



**pennsylvania**  
DEPARTMENT OF EDUCATION

# The Pennsylvania System of School Assessment

## Science Item and Scoring Sampler



**2021\***  
**Grade 4**

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\* This is a revised version of the 2017 Item and Scoring Sampler.

## SCIENCE TEST DIRECTIONS

### Directions:

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

#### Multiple-Choice Questions:

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

For the multiple-choice questions:

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

#### Open-Ended Questions:

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

For the open-ended questions:

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

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

### 2 Points

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

### 1 Point

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

### 0 Points

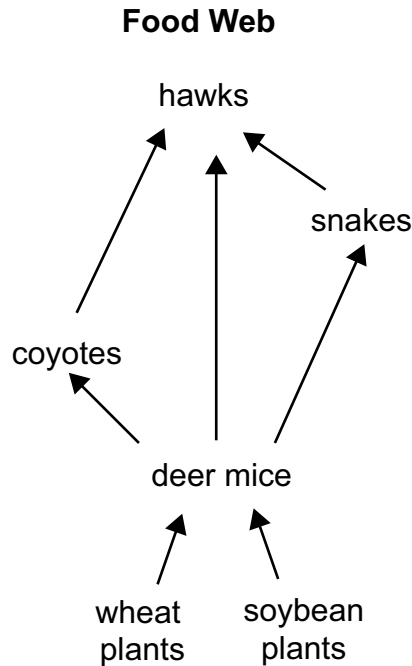
- The response provides *insufficient* evidence to demonstrate any understanding of the scientific content, concepts, and procedures as required by the task(s) for that grade level.
- The response may show only information copied or rephrased from the question or *insufficient* correct information to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

## MULTIPLE-CHOICE QUESTIONS

1. Which process has increased the availability of fresh food to many people all over the United States?
- A. boiling and storing food in glass jars
  - B. packing meat in salt to remove water
  - C. transporting food in refrigerated trucks
  - D. using stoves powered by natural gas to cook food

Item Information	
Alignment	S4.A.1.1.2
Answer Key	C
Depth of Knowledge	2
p-value A	14%
p-value B	9%
p-value C	53% (correct answer)
p-value D	24%
Option Annotations	<p>A. Boiling and storing food in glass jars preserves it for later use.</p> <p>B. Packing meat in salt preserves the meat for later use.</p> <p>C. Key: Refrigerated transport of food improves people's access to fresh food.</p> <p>D. Using stoves allows people to heat and prepare food.</p>

2. Use the food web below to answer the question.



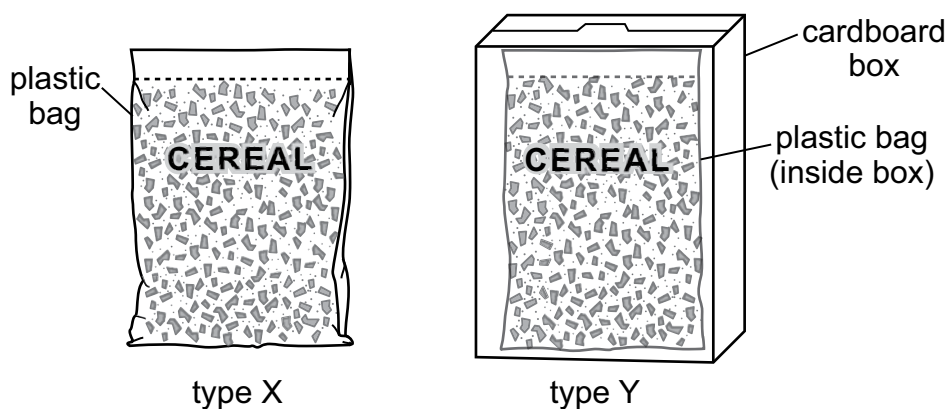
Cold temperatures reduced the snake population in this food web. How will the hawks **most likely** respond to this change in their environment?

- A. The hawks will hibernate.
- B. The hawks will eat more deer mice.
- C. The hawks will feed on wheat plants.
- D. The hawks will use sunlight to produce energy.

Item Information	
Alignment	S4.A.1.3.4
Answer Key	B
Depth of Knowledge	2
p-value A	17%
p-value B	62% (correct answer)
p-value C	11%
p-value D	10%
Option Annotations	<p>A. Hawks do not hibernate.</p> <p>B. Key: With fewer snakes available to eat, the hawks will eat more deer mice.</p> <p>C. Hawks are carnivores; they do not eat plants.</p> <p>D. Producers, not hawks, use sunlight to produce energy.</p>

3. Use the drawing below to answer the question.

### Types of Breakfast Cereal Packaging



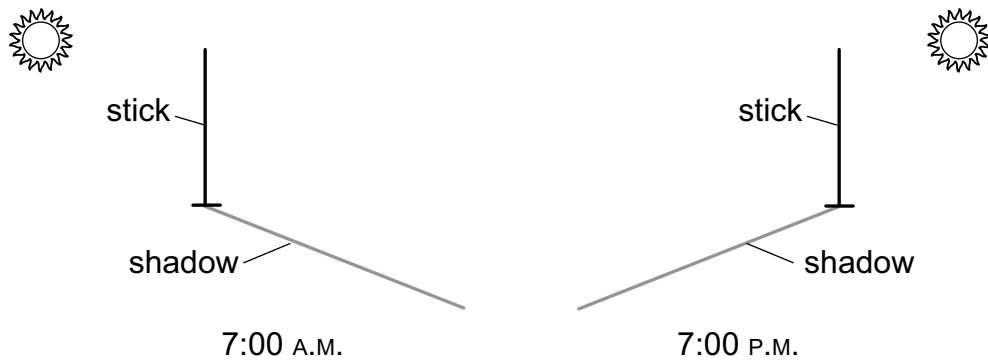
Breakfast cereals are usually packaged in one of two ways. Which statement **best** compares these two types of packaging?

