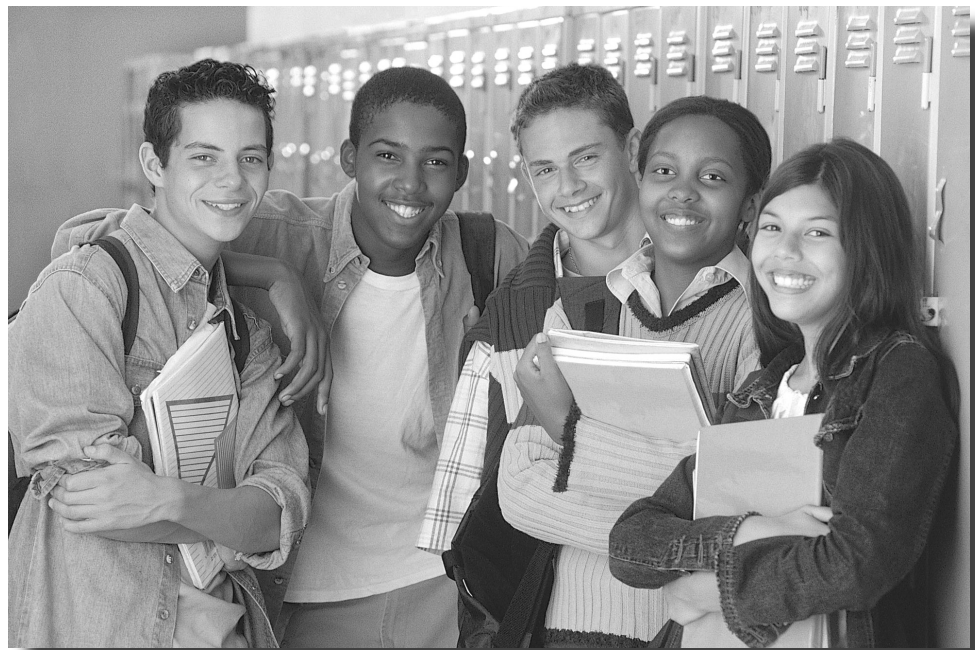




The Pennsylvania System of School Assessment



2005–2006

Science Item and Scoring Sampler Grade 8

Pennsylvania Department of Education Bureau of Assessment and Accountability 2005–2006

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INTRODUCTION

General Introduction

The Department of Education provides districts and schools with tools to assist in delivering focused instructional programs aligned to the state assessment system. These tools include assessment anchor documents, assessment handbooks, and content-based item and scoring samplers. This 2005–2006 Science Item and Scoring Sampler is a useful tool for Pennsylvania educators in the preparation of local instructional programs and the statewide PSSA assessments.

What's Included

This item and scoring sampler contains a science scenario and science multiple-choice and open-ended items. These items are examples of science items that may be used to assess student performance on the PSSA. These items provide an idea of the types of items that will appear on the operational Spring 2008 PSSA. Each item has been through a rigorous review process to ensure alignment with the Assessment Anchors and State Standards, but they have not been reviewed by Pennsylvania teachers or administered in Pennsylvania schools.

Purpose and Uses

The items in this sampler may be used as examples for creating assessment items at the classroom level, and they may also be copied and used as part of a local instructional program.* Classroom teachers may find it beneficial to have students respond to the open-ended item in this sampler. Educators can then use the sampler as a guide to score the responses either independently or together with colleagues within a school or district.

Item Format and Scoring Guidelines

The multiple-choice items have four answer choices. A correct response to each multiple-choice item is worth 1 point.

The science scenario presents a topic or common theme that is explored by four multiple-choice items.

Each short open-ended (SOE) item is designed to take about ten minutes to complete. However, during an actual testing event students are given additional time as necessary to complete the test items. The open-ended items in science are scored with item-specific guides on a 0–2 scale. An item-specific scoring guide is presented within this sampler and is similar to those which will be used to score open-ended items in future PSSA science assessments.

Also included is the General Description of Scoring Guidelines used to develop the item-specific guides. The General Scoring Guidelines should be used to develop any item-specific scoring guides created for use within local instructional programs.*

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

GENERAL DESCRIPTION OF 2-POINT SCIENCE SCORING GUIDELINES:

- 2 – 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 – 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 – 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.

