



# The Pennsylvania System of School Assessment

## Science Item and Scoring Sampler

# SUPPLEMENT

2009–2010  
Grade 4

# SCIENCE

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# SCIENCE

## ***INTRODUCTION***

The 2009–2010 Science Item and Scoring Sampler Supplement displays released items from the 2009 PSSA operational test. The sampler supplement is to be used in conjunction with the previous year’s item sampler. The 2008–2009 Science Item and Scoring Sampler can be found on the PDE website at <http://www.pde.state.pa.us/>. Select the “Pre K–12 Schools” tab at the top of the page. Then select “Assessment” in the “Learn About” column to the left. Select “Resource Materials” in the “Learn About” column of the next page, and then scroll down to find the appropriate sampler. Alternately, you may type in or click this link to reach the location of the item samplers:

[http://www.pde.state.pa.us/a\\_and\\_t/cwp/view.asp?a=108&Q=73314&a\\_and\\_tNav=|680|&a\\_and\\_tNav=|](http://www.pde.state.pa.us/a_and_t/cwp/view.asp?a=108&Q=73314&a_and_tNav=|680|&a_and_tNav=|)

This item and scoring sampler supplement contains 16 science multiple-choice items and 2 open-ended items. Each item is preceded by the Assessment Anchor and Eligible Content coding. The multiple-choice answer options are followed by a list of rationales. The correct answer is indicated by an asterisk. The table following each item displays the percentages of students who chose each answer option. The correct answer is also shaded in these tables. The table following each open-ended item indicates the students’ performance at each score point. Sample student responses for each of the scoring levels are also included for the open-ended items.

# SCIENCE

## MULTIPLE-CHOICE ITEMS

**Note: All percentages listed in the tables below each item have been rounded.**

### A.1.1.2

1. Which statement describes a positive result from the invention of cars?
- A Cars transport people. \*
  - B Cars make lots of noise.
  - C Car oil needs to be changed.
  - D Car exhaust increases pollution.

- A *Key: The ability to transport people faster than horses or walking is a positive result of the invention of cars.*
- B *Noise is thought of by most people as a negative result of the invention of cars.*
- C *Maintenance requirements are negative as they require the expenditure of time and money.*
- D *Pollution is a negative effect of cars that burn fossil fuels.*

A	B	C	D
69%	4%	9%	17%

# SCIENCE

## A.2.1.2

Use the chart below to answer question 2.

**Evaporation Investigation**

Investigation Information	Container 1	Container 2
starting temperature	84°F	50°F
starting amount of water		
size of container		
placement of container		
amount of water in container after day 1		

2. A student wants to determine whether hot or cold water evaporates faster. The student has created an information chart. Which statement must be true for the investigation to be fair?
- A The containers must be placed in different rooms.
  - B Container 1 must be larger since the water is warmer.
  - C The starting amount of water in both containers must be equal. \*
  - D The amount of water left in both containers after one day must be equal.

- A *The containers should be in the same room so that conditions are as similar as possible so as not to introduce confounding variables.*
- B *The container with warmer water should be the same size and shape as the container with cooler water.*
- C *Key: For this to be a fair test, the starting amounts of water must be the same, in addition to being in the same place and within the same type of container.*
- D *The amount of water remaining after one day will most likely vary. This is the dependent variable for this investigation.*

A	B	C	D
14%	10%	66%	10%

# SCIENCE

## A.2.2.1

3. Which tool is **best** used to study the parts of a flower?
- A telescope
  - B binoculars
  - C flat mirror
  - D hand lens \*

- A Telescopes are typically used for viewing distant objects, rather than enlarging the view of small objects.
- B Binoculars are typically used for viewing distant objects, rather than enlarging the view of small objects.
- C Mirrors are typically used for reflecting images of objects, rather than enlarging the view of small objects.
- D Key: Hand lenses are typically used for examining objects that are generally too big for viewing with a standard microscope, but too small to see enough detail with the unaided eye.

A	B	C	D
13%	7%	8%	73%

## A.3.1.1

4. Which system is human-made?
- A ocean system
  - B nervous system
  - C weather system
  - D computer system \*

- A Oceans are natural systems.
- B The nervous system is part of an animal's body and is therefore a natural system.
- C Weather systems are not typically made by people.
- D Key: Computers would not exist if humans did not make them.

