

Pennsylvania PSSA 2024
Grade 8 Science

Exam & Answer Key Materials
Pages 2 - 51



pennsylvania
DEPARTMENT OF EDUCATION

The Pennsylvania System of School Assessment

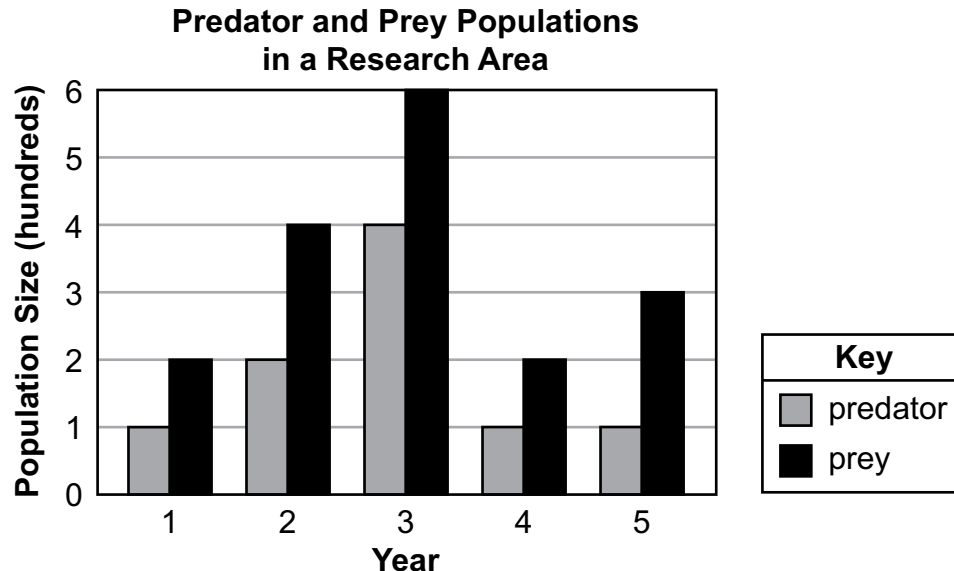
Science Item and Scoring Sampler



**2024–2025
Grade 8**

Multiple-Choice Questions

1. Use the graph below to answer the question.

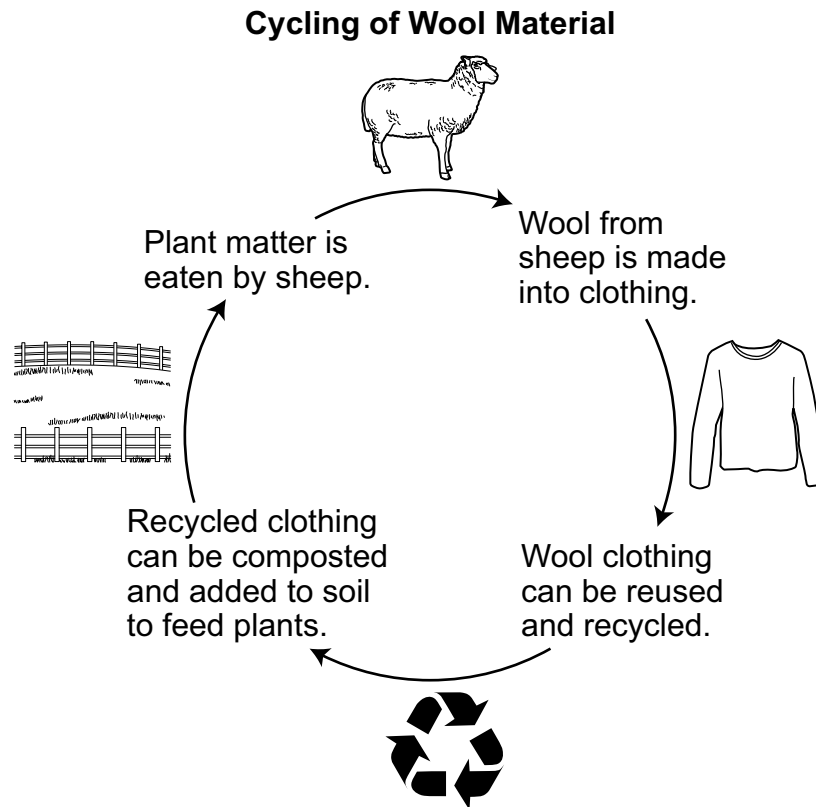


Scientists measured the sizes of a predator population and a prey population in an area over time. Which prediction describes events that are **most likely** to occur based on the evidence?

