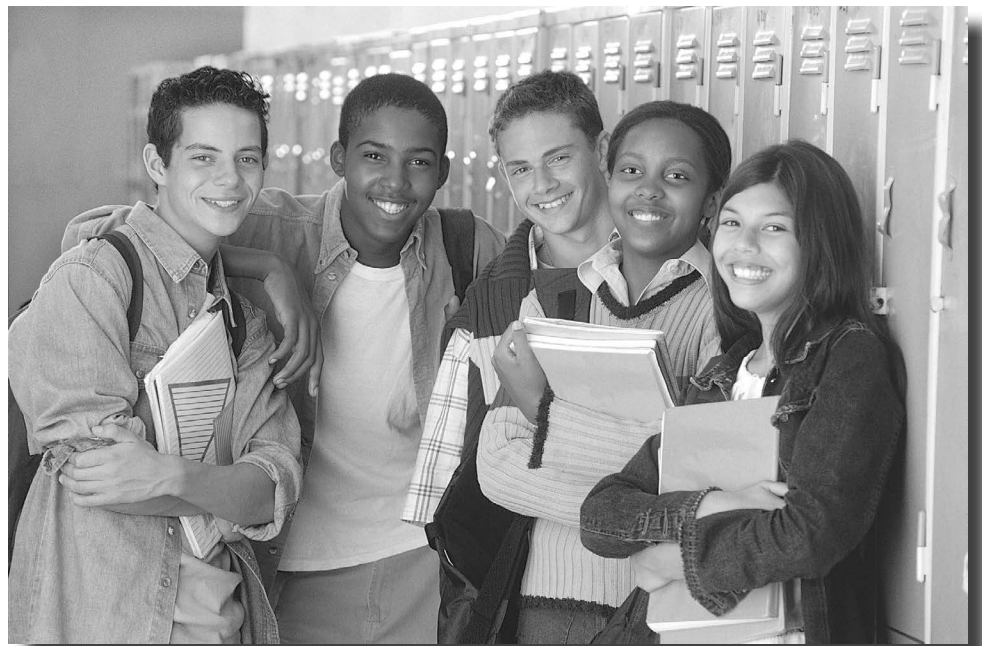




pennsylvania
DEPARTMENT OF EDUCATION

The Pennsylvania System of School Assessment

Science Item and Scoring Sampler



2023–2024
Grade 8

INFORMATION ABOUT SCIENCE

Introduction 1

 General Introduction 1

 What Is Included 1

 Purposes and Uses 1

 Item Format and Scoring Guidelines 2

 Testing Time and Mode of Testing Delivery for the PSSA. 2

 Item and Scoring Sampler Format 3

PSSA SCIENCE GRADE 8

Science Test Directions 4

 General Description of Scoring Guidelines for Science Open-Ended Items 5

Multiple-Choice Questions. 6

Open-Ended Item. 22

 Item-Specific Scoring Guideline 23

Open-Ended Item. 32

 Item-Specific Scoring Guideline 33

Sample Item Summary. 38

INTRODUCTION

General Introduction

The Pennsylvania Department of Education (PDE) provides districts and schools with tools to assist in delivering focused instructional programs aligned with the Pennsylvania Academic Standards (PAS). These tools include Academic Standards, Assessment Anchors and Eligible Content (AAEC) documents, assessment handbooks, and content-based item and scoring samplers. This Item and Scoring Sampler is a useful tool for Pennsylvania educators in preparing local instructional programs by providing samples of test item types and scored student responses. The item sampler is not designed to be used as a pretest, a curriculum, or any other benchmark for operational testing.

This Item and Scoring Sampler is available in Braille format. For more information regarding Braille, call (717) 901-2238.

What Is Included

This sampler contains test questions, or test “items,” that have been written to align to the Assessment Anchors that are based on the PAS. The sample test questions model the types of items that may appear on an operational PSSA. Each sample test question has been through a rigorous review process to ensure alignment with the Assessment Anchors prior to being piloted in an embedded field test within a PSSA assessment and then used operationally on a PSSA assessment. Answer keys, scoring guidelines, and any related stimulus material are also included. Additionally, sample student responses are provided with each open-ended (OE) item to demonstrate the range of responses that students provided in response to these items.

Purposes and Uses

The items in this sampler may be used¹ as examples for creating assessment items at the classroom level. Classroom teachers may find it beneficial to have students respond to the open-ended items in this sampler. Educators may then use the sampler as a guide to score the responses either independently or together with colleagues within a school or district. This sampler also includes the *General Description of Scoring Guidelines for Science Open-Ended Items* that students will have access to during a PSSA science administration. The general description of scoring guidelines may be distributed to students for use during local assessments and may also be used by educators when scoring local assessments.

¹ The permission to copy and/or use these materials does not extend to commercial purposes.

Item Format and Scoring Guidelines

The multiple-choice (MC) items have four answer choices. Each correct response to an MC item is worth one point.

Each open-ended (OE) item in science is scored using an item-specific scoring guideline based on a 0–2-point scale.

Testing Time and Mode of Testing Delivery for the PSSA

The PSSA is delivered in a traditional paper-and-pencil format as well as in an online format. The estimated time to respond to a test question is the same for both methods of test delivery. The following table shows the estimated response time for each item type.

| Science Item Type | MC | OE |
|--------------------------------------|-----------|-----------|
| Estimated Response Time (minutes) | 1 | 5 |

During an official test administration, students are given as much additional time as is necessary to complete the test questions.

Item and Scoring Sampler Format

This sampler includes the test directions and scoring guidelines that appear in the PSSA science assessments. Each MC item is followed by a table that includes the alignment, the answer key, the depth of knowledge (DOK) level, the percentage² of students who chose each answer option, and a brief answer-option analysis or rationale. Each OE item is followed by a table that includes the item alignment, DOK level, and mean student score. Additionally, each of the included item-specific scoring guidelines is combined with sample student responses representing each score point to form a practical item-specific scoring guide. The *General Description of Scoring Guidelines for Science Open-Ended Items* used to develop the item-specific scoring guidelines should be used if any additional item-specific scoring guidelines are created for use within local instructional programs. The student responses in this item and scoring sampler are actual student responses; however, the handwriting has been changed to protect the students' identities and to make the item and scoring sampler accessible to as many people as possible.