- A. Type X produces less waste than type Y.
- B. Type X costs more to produce than type Y.
- C. Type X helps keep cereal fresh longer than type Y.
- D. Type X protects cereal better during shipping than type Y.

Item Information	
Alignment	S4.A.1.3.5
Answer Key	A
Depth of Knowledge	2
p-value A	66% (correct answer)
p-value B	10%
p-value C	14%
p-value D	10%
Option Annotations	<p>A. Key: Without the cardboard box, type X produces less waste than type Y.</p> <p>B. Type X uses fewer resources for packaging, which reduces costs.</p> <p>C. Type Y has more packaging, which means type Y may keep cereal fresh longer than type X.</p> <p>D. Type Y has more packaging, which means type Y may protect cereal better than type X.</p>

## 4. Use the drawings below to answer the question.

## Shadows



When is the next time that the shadow will look **most** similar to the shadow at 7:00 A.M.?

- A. 5:00 A.M. the next morning
- B. 7:00 A.M. the next morning
- C. 5:00 P.M. the next evening
- D. 7:00 P.M. the next evening

## Item Information

Alignment	S4.A.2.1.3
Answer Key	B
Depth of Knowledge	2
p-value A	11%
p-value B	57% (correct answer)
p-value C	9%
p-value D	23%
Option Annotations	<p>A. The shadow at 5:00 A.M. will be shorter than the shadow at 7:00 A.M.</p> <p>B. Key: The shadow at 7:00 A.M. the next morning will be most similar to the shadow at the same time on the previous day.</p> <p>C. Evening shadows appear on the opposite side of the stick as in the morning.</p> <p>D. The shadow at 7:00 P.M. will be on the opposite side of the stick as the shadow at 7:00 A.M.</p>

5. Use the table below to answer the question.

Number of Hawks Observed during Four Days in August

Day	Number of Hawks Observed		
	Sharp-Shinned Hawk	Broad-Winged Hawk	Red-Tailed Hawk
1	2	3	2
2	0	0	0
3	0	11	4
4	6	14	1

Bird watchers at Hawk Mountain Sanctuary in Pennsylvania recorded the number of hawks observed during four days in August. Which conclusion can **best** be made from the data?

- A. The greatest number of hawks was observed on day 4.
- B. Broad-winged hawks fly faster than other types of hawks.
- C. More red-tailed hawks were observed than sharp-shinned hawks.
- D. Migrating hawks prefer Hawk Mountain Sanctuary over other bird sanctuaries.

Item Information	
Alignment	S4.A.2.1.4
Answer Key	A
Depth of Knowledge	3
p-value A	67% (correct answer)
p-value B	13%
p-value C	10%
p-value D	10%
Option Annotations	<p>A. Key: Twenty-one hawks were observed on day 4, which is more than on any other day.</p> <p>B. These data do not compare flight speed of different types of hawks.</p> <p>C. Observers counted 8 sharp-shinned hawks and 7 red-tailed hawks.</p> <p>D. These data do not compare hawk observations from other bird sanctuaries.</p>



6. Use the chart below to answer the question.

**Parts of a Pond Ecosystem**

Part	Living or Nonliving?	Role in the System
water	living	provides oxygen
fish	living	consumer
algae	nonliving	producer
snail	nonliving	recycles matter

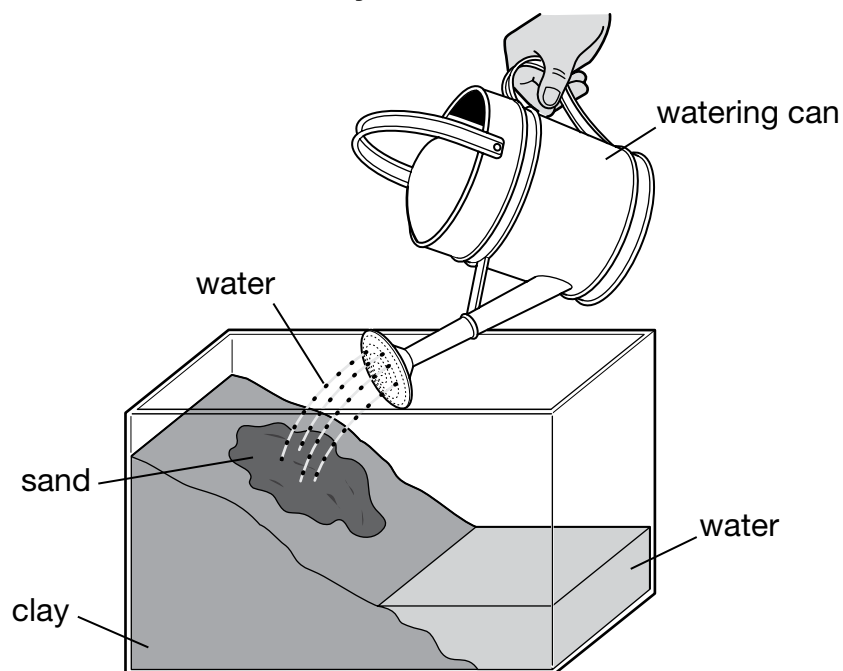
Which part of the pond ecosystem is correctly described in the chart?

