



pennsylvania
DEPARTMENT OF EDUCATION

The Pennsylvania System of School Assessment

Science Item and Scoring Sampler



2016–2017
Grade 4

Pennsylvania Department of Education Bureau of Curriculum, Assessment and Instruction—September 2016

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INTRODUCTION

The Pennsylvania Department of Education provides districts and schools with tools to assist in delivering focused instructional programs aligned with the Pennsylvania Academic Standards. In addition to the Academic Standards, these tools include Assessment Anchor documents, assessment handbooks, and content-based item and scoring samplers. Each Item and Scoring Sampler is a useful tool for Pennsylvania educators in preparing local instructional programs and can also be useful in preparing students for the statewide assessment.

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 Pennsylvania Academic Standards (PAS). The sample test questions model the types of items that will 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 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 used as models for creating assessment items at the classroom level, and they may also be copied and used as part of a local instructional program.¹ Classroom teachers may find it beneficial to have students respond to the open-ended items in this sampler. Educators can then use the item’s scoring guideline and sample responses as a basic guide to score the responses, either independently or together with colleagues within a school or district. The sampler also includes the *General Description of Scoring Guidelines for Science Open-Ended Items* used to develop the item-specific guidelines. The general description of scoring guidelines can be used if any additional item-specific scoring guidelines are created for use within local instructional programs.¹

ITEM FORMAT AND SCORING GUIDELINES

The multiple-choice (MC) questions have four answer choices. Each correct response to an MC question 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 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. During an official testing administration, students are given additional time as necessary to complete the test questions. The following table shows the estimated response time per item for each item type.

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

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ITEM AND SCORING SAMPLER FORMAT

This sampler includes the test directions and scoring guidelines that appear in the PSSA science assessments. Each sample multiple-choice question 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 open-ended item is followed by a table that includes the item alignment, DOK, 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.

Example Multiple-Choice Question Information Table

| Item Information | | Option Annotations | | | |
|---|----------------|---|--|--|--|
| Alignment | Assigned AAEC | Brief answer option analysis or rationale | | | |
| Answer Key | Correct Answer | | | | |
| Depth of Knowledge | Assigned DOK | | | | |
| <i>p</i>-values | | | | | |
| A | B | | | | |
| | | | | | |
| Percentage of students who selected each option | | | | | |

Example Open-Ended Item Information Table

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

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

SCIENCE TEST 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

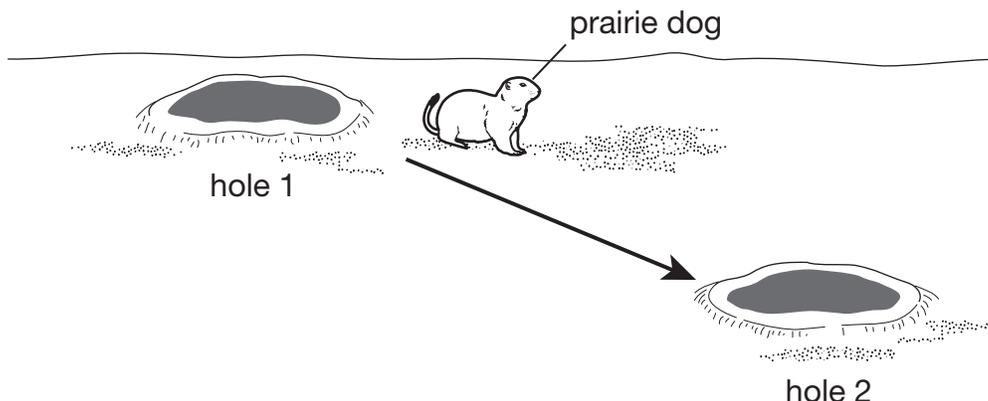
- The response demonstrates a *partial* understanding of the scientific content, concepts, and procedures required by the task(s).
- The response is somewhat correct with *partial* understanding of the required scientific content, concepts, and/or procedures demonstrated and/or explained. The response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

Use the drawing below to answer question 1.



1. Students are studying how fast a prairie dog can travel from hole 1 to hole 2. Which data should the students observe and record?
- A. size or depth of the holes
 - B. size and depth of the holes
 - C. time or distance traveled between the holes
 - D. time and distance traveled between the holes

| Item Information | | | | Option Annotations |
|---------------------------|----------|------------|----------|---|
| Alignment | | S4.A.1.3.1 | | A. Studying hole size or depth provides volume data, but studying speed requires distance and time measurements. B. Studying hole size and depth provides volume data, but studying speed requires distance and time measurements. C. Studying speed requires both time and distance measurements, not just one. D. Key: Studying speed involves measuring the distance between the holes and the time required to travel that distance. |
| Answer Key | | D | | |
| Depth of Knowledge | | 2 | | |
| p-values | | | | |
| A | B | C | D | |
| 4% | 8% | 17% | 70% | |

2. Which statement **best** compares the sizes of two bodies of water?
- A. A lake is larger than a pond.
 - B. A lake is larger than an ocean.
 - C. An ocean is smaller than a bay.
 - D. An ocean is smaller than a pond.