Example Multiple-Choice Item Information Table

| Item Information | |
|--------------------|--|
| Alignment | Assigned AAEC |
| Answer Key | Correct Answer |
| Depth of Knowledge | Assigned DOK |
| p-value A | Percentage of students who selected option A |
| p-value B | Percentage of students who selected option B |
| p-value C | Percentage of students who selected option C |
| p-value D | Percentage of students who selected option D |
| Option Annotations | Brief answer-option analysis or rationale |

Example Open-Ended Item Information Table

| Alignment | Assigned AAEC | Depth of Knowledge | Assigned DOK | Mean Score | Average Score |
|-----------|---------------|--------------------|--------------|------------|---------------|
|-----------|---------------|--------------------|--------------|------------|---------------|

² All p-value percentages listed in the item information tables have been rounded.

SCIENCE TEST DIRECTIONS

Directions:

On the following pages are the Science questions. There are two types of questions.

Multiple-Choice Questions:

Some questions will ask you to select an answer from among four choices. These questions will be found in your test booklet.

For the multiple-choice questions:

- Read each question, and choose the best answer.
- Record your choice in the answer booklet.
- Only one of the answers provided is the correct response.

Open-Ended Questions:

Other questions will require you to write your response. These questions will be found in your answer booklet.

For the open-ended questions:

- Be sure to read the directions carefully.
- If the question asks you to do two tasks, be sure to complete both tasks.
- If the question asks you to compare, be sure to compare. Also, if the question asks you to explain, describe, or identify, be sure to explain, describe, or identify.

General Description of Scoring Guidelines for Science Open-Ended Items

2 Points

- The response demonstrates a *thorough* understanding of the scientific content, concepts, and procedures required by the task(s).
- The response provides a clear, complete, and correct response as required by the task(s). The response may contain a minor blemish or omission in work or explanation that does not detract from demonstrating a *thorough* understanding.

1 Point

- The response demonstrates a *partial* understanding of the scientific content, concepts, and procedures required by the task(s).
- The response is somewhat correct with *partial* understanding of the required scientific content, concepts, and/or procedures demonstrated and/or explained. The response may contain some work that is incomplete or unclear.

0 Points

- The response provides *insufficient* evidence to demonstrate any understanding of the scientific content, concepts, and procedures as required by the task(s) for that grade level.
- The response may show only information copied or rephrased from the question or *insufficient* correct information to receive a score of 1.

MULTIPLE-CHOICE QUESTIONS

1. Which question could **best** be investigated using scientific inquiry?
- A. When do most people plant flower gardens?
 - B. Which color of flowers do people like to grow in their gardens?
 - C. How many flowering plants have become extinct throughout Earth's history?
 - D. How does the amount of sunlight received affect the growth of flowering plants?

| Item Information | |
|--------------------|---|
| Alignment | S8.A.1.1.2 |
| Answer Key | D |
| Depth of Knowledge | 2 |
| p-value A | 8% |
| p-value B | 8% |
| p-value C | 20% |
| p-value D | 64% (correct answer) |
| Option Annotations | <p>A. People plant gardens at different times around the world. This question is best answered with a survey.</p> <p>B. Color preference is subjective. This question is best answered with a survey.</p> <p>C. This question is best answered through historical research.</p> <p>D. Key: This question is best answered with a scientific hypothesis and investigation.</p> |

2. Which unintended effect could result from overusing chemical pesticides to control insects on agricultural crops?
- A. crops producing their own chemical pesticides
 - B. insect pests switching to a different food source
 - C. crops requiring more water and nutrients to survive
 - D. insect pests becoming resistant to certain pesticides

| Item Information | |
|--------------------|---|
| Alignment | S8.A.1.2.1 |
| Answer Key | D |
| Depth of Knowledge | 2 |
| p-value A | 15% |
| p-value B | 13% |
| p-value C | 32% |
| p-value D | 40% (correct answer) |
| Option Annotations | <p>A. Applying chemical pesticides is unlikely to cause crops to produce their own chemical pesticides.</p> <p>B. An intended goal of using chemical pesticides is to protect plants from insect pests, and insects are unlikely to seek a different food source.</p> <p>C. Crops protected by pesticides are likely to require less water and nutrients because the plants are not stressed by insect pests.</p> <p>D. Key: Studies have shown that insect populations can adapt and become resistant to certain pesticides.</p> |

3. A family adopts a pet dog from the local animal shelter. The family does not know the breed of the dog. To help determine the breed, the family compares the traits of the dog to the traits of known dog breeds. The family concludes that the dog’s parents were two different breeds. Which scientific concept did the family **most likely** use to form this conclusion?
- A. natural selection
 - B. Newton’s first law
 - C. Mendelian genetics
 - D. the theory of evolution

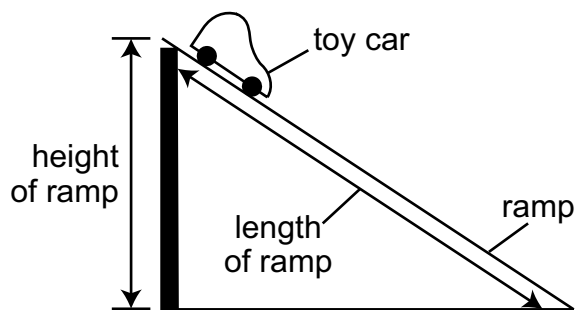
| Item Information | |
|--------------------|---|
| Alignment | S8.A.1.2.3 |
| Answer Key | C |
| Depth of Knowledge | 2 |
| p-value A | 18% |
| p-value B | 7% |
| p-value C | 63% (correct answer) |
| p-value D | 12% |
| Option Annotations | <p>A. Natural selection favors traits that help an organism survive and does not determine breeds.</p> <p>B. Newton’s laws describe rules of physical motion and force.</p> <p>C. Key: The concept of Mendelian genetics describes how the traits of parents can determine traits in offspring.</p> <p>D. Dog breeds are the result of selective breeding, not evolution.</p> |