A	B	C	D
4%	20%	5%	71%

# SCIENCE

## A.3.1.3

5. Which part of the ecosystem is alive and provides oxygen for animals?

- A soil
- B plant \*
- C water
- D mushroom

*A Soil is not considered living since it does not engage in purposeful reproduction or respond to stimuli.*

*B Key: Plants are the major provider of oxygen for Earth's atmosphere. Plants are considered living because they engage in purposeful reproduction and respond to stimuli.*

*C Water is composed of hydrogen and oxygen, but this oxygen is not free for animals to use. Water is also not considered living.*

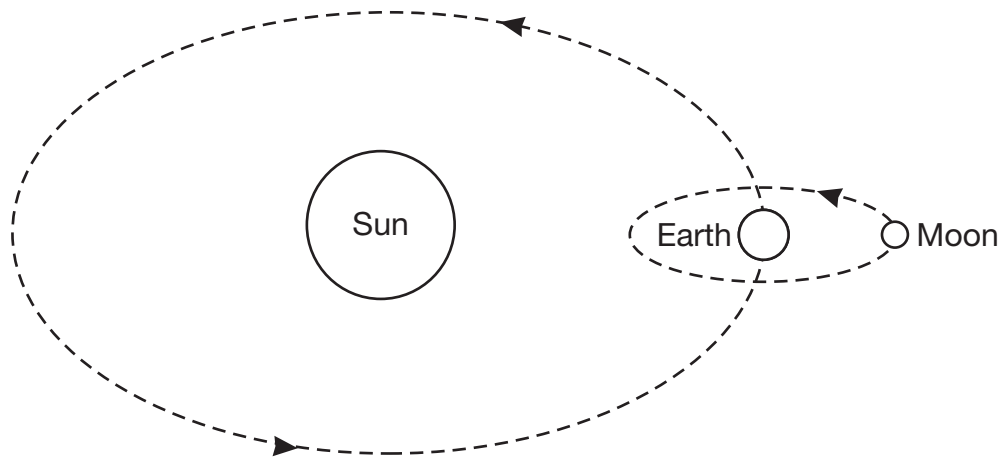
*D Mushrooms, like animals, require oxygen to live.*

A	B	C	D
7%	75%	16%	3%

# SCIENCE

## A.3.2.2

Use the model below to answer question 6.



6. Which statement describes the motion represented in this model?
- A Earth goes around the Moon, and the Sun goes around Earth.
  - B The Moon goes around Earth, and Earth goes around the Sun. \*
  - C The Moon goes around the Sun, and the Sun goes around Earth.
  - D The Sun goes around the Moon, and Earth goes around the Sun.

- A This response is incorrect, since it describes an opposite pattern of what is shown in the model.
- B Key: The arrows and dotted lines on the diagram indicate that the Moon orbits Earth, and Earth orbits the Sun.
- C The Moon does travel around the Sun as it orbits Earth. However, the Sun does not go around Earth.
- D The dotted lines represent the paths of the Moon and Earth, not the Sun. Earth does orbit the Sun.

A	B	C	D
7%	83%	5%	4%

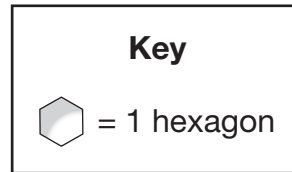
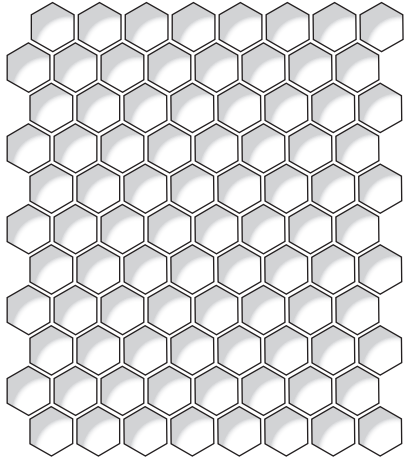


# SCIENCE

## A.3.3.1

Use the picture below to answer question 7.

**Honeycomb**



7. Which statement describes the pattern shown in the honeycomb?
- A Each hexagon has eight sides.
  - B Each hexagon is part of a row. \*
  - C Some hexagons are larger than others.
  - D Some hexagons have less than six sides.