| Item Information | | Option Annotations | | | |
|---------------------------|------------|--|----|--|--|
| Alignment | S4.A.1.3.2 | A. Key: A lake is larger than a pond. B. An ocean is larger than a lake. C. An ocean is larger than a bay. D. An ocean is larger than a pond. | | | |
| Answer Key | A | | | | |
| Depth of Knowledge | 2 | | | | |
| p-values | | | | | |
| A | B | | | | |
| 84% | 5% | 7% | 4% | | |

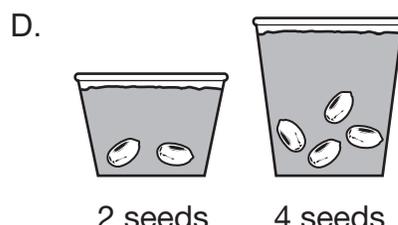
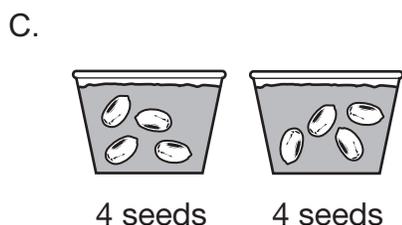
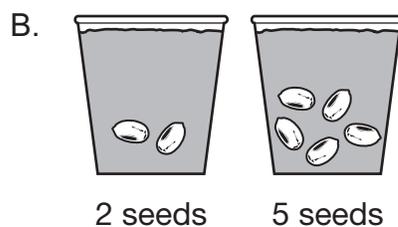
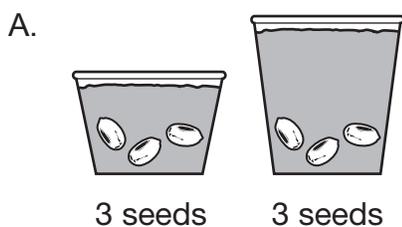
3. Groups of reindeer often travel 3,000 miles during their annual migration across Canada. What is the **most likely** reason the reindeer migrate during the winter months?
- A. to grow more fur
 - B. to find more food
 - C. to compete with other animals
 - D. to protect young from predators

| Item Information | | | | Option Annotations |
|---------------------------|----------|------------|----------|--|
| Alignment | | S4.A.1.3.4 | | A. Reindeer are unlikely to travel such long distances so that they can expend more energy to grow fur. B. Key: Reindeer travel extensive distances seeking food sources for their groups during winter when food is limited. C. Competition makes it more difficult for reindeer to survive, so seeking competition is not a reason for migration. D. Reindeer use defensive behaviors to protect young from predators rather than migrating thousands of miles. |
| Answer Key | | B | | |
| Depth of Knowledge | | 2 | | |
| p-values | | | | |
| A | B | C | D | |
| 9% | 69% | 6% | 16% | |

4. Many people use electricity from coal-fired power plants. How do these power plants **most likely** affect the environment?
- A. by improving the quality of drinking-water sources
 - B. by releasing chemicals that can cause air pollution
 - C. by producing plastics that can harm ocean animals
 - D. by removing harmful materials from rivers and streams

| Item Information | | | | Option Annotations |
|---------------------------|----------|------------|----------|--|
| Alignment | | S4.A.1.3.5 | | A. Mining coal for use in coal-fired power plants can reduce, not improve, the quality of drinking-water sources. B. Key: Burning coal in coal-fired power plants results in the release of chemicals into the air, which can cause pollution. C. Coal-fired power plants produce electricity, not plastics. D. Water-treatment plants can remove harmful materials from rivers and streams, but coal-fired plants are not designed for this purpose. |
| Answer Key | | B | | |
| Depth of Knowledge | | 1 | | |
| p-values | | | | |
| A | B | C | D | |
| 8% | 71% | 10% | 11% | |

5. A student is investigating seed growth in different light conditions. The student places one container with seeds in sunlight and another container in the dark. The student leaves the containers there for three days. Which experimental setup allows the student to perform a fair test?



| Item Information | | | | Option Annotations |
|---------------------------|----------|------------|----------|---|
| Alignment | | S4.A.2.1.2 | | A. This experimental setup shows the seeds in two different-size containers, adding another variable to the experiment. B. This experimental setup has different numbers of seeds in each container, adding another variable to the experiment. C. Key: This experimental setup shows equal numbers of seeds in equal-size containers for a fair test. D. This experimental setup shows two different-size containers, each with a different number of seeds, which adds multiple variables to the experiment. |
| Answer Key | | C | | |
| Depth of Knowledge | | 2 | | |
| p-values | | | | |
| A | B | C | D | |
| 15% | 9% | 67% | 9% | |

Use the data table below to answer question 6.