- A. water
- B. algae
- C. snail
- D. fish

Item Information	
Alignment	S4.A.3.1.3
Answer Key	D
Depth of Knowledge	2
p-value A	17%
p-value B	13%
p-value C	4%
p-value D	66% (correct answer)
Option Annotations	<p>A. Water is a nonliving part of a pond ecosystem.</p> <p>B. Algae are a living part of a pond ecosystem.</p> <p>C. A snail is a living part of a pond ecosystem.</p> <p>D. Key: Fish are living consumers in a pond ecosystem.</p>

7. Use the drawing below to answer the question.

Water Cycle Model

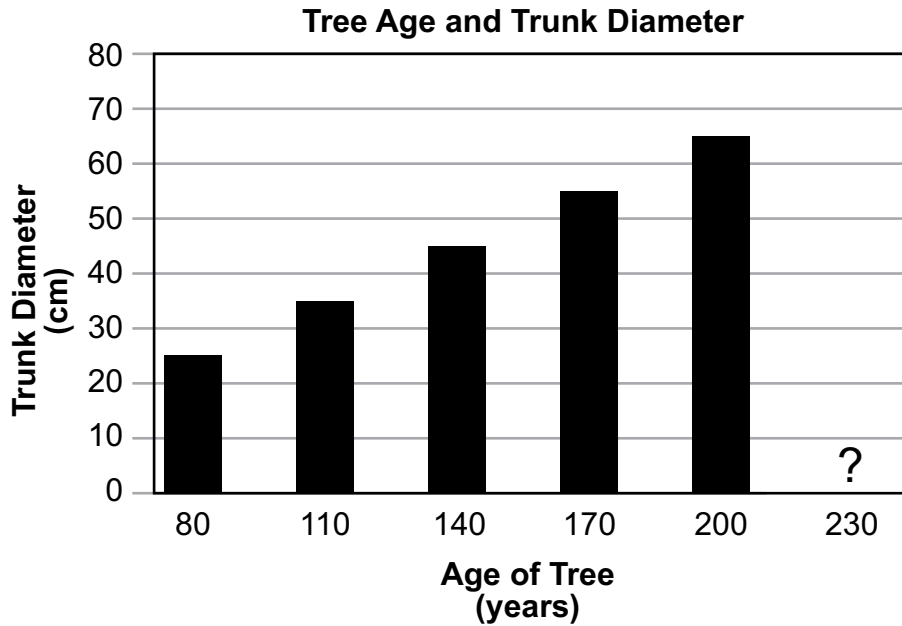


A student builds a model to show some of the steps in the water cycle. Which steps in the water cycle is the student **most likely** modeling?

- A. precipitation and runoff
- B. runoff and condensation
- C. evaporation and precipitation
- D. condensation and evaporation

Item Information	
Alignment	S4.A.3.2.2
Answer Key	A
Depth of Knowledge	3
p-value A	46% (correct answer)
p-value B	18%
p-value C	22%
p-value D	14%
Option Annotations	<p>A. Key: This model shows water sprinkling out of a can (precipitation) and water flowing across the sand surface (runoff).</p> <p>B. This model shows runoff but does not show condensation.</p> <p>C. This model shows precipitation but does not show evaporation.</p> <p>D. This model shows neither condensation nor evaporation.</p>

8. Use the graph below to answer the question.



About how much will the diameter of the tree's trunk **most likely** increase between year 200 and year 230?

- A. 1 cm
- B. 10 cm
- C. 25 cm
- D. 50 cm

Item Information	
Alignment	S4.A.3.3.2
Answer Key	B
Depth of Knowledge	2
p-value A	6%
p-value B	53% (correct answer)
p-value C	20%
p-value D	21%
Option Annotations	<p>A. The pattern suggests the tree will grow 1 cm in diameter every 3 years.</p> <p>B. Key: The pattern suggests the tree will grow 10 cm in diameter over 30 years.</p> <p>C. It takes the tree approximately 75 years to increase its diameter by 25 cm.</p> <p>D. It takes the tree approximately 150 years to increase its diameter by 50 cm.</p>

9. Which physical characteristic can be passed on to offspring?

- A. long beard
- B. strong arm
- C. pierced ear
- D. brown hair

Item Information	
Alignment	S4.B.2.2.1
Answer Key	D
Depth of Knowledge	2
p-value A	15%
p-value B	27%
p-value C	10%
p-value D	48% (correct answer)
Option Annotations	<p>A. A long beard is a characteristic acquired during a person's lifetime; it is not genetic and cannot be passed from parents to offspring.</p> <p>B. Arm strength is acquired during a person's lifetime; it is not genetic and cannot be passed from parents to offspring.</p> <p>C. A pierced ear is a characteristic acquired during a person's lifetime; it is not genetic and cannot be passed from parents to offspring.</p> <p>D. Key: Hair color is a genetic trait that is passed from parents to offspring.</p>

10. Erie National Wildlife Refuge has many creeks, ponds, and marshes. It attracts over 200 types of birds. Which birds depend **most** on the water in the refuge?
- A. birds that eat fish
  - B. birds that hibernate
  - C. birds that eat snakes
  - D. birds that build nests