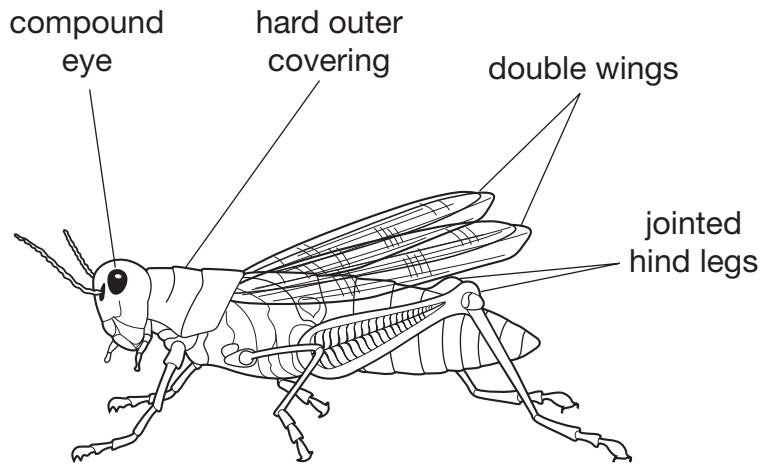
- A Hexagons have six sides, as shown in the key.  
B Key: The hexagons form a pattern of rows.  
C All of the hexagons in this picture appear to be the same size.  
D Since all of the cells are hexagons, each has six sides.

A	B	C	D
7%	83%	5%	5%

# SCIENCE

## B.1.1.2

Use the drawing below to answer question 8.



side view of grasshopper

8. Which feature of a grasshopper has the same purpose as the rib cage of a person?
- A compound eye
  - B hard outer covering \*
  - C double wings
  - D jointed hind legs

- A *The compound eye is for seeing, rather than protecting, the soft organs inside the insect.*
- B *Key: The hard outer covering of the insect protects its internal organs, just as the rib cage protects the heart and lungs of a person.*
- C *The wings are mainly used for flying.*
- D *The jointed hind legs are for movement. In a person, the rib cage does move slightly, but it does not carry the person anywhere.*

A	B	C	D
14%	57%	5%	24%

# SCIENCE

## B.2.1.2

9. Which adaptation of the American bullfrog helps it hide in grass?
- A long and sticky tongue
  - B over 6 inches in size
  - C brown and green color \*
  - D large eyes on top of head

- A *The long and sticky tongue is used for catching insects.*
- B *The large size does not help the bullfrog to hide in grass.*
- C *Key: The brown and green coloring is a form of protection that allows the bullfrog to better blend in with its surroundings.*
- D *The large eyes on the top of its head allow the bullfrog to see while it is partially submerged below the surface of water.*

A	B	C	D
3%	5%	90%	2%

## B.3.2.2

10. How might an increase in water pollution change part of an environment?
- A Skies are clearer.
  - B Streets are cleaner.
  - C Lakes grow more algae. \*
  - D Animals grow more quickly.