- Ⓐ The predator population will stay the same in year 6 because the prey population will be extinct.
- Ⓑ The predator population will increase in year 6 because the prey population is increasing.
- Ⓒ The prey population will decrease in year 6 because the predator population is decreasing.
- Ⓓ The prey population will increase in year 6 because the predator population will be extinct.

Category	Item-Specific Information
Alignment	3.1.6-8.1
Answer Key	B
Depth of Knowledge	3
p-value A	N/A
p-value B	N/A
p-value C	N/A
p-value D	N/A
Option Annotations	<p>A. The predator population would decrease as well if the prey population were extinct.</p> <p>B. Key: An increase in the prey population would likely result in an increase in the predator population.</p> <p>C. The prey population would likely increase rather than decrease if the predator population decreased.</p> <p>D. The predator population is not likely to go extinct since there is prey to feed on.</p>

2. Use the diagram below to answer the question.



Based on evidence in the diagram, which statement **best** describes the practice of using wool to make clothing?

- Ⓐ Using wool is unsustainable because sheep require a lot of land.
- Ⓑ Using wool is sustainable because wool clothing can be thrown away.
- Ⓒ Using wool is unsustainable because recycling is not always possible for every item.
- Ⓓ Using wool is sustainable because wool clothing can benefit the land the sheep use.

Category	Item-Specific Information
Alignment	3.4.6-8.A
Answer Key	D
Depth of Knowledge	2
p-value A	N/A
p-value B	N/A
p-value C	N/A
p-value D	N/A
Option Annotations	<p>A. The amount of land used for grazing is not a consideration of sustainability in the diagram.</p> <p>B. Throwing away wool products is not a sustainable practice.</p> <p>C. Wool is a sustainable product whether or not each wool item is recycled.</p> <p>D. Key: Mixing wool with soil to help grow plants that the sheep will eat is a sustainable practice.</p>

3. The western tarnished plant bug and the whitefly are two types of garden and crop pests. Instead of using chemical pesticides, some gardeners and farmers plant marigold flowers as a natural pest repellent. How could this strategy improve outdoor environments?
- Ⓐ Planting marigolds costs less than using chemicals.
 - Ⓑ Planting marigolds removes pollinators as well as other pests.
 - Ⓒ Planting marigolds is a safe and attractive way to eliminate pests.
 - Ⓓ Planting marigolds attracts different pests that are easier to eliminate.

Category	Item-Specific Information
Alignment	3.4.6-8.F
Answer Key	C
Depth of Knowledge	3
p-value A	N/A
p-value B	N/A
p-value C	N/A
p-value D	N/A
Option Annotations	<p>A. Cost was not accounted for in the strategy, nor does cost improve outdoor environments.</p> <p>B. Planting marigolds would not likely remove pollinators but would instead attract them.</p> <p>C. Key: Planting marigolds would reduce chemical pollution from pesticides.</p> <p>D. Planting marigolds would not necessarily attract different pests or make them easier to eliminate.</p>

4. The seat belts in a car are made from nylon. Nylon is a material that humans make from petroleum. Which statement is **best** supported by this information?
- Ⓐ Nylon is made from renewable natural resources.
 - Ⓑ Nylon is made from renewable synthetic resources.
 - Ⓒ Nylon is made from nonrenewable natural resources.
 - Ⓓ Nylon is made from nonrenewable synthetic resources.

Category	Item-Specific Information
Alignment	3.2.6-8.C
Answer Key	C
Depth of Knowledge	2
p-value A	N/A
p-value B	N/A
p-value C	N/A
p-value D	N/A
Option Annotations	<p>A. Petroleum is not a renewable resource.</p> <p>B. Petroleum is not a renewable resource and is a natural resource.</p> <p>C. Key: Petroleum is a nonrenewable natural resource.</p> <p>D. Petroleum is a natural resource.</p>

5. Use the information below to answer the question.

Information about Liquid X and Liquid Y

Liquid X	Liquid Y
<ul style="list-style-type: none"> • clear • colorless • density = 0.85 g/mL 	<ul style="list-style-type: none"> • clear • colorless • density = 1.15 g/mL

The table describes liquid X and liquid Y. A researcher pours 20.0 mL of each liquid into a test tube. As the two liquids mix, the test tube gets warmer and a yellow solid forms inside. The mass of the yellow solid is 40.0 g.