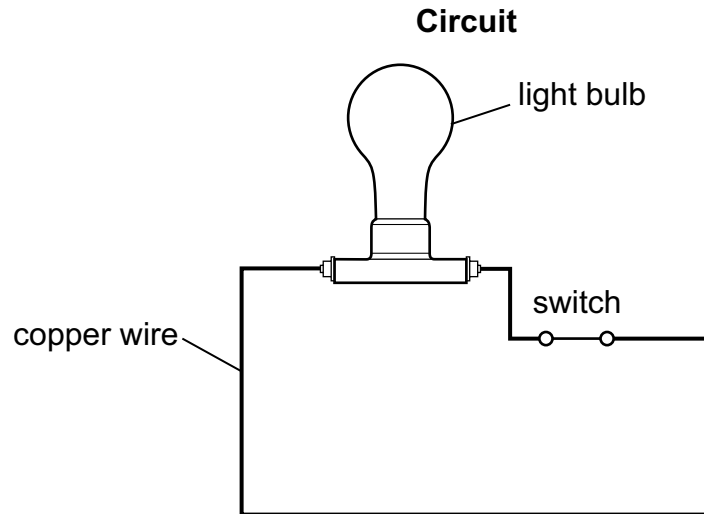
Item Information	
Alignment	S4.B.3.1.2
Answer Key	A
Depth of Knowledge	2
p-value A	78% (correct answer)
p-value B	7%
p-value C	4%
p-value D	11%
Option Annotations	<p>A. Key: Birds that eat fish depend on water habitats to support the fish.</p> <p>B. Hibernation reduces an organism's need for food or water.</p> <p>C. Birds that eat snakes depend on their eyesight and talons for survival.</p> <p>D. Birds that build nests depend on nesting materials and protective cover.</p>

11. Which sequence shows the **most likely** steps humans use to produce lumber from trees for construction purposes?

- A. growing → harvesting → shipping → processing → planting
- B. planting → harvesting → growing → shipping → processing
- C. growing → shipping → processing → planting → harvesting
- D. planting → growing → harvesting → processing → shipping

Item Information	
Alignment	S4.B.3.3.2
Answer Key	D
Depth of Knowledge	2
p-value A	10%
p-value B	10%
p-value C	6%
p-value D	74% (correct answer)
Option Annotations	<p>A. Planting is the first step required to produce lumber from trees.</p> <p>B. During lumber production, growing occurs before harvesting and processing occurs before shipping.</p> <p>C. Planting is the first step required to produce lumber from trees.</p> <p>D. Key: This sequence shows how humans produce lumber from trees.</p>

12. Use the diagram below to answer the question.



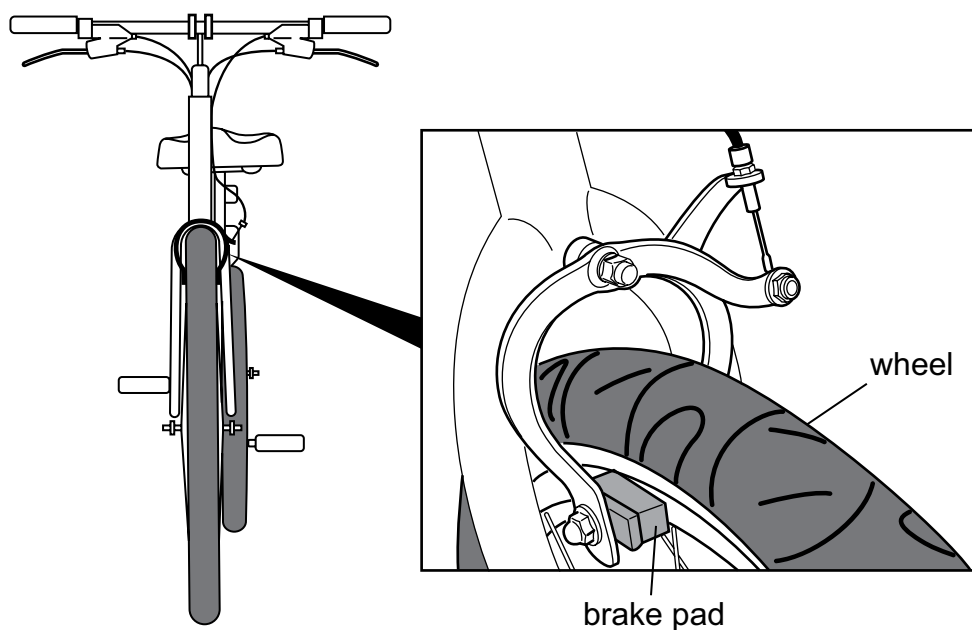
Which change is necessary for this circuit to work?

- A. Add a source of power.
- B. Add a second light bulb.
- C. Move the switch farther away from the light bulb.
- D. Replace the copper wire with a different type of metal wire.

Item Information	
Alignment	S4.C.2.1.3
Answer Key	A
Depth of Knowledge	2
p-value A	66% (correct answer)
p-value B	7%
p-value C	10%
p-value D	17%
Option Annotations	<p>A. Key: A working circuit requires a power source to provide electric current.</p> <p>B. Adding a second light bulb simply increases the load in the circuit.</p> <p>C. Moving the switch farther from the light bulb does not affect circuit function.</p> <p>D. Copper wire is an effective electrical conductor in a circuit.</p>

13. Use the drawing below to answer the question.

Bicycle Brake



Some bicycles have brake pads that squeeze the sides of the wheels. Which statement **best** describes how the motion of a bicycle changes when the brakes are used?