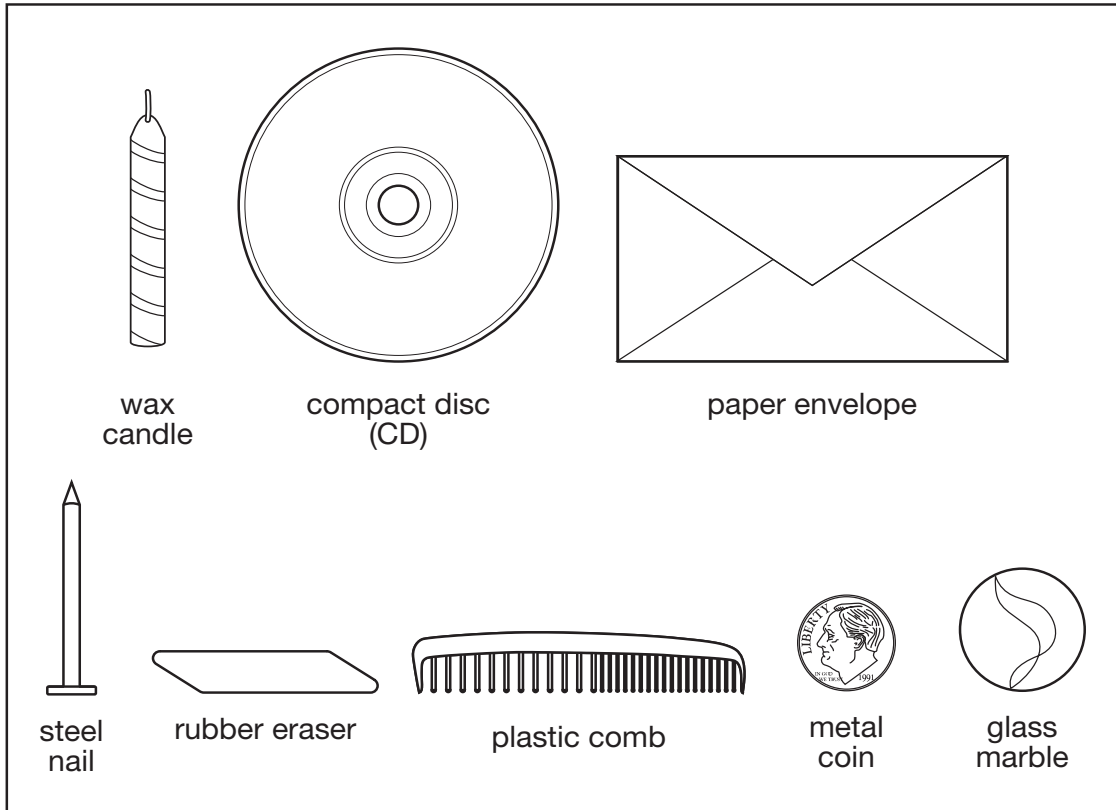
- A *Water pollution does not clear the skies.*
- B *Polluted water would not likely make streets any cleaner than non-polluted water.*
- C *Key: Pollutants, like nitrates from fertilizers, increase algae growth.*
- D *Pollutants are generally not promoters of animal growth. They are more likely to harm animals, thus negatively affecting growth.*

A	B	C	D
11%	12%	69%	8%

# SCIENCE

## C.1.1.2

Use the pictures below to answer question 11.



11. Which two objects will both conduct electricity?

- A steel nail and metal coin \*
- B wax candle and rubber eraser
- C glass marble and paper envelope
- D compact disc and plastic comb

- A Key: Metals are good conductors of electricity. The steel nail and the metal coin are made of metals.*
- B The wax candle and the rubber eraser are made of materials that are not electrical conductors.*
- C The glass marble and paper envelope are made of materials that are often used as insulators, since they do not conduct electricity.*
- D Compact disks look metallic, but they are plastic like the comb. These items can be used to produce static electricity, but they are not conductors.*

A	B	C	D
76%	7%	2%	14%

# SCIENCE

## C.2.1.2

12. A song is playing on a radio. Which statement describes the change in the flow of energy?
- A Electrical energy is changed to light energy.
  - B Electrical energy is changed to sound energy. \*
  - C Sound energy is changed to light energy.
  - D Sound energy is changed to electrical energy.

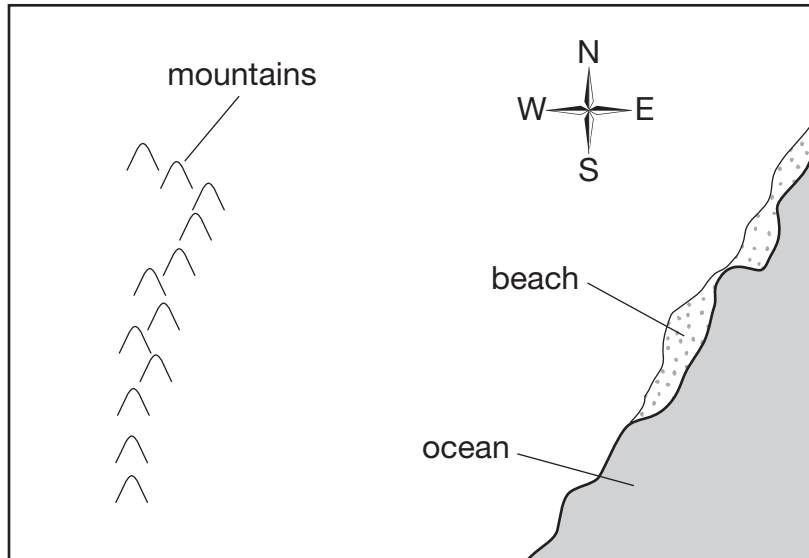
- A *Electrical energy can be transformed into light energy, but sound must be produced for a song to be heard.*
- B *Key: Electrical energy is converted into sound waves by causing vibrations within the radio's speakers.*
- C *Sound energy is produced by the radio, rather than transformed into light energy.*
- D *Sound energy is transformed into electrical energy by microphones rather than by the radio.*

