pennsylvania
DEPARTMENT OF EDUCATION

The Pennsylvania System of School Assessment

Science
Item and Scoring Sampler

2015–2016
Grade 4

Pennsylvania Department of Education Bureau of Curriculum, Assessment, and Instruction—August 2015

SCIENCE TEST DIRECTIONS

Below are the test directions available to students taking the paper-and-pencil version of the assessment. These directions may be used to help students navigate through the assessment.

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 QUESTIONS

2 POINTS

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

1 POINT

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

0 POINTS

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

MULTIPLE-CHOICE QUESTIONS

1. An increase in which human activity would **most likely** result in the most air pollution?

A. driving cars

B. watering plants

C. food production

D. recycling of plastic

Item Information	
Alignment	S4.A.1.3.5
Answer Key	A
Depth of Knowledge	2

***p*-values**			
A	**B**	**C**	**D**
72%	9%	8%	11%

Option Annotations

A. Key: The driving of cars contributes the most air pollution due to the burning of fossil fuels and the large numbers of cars in use.
B. The act of watering plants does not release pollutants into the air.
C. Comparatively few air pollutants are released during the many processes involved in food production.
D. Comparatively few air pollutants are released during the many processes involved in the recycling of plastic.

Use the table below to answer question 2.

Sunrise Times at Location X

Date	Sunrise Time
January 1	7:43 A.M.
February 1	7:29 A.M.
March 1	6:53 A.M.
April 1	6:03 A.M.
May 1	??

2. About what time did the Sun **most likely** rise on May 1 at location X?

A. 4:30 A.M.

B. 5:19 A.M.

C. 6:03 A.M.

D. 6:54 A.M.

Item Information	
Alignment	S4.A.2.1.3
Answer Key	B
Depth of Knowledge	2

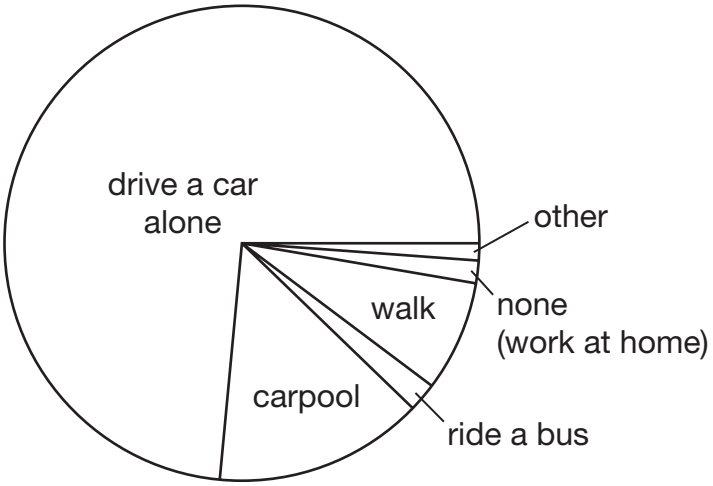
***p*-values**			
A	**B**	**C**	**D**
5%	80%	3%	11%

Option Annotations

A. Based on the pattern in the data, this sunrise time is too early.
B. Key: This sunrise time is consistent with the pattern in the data.
C. This is the same as the sunrise time for April 1, which does not match the pattern in the data.
D. Based on the pattern in the data, this sunrise time is too late.

Use the circle graph below to answer question 3.

Transportation Taken to Work in Wilkes-Barre, PA



3. Which conclusion can be made based on the data in the circle graph?

A. More people walk to work than ride a bus.

B. Riding a bus in Wilkes-Barre is very expensive.

C. Few people enjoy driving a car alone to get to work.

D. Carpooling is more popular than driving a car alone.

Item Information	
Alignment	S4.A.2.1.4
Answer Key	A
Depth of Knowledge	2

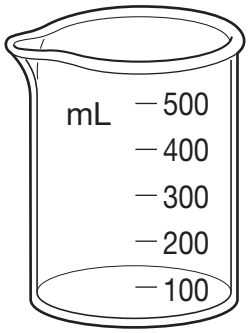
***p*-values**			
A	**B**	**C**	**D**
71%	8%	15%	5%

Option Annotations

A. Key: The section of the graph representing walking is larger than that of riding a bus, so more people walk to work than ride a bus.
B. This graph does not display the cost of transportation.
C. This graph does not display how many people enjoy driving a car alone.
D. Carpooling is used less often than driving a car alone.

Use the drawing below to answer question 4.