Plant Growth

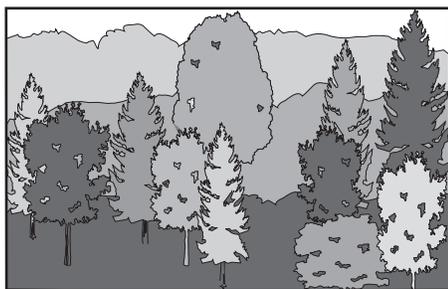
| Day | Plant Height (centimeters) |
|-----|----------------------------|
| 1 | 1.0 |
| 2 | 1.4 |
| 3 | 2.0 |
| 4 | 3.1 |
| 5 | 4.1 |
| 6 | 5.0 |
| 7 | 5.4 |
| 8 | ? |

6. How tall will the plant **most likely** be on day 8 if it continues to grow?
- A. less than 5.6 centimeters
 - B. more than 7.2 centimeters
 - C. between 5.8 and 6.5 centimeters
 - D. between 4.5 and 5.1 centimeters

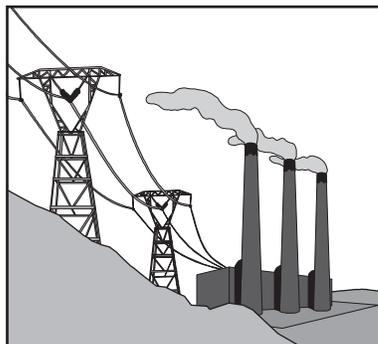
| Item Information | | | | Option Annotations |
|---------------------------|----------|------------|----------|---|
| Alignment | | S4.A.2.1.3 | | A. The plant has consistently shown daily growth greater than 0.2 cm, suggesting it will be taller than 5.6 cm on day 8. B. The plant has not shown growth greater than 1.1 cm on any one day, so a single-day increase of 1.8 cm is unlikely. C. Key: Given the growth trends on days 1–7, it is likely the plant will grow between 0.4 and 1.1 cm in a single day. D. This range suggests the plant has shrunk, which is unlikely. |
| Answer Key | | C | | |
| Depth of Knowledge | | 2 | | |
| p-values | | | | |
| A | B | C | D | |
| 8% | 6% | 79% | 6% | |

Use the drawings below to answer question 7.

System X



System Y



7. Which statement **best** describes the two systems?

- A. Both systems are natural.
- B. Both systems are human-made.
- C. System X is human-made, and System Y is natural.
- D. System X is natural, and System Y is human-made.

| Item Information | | | | Option Annotations |
|---------------------------|----------|------------|----------|---|
| Alignment | | S4.A.3.1.1 | | A. System X is natural, but System Y is human-made. B. System Y is human-made, but System X is natural. C. System X is natural, and System Y is human-made. D. Key: System X is natural, and System Y is human-made. |
| Answer Key | | D | | |
| Depth of Knowledge | | 1 | | |
| p-values | | | | |
| A | B | C | D | |
| 4% | 4% | 6% | 86% | |

Use the information below to answer question 8.

Steps to Model the Water Cycle

1. Place some soil in a plastic cup.
2. Put an ice cube on top of the soil.
3. Cover the top of the cup with plastic.
4. ?

8. A student models the water cycle by following the steps listed above. Which step would **most likely** come next?
- A. Turn the cup upside down.
 - B. Sprinkle water on the plastic.
 - C. Put the cup in a sunny location.
 - D. Place the cup in a bowl of water.

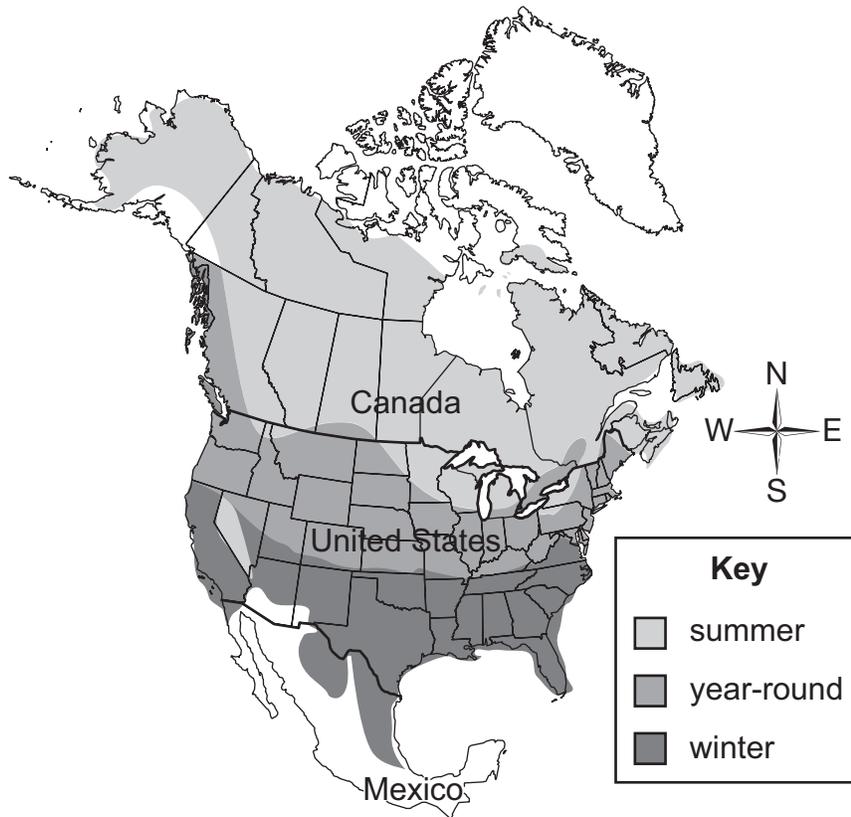
| Item Information | | | | Option Annotations |
|---------------------------|----------|------------|----------|---|
| Alignment | | S4.A.3.2.2 | | A. Turning the cup upside down buries the ice cube, which is not a step in the water cycle. B. Sprinkling water on the plastic will not affect the contents in the cup, so it is not the next step. C. Key: Placing the cup in a sunny location will cause the ice to melt, modeling infiltration of water into soil and evaporation into the air within the cup. D. Placing the cup in a bowl of water will not affect the contents in the cup, so it is not the next step. |
| Answer Key | | C | | |
| Depth of Knowledge | | 3 | | |
| p-values | | | | |
| A | B | C | D | |
| 9% | 11% | 73% | 7% | |