A	B	C	D
8%	65%	7%	19%

# SCIENCE

## C.3.1.3

Use the drawing below to answer question 13.



13. A student is at the beach. Which direction are the mountains from the student?

- A north
- B east
- C south
- D west \*

- A The area north of the beach does not have mountains.
- B The beach is on the eastern part of the map, and the mountains are west of the beach. The ocean is east of the beach.
- C South of the beach is the ocean.
- D Key: Using the compass rose, it is apparent that the mountains are west of the beach.

A	B	C	D
4%	8%	5%	82%

# SCIENCE

## D.1.1.1

14. Which action can form mountains?

- A land blocking streams
- B land pushing against land \*
- C water flooding a field
- D water rising above the soil

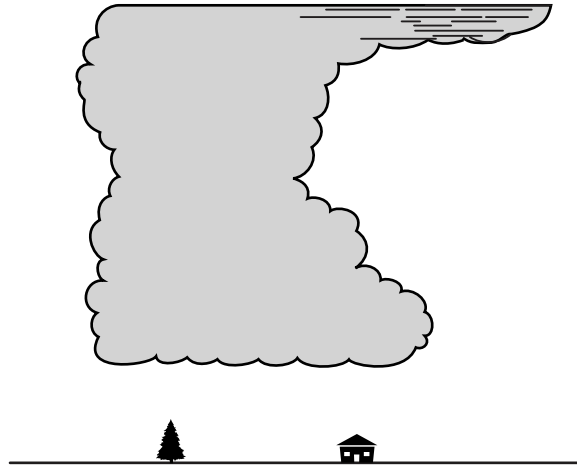
- A Land blocking streams causes water to back up, forming lakes rather than mountains.*
- B Key: Land pushing against land can form mountains, such as when continental plates collide.*
- C Water flooding a field may leave behind sediment that builds up in the field, but does not form mountains.*
- D Water from artesian springs can rise above the level of the soil, but this does not form mountains.*

A	B	C	D
12%	69%	6%	13%

# SCIENCE

## D.2.1.1

Use the picture below to answer question 15.



15. Which type of weather would be predicted with this type of cloud?

- A many days of rain or snow
- B fair weather and sunny skies
- C warmer air and clearing skies
- D heavy rain showers or thunderstorms \*

A Many days of rain or snow are usually produced by stratus clouds, rather than cumulonimbus clouds.

B Many small, puffy cumulus clouds or clear skies indicate fair weather.

C As cumulonimbus clouds precipitate rain, the temperature generally becomes cooler rather than warmer, and skies are not clear.

D Key: A tall, towering cumulonimbus cloud will most likely produce storms that are strong but generally last only a few hours.

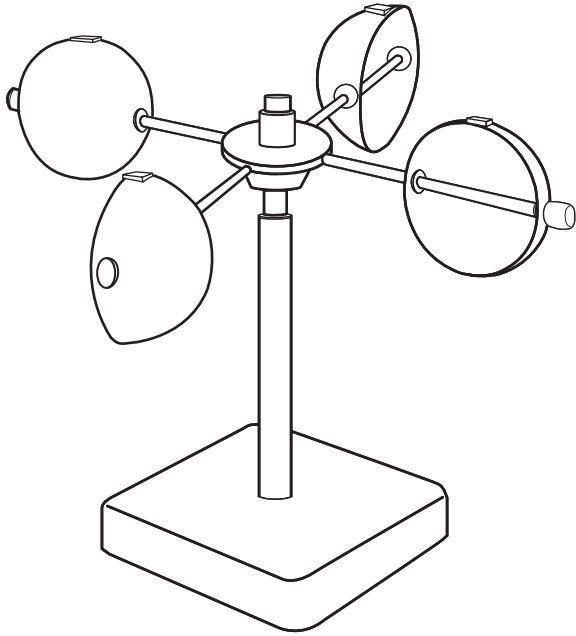
A	B	C	D
9%	2%	3%	86%



# SCIENCE

## D.2.1.3

Use the picture below to answer question 16.