4. Fires are common in grassland ecosystems. Dead grasses and small shrubs that accumulate on the ground provide an excellent source of fuel for the fires. Which statement describes how grassland ecosystems benefit from periodic fires?
- A. Ash left over from fires provides plants with additional nutrients.
 - B. Fires reduce ground cover, which creates new habitats for nonnative organisms.
 - C. The darker color of burned plant material is able to absorb more energy from sunlight.
 - D. The increased temperatures allow soil bacteria populations to remain active during winter.

| Item Information | |
|--------------------|--|
| Alignment | S8.A.1.3.4 |
| Answer Key | A |
| Depth of Knowledge | 2 |
| p-value A | 39% (correct answer) |
| p-value B | 26% |
| p-value C | 15% |
| p-value D | 20% |
| Option Annotations | <p>A. Key: Nutrients from the burned matter are stored in the ash, which is used by younger plants to promote regrowth.</p> <p>B. Nonnative organisms can be harmful to a grassland ecosystem.</p> <p>C. Burned plant material will not be able to perform photosynthesis, and any increase in temperature because of its darker color will not be helpful to the environment.</p> <p>D. Temporary increased temperatures from a fire are unlikely to affect soil bacteria populations during the winter months.</p> |

5. Use the diagram below to answer the question.

Ramp Height Investigation

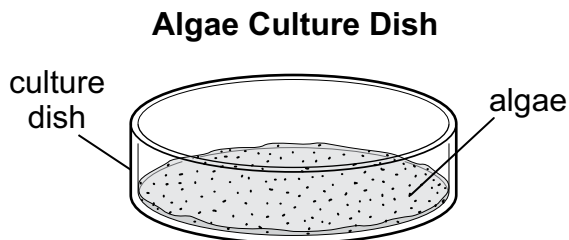


In a science class, students release the same toy car down four different ramps. Each ramp has the same length but a different height. Which dependent variable could be measured to find out how the ramp height affects the car?

- A. mass of each ramp
- B. length of each ramp
- C. weight of the car when it reaches the bottom of each ramp
- D. distance the car rolls after it reaches the bottom of each ramp

| Item Information | |
|--------------------|--|
| Alignment | S8.A.2.1.3 |
| Answer Key | D |
| Depth of Knowledge | 2 |
| p-value A | 9% |
| p-value B | 21% |
| p-value C | 12% |
| p-value D | 58% (correct answer) |
| Option Annotations | <p>A. The mass of the ramp itself will have no effect on how the ramp’s height affects the car.</p> <p>B. The length of the ramp is a controlled variable in the experiment.</p> <p>C. The weight of the car will not change based on its position on the ramp and should be kept constant during the investigation.</p> <p>D. Key: The distance the car rolls after reaching the end of the ramp depends on the height of the ramp.</p> |

6. Use the drawing below to answer the question.



A researcher hypothesizes that a specific temperature is optimal for the growth of a type of algae. To test this hypothesis, the researcher grew algae in culture dishes each kept at a different temperature. The data collected from which measurements would be needed to support the hypothesis?

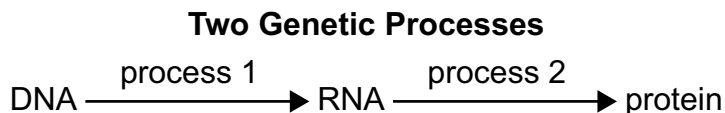
- A. the initial and final mass of the algae colony
- B. the initial and final volume of the culture dish
- C. the initial and final surface area of the culture dish
- D. the initial and final temperature of the algae colony

| Item Information | |
|--------------------|---|
| Alignment | S8.A.2.1.5 |
| Answer Key | A |
| Depth of Knowledge | 2 |
| p-value A | 42% (correct answer) |
| p-value B | 16% |
| p-value C | 13% |
| p-value D | 29% |
| Option Annotations | <p>A. Key: Measuring the difference between the initial and final masses of the algae would show how much growth occurred.</p> <p>B. The volume of the culture dish would not change during this experiment; it is a controlled variable.</p> <p>C. The surface area of the culture dish would not change during this experiment; it is a controlled variable.</p> <p>D. Temperature is the independent variable and is manipulated in this experiment.</p> |

7. A student is measuring the volume of a rectangular object. Which two tools could the student use to measure the volume of the object?
- A. beaker or microscope
 - B. thermometer or stopwatch
 - C. ruler or graduated cylinder
 - D. balance scale or hand lens

| Item Information | |
|--------------------|--|
| Alignment | S8.A.2.2.1 |
| Answer Key | C |
| Depth of Knowledge | 1 |
| p-value A | 7% |
| p-value B | 6% |
| p-value C | 65% (correct answer) |
| p-value D | 22% |
| Option Annotations | <p>A. A beaker filled with water could provide an estimated change in volume, but a microscope magnifies the image of an object.</p> <p>B. A thermometer measures temperature, and a stopwatch measures time. Neither can be used to measure volume.</p> <p>C. Key: A ruler could measure the rectangle’s three sides, and a graduated cylinder could measure the volume of water displaced by the object.</p> <p>D. A balance scale measures mass, and a hand lens magnifies the image of an object. Neither can be used to measure volume.</p> |

8. Use the diagram below to answer the question.



The diagram shows two genetic processes. Which statement **best** describes one of the processes shown?