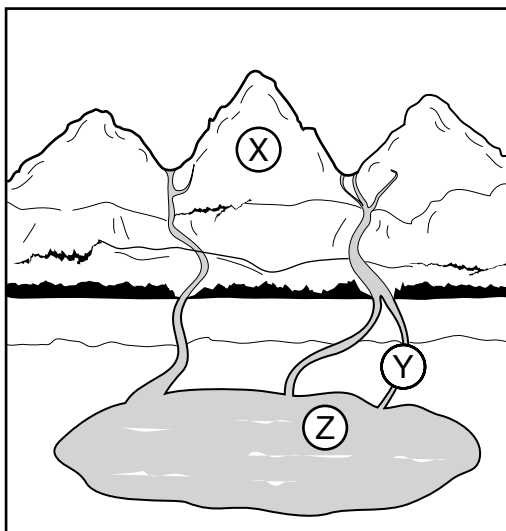
- A. The bicycle speeds up due to the friction between the brake pad and the wheel.
- B. The bicycle slows down due to the friction between the brake pad and the wheel.
- C. The bicycle speeds up due to the magnetism between the brake pad and the wheel.
- D. The bicycle slows down due to the magnetism between the brake pad and the wheel.



Item Information	
Alignment	S4.C.3.1.1
Answer Key	B
Depth of Knowledge	2
p-value A	7%
p-value B	73% (correct answer)
p-value C	4%
p-value D	16%
Option Annotations	<p>A. Frictional force reduces, not increases, the speed of the bicycle.</p> <p>B. Key: Frictional force between the brake pad and the wheel causes the bicycle to slow down.</p> <p>C. Frictional force is produced when brake pads squeeze the sides of the wheel.</p> <p>D. Frictional force is produced when brake pads squeeze the sides of the wheel.</p>

14. Use the drawing and chart below to answer the question.

Environment



Features of an Environment

Feature	Student 1	Student 2	Student 3	Student 4
X	valley	mountain	valley	mountain
Y	peninsula	river	peninsula	river
Z	watershed	lake	lake	watershed

Which student correctly labeled the environmental features?

- A. student 1
- B. student 2
- C. student 3
- D. student 4

Item Information	
Alignment	S4.D.1.1.2
Answer Key	B
Depth of Knowledge	2
p-value A	8%
p-value B	63% (correct answer)
p-value C	8%
p-value D	21%
Option Annotations	<p>A. This student incorrectly labeled all the environmental features.</p> <p>B. Key: This student correctly labeled feature X (mountain), feature Y (river), and feature Z (lake) in this environment.</p> <p>C. This student correctly labeled only feature Z (lake) in this environment.</p> <p>D. This student correctly labeled only feature X (mountain) and feature Y (river) in this environment.</p>

15. Which statement **best** describes a pond?

- A. It is made of salt water that is frozen.
- B. It is made of salt water that is flowing.
- C. It is made of fresh water that does not flow.
- D. It is made of fresh water that does not freeze.

Item Information	
Alignment	S4.D.1.3.3
Answer Key	C
Depth of Knowledge	2
p-value A	5%
p-value B	15%
p-value C	71% (correct answer)
p-value D	9%
Option Annotations	A. A pond is made of fresh water. B. A pond is a standing body of fresh water. C. Key: A pond is a standing body of fresh water. D. A pond is made of fresh water, but it can freeze in low temperatures.

16. In late spring, a student notices very tall, puffy clouds forming quickly in the sky. The clouds seem to be getting taller and are turning dark gray. Which weather forecast can **best** be made from these observations?
- A. Cirrus clouds are forming and fair weather is expected.
  - B. Cumulus clouds are forming and dry, cold weather is expected.
  - C. Cumulonimbus clouds are forming and a thunderstorm is likely.
  - D. Stratus clouds are forming and a late-season snowstorm is likely.

Item Information	
Alignment	S4.D.2.1.1
Answer Key	C
Depth of Knowledge	2
p-value A	9%
p-value B	9%
p-value C	74% (correct answer)
p-value D	8%
Option Annotations	<p>A. Cirrus clouds, often seen in fair weather, are long, thin, wispy, and white.</p> <p>B. Cumulus clouds are puffy white or light gray and look like cotton balls.</p> <p>C. Key: Cumulonimbus clouds are thunderstorm clouds—they grow tall and become dark gray before producing severe weather events.</p> <p>D. Stratus clouds are gray and form low to the ground, covering most of the sky.</p>

## OPEN-ENDED ITEM

17. Use the information below to answer the question.

**Objects**

- horse-drawn wagon
- bicycle
- automobile
- train
- airplane
- boat

A student made a list of some objects.

**Part A:** Describe one similarity shared by all the objects in the list.

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**Part B:** Choose one of the objects from the list and describe a positive **or** a negative impact it has had on society or the environment.

**Object:** \_\_\_\_\_

**Description of Positive or Negative Impact:** \_\_\_\_\_

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## SCORING GUIDE

## #17 Item Information

Alignment	S4.A.1.1.2	Depth of Knowledge	2	Mean Score	1.34
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## Item-Specific Scoring Guideline

Score	Description
2	<p>The response demonstrates a <i>thorough</i> understanding of how to identify and describe examples of common technological changes past to present in the community (e.g., energy production, transportation, communications, agriculture, packaging materials) that have either positive or negative impacts on society or the environment by</p> <ul style="list-style-type: none"> <li>describing one similarity shared by all objects in the list</li> </ul> <p><b>AND</b></p> <ul style="list-style-type: none"> <li>describing a positive or negative impact one of the objects from the list has had on society or the environment.</li> </ul> <p>The response is clear, complete, and correct.</p>
1	<p>The response demonstrates a <i>partial</i> understanding of how to identify and describe examples of common technological changes past to present in the community (e.g., energy production, transportation, communications, agriculture, packaging materials) that have either positive or negative impacts on society or the environment by</p> <ul style="list-style-type: none"> <li>describing one similarity shared by all objects in the list</li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>describing a positive or negative impact one of the objects from the list has had on society or the environment.</li> </ul> <p>The response may contain some work that is incomplete or unclear.</p>
0	<p>The response provides <i>insufficient</i> evidence to demonstrate any understanding of the concept being tested.</p>