Tool



4. Which type of information can a student collect using the tool in the drawing?

A. mass of a solid

B. height of a solid

C. volume of a liquid

D. temperature of a liquid

Item Information	
Alignment	S4.A.2.2.1
Answer Key	C
Depth of Knowledge	2

***p*-values**			
A	**B**	**C**	**D**
10%	14%	69%	7%

Option Annotations

A. Determining the mass of a solid would require a balance, not a beaker.
B. Determining the height of a solid would require a meter stick, not a beaker.
C. Key: A beaker can be used to measure the volume of a liquid.
D. Determining the temperature of a liquid would require a thermometer, not a beaker.

5. Which two systems are **most likely** both human-made?

A. a river and a sailboat

B. a flower and a beehive

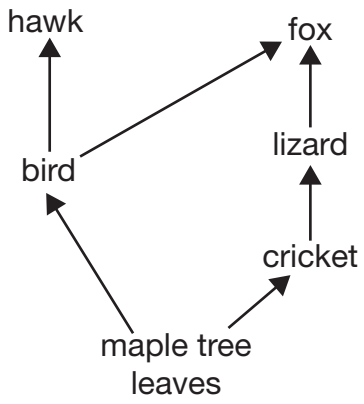
C. a planet and a telescope

D. a stapler and a computer

Item Information				Option Annotations
Alignment	S4.A.3.1.1			A. A sailboat is human-made, but a river is naturally formed. B. Both systems are naturally formed. C. A telescope is human-made, but a planet is naturally formed. D. Key: Both systems are human-made.
Answer Key	D			
Depth of Knowledge	2			
***p*-values**				
A	**B**	**C**	**D**	
5%	4%	3%	87%	

Use the food web below to answer question 6.

Forest Food Web



6. Which statement **best** describes sunlight and how it affects this food web?

A. Sunlight is living and enters the food web through the hawk and the fox.

B. Sunlight is living and enters the food web through the maple tree leaves.

C. Sunlight is nonliving and enters the food web through the hawk and the fox.

D. Sunlight is nonliving and enters the food web through the maple tree leaves.

Item Information	
Alignment	S4.A.3.1.2
Answer Key	D
Depth of Knowledge	2

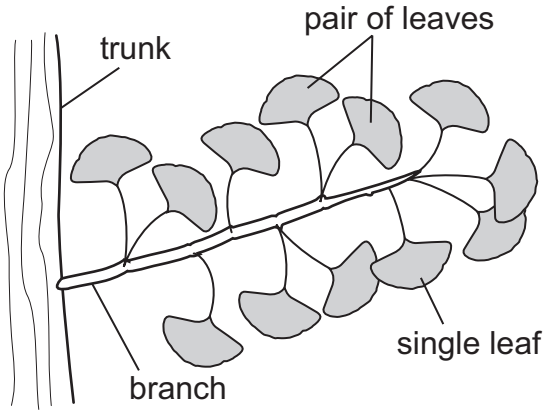
***p*-values**			
A	**B**	**C**	**D**
10%	29%	11%	49%

Option Annotations

A. Sunlight is nonliving.
B. Sunlight is nonliving.
C. Sunlight is nonliving, but it does not enter food webs through consumers such as the hawk and the fox.
D. Key: Sunlight is nonliving and enters food webs through producers such as the maple trees.

Use the drawing below to answer question 7.

Part of a Tree



7. Which statement **best** describes a pattern in the leaves of this tree?

A. Single leaves grow farther from the branch than pairs of leaves.

B. Single leaves are located closer to the trunk than pairs of leaves.

C. Pairs of leaves and single leaves grow on both sides of the branch.

D. Pairs of leaves and single leaves only grow on one side of the branch.

Item Information	
Alignment	S4.A.3.3.1
Answer Key	C
Depth of Knowledge	2

***p*-values**			
A	**B**	**C**	**D**
11%	6%	77%	7%

Option Annotations

A. Pairs of leaves and single leaves are the same distance from the branch.
B. A pair of leaves is located nearest to the trunk.
C. Key: Pairs of leaves and single leaves grow on both sides of the branch.
D. Pairs of leaves and single leaves grow on both sides of the branch.

8. Which of the following shows the correct order of a frog's life cycle?

A. tadpole → young frog → egg → adult frog

B. adult frog → egg → young frog → tadpole

C. egg → tadpole → young frog → adult frog

D. young frog → egg → adult frog → tadpole

Item Information	
Alignment	S4.B.1.1.5
Answer Key	C
Depth of Knowledge	1

***p*-values**			
A	**B**	**C**	**D**
3%	2%	93%	2%

Option Annotations

A. Tadpoles do not develop into eggs, and eggs do not develop into adult frogs.
B. Young frogs do not develop into tadpoles.
C. Key: Eggs hatch as tadpoles, which develop into young frogs, then develop into adult frogs.
D. Young frogs do not develop into eggs, and adult frogs do not develop into tadpoles.

9. In the spring, some golden eagles fly north over Pennsylvania. In the fall, they fly back south for the winter. Which statement **best** describes why these golden eagles live in southern areas in winter?