- A. RNA is the input of process 1.
- B. Protein is the output of process 2.
- C. Process 1 is a feedback mechanism.
- D. Process 2 is a feedback mechanism.

| Item Information | |
|--------------------|---|
| Alignment | S8.A.3.1.3 |
| Answer Key | B |
| Depth of Knowledge | 2 |
| p-value A | 12% |
| p-value B | 63% (correct answer) |
| p-value C | 13% |
| p-value D | 12% |
| Option Annotations | <p>A. RNA is the input of process 2 and the output of process 1.</p> <p>B. Key: The right-facing arrow from RNA to protein indicates that protein is the output of process 2.</p> <p>C. Process 1 consists of an input (DNA) directly affecting an output (RNA). The diagram does not indicate any feedback loop in which the output influences the input.</p> <p>D. Process 2 consists of an input (RNA) directly affecting an output (protein). The diagram does not indicate any feedback loop in which the output influences the input.</p> |

9. Which list correctly shows characteristics of fungi and animals?
- A. Fungi: have a cell wall, break down dead organisms
Animals: have no cell wall, feed on other organisms
 - B. Fungi: have a cell wall, feed on other organisms
Animals: have a cell wall, make food from sunlight
 - C. Fungi: have no cell wall, make food from sunlight
Animals: have a cell wall, feed on other organisms
 - D. Fungi: have no cell wall, make food from sunlight
Animals: have no cell wall, break down dead organisms

| Item Information | |
|--------------------|---|
| Alignment | S8.B.1.1.3 |
| Answer Key | A |
| Depth of Knowledge | 2 |
| p-value A | 51% (correct answer) |
| p-value B | 9% |
| p-value C | 34% |
| p-value D | 6% |
| Option Annotations | <p>A. Key: Fungi do have cell walls and are decomposers; animal cells lack a cell wall and are consumers.</p> <p>B. Fungi do not eat to consume nutrients; animal cells lack a cell wall and do not perform photosynthesis to get energy.</p> <p>C. Fungi do not perform photosynthesis to get energy; animal cells lack a cell wall.</p> <p>D. Fungi have cell walls but do not perform photosynthesis to get energy; animals consume other organisms and are not decomposers.</p> |

10. A student observes a large amount of fallen tree leaves on the school grounds. Which solution for cleaning up the leaves would have the **most** positive impact on the environment?
- A. piling the leaves to burn them
 - B. piling the leaves to compost them
 - C. raking the leaves into plastic bags to store them
 - D. raking the leaves into trucks to transport them to a landfill

| Item Information | |
|--------------------|---|
| Alignment | S8.B.3.3.3 |
| Answer Key | B |
| Depth of Knowledge | 2 |
| p-value A | 6% |
| p-value B | 69% (correct answer) |
| p-value C | 12% |
| p-value D | 13% |
| Option Annotations | <p>A. Burning the leaves would add air pollution to the environment.</p> <p>B. Key: Composting the leaves would allow for the natural decomposition of plant matter and would recycle nutrients back to the soil.</p> <p>C. Using plastic bags would introduce new waste that does not easily break down in the environment.</p> <p>D. Using trucks to transport the leaves to a landfill would require burning fossil fuels, which adds pollution to the atmosphere.</p> |

11. Use the chart below to answer the question.

Examples of Energy Sources

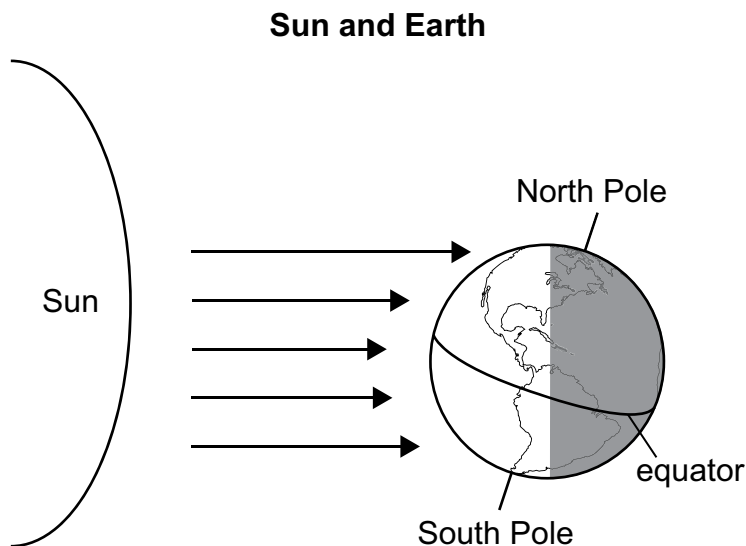
| Renewable | Nonrenewable |
|------------|--------------|
| solar | uranium |
| wind | coal |
| geothermal | hydropower |

A student made a chart to compare energy sources. Which energy source was **incorrectly** placed in the chart?

- A. coal
- B. uranium
- C. geothermal
- D. hydropower

| Item Information | |
|--------------------|---|
| Alignment | S8.C.2.1.1 |
| Answer Key | D |
| Depth of Knowledge | 2 |
| p-value A | 20% |
| p-value B | 13% |
| p-value C | 14% |
| p-value D | 53% (correct answer) |
| Option Annotations | <p>A. Coal is correctly listed as nonrenewable because it cannot be replenished naturally in a short period of time.</p> <p>B. Uranium is correctly listed as nonrenewable because it cannot be replenished naturally in a short period of time.</p> <p>C. Geothermal is correctly listed as renewable because heat energy is constantly generated beneath Earth’s crust.</p> <p>D. Key: Hydropower should be listed as a renewable energy source because it relies on the movement of water in the water cycle, which is powered by energy from the Sun.</p> |

12. Use the diagram below to answer the question.



Polar areas of Earth receive lower levels of direct sunlight than other areas on the planet. Which statement **best** describes how the lower levels of direct sunlight affect the environment in polar areas?