9. Which trait would a mouse **most likely** inherit from its parents?
- A. a scar on its foot
 - B. the color of its fur
 - C. the habitat where it lives
 - D. a favorite food it likes to eat

| Item Information | | | | Option Annotations |
|---------------------------|----------|------------|----------|--|
| Alignment | | S4.B.2.2.1 | | A. A scar is a trait that occurs during a mouse’s lifetime, so it is not genetic nor can it be passed from parents to offspring. B. Key: Fur color is a genetic trait that is passed from parents to offspring. C. An organism selects its habitat during its lifetime, so this is a life trait that is neither genetic nor inherited. D. Food preference is a behavioral trait, not a genetic trait; only genetic traits can be inherited. |
| Answer Key | | B | | |
| Depth of Knowledge | | 1 | | |
| p-values | | | | |
| A | B | C | D | |
| 6% | 62% | 20% | 12% | |

Use the map below to answer question 10.

Canada Geese Seasonal Habitat

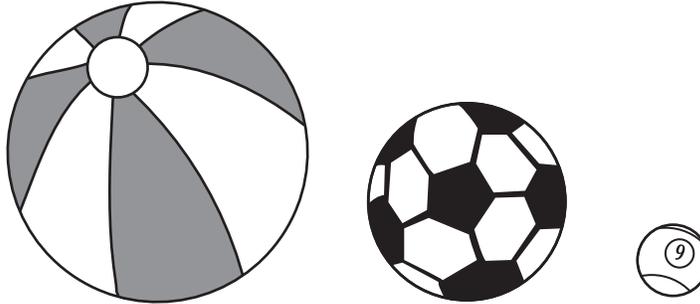


10. In winter, Canada geese migrate from Canada to the United States and Mexico. Which change occurs in Canada during winter that causes the geese to fly south?
- A. Sunrise occurs earlier in the day.
 - B. There is less food available to eat.
 - C. There are more animals that eat geese.
 - D. Snow makes it hard for the geese to see.

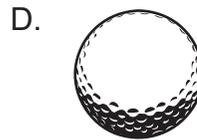
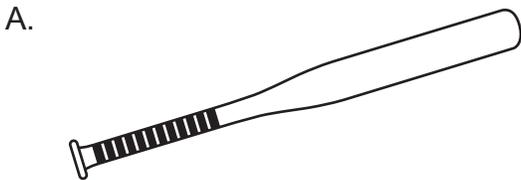
| Item Information | | | | Option Annotations |
|---------------------------|----------|------------|----------|--|
| Alignment | | S4.B.3.2.3 | | A. In winter, sunrise does occur earlier each day, but low temperatures and limited food cause geese to migrate south. B. Key: Low temperatures and limited hours of sunlight limit plant growth in winter—causing geese to migrate south. C. Predators may also move south in Canada and threaten geese, but limited food resources cause geese to migrate. D. Snow makes it difficult for geese to locate food. |
| Answer Key | | B | | |
| Depth of Knowledge | | 2 | | |
| p-values | | | | |
| A | B | C | D | |
| 12% | 60% | 8% | 19% | |

Use the drawing below to answer question 11.

Three Objects



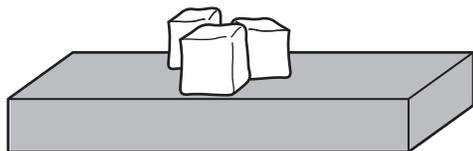
11. A student placed three objects into a group based on a physical characteristic. Which other object also belongs in this group?



| Item Information | | | | Option Annotations |
|---------------------------|----------|------------|----------|---|
| Alignment | | S4.C.1.1.2 | | A. All the objects shown are spherical, but the bat has a cylindrical shape. B. All the objects shown appear smooth, but the crumpled paper appears rough. C. All the objects shown have a constant shape, but the jump rope is a string and its shape can change. D. Key: The ball shown is spherical and shares the same shape as the objects shown. |
| Answer Key | | D | | |
| Depth of Knowledge | | 2 | | |
| p-values | | | | |
| A | B | C | D | |
| 5% | 2% | 3% | 89% | |

Use the drawings below to answer question 12.