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

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

**Part A (1 point):**

- All of the objects are used for travel/transportation.
- All of the objects were invented by people.
- All of the objects make work easier for people.
- All of the objects can transport people and things from one place to another.
- All of the objects can change speed.
- Any other reasonable description of a similarity shared by all of the objects

**Part B (1 point):**

Positive Impact:

- faster transportation of food to prevent spoilage (all)
- ability to carry heavy objects from place to place (all)
- ability to travel over water (boat, airplane)
- ability to transport medicine to people
- ability to travel over mountains (train, wagon, airplane)
- ability to transport people over great distances (all)
- ability to move faster (all)
- any other description of a positive effect one of the objects has had on society

Negative Impact:

- A lot of land must be used to build roads, tracks, airports, etc. (all)
- Metals and other materials have to be mined, which can harm the environment. (all)
- Most fuels come from nonrenewable resources. (all but wagon and bicycle)
- Fossil fuels can add pollution to the atmosphere. (all but wagon and bicycle)
- Engines can produce noise pollution.
- Animals may be struck. (automobile, train, airplane, boat)
- Animal migratory paths can be blocked by roads and tracks. (wagon, bicycle, car, train)
- any other description of a negative effect one of the objects has had on society



## STUDENT RESPONSE

Response Score: 2 points

17. Use the information below to answer the question.

## Objects

- horse-drawn wagon
- bicycle
- automobile
- train
- airplane
- boat

A student made a list of some objects.

**Part A:** Describe one similarity shared by all the objects in the list.

*They are all used for transport.*

**Part B:** Choose one of the objects from the list and describe a positive **or** a negative impact it has had on society or the environment.Object: *airplane*Description of Positive or Negative Impact: *A positive*

*impact an airplane has is that it is very fast and it can transport people very fast.*

The response demonstrates a *thorough* understanding of how to identify and describe examples of common technological changes past to present in the community that have either positive or negative impacts on society or the environment. In Part A, the response correctly describes one similarity shared by all of the objects in the list: “*They are all used for transport.*” In Part B, the response has an object selected from the list (“*airplane*”) and has correctly described a positive impact the object has had on society or the environment: “*it is very fast and it can transport people very fast.*” The response is clear, complete, and correct.

## STUDENT RESPONSE

Response Score: 1 point



## PART A

Question 17  
Page 1 of 2

Item ID ?

Use the information below to answer the question.

**Objects**

- horse-drawn wagon
- bicycle
- automobile
- train
- airplane
- boat

A student made a list of some objects.

**Part A:** Describe one similarity shared by all the objects in the list.

EQ

A bicycle and a horse-drawn wagon don't need power to move.

59 / 1000

Review/End Test Pause Flag Options Next

Question 17  
Page 2 of 2



Use the information below to answer the question.

#### Objects

- horse-drawn wagon
- bicycle
- automobile
- train
- airplane
- boat

A student made a list of some objects.

**Part B:** Choose one of the objects from the list and describe a positive **or** a negative impact it has had on society or the environment.

**Object:**

**Description of Positive or Negative Impact:**

EQ

A boat is a negative impact because what if it was a oil boat it could crash and sink and all the oil would go into the ocean killing sea animals.

146 / 1000

Review/End Test

Pause

Flag

Options

Back

Next

The response demonstrates a *partial* understanding of how to identify and describe examples of common technological changes past to present in the community that have either positive or negative impacts on society or the environment. In Part A, the response “A bicycle and a horse-drawn wagon don’t need power to move” does not describe a similarity shared by all of the objects in the list and does not receive any credit. In Part B, the response has an object selected from the list (“boat”) and has correctly described a negative impact the object has had on society or the environment: “a oil boat it could crash and sink and all the oil would go into the ocean killing sea animals.” The response contains some work that is incomplete or unclear.

## STUDENT RESPONSE

Response Score: 0 points

17. Use the information below to answer the question.

## Objects

- horse-drawn wagon
- bicycle
- automobile
- train
- airplane
- boat

A student made a list of some objects.

**Part A:** Describe one similarity shared by all the objects in the list.

A bicycle and train are  
similarity-

**Part B:** Choose one of the objects from the list and describe a positive **or** a negative impact it has had on society or the environment.Object: bicycle

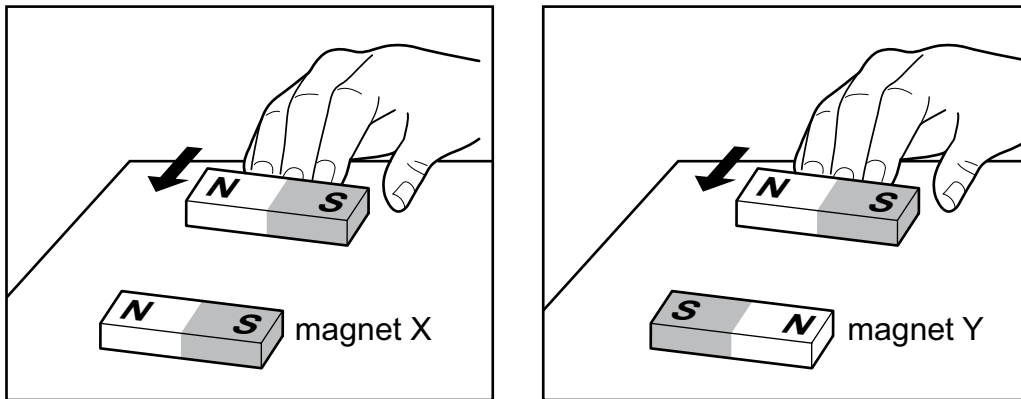
Description of Positive or Negative Impact: You cant  
cary a bicycle you ride it.