- A. Polar areas have a cold environment and a low diversity of plants and animals.
- B. Polar areas have a warm environment and a high diversity of plants and animals.
- C. Polar areas have a cold environment and a high diversity of plants and animals.
- D. Polar areas have a warm environment and a low diversity of plants and animals.

| Item Information | |
|--------------------|---|
| Alignment | S8.C.2.2.1 |
| Answer Key | A |
| Depth of Knowledge | 3 |
| p-value A | 73% (correct answer) |
| p-value B | 9% |
| p-value C | 12% |
| p-value D | 6% |
| Option Annotations | <p>A. Key: Earth’s poles receive less solar energy per unit area, resulting in colder temperatures and not enough energy to support high biodiversity.</p> <p>B. Polar areas have cold environments and low biodiversity because they do not receive enough energy from sunlight to support warmer temperatures and a higher diversity of plants and animals.</p> <p>C. Polar areas have low biodiversity because they do not receive enough energy from sunlight to support a higher diversity of plants and animals.</p> <p>D. Polar areas have cold environments because they receive less solar energy per unit area.</p> |

13. Which statement describes the energy of a ball after it is thrown straight up into the air?
- A. When the ball is about to hit the ground, its kinetic energy is lowest.
 - B. When the ball is about to hit the ground, its potential energy is highest.
 - C. When the ball is at its highest point, its kinetic energy is equal to its potential energy.
 - D. When the ball is at its highest point, its potential energy is highest and its kinetic energy is lowest.

| Item Information | |
|--------------------|--|
| Alignment | S8.C.3.1.2 |
| Answer Key | D |
| Depth of Knowledge | 2 |
| p-value A | 10% |
| p-value B | 18% |
| p-value C | 20% |
| p-value D | 52% (correct answer) |
| Option Annotations | <p>A. The ball’s kinetic energy will continue to increase as it falls toward the ground.</p> <p>B. The potential energy of the ball decreases as the ball falls to the ground.</p> <p>C. Potential energy and kinetic energy are inversely related. At the highest point, the ball has the most potential energy and the least kinetic energy.</p> <p>D. Key: The ball’s potential energy is greatest at its highest point because it has the most stored energy. The ball’s kinetic energy is lowest at this point because the ball has not started to move downward yet.</p> |

14. Sometimes people must clear grassland areas to grow crops. This practice often replaces deep-rooted native plant species with shallow-rooted crop plants. In addition, most crop plants must be harvested and replanted each year, leaving the soil bare for part of the year. Which effect would replacing grassland with farmland **most likely** have on the area?
- A. increased erosion of soil
 - B. increased nutrients in the soil
 - C. increased diversity of species
 - D. increased water available to plants

| Item Information | |
|--------------------|--|
| Alignment | S8.D.1.2.2 |
| Answer Key | A |
| Depth of Knowledge | 3 |
| p-value A | 40% (correct answer) |
| p-value B | 35% |
| p-value C | 16% |
| p-value D | 9% |
| Option Annotations | <p>A. Key: Leaving the soil bare for part of the year allows wind and water to erode the soil more quickly.</p> <p>B. Replacing grassland with farmland is more likely to decrease the amount of nutrients available in the soil.</p> <p>C. Replacing grassland with farmland is more likely to decrease the variety of plant and animal species that live in the area.</p> <p>D. Replacing grassland with farmland is more likely to decrease the amount of water that is stored in the soil.</p> |

15. Water system X brings fresh water from mountaintops to water system Y. Water system Y is a large basin filled with salt water. What are these two types of water systems?
- A. water system X: wetland
water system Y: river
 - B. water system X: lake
water system Y: ocean
 - C. water system X: lake
water system Y: stream
 - D. water system X: river
water system Y: ocean

| Item Information | |
|--------------------|--|
| Alignment | S8.D.1.3.3 |
| Answer Key | D |
| Depth of Knowledge | 2 |
| p-value A | 8% |
| p-value B | 20% |
| p-value C | 8% |
| p-value D | 64% (correct answer) |
| Option Annotations | <p>A. Water system X is not a wetland, because a wetland stores water. Water system Y is not a river, because a river transports fresh water.</p> <p>B. Water system X is not a lake, because a lake is a body of water surrounded by land and does not transport water.</p> <p>C. Water system X is not a lake, because a lake is a body of water surrounded by land and does not transport water. Water system Y is not a stream, because a stream transports fresh water.</p> <p>D. Key: A river transports fresh water from high elevation to low elevation, and an ocean is a large basin filled with salt water.</p> |

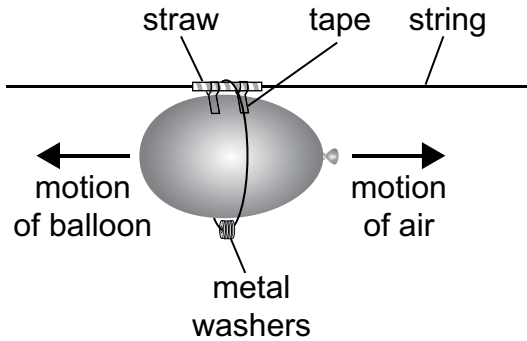
16. A student observes two high tides and two low tides along an ocean shoreline during a fixed 24-hour period. Which combination of factors is **most** responsible for causing this pattern of tides?
- A. The tides are caused by the rotation of Earth and the gravitational attraction between the Moon and the Sun.
 - B. The tides are caused by the rotation of Earth and the gravitational attraction between Earth and the Moon.
 - C. The tides are caused by the rotation of the Moon and the gravitational attraction between Earth and the Moon.
 - D. The tides are caused by the rotation of the Moon and the gravitational attraction between the Moon and the Sun.

| Item Information | |
|--------------------|--|
| Alignment | S8.D.3.1.1 |
| Answer Key | B |
| Depth of Knowledge | 2 |
| p-value A | 24% |
| p-value B | 42% (correct answer) |
| p-value C | 25% |
| p-value D | 9% |
| Option Annotations | <p>A. The gravitational attraction between Earth and the Moon is the primary cause for Earth’s tidal patterns.</p> <p>B. Key: The rotation of Earth combined with the gravitational attraction between Earth and the Moon has the most direct impact on Earth’s tidal patterns.</p> <p>C. The rotation of the Moon has little effect on Earth’s tidal patterns.</p> <p>D. The gravitational attraction between Earth and the Moon is the primary cause for Earth’s tidal patterns. The rotation of the Moon has little effect on Earth’s tidal patterns.</p> |

OPEN-ENDED ITEM

17. A student is testing if the mass of a balloon rocket affects how far it travels on a string by attaching metal washers to the balloon. The student measures the initial circumference of the balloon at the beginning of each trial.