Ice Cubes Melting



10:00 A.M.



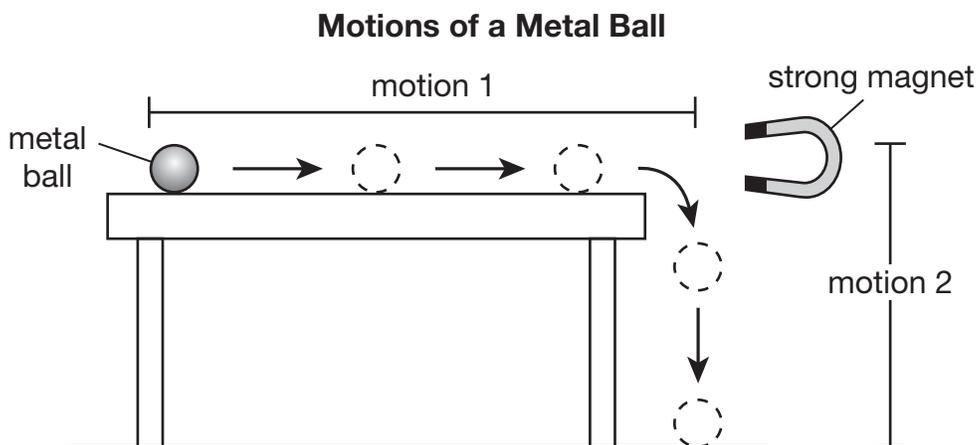
10:15 A.M.

12. Which statement **best** explains why the ice cubes begin to melt?

- A. Heat energy is flowing from the air to the ice cubes.
- B. Light energy is flowing from the air to the ice cubes.
- C. Electrical energy is flowing from the ice cubes to the air.
- D. Chemical energy is flowing from the ice cubes to the air.

| Item Information | | | | Option Annotations |
|---------------------------|----------|------------|----------|--|
| Alignment | | S4.C.2.1.2 | | A. Key: The ice cubes are taking in heat energy from the air, which causes the ice cubes to change from a solid to a liquid. B. Heat energy is needed to cause a phase change in ice; light energy is a different form of energy than heat. C. To change from a solid to a liquid, ice must take in heat energy—not lose electrical energy to the air. D. To change from a solid to a liquid, ice must take in heat energy—not lose chemical energy to the air. |
| Answer Key | | A | | |
| Depth of Knowledge | | 2 | | |
| p-values | | | | |
| A | B | C | D | |
| 83% | 9% | 4% | 4% | |

Use the drawing below to answer question 13.



13. Which statement **best** describes the motions of the metal ball?

- A. Both motions are caused by gravity.
- B. Both motions are caused by the magnet.
- C. Motion 1 is caused by the magnet, and motion 2 is caused by gravity.
- D. Motion 1 is caused by gravity, and motion 2 is caused by the magnet.

| Item Information | | | | Option Annotations |
|---------------------------|----------|------------|----------|--|
| Alignment | | S4.C.3.1.1 | | A. Only motion 2 is caused by gravity. B. Only motion 1 is caused by the magnet. C. Key: Motion 1 is caused by the attractive force of the magnet, and motion 2 is caused by the force of gravity. D. Motion 1 is caused by the attractive force of the magnet, and motion 2 is caused by the force of gravity. |
| Answer Key | | C | | |
| Depth of Knowledge | | 2 | | |
| p-values | | | | |
| A | B | C | D | |
| 10% | 14% | 62% | 14% | |

14. A student observes a handful of soil. Which statement **best** describes the soil?

- A. It is made of large rock pieces and living organisms.
- B. It is made from rock that was carried to the shore by waves.
- C. It is made of small rock pieces and decomposed organisms.
- D. It is made from hardened lava that formed from a volcanic eruption.

| Item Information | | | | Option Annotations |
|---------------------------|----------|------------|----------|--|
| Alignment | | S4.D.1.1.3 | | A. Soil may include rock pieces, but living organisms are not part of soil. B. Rock carried to shore by waves is not soil because soil includes matter from organisms that were once living. C. Key: Soil is composed of small pieces of rock and decomposed matter from organisms that were once alive. D. Hardened lava is rock, not soil, because it lacks matter from organisms that were once alive. |
| Answer Key | | C | | |
| Depth of Knowledge | | 2 | | |
| p-values | | | | |
| A | B | C | D | |
| 14% | 10% | 66% | 10% | |