A. In northern areas, there is less food for eagles in winter.

B. In northern areas, there are more competing birds in winter.

C. In southern areas, there are fewer eagle predators in winter.

D. In southern areas, there is more space for eagle nesting in winter.

Item Information				Option Annotations
Alignment	S4.B.3.2.3			A. Key: Cold weather leads to ice and snow accumulation in northern areas, which decreases the amount of food available to eagles in winter. B. There are fewer birds in northern areas in winter. C. There are few eagle predators regardless of location. D. There is less or equal space in southern areas in winter.
Answer Key	A			
Depth of Knowledge	2			
***p*-values**				
A	**B**	**C**	**D**	
56%	5%	15%	24%	

10. Which type of land use is **least likely** in a city?

A. housing

B. businesses

C. large farms

D. small parks

Item Information	
Alignment	S4.B.3.3.4
Answer Key	C
Depth of Knowledge	1

***p*-values**			
A	**B**	**C**	**D**
5%	7%	81%	7%

Option Annotations

A. Housing is a common use of land in cities.
B. Businesses are a common use of land in cities.
C. Key: Large farms use a lot of land and are typically found outside city limits.
D. Small parks are a common use of land in cities.

11. Which sense can **best** be used to describe the texture of an object?

A. taste

B. sight

C. smell

D. touch

Item Information				Option Annotations
Alignment	S4.C.1.1.1			A. Taste is a sense for detecting the flavor of an object. B. Sight is the sense for visually observing objects. C. Smell is the sense for detecting aromas or scents. D. Key: Touch is the sense by which a material is perceived by means of physical contact, and texture is a physical structure of a material.
Answer Key	D			
Depth of Knowledge	2			
***p*-values**				
A	**B**	**C**	**D**	
7%	11%	5%	76%	

12. Which forms of energy are produced by the Sun?

A. light and heat

B. light and chemical

C. electrical and heat

D. electrical and chemical

Item Information				Option Annotations
Alignment	S4.C.2.1.1			A. Key: Light and heat are produced by the Sun. B. Chemical energy is not produced by the Sun. C. Electrical energy is not produced by the Sun. D. Chemical and electrical energy are not produced by the Sun.
Answer Key	A			
Depth of Knowledge	2			
***p*-values**				
A	**B**	**C**	**D**	
84%	4%	9%	3%	

Use the drawing below to answer question 13.

Farm

13. Which statement **best** describes the location of some objects in the drawing?

A. The house is behind the trees.

B. The stream is in front of the geese.

C. The rock is to the right of the horse.

D. The horse is to the left of the house.

Item Information	
Alignment	S4.C.3.1.3
Answer Key	B
Depth of Knowledge	2

***p*-values**			
A	**B**	**C**	**D**
7%	76%	6%	10%

Option Annotations

A. The house is in front of the trees.
B. Key: The stream is in front of the geese.
C. The rock is to the left of the horse.
D. The horse is to the right of the house.

14. Which statement **best** explains why sinkholes form over salt beds more easily than over harder rock?

A. Salt is more easily removed by groundwater.

B. Salt beds are only found on the bottom of lakes.

C. Hard rocks are more easily removed by groundwater.

D. Hard rocks are only found toward the tops of mountains.

Item Information	
Alignment	S4.D.1.1.1
Answer Key	A
Depth of Knowledge	2

***p*-values**			
A	**B**	**C**	**D**
55%	20%	13%	12%

Option Annotations
A. Key: Water dissolves salt more easily than it dissolves hard rock. B. Locations of salt beds are not limited to lakes. C. Hard rocks are not easily dissolved by groundwater. D. Hard rocks are found at all elevations.

15. One student makes a model of a lake and another student makes a model of a river. Which statement **best** describes the water in one of the models?

A. The lake model contains salt water.

B. The lake model contains cold water.

C. The river model contains muddy water.

D. The river model contains flowing water.

Item Information	
Alignment	S4.D.1.3.3
Answer Key	D
Depth of Knowledge	2

***p*-values**			
A	**B**	**C**	**D**
9%	10%	9%	72%

Option Annotations

A. Most lakes contain fresh water.
B. Both lakes and rivers can contain cold water.
C. Both lakes and rivers can contain muddy water.
D. Key: Rivers are characterized by flowing water.