Balloon Rocket Investigation



| Number of Washers | Circumference of Balloon (cm) | Distance Traveled (cm) |
|-------------------|-------------------------------|------------------------|
| 0 | 50 | 200 |
| 2 | 50 | ? |
| 4 | 50 | ? |
| 6 | 50 | ? |

Part A: Predict the general relationship between the distance the balloon rocket would likely travel and the number of washers it carries.

Part B: In a second investigation the student uses no washers but changes the balloon's circumference. Predict the general relationship between the distance the balloon rocket would likely travel and the circumference of the balloon.

SCORING GUIDE

#17 Item Information

| | | | | | |
|-----------|------------|--------------------|---|------------|------|
| Alignment | S8.A.2.1.1 | Depth of Knowledge | 3 | Mean Score | 0.74 |
|-----------|------------|--------------------|---|------------|------|

Item-Specific Scoring Guideline

| Score | Description |
|-------|--|
| 2 | <p>The response demonstrates a <i>thorough</i> understanding of how to use evidence, observations, or a variety of scales (e.g., mass, distance, volume, temperature) to describe relationships by</p> <ul style="list-style-type: none"> predicting the general relationship between the distance the balloon rocket would likely travel and the number of washers it carries <p>AND</p> <ul style="list-style-type: none"> predicting the general relationship between the distance the balloon rocket would likely travel and the circumference of the balloon. <p>The response is clear, complete, and correct.</p> |
| 1 | <p>The response demonstrates a <i>partial</i> understanding of how to use evidence, observations, or a variety of scales (e.g., mass, distance, volume, temperature) to describe relationships by</p> <ul style="list-style-type: none"> predicting the general relationship between the distance the balloon rocket would likely travel and the number of washers it carries <p>OR</p> <ul style="list-style-type: none"> predicting the general relationship between the distance the balloon rocket would likely travel and the circumference of the balloon. <p>The response may contain some work that is incomplete or unclear.</p> |
| 0 | <p>The response provides <i>insufficient</i> evidence to demonstrate any understanding of the concept being tested.</p> |

Note: No deductions should be taken for misspelled words or grammatical errors.

Responses that will receive credit (responses are not limited to these examples):

Part A (1 point):

- As the number of washers added to the balloon rocket increases, the distance the balloon rocket travels will decrease. This inverse relationship is likely because adding washers increases the balloon's mass but the force moving the balloon remains the same. The result is the balloon will travel less distance.

Part B (1 point):

- The larger the circumference of the balloon, the greater the distance the balloon rocket will travel. The greater the circumference of the balloon, the more air will exit the balloon as thrust, or a pushing force, to move the balloon a greater distance. This is a direct relationship.
- Inversely, a smaller circumference would have less air to act as a pushing force, resulting in less distance traveled.

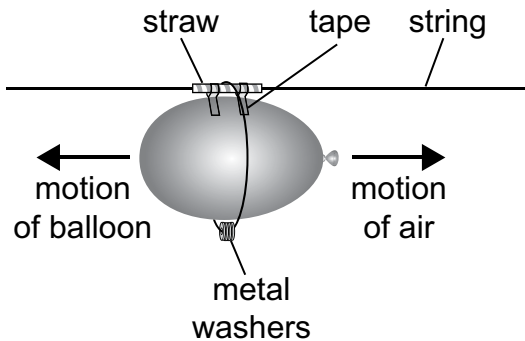
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STUDENT RESPONSE

Response Score: 2 points

17. A student is testing if the mass of a balloon rocket affects how far it travels on a string by attaching metal washers to the balloon. The student measures the initial circumference of the balloon at the beginning of each trial.

Balloon Rocket Investigation



Data

| Number of Washers | Circumference of Balloon (cm) | Distance Traveled (cm) |
|-------------------|-------------------------------|------------------------|
| 0 | 50 | 200 |
| 2 | 50 | ? |
| 4 | 50 | ? |
| 6 | 50 | ? |

Part A: Predict the general relationship between the distance the balloon rocket would likely travel and the number of washers it carries.

The Balloons going to cover more distance with less metal washers

Part B: In a second investigation the student uses no washers but changes the balloon's circumference. Predict the general relationship between the distance the balloon rocket would likely travel and the circumference of the balloon.

The Balloon rocket would travel longer if the circumference is longer and wider. The Circumference is larger that's the more Air in the Balloon.

The response demonstrates a thorough understanding of how to use evidence, observations, or a variety of scales to describe relationships. In Part A, the response correctly predicts the general relationship between the distance the balloon rocket would likely travel and the number of washers it carries (*The Balloons going to cover more distance with less metal washers*). In Part B, the response correctly predicts the general relationship between the distance the balloon rocket would likely travel and the circumference of the balloon (*The Balloon rocket would travel longer if the circumference is longer and wider*). The response is clear, complete, and correct.

STUDENT RESPONSE

Response Score: 1 point



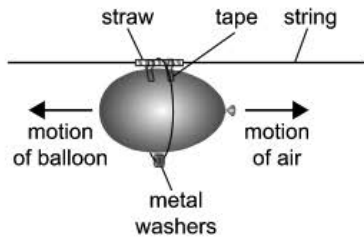
PART A

Question 17
Page 1 of 2



A student is testing if the mass of a balloon rocket affects how far it travels on a string by attaching metal washers to the balloon. The student measures the initial circumference of the balloon at the beginning of each trial.

Balloon Rocket Investigation



| Data | | |
|-------------------|-------------------------------|------------------------|
| Number of Washers | Circumference of Balloon (cm) | Distance Traveled (cm) |
| 0 | 50 | 200 |
| 2 | 50 | ? |
| 4 | 50 | ? |
| 6 | 50 | ? |

Part A: Predict the general relationship between the distance the balloon rocket would likely travel and the number of washers it carries.

The balloon rocket would travel less distance with the increased number of washers on it because the weight of the washers would slow it down.