15. How is an ocean **best** described?

- A. a body of salt water on Earth’s surface that is frozen
- B. a body of fresh water that moves from high to low elevations
- C. a body of salt water that covers a large part of Earth’s surface
- D. a body of fresh water that is underground and used for drinking

| Item Information | | | | Option Annotations |
|---------------------------|----------|------------|----------|---|
| Alignment | | S4.D.1.3.1 | | A. Oceans are bodies of salt water, but they are not frozen. B. Rivers are characterized as bodies of fresh water that move from areas of high elevation to low elevation. C. Key: Oceans are large bodies of salt water that cover over 70% of Earth’s surface. D. Groundwater is characterized as fresh water stored underground in aquifers and can be used for drinking. |
| Answer Key | | C | | |
| Depth of Knowledge | | 1 | | |
| p-values | | | | |
| A | B | C | D | |
| 4% | 8% | 84% | 4% | |

16. Which statement **best** describes the Sun-Earth-Moon system?

- A. Earth orbits both the Sun and the Moon.
- B. Earth orbits the Moon, and the Sun orbits Earth.
- C. The Moon orbits Earth, and Earth orbits the Sun.
- D. The Sun orbits Earth, and the Moon orbits the Sun.

| Item Information | | | | Option Annotations |
|---------------------------|----------|------------|----------|---|
| Alignment | | S4.D.3.1.1 | | A. Earth orbits the Sun, but the Moon orbits Earth. B. The Moon orbits Earth, and Earth orbits the Sun. C. Key: The Moon orbits Earth, and Earth orbits the Sun. D. Earth orbits the Sun, and the Moon orbits Earth. |
| Answer Key | | C | | |
| Depth of Knowledge | | 2 | | |
| p-values | | | | |
| A | B | C | D | |
| 17% | 10% | 61% | 11% | |

OPEN-ENDED ITEM

17. In the morning, a student eats cereal for breakfast and throws away the empty cardboard cereal box. The student then rides in a bus to school.

Part A: Explain how one of the student’s morning activities may have a negative effect on the environment.

Part B: Describe an activity that could replace one of the student’s morning activities and reduce a negative effect on the environment.

SCORING GUIDE

#17 ITEM INFORMATION

| | | | | | |
|------------------|------------|---------------------------|---|-------------------|------|
| Alignment | S4.A.1.3.5 | Depth of Knowledge | 2 | Mean Score | 1.22 |
|------------------|------------|---------------------------|---|-------------------|------|

ITEM-SPECIFIC SCORING GUIDELINE

| Score | Description |
|--------------|--|
| 2 | <p>The response demonstrates a <i>thorough</i> understanding of how everyday human activities (e.g., solid waste production, food production and consumption, transportation, water consumption, energy production and use) may change the environment by</p> <ul style="list-style-type: none"> • explaining how one of the student’s morning activities may have a negative effect on the environment <p>AND</p> <ul style="list-style-type: none"> • describing an activity that could replace one of the student’s morning activities and reduce a negative effect on the environment. <p>The response is clear, complete, and correct.</p> |
| 1 | <p>The response demonstrates a <i>partial</i> understanding of how everyday human activities (e.g., solid waste production, food production and consumption, transportation, water consumption, energy production and use) may change the environment by</p> <ul style="list-style-type: none"> • explaining how one of the student’s morning activities may have a negative effect on the environment <p>OR</p> <ul style="list-style-type: none"> • describing an activity that could replace one of the student’s morning activities and reduce a negative effect on the environment. <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):

- Throwing away cardboard cereal box
 - takes up space in landfills.
 - adds to air pollution if it is burned.
 - causes more natural resources to be used to make new cardboard.

OR

- Riding the bus
 - adds to air pollution.
 - requires the use of fossil fuels (nonrenewable resources).

Part B (1 point):

- The student could recycle (or reuse) the cereal box, which conserves natural resources.
- The student could compost the cereal box to keep it out of a landfill.
- The student could choose a food with less packaging.
- The student could walk (or ride a bike) to school, which produces less pollution.

STUDENT RESPONSE

RESPONSE SCORE: 2 POINTS

17. In the morning, a student eats cereal for breakfast and throws away the empty cardboard cereal box. The student then rides in a bus to school.

Part A: Explain how one of the student's morning activities may have a negative effect on the environment.

the activity that is negative is riding the bus.
it is negativ because the gas from the bus is
pouluting the air.

Part B: Describe an activity that could replace one of the student's morning activities and reduce a negative effect on the environment.

the activity that could be replaced is
ridding the bus, it could be replaced by
either walking, running, jogging, or bike riding

The response demonstrates a *thorough* understanding of how everyday human activities may change the environment by correctly completing both tasks. The response explains how one of the student's morning activities may have a negative effect on the environment ("riding the bus . . . because the gas from the bus is pouluting the air") and correctly describes an activity that could replace one of the student's morning activities and reduce a negative effect on the environment ("replaced is ridding the bus . . . by either walking, running, jogging, or bike riding"). Any of these given activities would earn credit by themselves. The response is clear, complete, and correct.