16. Which statement describes the movement of objects in the Sun-Earth-Moon system?

A. Earth travels around the Moon and the Sun.

B. The Sun travels around Earth and the Moon.

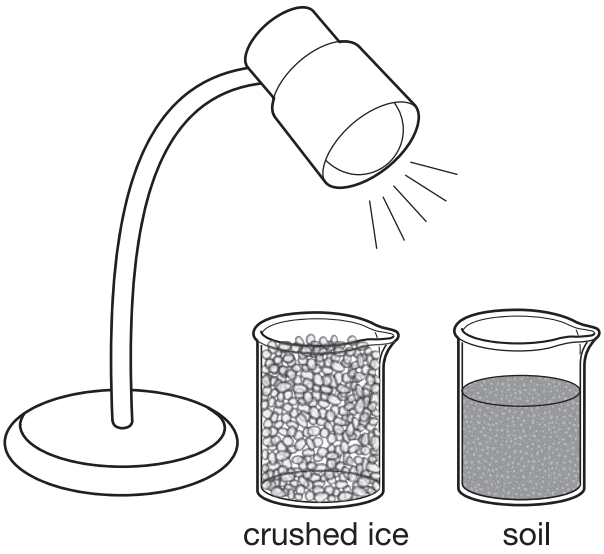
C. Earth travels around the Sun, and the Moon travels around Earth.

D. The Sun travels around Earth, and the Moon travels around Earth.

Item Information				Option Annotations
Alignment	S4.D.3.1.1			A. Earth does not travel around the Moon. B. The Sun does not travel around Earth or the Moon. C. Key: Earth travels around the Sun, and the Moon travels around Earth. D. The Sun does not travel around Earth.
Answer Key	C			
Depth of Knowledge	2			
***p*-values**				
A	**B**	**C**	**D**	
16%	9%	61%	14%	

OPEN-ENDED QUESTIONS

Use the drawings below to answer question 17.



17. A student placed these two objects directly beneath a lamp for 10 minutes. Describe how each object was **most likely** affected by the lamp.

Crushed ice: _____

_____

_____

_____

Soil: _____

_____

_____

_____

SCORING GUIDE

#17 ITEM INFORMATION

Alignment	S4.A.1.3.3	**Depth of Knowledge**	2	**Mean Score**	1.42

ITEM-SPECIFIC SCORING GUIDELINE

Score	Description
2	The response demonstrates a *thorough* understanding of the change to objects caused by temperature change or light by: • describing how the crushed ice was most likely affected by the lamp **AND** • describing how the soil was most likely affected by the lamp. The response is clear, complete, and correct.
1	The response demonstrates a *partial* understanding of the change to objects caused by temperature change or light by: • describing how the crushed ice was most likely affected by the lamp **OR** • describing how the soil was most likely affected by the lamp. 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.
Non-scorables	B – No response written R – Refusal to respond F – Foreign language K – Off task U – Unreadable

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

Responses that will receive credit:

Crushed ice (1 point):

- Some (or all) of the ice melted and changed into a liquid (water).
- The level of the ice in the beaker decreased.
- The movement of molecules in the ice sped up.
- Energy was added to the ice.

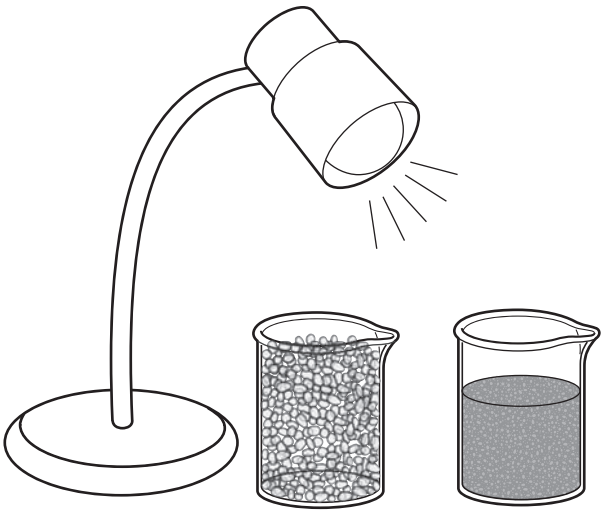
Soil (1 point):

- The soil becomes warmer on top.
- The soil becomes drier on top.
- Energy was added to the soil.

STUDENT RESPONSE

RESPONSE SCORE: 2 POINTS

Use the drawings below to answer question 17.



17. A student placed these two objects directly beneath a lamp for 10 minutes. Describe how each object was **most likely** affected by the lamp.

Crushed ice: The Ice probibly melted. The light provids heat too, and crushed Ice is cold, so it probibly melted.