16. What can be measured using this weather instrument?

- A temperature
- B precipitation
- C wind speed \*
- D air pressure

- A *This instrument does not appear to have any gauges that would indicate its ability to take temperature readings.*
- B *Rainwater would flow out of the cups on this instrument because they are positioned vertically rather than horizontally.*
- C *Key: The faster this instrument rotates, the greater the wind speed. Thus, this instrument is best suited to measure this weather condition.*
- D *The instrument is affected by air movements (wind) rather than air pressure.*

A	B	C	D
5%	4%	79%	12%

# SCIENCE

## FIRST OPEN-ENDED ITEM

A.2.1.4

Use the table below to answer question 17.

4th Graders' Favorite Seasons

Season	Number of Students
fall	96
winter	103
spring	75
summer	326

17. Six hundred 4th graders were asked, "What is your favorite season?" Their responses were recorded in the table.

**Part A:** Write one conclusion about the favorite seasons of these 4th graders.

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**Part B:** Give one fact that supports the conclusion.

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Sampler Sequence	Scorepoint 2	Scorepoint 1	Scorepoint 0
17	46%	35%	20%

# SCIENCE

## ITEM-SPECIFIC SCORING GUIDELINE

### Item #17

This item is reported under Category A, The Nature of Science.

#### Assessment Anchor:

A.2.1– Apply skills necessary to conduct an experiment or design a solution to solve a problem.

#### Specific Eligible Content addressed by this item:

A.2.1.4– State a conclusion that is consistent with the information/data.

#### Scoring Guide:

Part A: Write one conclusion about the favorite seasons of these 4th graders.

Part B: Give one fact that supports the conclusion.

Score	In response to this item, the student—
2	demonstrates a <i>thorough</i> understanding of how to state a conclusion that is consistent with the data for the fourth graders by correctly making one conclusion based on the data <b>and</b> giving one fact that supports that conclusion. The response is clear, complete, and correct.
1	demonstrates a <i>partial</i> understanding of how to state a conclusion that is consistent with the data for the fourth graders by correctly making one conclusion based on the data <b>or</b> by giving one fact based on the data that could be used to make a conclusion. The response may contain some work that is incomplete or unclear.
0	provides <i>insufficient</i> evidence to demonstrate any understanding of the content being tested.
Non-scorable	BLK (blank) – No response or written refusal to respond or response too brief to determine response OT – Off task/topic LOE – Response in a language other than English IL – Illegible

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

# SCIENCE

## FIRST OPEN-ENDED ITEM RESPONSES

Response Score: 2 points

A.2.1.4

Use the table below to answer question 17.

4th Graders' Favorite Seasons

Season	Number of Students
fall	96
winter	103
spring	75
summer	326

17. Six hundred 4th graders were asked, "What is your favorite season?" Their responses were recorded in the table.

**Part A:** Write one conclusion about the favorite seasons of these 4th graders.

More 4th graders liked Fall than the other 4th graders who liked the season spring

**Part B:** Give one fact that supports the conclusion.

I know that more people like Fall than spring because 96 students like the season Fall and 75 students like The season spring

The student provides a correct conclusion about the favorite seasons of the 4<sup>th</sup> graders in part A ("More 4<sup>th</sup> graders liked Fall than . . . 4<sup>th</sup> graders who liked the season spring") and gives a fact that supports the conclusion by using data from the table (" . . . 96 students like the season Fall and 75 students like The season spring") for part B.

# SCIENCE

Response Score: 1 point

A.2.1.4

Use the table below to answer question 17.

4th Graders' Favorite Seasons

Season	Number of Students
fall	96
winter	103
spring	75
summer	326

17. Six hundred 4th graders were asked, "What is your favorite season?" Their responses were recorded in the table.

**Part A:** Write one conclusion about the favorite seasons of these 4th graders.

Spring is the least liked season out of the four.