STUDENT RESPONSE

RESPONSE SCORE: 1 POINT

17. In the morning, a student eats cereal for breakfast and throws away the empty cardboard cereal box. The student then rides in a bus to school.

Part A: Explain how one of the student's morning activities may have a negative effect on the environment.

He put the cardboard box in
the trash can.

Part B: Describe an activity that could replace one of the student's morning activities and reduce a negative effect on the environment.

He could put the cereal box
in a recycling bin.

The response demonstrates a *partial* understanding of how everyday human activities may change the environment by correctly completing one of the tasks. The response identifies an activity ("He put the cardboard box in the trash can."), but fails to explain how the activity may have a negative effect on the environment, so no credit is earned. The response correctly describes an activity that could replace one of the student's morning activities and reduce a negative effect on the environment ("put the cereal box in a recycling bin"). The response contains some work that is incomplete or unclear.

STUDENT RESPONSE

RESPONSE SCORE: 0 POINTS

17. In the morning, a student eats cereal for breakfast and throws away the empty cardboard cereal box. The student then rides in a bus to school.

Part A: Explain how one of the student's morning activities may have a negative effect on the environment.

it affects him because he
did not brosh teeth.

Part B: Describe an activity that could replace one of the student's morning activities and reduce a negative effect on the environment.

he ate a real good breckfest
and rod the bus.

The response provides *insufficient* evidence to demonstrate any understanding of how everyday human activities may change the environment. The response ("he did not brosh teeth") does not explain how the activities given in the prompt may have a negative effect on the environment, so no credit is earned. Additionally, the response does not describe an activity that could replace one of the student's morning activities and reduce a negative effect on the environment. The sentence "he ate a real good breckfest and rod the bus" describes his current activities and does not receive any credit.

OPEN-ENDED ITEM

Use the drawing below to answer question 18.

Mantis



18. A mantis is a green insect that can grow up to 6 inches in length. It is a predator that can move very quickly. Also, it has excellent vision. A mantis can turn its head from side to side, unlike most other insects.

Part A: Identify two adaptations that help a mantis survive in its environment.

Adaptation 1: _____

Adaptation 2: _____

Part B: Describe how a mantis uses **one** of the two adaptations listed in **Part A** to survive in its environment.

SCORING GUIDE

#18 ITEM INFORMATION

| | | | | | |
|------------------|------------|---------------------------|---|-------------------|------|
| Alignment | S4.B.2.1.2 | Depth of Knowledge | 2 | Mean Score | 1.49 |
|------------------|------------|---------------------------|---|-------------------|------|

ITEM-SPECIFIC SCORING GUIDELINE

| Score | Description |
|--------------|---|
| 2 | <p>The response demonstrates a <i>thorough</i> understanding of how specific adaptations can help a living organism survive (e.g., protective coloration, mimicry, leaf sizes and shapes, ability to catch or retain water) by</p> <ul style="list-style-type: none"> • identifying two adaptations that help a mantis survive in its environment <p>AND</p> <ul style="list-style-type: none"> • describing how a mantis uses one of the two adaptations listed in Part A to survive in its environment. <p>The response is clear, complete, and correct.</p> |
| 1 | <p>The response demonstrates a <i>partial</i> understanding of how specific adaptations can help a living organism survive (e.g., protective coloration, mimicry, leaf sizes and shapes, ability to catch or retain water) by</p> <ul style="list-style-type: none"> • identifying two adaptations that help a mantis survive in its environment <p>OR</p> <ul style="list-style-type: none"> • describing how a mantis uses an adaptation listed in Part A to survive in its environment. <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 for identifying two bullet points):

- leaf-shaped body
- large eyes/excellent vision
- six long legs
- green coloration
- ability to turn its head from side to side
- ability to move quickly
- long body length

Part B (1 point):

- The mantis is better at finding and/or catching prey because of
 - its ability to move quickly.
 - its large eyes/excellent vision.
 - its ability to turn its head from side to side.
 - its long legs/long body length.
 - its ability to blend into its environment (green coloration, leaf-shaped body).

OR

- The mantis is less likely to be preyed upon by other organisms because of
 - its large size.
 - its ability to blend into its environment (green coloration, leaf-shaped body).
 - its ability to move quickly.
 - its ability to spot predators.

OR

- The mantis is likely to escape danger because of
 - its ability to move quickly.
 - its excellent vision.
 - its ability to see in many directions.

(Note: Information in parentheses is not necessary to receive full credit for Part A or Part B.)

STUDENT RESPONSE

RESPONSE SCORE: 2 POINTS



PARTS A AND B

Question 18
Page 1 of 1

Line Guide

Item ID

?

Use the drawing below to answer the question.

Mantis



A mantis is a green insect that can grow up to 6 inches in length. It is a predator that can move very quickly. Also, it has excellent vision. A mantis can turn its head from side to side, unlike most other insects.

Part A: Identify two adaptations that help a mantis survive in its environment.

Adaptation 1:
his eye sight 13/50

Adaptation 2:
his speed 9/50

Part B: Describe how a mantis uses **one** of the two adaptations listed in **Part A** to survive in its environment.