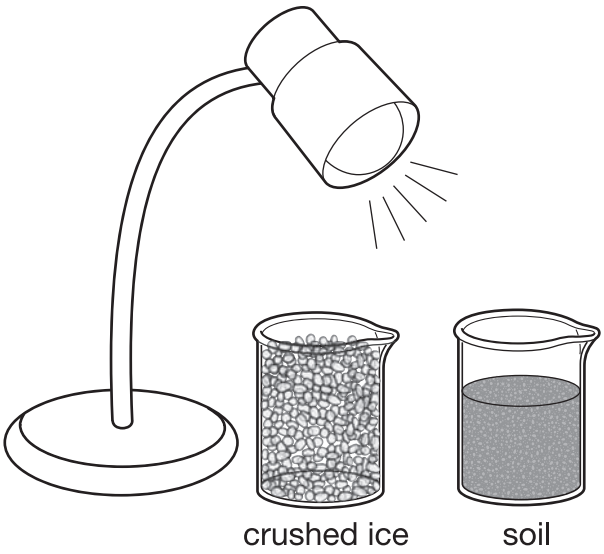
Soil: It probibly got really dry and crusty. Soil needs to keep moist, and with the heat from the light it most likely dryed up.

This response demonstrates a thorough understanding of the changes to objects caused by the lamp. For both the ice and the soil, the student describes a probable change and explains that heat from the lamp would cause the changes.

STUDENT RESPONSE

RESPONSE SCORE: 1 POINT

Use the drawings below to answer question 17.



17. A student placed these two objects directly beneath a lamp for 10 minutes. Describe how each object was **most likely** affected by the lamp.

Crushed ice: it will melt

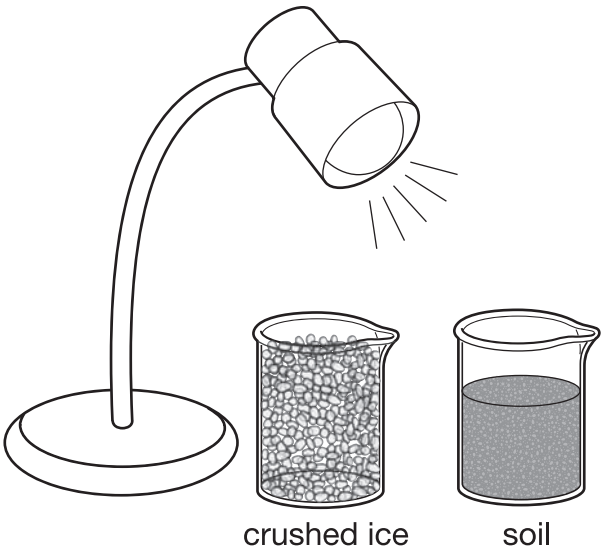
Soil: it won't melt.

This response demonstrates a partial understanding of the effects of the lamp on the objects. "It will melt" correctly identifies an effect on the ice, but no effect on the soil is described.

STUDENT RESPONSE

RESPONSE SCORE: 0 POINTS

Use the drawings below to answer question 17.



17. A student placed these two objects directly beneath a lamp for 10 minutes. Describe how each object was **most likely** affected by the lamp.

Crushed ice: of corse crushed ice is gonna be afected by the lamp

Soil: the soil will not get affected by the lamp.

This response provides insufficient evidence to demonstrate any understanding of the changes to objects caused by exposure to heat or light. "Of corse crushed ice is gonna be afected by the lamp" does not explain what that effect would be.

Question 18

Line Guide

Use the diagram below to answer the question.

A community park has a pond.

Part A: Identify one living and one nonliving thing at the pond.

EQ

0 / 1000

Part B: Describe one role of a nonliving thing in the pond ecosystem.

EQ

0 / 1000

Review/End Test | Pause | Flag | Options | Back

SCORING GUIDE

#18 ITEM INFORMATION

Alignment	S4.A.3.1.3	**Depth of Knowledge**	2	**Mean Score**	1.34

ITEM-SPECIFIC SCORING GUIDELINE

Score	Description
2	The response demonstrates a *thorough* understanding of how to categorize the parts of an ecosystem as living or nonliving and describe their roles in the system by identifying one living and one nonliving thing at the pond and by describing one role of the nonliving thing identified. Response may contain a minor blemish (e.g., misspelled words) or omission in work or explanation that does not detract from demonstrating a thorough understanding.
1	The response demonstrates a *partial* understanding of how to categorize the parts of an ecosystem as living or nonliving and describe their roles in the system by identifying one living and one nonliving thing at the pond or by describing one role of a nonliving thing at the pond. A response that only identifies a living thing at the pond is insufficient for earning a score of one. 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 how to categorize the parts of an ecosystem as living or nonliving and describe their roles in the system. Response may show only information copied or rephrased from the question. Nothing is correct, relevant, or sufficient to earn a score of one.
Non-scorables	B – No response written R – Refusal to respond F – Foreign language K – Off task U – Unreadable

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

Responses that will receive credit:

Part A: One living and one nonliving thing.