Special Categories within zero reported separately:

- BLK – Blank, entirely erased, or written refusal to respond
OT – Off task
IL – Illegible
LOE – Response in a language other than English

SCIENCE REPORTING CATEGORIES

Science scores are reported in four categories:

- A** – The Nature of Science
- B** – Biological Sciences
- C** – Physical Sciences
- D** – Earth and Space Sciences

Sample Items

The science stand-alone multiple-choice items begin on page 6. Each item is preceded by the Assessment Anchor and eligible content coding. Answer options A–D are followed by a brief analysis or rationale. The correct answer is indicated by an asterisk (*).

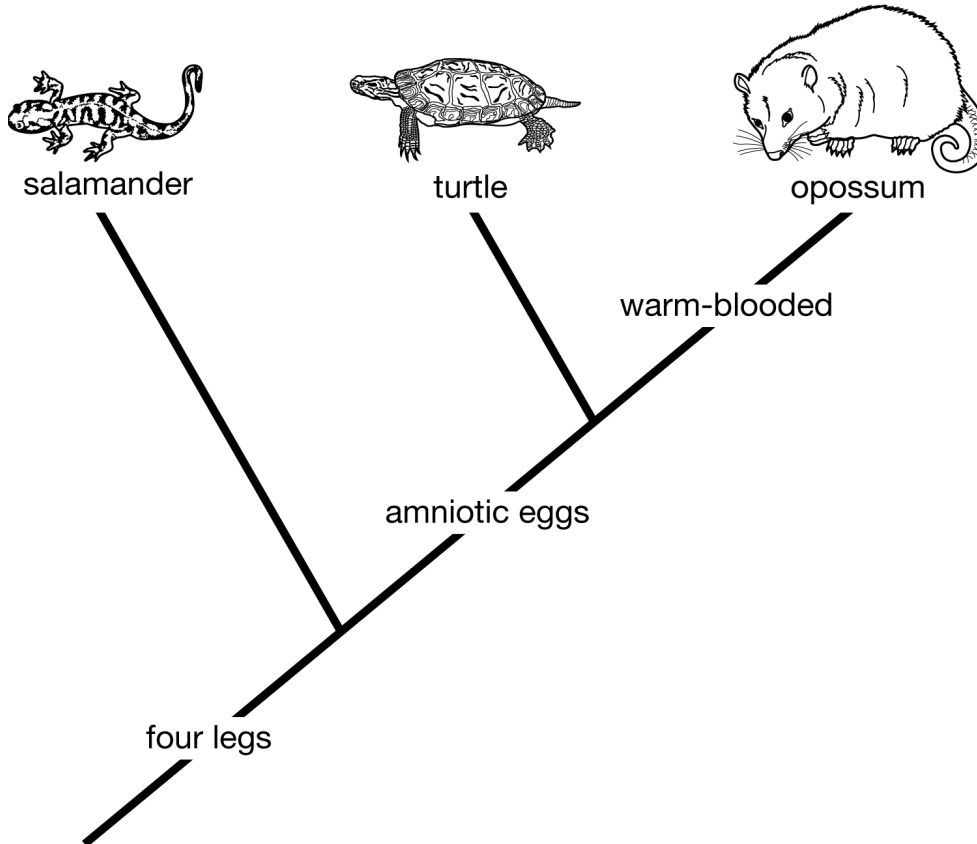
One science scenario and one stand-alone 2-point SOE item follow the multiple-choice items. The SOE item is displayed with an item-specific scoring guide and samples of responses with scores and annotations.

SCIENCE

A.3.2.1, B.1.1.2

Use the relationship diagram below to answer question 1.

Relationship Diagram



1. Which statement most accurately describes a relationship between two animals in the relationship diagram?

- A The turtle and opossum have amniotic eggs. *
- B The turtle and salamander have amniotic eggs.
- C The turtle and opossum are warm-blooded.
- D The turtle and salamander are warm-blooded.

- A Key: According to the diagram, the turtle and the opossum have amniotic eggs.
B The salamander does not have amniotic eggs.
C The turtle is not warm-blooded.
D Neither the turtle nor the salamander is warm-blooded.

SCIENCE

D.3.1.3

Use the table below to answer question 2.

Objects in the Solar System

Object	What It Is Made of	Location Where Seen
1	gases and dust	orbiting the Sun
2	rock	orbiting the Sun
3	rock	entering a planet's atmosphere
4	rock	lying in a hole in a field

2. Which object is a meteor?

- A object 1
- B object 2
- C object 3 *
- D object 4

- A Object 1 is a comet.
- B Object 2 is an asteroid.
- C Key: A meteor is made of rock and moves through Earth's atmosphere.
- D Object 4 could be a meteorite or a terrestrial rock; it is not a meteor.