EQ
His speed helps him or her to attack its pray. Thats what I think he uses his adaptations.

89 / 1000

Review/End Test Pause Flag Options

The response demonstrates a *thorough* understanding of how specific adaptations can help a living organism survive by correctly completing both tasks. The response identifies two adaptations that help a mantis survive in its environment (“his eye sight, his speed”) and describes how a mantis uses one of the adaptations listed in Part A to survive in its environment (“speed helps him or her to attack its pray”). The response is clear, complete, and correct.

STUDENT RESPONSE

RESPONSE SCORE: 1 POINT



PARTS A AND B

Question 18
Page 1 of 1

Item ID

?



Mantis

Part A: Identify two adaptations that help a mantis survive in its environment.

Adaptation 1:
they can move very quickly
26/50

Adaptation 2:
they could move they head from side to side
43/50

Part B: Describe how a mantis uses **one** of the two adaptations listed in **Part A** to survive in its environment.

Eci
I said that they can move very quickly and that they could move they head from side to side

91 / 1000

A mantis is a green insect that can grow up to 6 inches in length. It is a predator that can move very quickly. Also, it has excellent vision. A mantis can turn its head from side to side, unlike most other insects.

Options

Flag

Pause

Review/End Test

The response demonstrates a *partial* understanding of how specific adaptations can help a living organism survive by correctly completing one task. The response identifies two adaptations that help a mantis survive in its environment (“*move very quickly, move they head from side to side*”) but fails to describe how a mantis uses one of the adaptations listed in Part A to survive in its environment. The response contains some work that is incomplete or unclear.

STUDENT RESPONSE

RESPONSE SCORE: 0 POINTS



PARTS A AND B

Question 18
Page 1 of 1

Line Guide

Use the drawing below to answer the question.

Mantis



A mantis is a green insect that can grow up to 6 inches in length. It is a predator that can move very quickly. Also, it has excellent vision. A mantis can turn its head from side to side, unlike most other insects.

Part A: Identify two adaptations that help a mantis survive in its environment.

Adaptation 1:
phsyical 8/50

Adaptation 2:
behavirol 9/50

Part B: Describe how a mantis uses **one** of the two adaptations listed in **Part A** to survive in its environment.

Eq
physical to prtect itself from - prey. 38 / 1000

Review/End Test Pause Flag Options

The response provides *insufficient* evidence to demonstrate any understanding of how specific adaptations can help a living organism survive. The response (“*physical*,” “*behavirol*”) is not specific enough to identify the adaptations that help a mantis survive in its environment. No credit is earned in Part B because no specific adaptation is given in Part A to indicate which adaptation is being used to help the mantis “*prtect itself from - prey*.”

SAMPLE ITEM SUMMARY

MULTIPLE-CHOICE

| Sample Number | Alignment | Answer Key | Depth of Knowledge | p-values | | | |
|---------------|------------|------------|--------------------|----------|-----|-----|-----|
| | | | | A | B | C | D |
| 1 | S4.A.1.3.1 | D | 2 | 4% | 8% | 17% | 70% |
| 2 | S4.A.1.3.2 | A | 2 | 84% | 5% | 7% | 4% |
| 3 | S4.A.1.3.4 | B | 2 | 9% | 69% | 6% | 16% |
| 4 | S4.A.1.3.5 | B | 1 | 8% | 71% | 10% | 11% |
| 5 | S4.A.2.1.2 | C | 2 | 15% | 9% | 67% | 9% |
| 6 | S4.A.2.1.3 | C | 2 | 8% | 6% | 79% | 6% |
| 7 | S4.A.3.1.1 | D | 1 | 4% | 4% | 6% | 86% |
| 8 | S4.A.3.2.2 | C | 3 | 9% | 11% | 73% | 7% |
| 9 | S4.B.2.2.1 | B | 1 | 6% | 62% | 20% | 12% |
| 10 | S4.B.3.2.3 | B | 2 | 12% | 60% | 8% | 19% |
| 11 | S4.C.1.1.2 | D | 2 | 5% | 2% | 3% | 89% |
| 12 | S4.C.2.1.2 | A | 2 | 83% | 9% | 4% | 4% |
| 13 | S4.C.3.1.1 | C | 2 | 10% | 14% | 62% | 14% |
| 14 | S4.D.1.1.3 | C | 2 | 14% | 10% | 66% | 10% |
| 15 | S4.D.1.3.1 | C | 1 | 4% | 8% | 84% | 4% |
| 16 | S4.D.3.1.1 | C | 2 | 17% | 10% | 61% | 11% |

OPEN-ENDED

| Sample Number | Alignment | Points | Depth of Knowledge | Mean Score |
|---------------|------------|--------|--------------------|------------|
| 17 | S4.A.1.3.5 | 2 | 2 | 1.22 |
| 18 | S4.B.2.1.2 | 2 | 2 | 1.49 |

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PSSA Grade 4 Science Item and Scoring Sampler

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