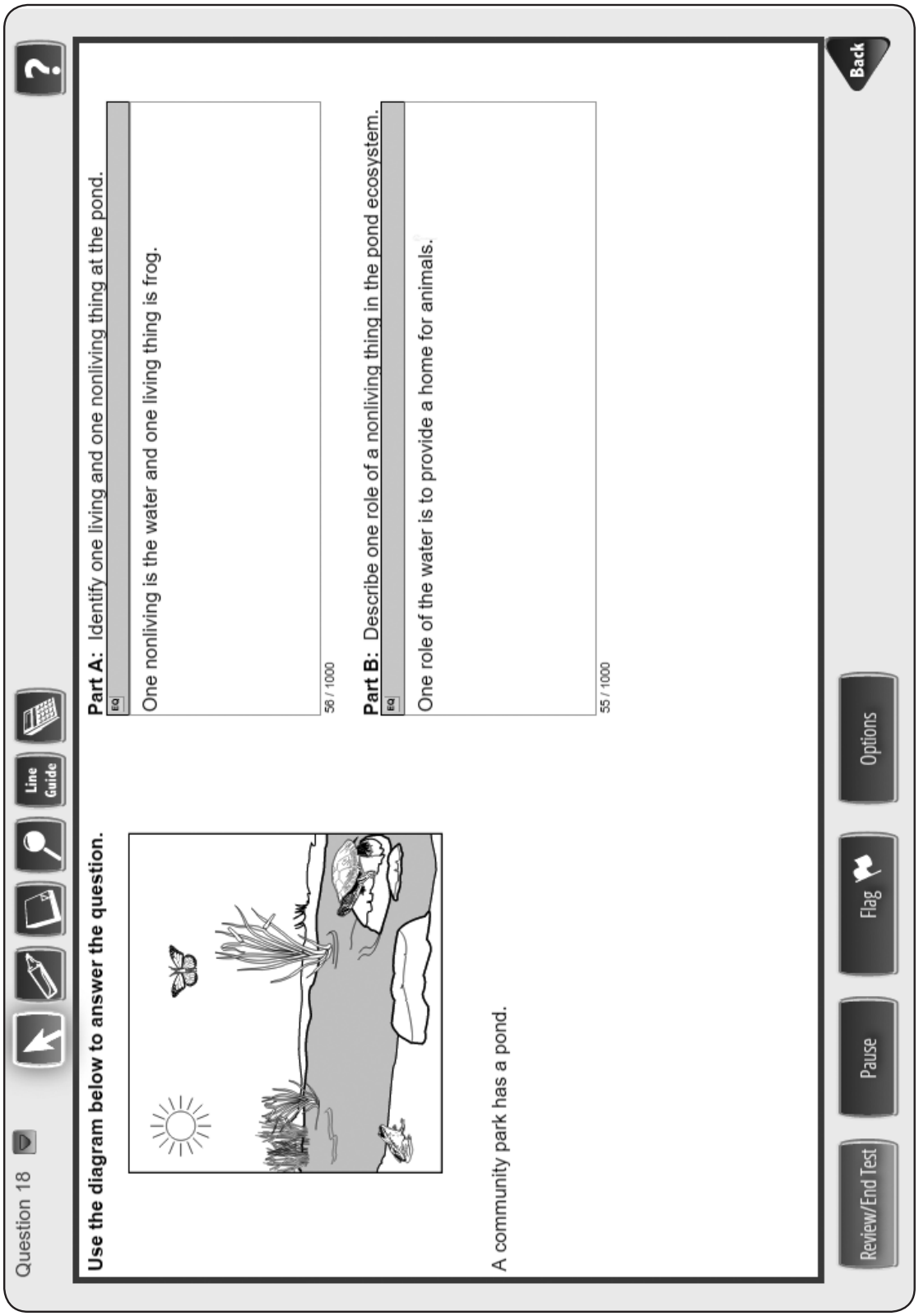
- *Living*: aquatic plants, frog, turtle, or butterfly
- *Nonliving*: sunlight, rocks, air, water, or soil

Part B: One role of the nonliving thing.

- The sunlight provides energy for the plants to do photosynthesis.
  OR
- The rocks provide a place for the turtle to rest.
  OR
- The air provides oxygen for the plants, turtle, and frog.
  OR
- The water provides a place for the frog and turtle to live.
  OR
- The soil provides nutrients for the plants.

