many more miles the hybrid SUV can drive than the gasoline powered vehicle.
- In part F many students were able to propose a realistic solution that schools could implement to reduce energy use for heating and cooling. Some students proposed passive solar heating, including south facing windows, dark-colored roofs, or adjusting the thermostat to reduce energy use for heating. Students also correctly proposed planting shade trees or using light-colored roofs to reduce energy use for cooling.
- In part G many students were able to correctly calculate the energy use in the school building using LED light bulbs.

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 many students incorrectly state that a vapor recovery nozzle captures vehicle emissions.	• "A vapor recovery nozzle is used at gas stations to reduce atmospheric pollution by capturing gasoline vapors that would otherwise escape into the air during refueling. When refueling a vechiles tank, the nozzle collects the vapors and routes them back into an underground storage tank or vapor recovery system, which prevents them from being released into the atmosphere."
• In part C some students incorrectly identified emissions other than NOx or SOx as primary pollutants that contribute to acid rain formation.	• "A decrease in people commuting to work in their personal vehicles would decrease the amount of nitrogen oxides released into the atmosphere, which combine with water vapor and form the secondary pollutant of acid rain."
• In part C some students overlooked "working from home" and "less people commuting" in the prompt stem and incorrectly replied that more people are commuting on public transportation or carpooling.	• "When less people are driving motor vehicles and commuting to work, this means less SO2 is emitted into the atmosphere, which lowers the amount of acid rain."
• In part D many students did not use parentheses to establish the correct order of operations. They submitted the correct answer but did not show a correct setup indicating that they subtracted 22 from 36 before dividing by 22. Some students did not show that they multiplied the decimal answer by 100 to reflect a percent change.	• "(36 mpg - 22 mpg) / (22 mpg) x 100 = 63.63636364 = 64%"

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?

- Many students did not earn points related to content knowledge from Unit 7: Atmospheric Pollution. The nuances of atmospheric pollution—sources, types, and impacts of different pollutants—can be challenging. Encourage students to spend time with this material so that they can better express their understanding of the types and dynamics of atmospheric pollutants.

- Provide plenty of time for students to practice the various math skills outlined in the Science Practice 6: Mathematical Routines, including dimensional analysis and percent change calculations.

- Units are not required to earn setup points on the exam; however, students who did not use units tended to not earn points for the math portion of the exam. It is highly recommended that students be taught and given opportunities to practice dimensional analysis with unit cancellation. This improves their chances of arriving at the correct answer and is a key skill for solving more complex mathematical problems.

- Coach students to proofread mathematical operations, including the use of parentheses, to ensure that calculations reflect the correct order of operations.

- If reporting a unit with their response, students should carefully proofread to ensure that the reported unit aligns with the prompt stem.

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:

- Teachers can 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.

- Teachers can have students practice typing examples of mathematical operations from FRQ 3 on released AP Environmental Science Exams. Students can then review and score each other's responses to learn best practices. Released questions from recent exams can be found on the exam information page on AP Central, while released questions from older exams are in 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 review aspects of atmospheric pollution, consider assigning AP Daily videos from Unit 7.

- To coach students in identifying and articulating realistic solutions to environmental problems, teachers can consider a project based learning approach (PBL). For instructors new to the PBL approach, the College Board has developed a year-long 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 topics of discussion 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 an 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.