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—
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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

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

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 percentage[2] 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

<table>
<tr><th colspan="5">Item Information</th><th>Option Annotations</th></tr>
<tr><td colspan="3">Alignment</td><td colspan="2">Assigned AAEC</td><td rowspan="8">Brief answer option analysis or rationale</td></tr>
<tr><td colspan="3">Answer Key</td><td colspan="2">Correct Answer</td></tr>
<tr><td colspan="3">Depth of Knowledge</td><td colspan="2">Assigned DOK</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td colspan="5">p-values</td></tr>
<tr><td>A</td><td>B</td><td>C</td><td>D</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Percentage of students who selected each option</td></tr>
</table>

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 Points

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 ITEMS

Use the drawing below to answer question 1.

The drawing shows a prairie dog and two holes that have been dug in the ground. The labels on the drawing are hole 1, prairie dog, and hole two. Hole 1 is in the top left of the drawing and hole 2 is in the bottom right. The prairie dog is to the right of hole 1. There is an arrow pointing from hole 1 to hole 2.

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	
Alignment	S4.A.1.3.1
Answer Key	D
Depth of Knowledge	2
p-value A	4%
p-value B	8%
p-value C	17%
p-value D	70% (correct answer)
Option Annotations	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.

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	
Alignment	S4.A.1.3.2
Answer Key	A
Depth of Knowledge	2
p-value A	84% (correct answer)
p-value B	5%
p-value C	7%
p-value D	4%
Option Annotations	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.

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	
Alignment	S4.A.1.3.4
Answer Key	B
Depth of Knowledge	2
p-value A	9%
p-value B	69% (correct answer)
p-value C	6%
p-value D	16%
Option Annotations	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.

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	
Alignment	S4.A.1.3.5
Answer Key	B
Depth of Knowledge	1
p-value A	8%
p-value B	71% (correct answer)
p-value C	10%
p-value D	11%
Option Annotations	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.

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?

A. A drawing shows two different-size containers with seeds inside. The container on the left side of the drawing is short and the container on the right is tall. The label below each container is, three seeds.

B. A drawing shows two equal-size containers with seeds inside. Both containers are tall. The label below the container on the left side of the drawing is, two seeds. The label below the container on the right is, five seeds.

C. A drawing shows two equal-size containers with seeds inside. Both containers are short. The label below each container is, four seeds.

D. A drawing shows two different-size containers with seeds inside. The container on the left side of the drawing is short and the container on the right is tall. The label below the container on the left side of the drawing is, two seeds. The label below the container on the right is, four seeds.

Item Information	
Alignment	S4.A.2.1.2
Answer Key	C
Depth of Knowledge	2
p-value A	15%
p-value B	9%
p-value C	67% (correct answer)
p-value D	9%
Option Annotations	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.

Use the data table below to answer question 6.

Plant Growth

Day	Plant Height (centimeter)
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. 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	
Alignment	S4.A.2.1.3
Answer Key	C
Depth of Knowledge	2
p-value A	8%
p-value B	6%
p-value C	79% (correct answer)
p-value D	6%
Option Annotations	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.

Use the drawings below to answer question 7.

The title of the drawing on the left is, System X. The drawing shows trees. The title of the drawing on the right is, System Y. The drawing shows a building with smoke coming out of smoke stacks and electric power lines.

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	
Alignment	S4.A.3.1.1
Answer Key	D
Depth of Knowledge	1
p-value A	4%
p-value B	4%
p-value C	6%
p-value D	86% (correct answer)
Option Annotations	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.

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	
Alignment	S4.A.3.2.2
Answer Key	C
Depth of Knowledge	3
p-value A	9%
p-value B	11%
p-value C	73% (correct answer)
p-value D	7%
Option Annotations	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.

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	
Alignment	S4.B.2.2.1
Answer Key	B
Depth of Knowledge	1
p-value A	6%
p-value B	62% (correct answer)
p-value C	20%
p-value D	12%
Option Annotations	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.

Use the map below to answer question 10.

The title of the map is, Canada Geese Seasonal Habitat. A map of North America is shown. The labels from top to bottom are, Canada, United States, and Mexico. The shading on the map from top to bottom is, light gray, medium gray, and dark gray. The key to the right of the map shows a light gray box with the label, summer, a medium gray box, with the label, year-round, and a dark gray box, with the label, winter. There is a compass shown to the right of the map. The labels on the compass, starting from the left in a clockwise direction are, W, N, E, and S.

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	
Alignment	S4.B.3.2.3
Answer Key	B
Depth of Knowledge	2
p-value A	12%
p-value B	60% (correct answer)
p-value C	8%
p-value D	19%
Option Annotations	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.

Use the drawing below to answer question 11.

The title of the drawing is, Three Objects. The object on the left side of the drawing is a large sphere, the object in the middle is a medium sphere, and the object on the right is a small sphere.

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

A. A baseball bat is shown.

B. A crumpled piece of paper is shown.

C. A jump rope is shown.

D. A golf ball is shown.

Item Information	
Alignment	S4.C.1.1.2
Answer Key	D
Depth of Knowledge	2
p-value A	5%
p-value B	2%
p-value C	3%
p-value D	89% (correct answer)
Option Annotations	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.

Use the drawings below to answer question 12.