**Part B:** Give one fact that supports the conclusion.

Spring is the least liked season of the fourth graders

The student provides a correct conclusion ("Spring is the least liked season out of the four"), but, in part B, the student repeats the conclusion instead of providing a supporting fact.

# SCIENCE

Response Score: 0

A.2.1.4

Use the table below to answer question 17.

4th Graders' Favorite Seasons

Season	Number of Students
fall	96
winter	103
spring	75
summer	326

17. Six hundred 4th graders were asked, "What is your favorite season?" Their responses were recorded in the table.

**Part A:** Write one conclusion about the favorite seasons of these 4th graders.

I like Fall because I jump in leaves. I like winter because I can go sledding I like spring because of the flowers. I like summer because I swim.

**Part B:** Give one fact that supports the conclusion.

No matter what season it is I will always like it except the bees because I never got stung and I'm scared.

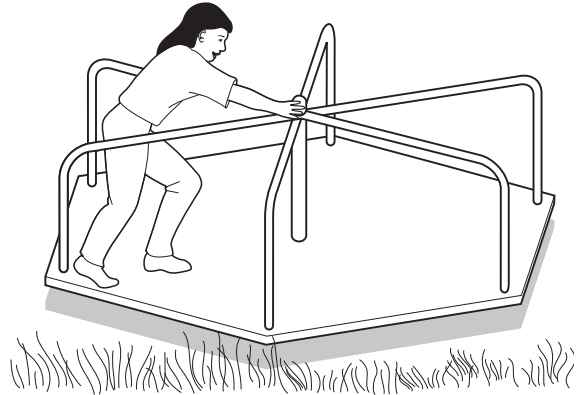
The student does not provide a correct conclusion for part A based on the data from the table, and the student also does not provide a fact to support a conclusion in part B.

# SCIENCE

## SECOND OPEN-ENDED ITEM

C.3.1.2

Use the pictures below to answer question 18.



18. At the playground there is a swing and a merry-go-round.

**Part A:** Describe one motion a child will experience riding on a swing.

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**Part B:** Describe one motion a child will experience riding on a merry-go-round.

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Sampler Sequence	Scorepoint 2	Scorepoint 1	Scorepoint 0
18	62%	20%	18%

# SCIENCE

## ITEM-SPECIFIC SCORING GUIDELINE

### Item #18

This item is reported under Category C, Physical Sciences.

#### Assessment Anchor:

C.3.1– Identify and describe different types of force and motion, or the effect of the interaction between force and motion.

#### Specific Eligible Content addressed by this item:

C.3.1.2– Compare the relative movement of objects or describe types of motion that are evident (e.g., bouncing ball, moving in a straight line, back and forth, merry-go-round).

#### Scoring Guide:

Part A: Describe one motion a child will experience riding on a swing.

Part B: Describe one motion a child will experience riding on a merry-go-round.

Score	In response to this item, the student—
2	demonstrates a <i>thorough</i> understanding of how to describe different types of motion by correctly showing one type of motion experienced by the child on the swing <b>and</b> one type of motion experienced by the child on the merry-go-round. The response is clear, complete, and correct.
1	demonstrates a <i>partial</i> understanding of how to describe different types of motion by correctly showing one type of motion experienced by the child on the swing <b>or</b> by showing one type of motion experienced by the child on the merry-go-round. The response may contain some work that is incomplete or unclear.
0	provides <i>insufficient</i> evidence to demonstrate any understanding of the content being tested.
Non-scorable	BLK (blank) – No response or written refusal to respond or response too brief to determine response OT – Off task/topic LOE – Response in a language other than English IL – Illegible

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



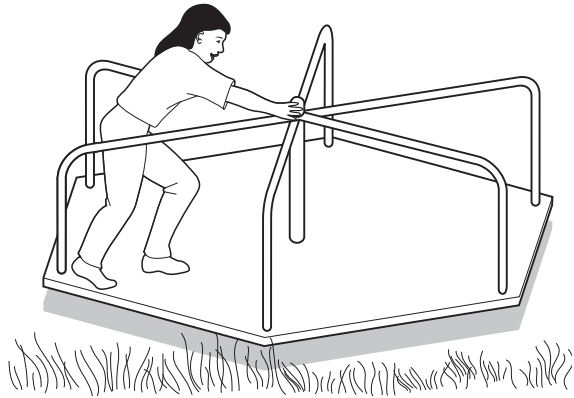
# SCIENCE

## SECOND OPEN-ENDED ITEM RESPONSES

Response Score: 2 points

C.3.1.2

Use the pictures below to answer question 18.