142 / 1000



PART B

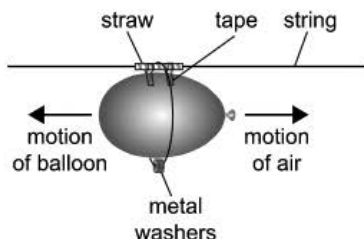
Question 17
Page 2 of 2



Item ID ?

A student is testing if the mass of a balloon rocket affects how far it travels on a string by attaching metal washers to the balloon. The student measures the initial circumference of the balloon at the beginning of each trial.

Balloon Rocket Investigation



| Data | | |
|-------------------|-------------------------------|------------------------|
| Number of Washers | Circumference of Balloon (cm) | Distance Traveled (cm) |
| 0 | 50 | 200 |
| 2 | 50 | ? |
| 4 | 50 | ? |
| 6 | 50 | ? |

Part B: In a second investigation the student uses no washers but changes the balloon's circumference. Predict the general relationship between the distance the balloon rocket would likely travel and the circumference of the balloon.

The balloon would travel less distance because there would be less air pushing the balloon forward.

99 / 1000

Review/End Test Pause Flag Options Back Next

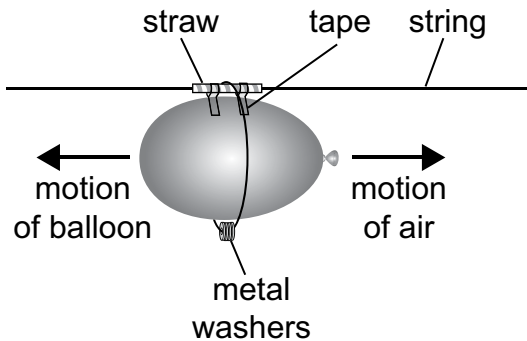
The response demonstrates a partial understanding of how to use evidence, observations, or a variety of scales to describe relationships. In Part A, the response correctly predicts the general relationship between the distance the balloon rocket would likely travel and the number of washers it carries (*The balloon rocket would travel less distance with the increased number of washers*). In Part B, the response (*The balloon would travel less distance because there would be less air pushing the balloon forward*) provides an incomplete prediction of the general relationship between the distance the balloon rocket would likely travel and the circumference of the balloon. The response did not state whether the circumference of the balloon increased or decreased and receives no credit.

STUDENT RESPONSE

Response Score: 0 points

17. A student is testing if the mass of a balloon rocket affects how far it travels on a string by attaching metal washers to the balloon. The student measures the initial circumference of the balloon at the beginning of each trial.

Balloon Rocket Investigation



Data

| Number of Washers | Circumference of Balloon (cm) | Distance Traveled (cm) |
|-------------------|-------------------------------|------------------------|
| 0 | 50 | 200 |
| 2 | 50 | ? |
| 4 | 50 | ? |
| 6 | 50 | ? |

Part A: Predict the general relationship between the distance the balloon rocket would likely travel and the number of washers it carries.

as the number of washers increase the distance traveled gets larger.

Part B: In a second investigation the student uses no washers but changes the balloon's circumference. Predict the general relationship between the distance the balloon rocket would likely travel and the circumference of the balloon.

with no washers the ballon would only travel 200 cm.

The response provides insufficient evidence to demonstrate any understanding of how to use evidence, observations, or a variety of scales to describe relationships. In Part A, the response (*as the number of washers increase the distance traveled gets larger*) provides an incorrect prediction of the general relationship between the distance the balloon rocket would likely travel and the number of washers it carries and receives no credit. In Part B, the response (*with no washers the ballon would only travel 200 cm*) provides an incorrect prediction of the general relationship between the distance the balloon rocket would likely travel and the circumference of the balloon and receives no credit.

OPEN-ENDED ITEM

18. In England before the industrial revolution, peppered moths were mainly white with black speckles, but a small group within the population had a genetic mutation that caused them to appear dark gray. After industrialization, the increase in air pollution caused tree bark to darken. Eventually, the lighter-colored peppered moths became less common than the dark-gray moths.

Part A: Identify **one** possible advantage dark-gray peppered moths had over the lighter-colored moths after the industrial revolution.

Part B: Predict what will **most likely** happen to the coloration of peppered moths as pollution control measures increase in England.

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.



SCORING GUIDE

#18 Item Information

| | | | | | |
|------------------|------------|---------------------------|---|-------------------|------|
| Alignment | S8.B.2.1.1 | Depth of Knowledge | 2 | Mean Score | 0.94 |
|------------------|------------|---------------------------|---|-------------------|------|

Item-Specific Scoring Guideline

| Score | Description |
|--------------|---|
| 2 | <p>The response demonstrates a <i>complete</i> understanding of how inherited structures or behaviors help organisms survive and reproduce in different environments by</p> <ul style="list-style-type: none"> • identifying one advantage the dark-gray peppered moths had over the lighter-colored moths after the industrial revolution <p>AND</p> <ul style="list-style-type: none"> • predicting what will most likely happen to the coloration of peppered moths as pollution control measures increase in England. <p>The response is clear, complete, and correct.</p> |
| 1 | <p>The response demonstrates a <i>partial</i> understanding of how inherited structures or behaviors help organisms survive and reproduce in different environments by</p> <ul style="list-style-type: none"> • identifying one advantage the dark-gray peppered moths had over the lighter-colored moths after the industrial revolution <p>OR</p> <ul style="list-style-type: none"> • predicting what will most likely happen to the coloration of peppered moths as pollution control measures increase in England. <p>The response may contain some work that is incomplete or unclear.</p> |
| 0 | <p>The response provides <i>insufficient</i> evidence to demonstrate any understanding of the concept being tested.</p> |

Note: No deductions should be taken for misspelled words or grammatical errors.

Responses that will receive credit (responses are not limited to these examples):

Part A (1 point):

- camouflage
- ability to hide from predators
- ability to blend in with the surroundings/environment

Part B (1 point):

- The coloration will shift to lighter-colored peppered moths.
- The coloration will shift to moths that are white with black speckles.
- There will be fewer dark-colored or dark-gray peppered moths.