B.2.2.2

3. Which statement describes the pattern of inheritance that produces 100% red-flowered first-generation offspring?

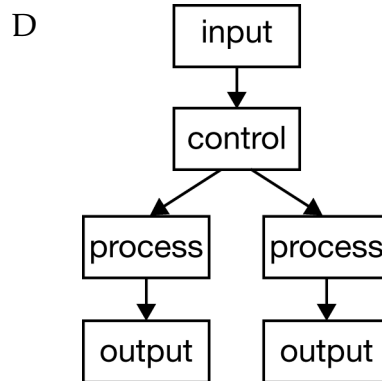
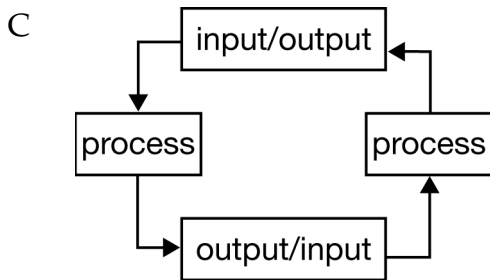
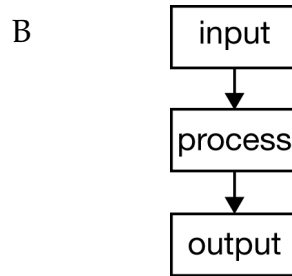
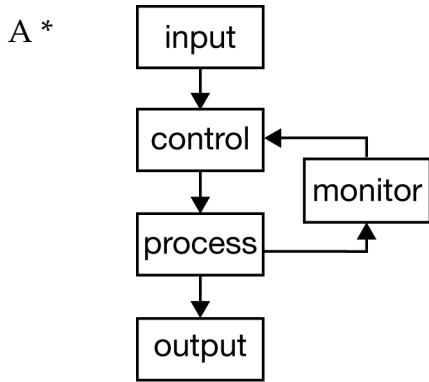
- A Red flowers are dominant and white flowers are recessive. *
- B Red flowers are recessive and white flowers are dominant.
- C Both red flowers and white flowers are recessive.
- D Both red flowers and white flowers are dominant.

- A Key: Since all offspring inherited the red flower trait, red must be the dominant trait. The only way to get 100% red-flowered offspring in this cross is if the red-flowered parent is homozygous dominant and the white-flowered parent is homozygous recessive.
- B This cross would result in all offspring having white flowers.
- C If only two traits are expressed, a single gene cannot have two recessive traits; one trait must be dominant.
- D If only two traits are expressed, a single gene cannot have two dominant traits; one trait must be recessive.

SCIENCE

A.3.1.4

4. A closed system includes a feedback mechanism. Which system has a feedback mechanism?



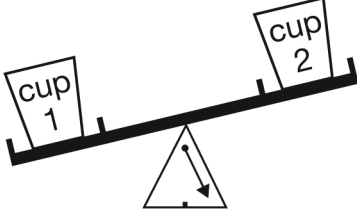
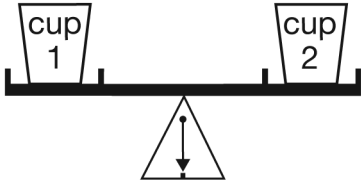
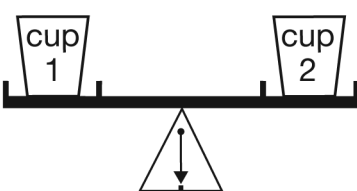
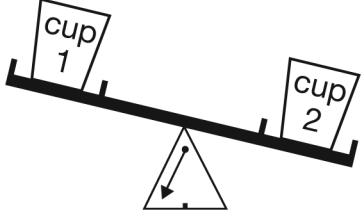
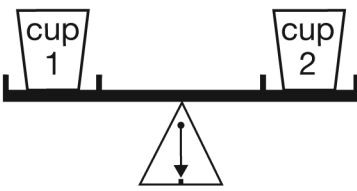
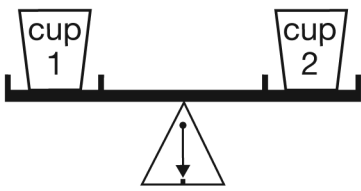
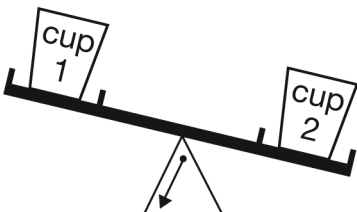
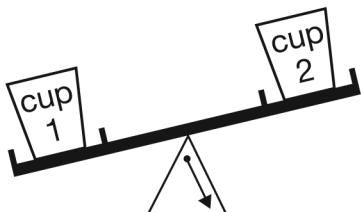
- A Key: This system includes a feedback mechanism, which controls the output.
B This system does not include a feedback mechanism.
C This system is a continuous process; it does not include a feedback mechanism.
D This system does not include a feedback mechanism.