18. At the playground there is a swing and a merry-go-round.

**Part A:** Describe one motion a child will experience riding on a swing.

A child on a swing might feel  
an up and down motion.

**Part B:** Describe one motion a child will experience riding on a merry-go-round.

A child will experience a  
spining motion on the  
merry-go-round.

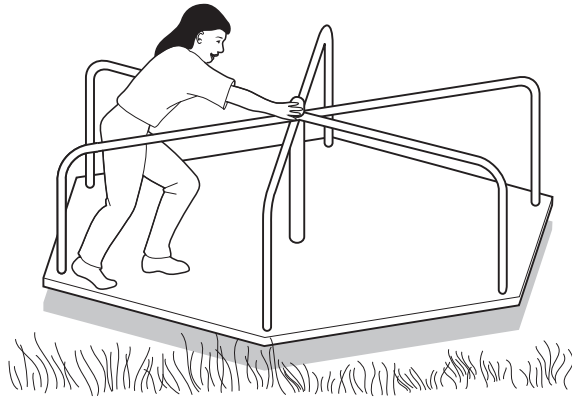
The student correctly describes "up and down" as a motion experienced on a swing and correctly describes "spining" as a motion experienced on a merry-go-round.

# SCIENCE

Response Score: 1 point

C.3.1.2

Use the pictures below to answer question 18.



18. At the playground there is a swing and a merry-go-round.

**Part A:** Describe one motion a child will experience riding on a swing.

One motion a child will experience riding on a swing is pushing and pulling.

**Part B:** Describe one motion a child will experience riding on a merry-go-round.

One motion a child will experience on a merry-go-round is being dizzy.

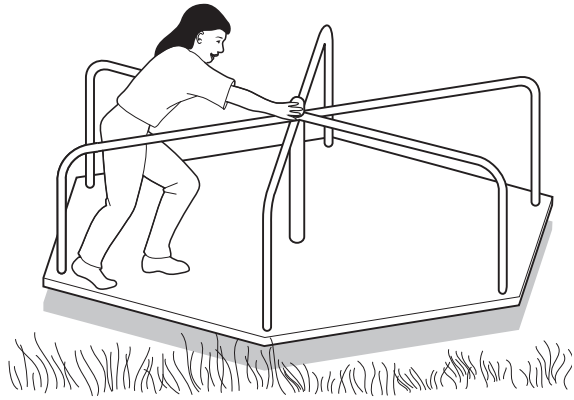
The student correctly describes the motion of a child on a swing (“pushing and pulling”). “Dizzy” is not a motion; it is a physical condition experienced as a result of the spinning motion of a merry-go-round.

# SCIENCE

Response Score: 0

C.3.1.2

Use the pictures below to answer question 18.



18. At the playground there is a swing and a merry-go-round.

**Part A:** Describe one motion a child will experience riding on a swing.

fun because you can race  
your friends.

**Part B:** Describe one motion a child will experience riding on a merry-go-round.

happy because they probably  
think it's fun!

The student is not describing a motion experienced by a child on a swing or on a merry-go-round.

# SCIENCE

## SUMMATIVE DATA TABLE

### Multiple-Choice Items

Sampler Sequence	A	B	C	D
1	69%	4%	9%	17%
2	14%	10%	66%	10%
3	13%	7%	8%	73%
4	4%	20%	5%	71%
5	7%	75%	16%	3%
6	7%	83%	5%	4%
7	7%	83%	5%	5%
8	14%	57%	5%	24%
9	3%	5%	90%	2%
10	11%	12%	69%	8%
11	76%	7%	2%	14%
12	8%	65%	7%	19%
13	4%	8%	5%	82%
14	12%	69%	6%	13%
15	9%	2%	3%	86%
16	5%	4%	79%	12%

### Open-Ended Items

Sampler Sequence	Scorepoint 2	Scorepoint 1	Scorepoint 0
17	46%	35%	20%
18	62%	20%	18%

**Science  
Grade 4  
Item and Scoring Sampler Supplement**

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