STUDENT RESPONSE

Response Score: 2 points



PART A

Question 18
Page 1 of 2

Item ID ?

In England before the industrial revolution, peppered moths were mainly white with black speckles, but a small group within the population had a genetic mutation that caused them to appear dark gray. After industrialization, the increase in air pollution caused tree bark to darken. Eventually, the lighter-colored peppered moths became less common than the dark-gray moths.

Part A: Identify **one** possible advantage dark-gray peppered moths had over the lighter-colored moths after the industrial revolution.

EQ

It is easier for dark-grey moths to hid from its pretodors

58 / 1000

Review/End Test Pause Flag Options Next

PART B

Question 18
Page 2 of 2

Item ID ?

In England before the industrial revolution, peppered moths were mainly white with black speckles, but a small group within the population had a genetic mutation that caused them to appear dark gray. After industrialization, the increase in air pollution caused tree bark to darken. Eventually, the lighter-colored peppered moths became less common than the dark-gray moths.

Part B: Predict what will **most likely** happen to the coloration of peppered moths as pollution control measures increase in England.

EQ

If pollution control measures increase then there will most likely be less dark-grey moths.

91 / 1000

Review/End Test Pause Flag Options Back Next

This response demonstrates a complete understanding of how inherited structures or behaviors help organisms survive and reproduce in different environments. In Part A, the response correctly identifies one advantage dark-gray peppered moths had over the lighter-colored moths after the industrial revolution (*easier for dark-grey moths to hid from its pretodors* [predators]). In Part B, the response correctly predicts what will most likely happen to the coloration of peppered moths as pollution control measures increase in England (*there will most likely be less dark-grey moths*). The response is clear, complete, and correct.

STUDENT RESPONSE

Response Score: 1 point

18. In England before the industrial revolution, peppered moths were mainly white with black speckles, but a small group within the population had a genetic mutation that caused them to appear dark gray. After industrialization, the increase in air pollution caused tree bark to darken. Eventually, the lighter-colored peppered moths became less common than the dark-gray moths.

Part A: Identify **one** possible advantage dark-gray peppered moths had over the lighter-colored moths after the industrial revolution.

camoflog.

Part B: Predict what will **most likely** happen to the coloration of peppered moths as pollution control measures increase in England.

They started to move places where they would be alive longer.

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.



This response demonstrates a partial understanding of how inherited structures or behaviors help organisms survive and reproduce in different environments. In Part A, the response correctly identifies one advantage dark-gray peppered moths had over the lighter-colored moths after the industrial revolution (*camoflog* [camouflage]). In Part B, the response (*They started to move places where they would be alive longer*) is an incorrect prediction of what will most likely happen to the coloration of peppered moths as pollution control measures increase in England and receives no credit.

STUDENT RESPONSE

Response Score: 0 points

18. In England before the industrial revolution, peppered moths were mainly white with black speckles, but a small group within the population had a genetic mutation that caused them to appear dark gray. After industrialization, the increase in air pollution caused tree bark to darken. Eventually, the lighter-colored peppered moths became less common than the dark-gray moths.

Part A: Identify **one** possible advantage dark-gray peppered moths had over the lighter-colored moths after the industrial revolution.

Natural Selection.

Part B: Predict what will **most likely** happen to the coloration of peppered moths as pollution control measures increase in England.

They will decrease due to to pollution in the air.

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.



This response provides insufficient evidence to demonstrate any understanding of how inherited structures or behaviors help organisms survive and reproduce in different environments. In Part A, the response (*Natural Selection*) is an incorrect advantage dark-gray peppered moths had over the lighter-colored moths after the industrial revolution and receives no credit. In Part B, the response (*They will decrease due to to pollution in the air*) does not clarify which coloration of moths would decrease. It is an unclear prediction of what will most likely happen to the coloration of peppered moths as pollution control measures increase in England and receives no credit.

SAMPLE ITEM SUMMARY

Multiple-Choice

| Sample Number | Alignment | Answer Key | Depth of Knowledge | p-value A | p-value B | p-value C | p-value D |
|---------------|------------|------------|--------------------|-----------|-----------|-----------|-----------|
| 1 | S8.A.1.1.2 | D | 2 | 8 | 8 | 20 | 64 |
| 2 | S8.A.1.2.1 | D | 2 | 15 | 13 | 32 | 40 |
| 3 | S8.A.1.2.3 | C | 2 | 18 | 7 | 63 | 12 |
| 4 | S8.A.1.3.4 | A | 2 | 39 | 26 | 15 | 20 |
| 5 | S8.A.2.1.3 | D | 2 | 9 | 21 | 12 | 58 |
| 6 | S8.A.2.1.5 | A | 2 | 42 | 16 | 13 | 29 |
| 7 | S8.A.2.2.1 | C | 1 | 7 | 6 | 65 | 22 |
| 8 | S8.A.3.1.3 | B | 2 | 12 | 63 | 13 | 12 |
| 9 | S8.B.1.1.3 | A | 2 | 51 | 9 | 34 | 6 |
| 10 | S8.B.3.3.3 | B | 2 | 6 | 69 | 12 | 13 |
| 11 | S8.C.2.1.1 | D | 2 | 20 | 13 | 14 | 53 |
| 12 | S8.C.2.2.1 | A | 3 | 73 | 9 | 12 | 6 |
| 13 | S8.C.3.1.2 | D | 2 | 10 | 18 | 20 | 52 |
| 14 | S8.D.1.2.2 | A | 3 | 40 | 35 | 16 | 9 |
| 15 | S8.D.1.3.3 | D | 2 | 8 | 20 | 8 | 64 |
| 16 | S8.D.3.1.1 | B | 2 | 24 | 42 | 25 | 9 |

Open-Ended

| Sample Number | Alignment | Points | Depth of Knowledge | Mean Score |
|---------------|------------|--------|--------------------|------------|
| 17 | S8.A.2.1.1 | 2 | 3 | 0.74 |
| 18 | S8.B.2.1.1 | 2 | 2 | 0.94 |

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PSSA Grade 8 Science Item and Scoring Sampler

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