The title above the drawings is, Ice Cubes Melting. The drawing on the left shows three ice cubes on a flat surface. The label below the drawing on the left is, 10:00 A.M. The drawing on the right shows the same three ice cubes on the flat surface that have partly melted. The label below the drawing on the left is, 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	
Alignment	S4.C.2.1.2
Answer Key	A
Depth of Knowledge	2
p-value A	83% (correct answer)
p-value B	9%
p-value C	4%
p-value D	4%
Option Annotations	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.

Use the drawing below to answer question 13.

The title of the drawing is, Motions of a Metal Ball. The labels on the drawing from left to right in a clockwise direction are: metal ball, motion 1, strong magnet, and motion 2. The drawing shows the movement of the metal ball from the left side of a table across the surface, and rolling off the right side of the table to the floor. A horseshoe magnet is shown to the right of the table above the surface.

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	
Alignment	S4.C.3.1.1
Answer Key	C
Depth of Knowledge	2
p-value A	10%
p-value B	14%
p-value C	62% (correct answer)
p-value D	14%
Option Annotations	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.

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	
Alignment	S4.D.1.1.3
Answer Key	C
Depth of Knowledge	2
p-value A	14%
p-value B	10%
p-value C	66% (correct answer)
p-value D	10%
Option Annotations	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.

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	
Alignment	S4.D.1.3.1
Answer Key	C
Depth of Knowledge	1
p-value A	4%
p-value B	8%
p-value C	84% (correct answer)
p-value D	4%
Option Annotations	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.

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	
Alignment	S4.D.3.1.1
Answer Key	C
Depth of Knowledge	2
p-value A	17%
p-value B	10%
p-value C	61% (correct answer)
p-value D	11%
Option Annotations	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.

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	The response demonstrates a *thorough* 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 explaining how one of the student's morning activities may have a negative effect on the environment AND describing an activity that could replace one of the student's morning activities and reduce a negative effect on the environment. The response is clear, complete, and correct.
1	The response demonstrates a *partial* 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 explaining how one of the student's morning activities may have a negative effect on the environment **OR** describing an activity that could replace one of the student's morning activities and reduce a negative effect on the environment. The response may contain some work that is incomplete or unclear.
0	The response provides *insufficient* evidence to demonstrate any understanding of the concept being tested.

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

Handwritten 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.

Student Response: 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.

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

Annotation: 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

Handwritten 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.

Student Response: He put the cradboard box in the trash box.

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

Student Response: He could put the cereal box in a recyleing bin.

Annotation: 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 cradboard 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 recyleing bin"). The response contains some work that is incomplete or unclear.

STUDENT RESPONSE

Handwritten 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.

Student Response: it affects him becase 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.

Student Response: he ate a real good breckfast and rod the bus.

Annotation: 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.

The title of the drawing is, Mantis. The drawing shows a mantis on a plant.

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.

Describe a possible positive effect and a possible negative effect of the widespread use of antibiotics or vaccinations.

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	The response demonstrates a *thorough* 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 identifying **two** adaptations that help a mantis survive in its environment **AND** describing how a mantis uses **one** of the two adaptations listed in Part A to survive in its environment. The response is clear, complete, and correct.
1	The response demonstrates a *partial* 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 identifying **two** adaptations that help a mantis survive in its environment **OR** describing how a mantis uses an adaptation listed in Part A to survive in its environment. The response may contain some work that is incomplete or unclear.
0	The response provides *insufficient* evidence to demonstrate any understanding of the concept being tested.

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

Online Response Score: 2 points

Use the drawing below to answer question 18.

The title of the drawing is, Mantis. The drawing shows a mantis on a plant.

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.

Describe a possible positive effect and a possible negative effect of the widespread use of antibiotics or vaccinations.

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

Adaptation 1 Student Response: his eye sight

Adaptation 2 Student Response: his speed

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

Student Response: His speed helps him or her to atack its pray. Thats what I think he uses his adaptations.

Annotation: 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 atack its pray”). The response is clear, complete, and correct.

STUDENT RESPONSE

Online Response Score: 1 point

Use the drawing below to answer question 18.

The title of the drawing is, Mantis. The drawing shows a mantis on a plant.

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.

Describe a possible positive effect and a possible negative effect of the widespread use of antibiotics or vaccinations.

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

Adaptation 1 Student Response: they can move very quickly

Adaptation 2 Student Response: they could move they head from side to side

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

Student Response: I said that they can move very quickly and that they could move they head from side to side

Annotation: 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

Online Response Score: 0 points

Use the drawing below to answer question 18.

The title of the drawing is, Mantis. The drawing shows a mantis on a plant.

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.

Describe a possible positive effect and a possible negative effect of the widespread use of antibiotics or vaccinations.

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

Adaptation 1 Student Response: phsyical

Adaptation 2 Student Response: behavirol

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

Student Response: phsyical to prtect itself from - prey.

Annotation: The response provides *insufficient* evidence to demonstrate any understanding of how specific adaptations can help a living organism survive. The response ("phsyical," "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."

SCIENCE—SUMMARY DATA

MULTIPLE-CHOICE

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

Sample Number	Alignment	Answer Key	Depth of Knowledge	*p*-value A	*p*-value B	*p*-value C	*p*-value D
14	S4.D.1.1.3	C	2	14%	10%	66% (correct answer)	10%
15	S4.D.1.3.1	C	1	4%	8%	84% (correct answer)	4%
16	S4.D.3.1.1	C	2	17%	10%	61% (correct answer)	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

PSSA Grade 4 Science
Item and Scoring Sampler