The response provides *insufficient* evidence to demonstrate any understanding of how to identify and describe examples of common technological changes past to present in the community that have either positive or negative impacts on society or the environment. In Part A, the response “A bicycle and train are similarity” does not describe a similarity shared by all objects in the list and does not receive any credit. In Part B, the response has an object selected from the list (“bicycle”), but the response “You cant cary a bicycle you ride it” is not a valid description of a positive or negative impact and does not receive any credit.

## OPEN-ENDED ITEM

18. Use the drawings below to answer the question.

## Bar Magnet Investigation



A student pushes a bar magnet across a tabletop toward magnet X. The student repeats this action toward magnet Y.

**Part A:** Predict the motion of magnet X.

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**Part B:** Predict the motion of magnet Y.

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



## SCORING GUIDE

## #18 Item Information

Alignment	S4.C.3.1.1	Depth of Knowledge	3	Mean Score	0.98
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## Item-Specific Scoring Guideline

Score	Description
2	<p>The response demonstrates a <i>thorough</i> understanding of changes in motion caused by forces (e.g., magnetic, pushes or pulls, gravity, friction) by</p> <ul style="list-style-type: none"> <li>predicting the motion of magnet X when the student's bar magnet is pushed toward it</li> </ul> <p><b>AND</b></p> <ul style="list-style-type: none"> <li>predicting the motion of magnet Y when the student's bar magnet is pushed toward it.</li> </ul> <p>The response is clear, complete, and correct.</p>
1	<p>The response demonstrates a <i>partial</i> understanding of changes in motion caused by forces (e.g., magnetic, pushes or pulls, gravity, friction) by</p> <ul style="list-style-type: none"> <li>predicting the motion of magnet X when the student's bar magnet is pushed toward it</li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>predicting the motion of magnet Y when the student's bar magnet is pushed toward it.</li> </ul> <p>The response may contain some work that is incomplete or unclear.</p>
0	<p>The response provides <i>insufficient</i> evidence to demonstrate any understanding of the concept being tested.</p>

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

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

**Part A (1 point):**

- Magnet X will move away from the student's magnet.
- The two magnets will repel each other.
- The two magnets will move away from each other.

**Part B (1 point):**

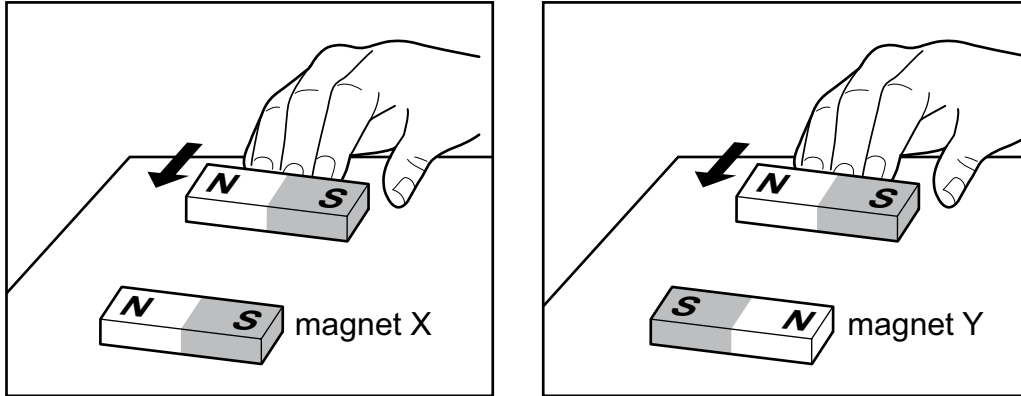
- Magnet Y will move toward the student's magnet.
- The two magnets will move toward each other.
- The two magnets will attract.

## STUDENT RESPONSE

Response Score: 2 points

18. Use the drawings below to answer the question.

## Bar Magnet Investigation



A student pushes a bar magnet across a tabletop toward magnet X. The student repeats this action toward magnet Y.

**Part A:** Predict the motion of magnet X.

The magnets will push away from each other.

**Part B:** Predict the motion of magnet Y.

the magnet will pull together.

The response demonstrates a *thorough* understanding of changes in motion caused by forces. In Part A, the response correctly predicts the motion of magnet X when the student's bar magnet is pushed toward it: "The magnets will push away from each other." In Part B, the response correctly predicts the motion of magnet Y when the student's bar magnet is pushed toward it: "The magnet will pull together." The response is clear, complete, and correct.

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



## STUDENT RESPONSE

Response Score: 1 point



## PART A

Question 18  
Page 1 of 2

Item ID ?

Use the drawings below to answer the question.

**Bar Magnet Investigation**

A student pushes a bar magnet across a tabletop toward magnet X. The student repeats this action toward magnet Y.

**Part A:** Predict the motion of magnet X.

EQ

It is a repelling motion.]

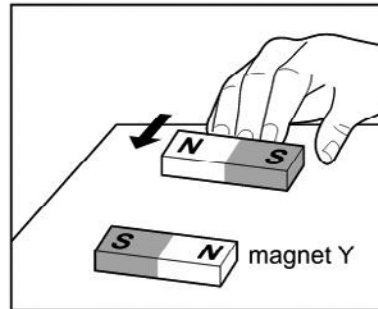
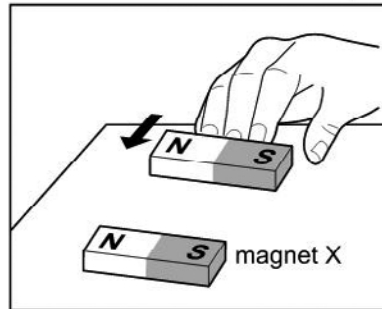
25 / 1000

Review/End Test Pause Flag Options Next



Question 18  
Page 2 of 2

Use the drawings below to answer the question.