SCIENCE

A.1.3.2, C.1.1.2

Use the chart below to answer question 5.

Comparing Observations of Balance

Observation	Balance before Frozen Water Melts	Balance after Frozen Water Melts
1		
2		
3		
4		

5. A student poured 10 milliliters of water into a small bowl and froze it. Then she placed the frozen water into cup 1. Next, she poured 10 milliliters of water into an identical cup (cup 2). She placed both cups on a balance and made observations as the frozen water in cup 1 melted. Which observation shows what happened during the student's investigation?

- A observation 1
- B observation 2
- C observation 3 *
- D observation 4

- A *The mass of the water does not decrease during a phase change.*
- B *The mass of the water does not decrease during a phase change.*
- C *Key: The mass of the water remains the same during a phase change.*
- D *The mass of the water does not increase during a phase change.*

SCIENCE

B.2.1.2

6. A scientist observed two populations of birds of the same species. One population lives in a warm climate, and the other population lives in a cold climate. The birds in the two populations look very different. The birds in the cold climate are larger than the birds in the warm climate and have smaller wingspans. Which statement explains why these two populations have different adaptations?

- A Birds in warm climates fly more often than birds in cold climates.
- B Birds in warm climates eat more food than birds in cold climates.
- C Birds in cold climates need to grow more slowly than birds in warm climates.
- D Birds in cold climates need to conserve more body heat than birds in warm climates. *

- A *Birds in warm climates do not necessarily fly more than birds in cold climates (e.g., ostrich, emu).*
- B *Birds in warm climates do not necessarily eat more food than birds in cold climates; they do not need additional energy to maintain body temperature.*
- C *There is no evidence to conclude that birds in cold climates need to grow more slowly than birds in warm climates.*
- D *Key: Birds in cold climates need to conserve more body heat than birds in warm climates, so they likely have larger bodies due to layers of fat under the skin and smaller wingspans to reduce surface area exposed to the elements.*

A.2.1.3

7. A student experimented with different factors that affect melting rates of snow. The student divided a pile of snow, placing equal amounts of snow into two identical containers. He then mixed dirt into the snow in one of the containers. A lighted bulb, which modeled energy from the sun, was placed directly above the two containers. After ten minutes, the amount of snow remaining in each container was measured. Which variable changed in this experiment?

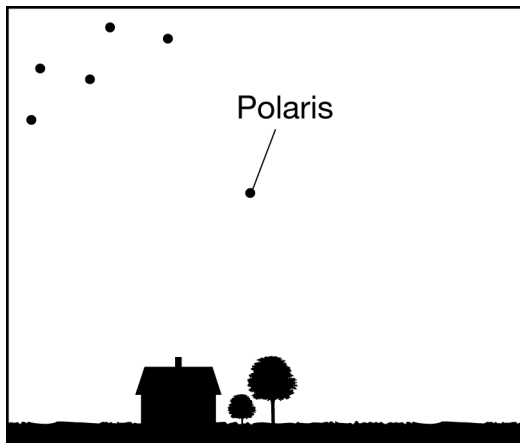
- A the size and shape of each container
- B the length of time the light shines on each container
- C the distance between the light bulb and each container
- D the amount of dirt that is mixed in each container *

- A *The size and the shape of the container in each experiment stayed the same.*
- B *The lighted bulb was placed over both containers for the same amount of time.*
- C *The distance between the light bulb and each container was the same.*
- D *Key: Only one container had dirt mixed with snow.*