STUDENT RESPONSE

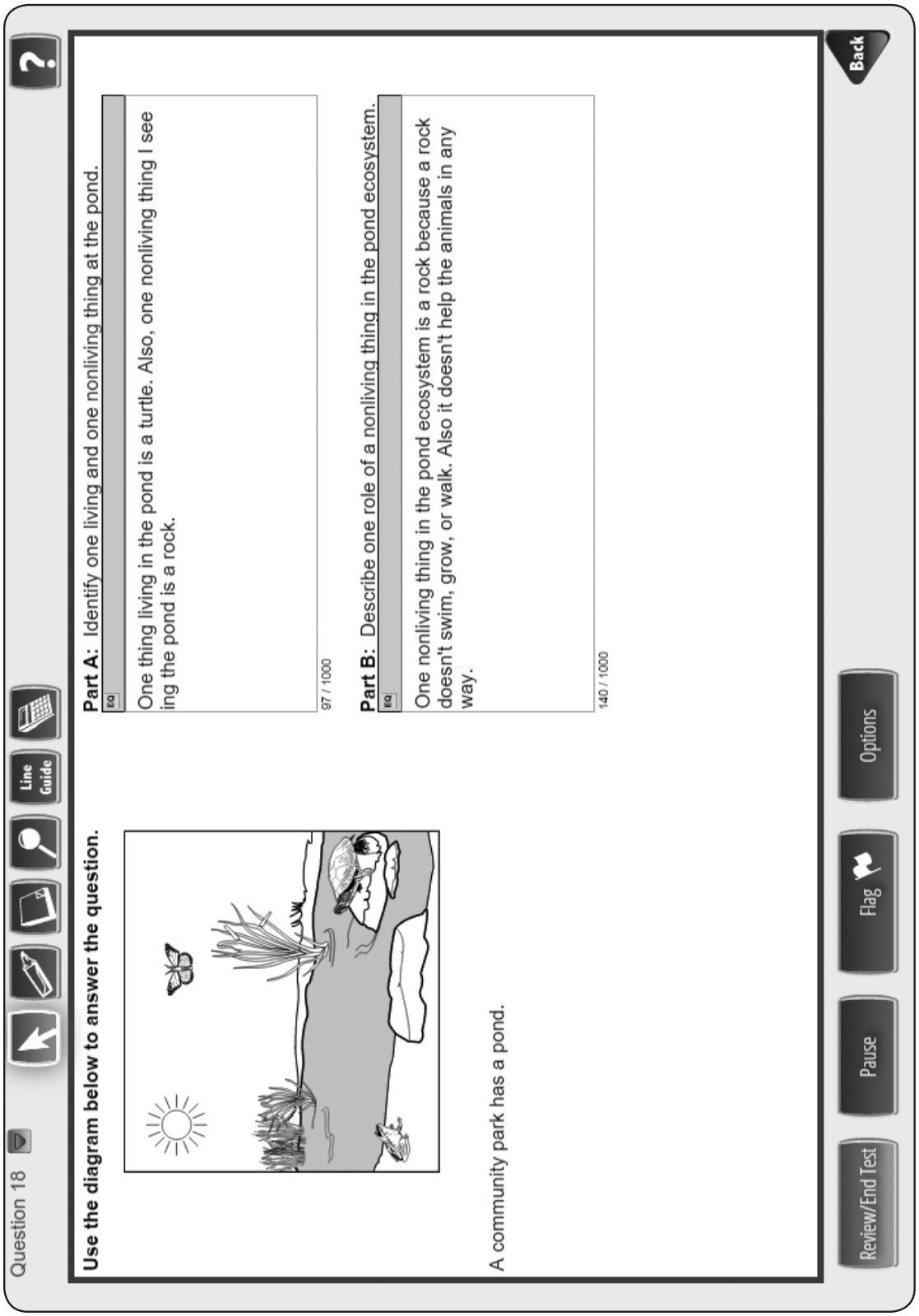
RESPONSE SCORE: 2 POINTS



This response demonstrates a thorough understanding of the categories of living vs. nonliving things and correctly describes a role of one of the nonliving elements in the pond ecosystem. Part A is correct; Part B—water provides "a home for animals" is an acceptable role in the ecosystem.