**Bar Magnet Investigation**

A student pushes a bar magnet across a tabletop toward magnet X. The student repeats this action toward magnet Y.

**Part B:** Predict the motion of magnet Y.

EQ

It is a moving motion.

22 / 1000

Review/End Test

Pause

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The response demonstrates a *partial* understanding of changes in motion caused by forces. In Part A, the response correctly predicts the motion of magnet X when the student's bar magnet is pushed toward it: "*It is a repelling motion.*" In Part B, the response "*It is a moving motion*" does not correctly predict the motion of magnet Y when the student's bar magnet is pushed toward it. The response in Part B is too vague to receive any credit. The response contains some work that is incomplete or unclear.

## STUDENT RESPONSE

Response Score: 0 points

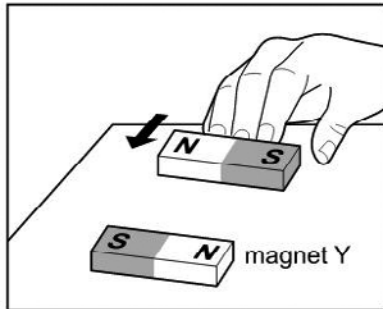
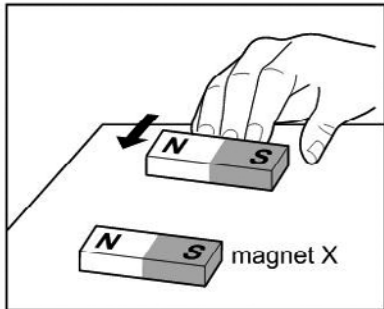


## PART A

Question 18  
Page 1 of 2

Use the drawings below to answer the question.

## Bar Magnet Investigation



A student pushes a bar magnet across a tabletop toward magnet X. The student repeats this action toward magnet Y.

**Part A:** Predict the motion of magnet X.

EQ

The magnets will keep coming closer until they stick together.

62 / 1000

Review/End Test

Pause

Flag

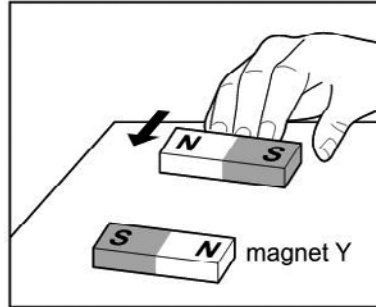
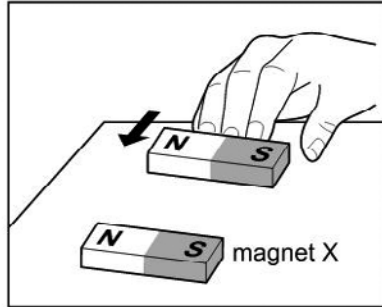
Options

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Question 18  
Page 2 of 2

Use the drawings below to answer the question.

### Bar Magnet Investigation



A student pushes a bar magnet across a tabletop toward magnet X. The student repeats this action toward magnet Y.

**Part B:** Predict the motion of magnet Y.

EQ

The magnets will push against each other and they'll never touch.

65 / 1000

Review/End Test

Pause

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The response provides *insufficient* evidence to demonstrate any understanding of changes in motion caused by forces. In Part A, the response “*The magnets will keep coming closer until they stick together*” is an incorrect response. It does not correctly predict the motion of magnet X when the student’s bar magnet is pushed toward it and does not receive any credit. In Part B, the response “*The magnets will push against each other and they’ll never touch*” is an incorrect response. It does not correctly predict the motion of magnet Y when the student’s bar magnet is pushed toward it and does not receive any credit.

## SAMPLE ITEM SUMMARY

## Multiple-Choice

Sample Number	Alignment	Answer Key	Depth of Knowledge	p-value A	p-value B	p-value C	p-value D
1	S4.A.1.1.2	C	2	14%	9%	53%	24%
2	S4.A.1.3.4	B	2	17%	62%	11%	10%
3	S4.A.1.3.5	A	2	66%	10%	14%	10%
4	S4.A.2.1.3	B	2	11%	57%	9%	23%
5	S4.A.2.1.4	A	3	67%	13%	10%	10%
6	S4.A.3.1.3	D	2	17%	13%	4%	66%
7	S4.A.3.2.2	A	3	46%	18%	22%	14%
8	S4.A.3.3.2	B	2	6%	53%	20%	21%
9	S4.B.2.2.1	D	2	15%	27%	10%	48%
10	S4.B.3.1.2	A	2	78%	7%	4%	11%
11	S4.B.3.3.2	D	2	10%	10%	6%	74%
12	S4.C.2.1.3	A	2	66%	7%	10%	17%
13	S4.C.3.1.1	B	2	7%	73%	4%	16%
14	S4.D.1.1.2	B	2	8%	63%	8%	21%
15	S4.D.1.3.3	C	2	5%	15%	71%	9%
16	S4.D.2.1.1	C	2	9%	9%	74%	8%

## Open-Ended

Sample Number	Alignment	Points	Depth of Knowledge	Mean Score
17	S4.A.1.1.2	2	2	1.34
18	S4.C.3.1.1	2	3	0.98