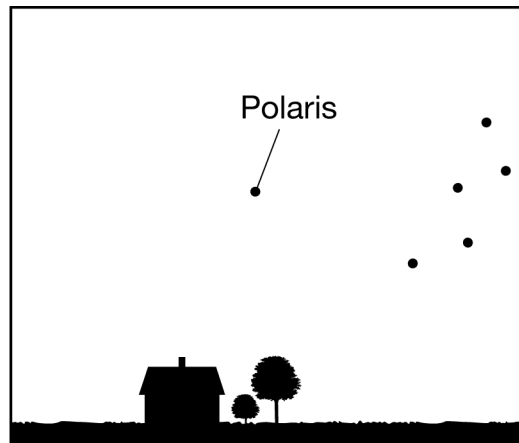
SCIENCE

D.3.1.1, A.1.3.2

Use the diagrams below to answer question 8.



looking north
8:00 P.M. January 1



looking north
8:00 P.M. August 1

8. The diagrams show the constellation Cassiopeia as observed from the same position on Earth. What causes this constellation to appear in different parts of the sky in different months of the year?

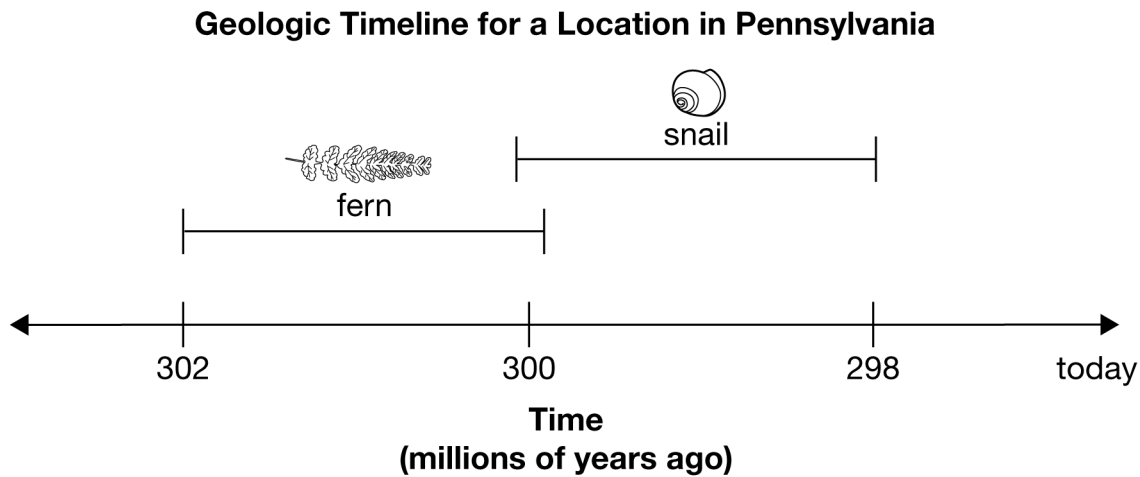
- A Earth's rotation on its axis
- B Earth's revolution around the Sun *
- C changing phases of the Moon in its orbit around Earth
- D changing speeds of stars in their orbits around the Sun

- A *Earth's rotation causes hourly changes of Cassiopeia's position in the sky; however, these observations were made at the same time of the day, seven months apart.*
- B *Key: The change in Earth's orbital position causes star locations in the sky to be different over time.*
- C *The Moon's phases do not affect the apparent position of stars in the sky.*
- D *Stars do not orbit the Sun.*

SCIENCE

A.1.3.2, D.1.1.4

Use the timeline below to answer question 9.



9. The diagram shows a geologic timeline and information about two types of organisms that formed fossils. Based on the timeline, which statement is correct?
- A The ferns adapted quickly to a different habitat.
 - B The environment became more suitable for snails. *
 - C The consumers in the area ate more snails than ferns.
 - D The snails were protected from predators by their shells.

- A *Ferns ceased to exist in this location about 300 million years ago (MYA), which indicates that they were not able to adapt to a new habitat.*
- B *Key: Over time, ferns ceased to exist in this location and snails appeared. This suggests that the environment became more suitable for snails.*
- C *There is no evidence to indicate that consumers preferred to eat ferns or snails.*
- D *Snails ceased to exist in this location about 298 MYA, but the timeline shows no relationship between the snails (or their shells) and their predators.*

SCIENCE

Grade 8 Science Scenario Begins on the Next Page

SCIENCE

Directions: Use the information presented on this page to answer questions 10 through 13.