STUDENT RESPONSE

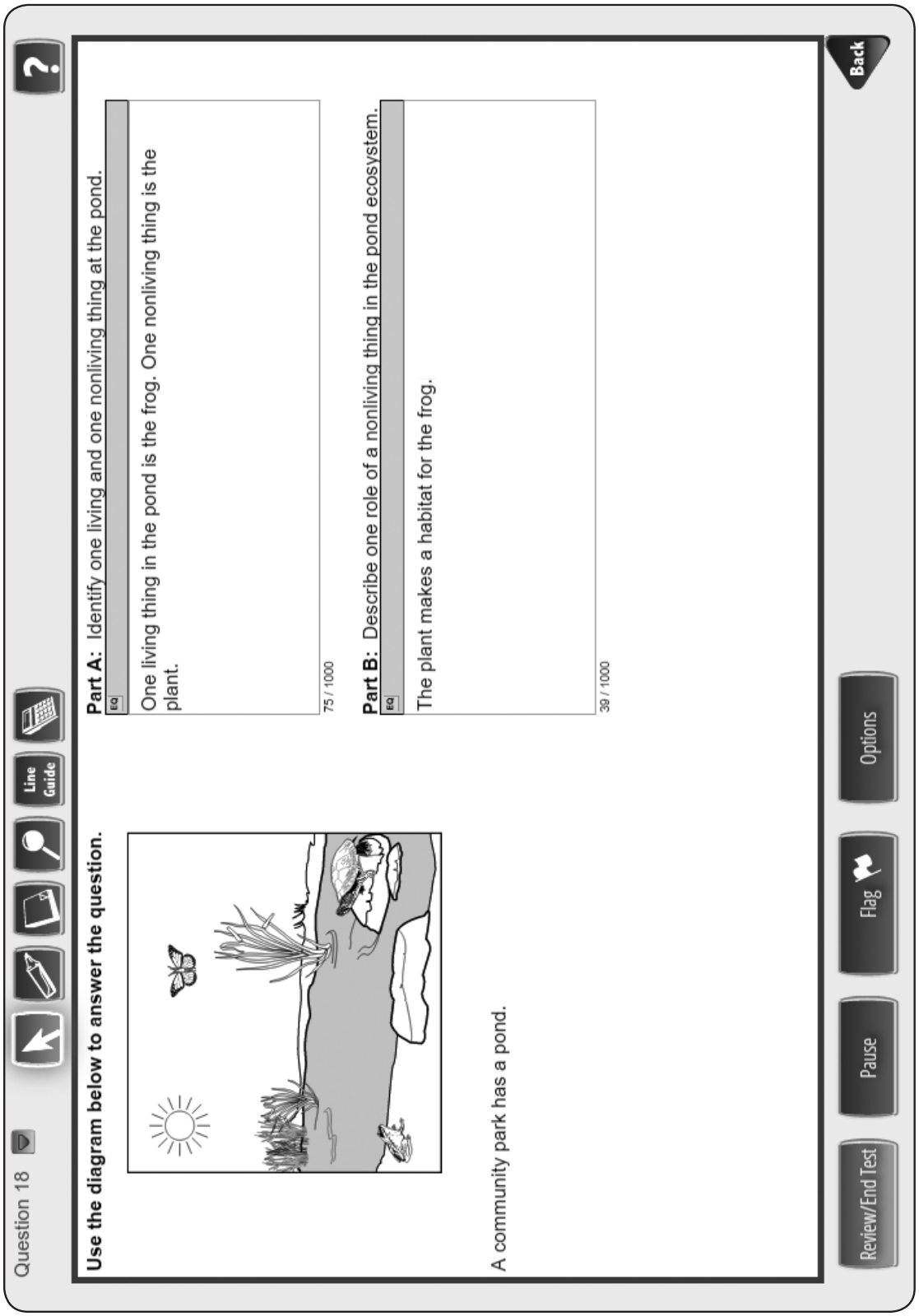
RESPONSE SCORE: 1 POINT



This response demonstrates a partial understanding of the roles of living and nonliving things within an ecosystem. Part A is correct. In Part B, the student describes why the rock is nonliving, not its role in the ecosystem.

STUDENT RESPONSE

RESPONSE SCORE: 0 POINTS



This response provides insufficient evidence to demonstrate any understanding of the concepts being tested. In Part A, the student identifies a plant as a nonliving thing, and in Part B, the student describes the role of a living thing, rather than a nonliving thing, in the pond ecosystem.

SCIENCE GRADE 4—SUMMARY DATA

MULTIPLE-CHOICE

Sample Number	Alignment	Answer Key	Depth of Knowledge	*p*-values			
				A	B	C	D
1	S4.A.1.3.5	A	2	72%	9%	8%	11%
2	S4.A.2.1.3	B	2	5%	80%	3%	11%
3	S4.A.2.1.4	A	2	71%	8%	15%	5%
4	S4.A.2.2.1	C	2	10%	14%	69%	7%
5	S4.A.3.1.1	D	2	5%	4%	3%	87%
6	S4.A.3.1.2	D	2	10%	29%	11%	49%
7	S4.A.3.3.1	C	2	11%	6%	77%	7%
8	S4.B.1.1.5	C	1	3%	2%	93%	2%
9	S4.B.3.2.3	A	2	56%	5%	15%	24%
10	S4.B.3.3.4	C	1	5%	7%	81%	7%
11	S4.C.1.1.1	D	2	7%	11%	5%	76%
12	S4.C.2.1.1	A	2	84%	4%	9%	3%
13	S4.C.3.1.3	B	2	7%	76%	6%	10%
14	S4.D.1.1.1	A	2	55%	20%	13%	12%
15	S4.D.1.3.3	D	2	9%	10%	9%	72%
16	S4.D.3.1.1	C	2	16%	9%	61%	14%

OPEN-ENDED

Sample Number	Alignment	Points	Depth of Knowledge	Mean Score
17	S4.A.1.3.3	2	2	1.42
18	S4.A.3.1.3	2	2	1.34