A class studied organisms living in a pond near their school and conducted an investigation. Algae and *Daphnia* are common organisms in pond water. Information about these organisms is included in the table. The students wrote down the steps they took and prepared a setup like the one shown.

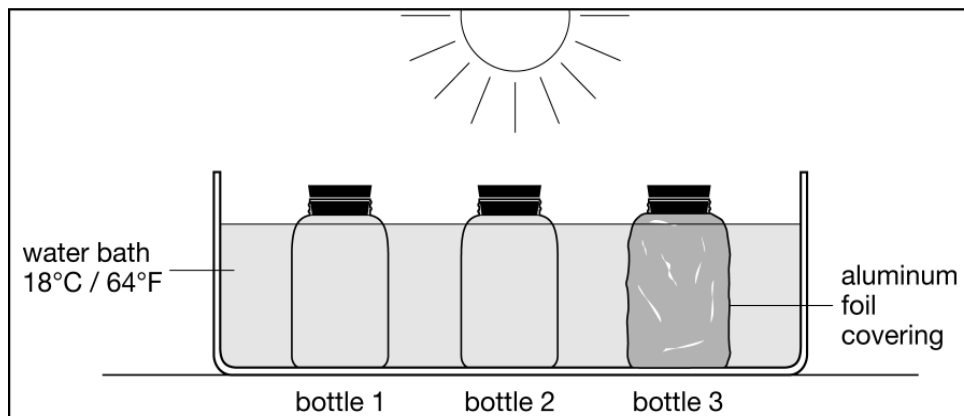
Organism Characteristics

Organism	How It Gets Food	What It Needs to Survive	What It Produces
<i>Daphnia</i>	eats plants	water, energy, oxygen	carbon dioxide, energy
algae	photosynthesizes	water, energy, light, carbon dioxide	oxygen, carbon dioxide, glucose

Steps Taken in the Investigation

1. Completely filled three clear glass bottles with equal amounts of pond water.
2. Sealed each bottle with a stopper.
3. Labeled the lid of each bottle.
4. Wrapped aluminum foil around bottle 3.
5. Put all three bottles in a water bath to maintain a constant temperature of 18°C/64°F.
6. Placed this setup in direct sunlight.
7. Measured the concentrations of dissolved oxygen and carbon dioxide in the pond water in bottle 1.
8. Waited four hours, then measured the concentrations of dissolved oxygen and carbon dioxide in bottles 2 and 3.

Setup for the Investigation



SCIENCE

Directions: Use the information presented on page 14 to answer questions 10 through 13.

A.2.1.2

10. Which question is a testable question that can be answered by conducting this investigation?
- A How much algae will the *Daphnia* eat in four hours?
 - B How productive is the algae in producing glucose by photosynthesis? *
 - C How does water temperature affect the growth of algae and *Daphnia*?
 - D How does the use of aluminum foil affect the population growth rate of *Daphnia*?

A.2.1.3

11. Which tool could the student use to measure a dependent variable in this investigation?
- A a microscope
 - B a thermometer
 - C a gas analyzer *
 - D a graduated cylinder

B.3.1.3

12. Which statement explains the relationship being studied in this investigation?
- A One species harms the other.
 - B One species benefits and the other is not affected.
 - C Each species benefits from the other. *
 - D Both species compete for the same resources.

C.2.1.3

13. Which energy conversion occurs in the organisms studied during this investigation?
- A solar energy to chemical energy *
 - B heat energy to mechanical energy
 - C chemical energy to electrical energy
 - D mechanical energy to chemical energy

The rationale for questions 10 through 13 are located on page 16.

SCIENCE

Rationale for questions 10 through 13.

Rationale for question 10

- A *This investigation is not set up to determine how much algae Daphnia will eat.*
- B *Key: One can determine the glucose productivity of the algae during that four hour period by measuring carbon dioxide and oxygen levels at the beginning of the investigation and after four hours.*
- C *Water temperature was kept constant over the four-hour period.*
- D *To determine how the use of aluminum foil affects the population growth rate of Daphnia, the Daphnia would have to be in contact with the foil.*

Rationale for question 11

- A *A microscope could be used to observe algae and Daphnia, but the physical appearance of the organisms is not a variable in this investigation.*
- B *A thermometer could be used to measure water and air temperatures, but temperature is a controlled variable in this investigation.*
- C *Key: A gas analyzer could be used to measure carbon dioxide and oxygen levels, which are two dependent variables in this investigation.*
- D *A graduated cylinder could be used to measure the volume of pond water used in each bottle, but the volume of water is a controlled variable in this investigation.*

Rationale for question 12

- A *Neither species harms the other in this investigation.*
- B *Both species benefit from each other in the investigation.*
- C *Key: Daphnia produce carbon dioxide that the algae need for photosynthesis. Algae produce oxygen that the Daphnia need for respiration. This is a mutualistic relationship.*
- D *The species do not compete for resources in this investigation.*

Rationale for question 13

- A *Key: Solar energy (sunlight) is converted to chemical energy by the algae during photosynthesis.*
- B *Heat energy is present in the organisms, but it is not converted to mechanical energy.*
- C *Chemical energy is present in the organisms, but it is not converted to electrical energy.*
- D *Chemical energy is present in the organisms, but it is not a result of mechanical energy conversion.*

SCIENCE

Grade 8 Open-Ended Item Begins on the Next Page

SCIENCE

A.2.1.5, B.3.2.3

This is a Short Open-Ended (SOE) question. It is worth two points.

Use the table below to answer question 14.

Plant Flowering Experiment

Species	Plant	Number of Hours		Receives 15 Minutes of Light during Dark Period?	Produces Flowers?
		In Light	In Dark		
X	1	14	10	no	yes
	2	10	14	yes	yes
	3	10	14	no	no
Y	4	14	10	no	no
	5	14	10	yes	no
	6	10	14	no	yes

14. A gardener wanted two plant species in his house to flower at the same time. He read that light is one factor that can affect whether plants produce flowers. The gardener designed an experiment to determine the effect of light on his two plant species (X and Y). He placed three plants of each species in separate rooms. Each plant was exposed to periods of light and dark. Some plants received an additional 15 minutes of light at the same time during the dark period. The results of the gardener's experiment are shown in the table.

A. Identify the plant **species** that needs long nights to flower and the plant **species** that needs short nights to flower. Explain your answers.

SCIENCE

B. Explain why 15 minutes of light helped one of the plants to produce flowers.

SCIENCE

Item #14

This item will be reported under Category A, The Nature of Science, and Category B, Biological Sciences.

Assessment Anchors:

- A.2.1 – Apply knowledge of scientific investigation or technological design in different contexts to make inferences to solve problems.
- B.3.2 – Identify evidence of change to infer and explain the ways different variables may affect change in natural or human-made systems.

Specific Eligible Content addressed by this item:

- A.2.1.5 – Use evidence from the investigation to clearly communicate and support conclusions.
- B.3.2.3 – Describe the response of organism to environmental changes (e.g., changes in climate, hibernation, migrations, coloration) and how those changes affect survival.

Scoring Guide:

Score	In response to this item, the student—
2	demonstrates a thorough understanding of the environmental conditions needed by plants to produce flowers by correctly identifying the plant species that is a long-night plant and the plant species that is a short-night plant and providing a correct explanation for each choice. In addition, the response correctly explains why 15 minutes of light helped one plant to flower. The response is clear, complete, and correct. Response may contain a minor blemish or omission in work or explanation that does not detract from demonstrating a thorough understanding.
1	demonstrates a partial understanding of the environmental conditions needed by plants to produce flowers by correctly identifying the plant species that is a long-night plant and the plant species that is a short-night plant and providing a correct explanation for each choice. OR The statement correctly explains why 15 minutes of light helped one plant to flower.

Scoring Guide is continued on Page 21.

SCIENCE

Score	In response to this item, the student—
0	<p>provides insufficient evidence to demonstrate any understanding of the environmental conditions needed by plants to produce flowers. The response may show only information copied or rephrased from the question or insufficient correct information to receive a score of 1.</p> <p>BLK – Blank, entirely erased, or written refusal to respond OT – Off task IL – Illegible LOE – Response in a language other than English</p>

Top-scoring Response:

Part A Response
<p>Plant species X is a short-night flowering plant because it produces flowers when the number of hours of darkness is less than the number of hours of light or when a long length of darkness is shortened by the 15 minutes of extra light. Plant species Y is a long-night flowering plant, because it produces flowers when the number of hours of darkness is more than the number of hours of light.</p>

(1 score point)

1 point for correct identification and explanation.

Part B Response
<p>The extra light shortened the length of darkness for the plant that is a short-night flowering plant.</p>

(1 score point)

1 point for correct explanation.

SCIENCE

Response Score: 2

Use the table below to answer question 14.

Plant Flowering Experiment

Species	Plant	Number of Hours		Receives 15 Minutes of Light during Dark Period?	Produces Flowers?
		In Light	In Dark		
X	1	14	10	no	yes
	2	10	14	yes	yes
	3	10	14	no	no
Y	4	14	10	no	no
	5	14	10	yes	no
	6	10	14	no	yes

14. A gardener wanted two plant species in his house to flower at the same time. He read that light is one factor that can affect whether plants produce flowers. The gardener designed an experiment to determine the effect of light on his two plant species (X and Y). He placed three plants of each species in separate rooms. Each plant was exposed to periods of light and dark. Some plants received an additional 15 minutes of light at the same time during the dark period. The results of the gardener's experiment are shown in the table.

- A. Identify the plant **species** that needs long nights to flower and the plant **species** that needs short nights to flower. Explain your answers.

A. Plant species X is a short-night flowering plant because it produces flowers when the number of hours of darkness is shortened by the 15 minutes of extra light. Plant species Y is a long night flowering plant, because it produces flowers when the number of hours of darkness is more than the number of hours of light.

The student's response in part A provides a correct identification and explanation.

GO TO THE NEXT PAGE TO FINISH THE QUESTION.

SCIENCE

14. *Continued.* Please refer to the previous page for graphic and stimulus text.

B. Explain why 15 minutes of light helped one of the plants to produce flowers.

B. The extra light shortened the length of darkness for the plant that is a short-night flowering plant.

The student's response in part A provides a correct explanation.

SCIENCE

Response Score: 1

Use the table below to answer question 14.

Plant Flowering Experiment

Species	Plant	Number of Hours		Receives 15 Minutes of Light during Dark Period?	Produces Flowers?
		In Light	In Dark		
X	1	14	10	no	yes
	2	10	14	yes	yes
	3	10	14	no	no
Y	4	14	10	no	no
	5	14	10	yes	no
	6	10	14	no	yes

14. A gardener wanted two plant species in his house to flower at the same time. He read that light is one factor that can affect whether plants produce flowers. The gardener designed an experiment to determine the effect of light on his two plant species (X and Y). He placed three plants of each species in separate rooms. Each plant was exposed to periods of light and dark. Some plants received an additional 15 minutes of light at the same time during the dark period. The results of the gardener's experiment are shown in the table.

- A. Identify the plant **species** that needs long nights to flower and the plant **species** that needs short nights to flower. Explain your answers.

A.

X is the plant which likes light. It produces flowers when there is more light than dark. The other type of plant likes dark because it makes flowers when there is more dark than light.

The student's response in part A provides a correct identification and explanation.

GO TO THE NEXT PAGE TO FINISH THE QUESTION.

SCIENCE

14. *Continued.* Please refer to the previous page for graphic and stimulus text.

B. Explain why 15 minutes of light helped one of the plants to produce flowers.

B.
All plants need light to make flowers.

The student's response in part B is non-responsive to the task. The response does not explain why the additional exposure to light helped one plant to flower.

SCIENCE

Response Score: 0

Use the table below to answer question 14.

Plant Flowering Experiment

Species	Plant	Number of Hours		Receives 15 Minutes of Light during Dark Period?	Produces Flowers?
		In Light	In Dark		
X	1	14	10	no	yes
	2	10	14	yes	yes
	3	10	14	no	no
Y	4	14	10	no	no
	5	14	10	yes	no
	6	10	14	no	yes

14. A gardener wanted two plant species in his house to flower at the same time. He read that light is one factor that can affect whether plants produce flowers. The gardener designed an experiment to determine the effect of light on his two plant species (X and Y). He placed three plants of each species in separate rooms. Each plant was exposed to periods of light and dark. Some plants received an additional 15 minutes of light at the same time during the dark period. The results of the gardener's experiment are shown in the table.

A. Identify the plant **species** that needs long nights to flower and the plant **species** that needs short nights to flower. Explain your answers.

A.

Plant 1 has 14 and plant 2 has 10 and plant 3 also has 10.

The student's response in part A is incorrect.

GO TO THE NEXT PAGE TO FINISH THE QUESTION.

SCIENCE

14. *Continued.* Please refer to the previous page for graphic and stimulus text.

B. Explain why 15 minutes of light helped one of the plants to produce flowers.

B.

Plant 1 and 2 and 3.

The student's response in part B repeats information given in the graphic.