Which statement **best** explains what happened in the test tube?

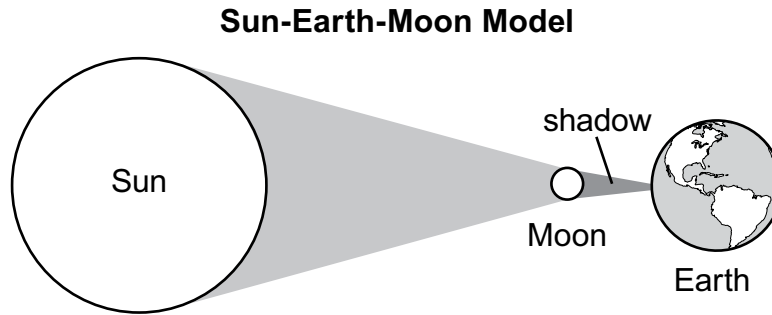
- Ⓐ A chemical reaction occurred because a new substance was made.
- Ⓑ A chemical reaction occurred because the two liquids had different densities.
- Ⓒ A chemical reaction did not occur, because a change in state is evidence of only a physical change and not a chemical change.
- Ⓓ A chemical reaction did not occur, because the mass of the liquids before mixing was equal to the mass of the yellow solid.

Category	Item-Specific Information
Alignment	3.2.6-8.D
Answer Key	A
Depth of Knowledge	2
p-value A	N/A
p-value B	N/A
p-value C	N/A
p-value D	N/A
Option Annotations	<p>A. Key: Chemical reactions result in new substances being formed.</p> <p>B. The densities of the two liquids are independent of a chemical reaction occurring.</p> <p>C. A change in state can provide evidence of both physical and chemical changes.</p> <p>D. The masses of the liquids were not provided in the information.</p>

6. A student wants to investigate how the mass of a toy car affects its motion. The student will use a ramp, a block, and four toy cars. Each toy car has a different mass. Which data should the student measure during this investigation?
- Ⓐ the length of each toy car
 - Ⓑ the color and shape of each toy car
 - Ⓒ the amount of force used to hold each toy car at the top of the ramp
 - Ⓓ the distance each toy car pushes a small block placed at the end of the ramp

Category	Item-Specific Information
Alignment	3.2.6-8.H
Answer Key	D
Depth of Knowledge	2
p-value A	N/A
p-value B	N/A
p-value C	N/A
p-value D	N/A
Option Annotations	<p>A. Cars of varying lengths can have the same mass, resulting in the same motion.</p> <p>B. Cars of varying colors and shapes can have the same mass, resulting in the same motion.</p> <p>C. The amount of force used to hold a car does not affect the car's mass and so would not affect the car's motion.</p> <p>D. Key: The distance the block is moved will depend on the motion of the car, which is affected by its mass.</p>

7. Use the model below to answer the question.



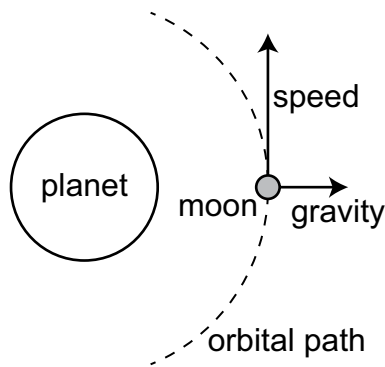
The model shows an event that causes part of Earth to be in a shadow. Which statement **best** describes the event shown in this model?

- Ⓐ It shows a full moon, which happens when the Moon rotates so its dark side faces Earth.
- Ⓑ It shows a new moon, which happens when the Moon rotates so its bright side faces Earth.
- Ⓒ It shows a solar eclipse, which happens when the Moon is directly between Earth and the Sun.
- Ⓓ It shows a lunar eclipse, which happens when the Moon is directly between Earth and the Sun.

Category	Item-Specific Information
Alignment	3.3.6-8.A
Answer Key	C
Depth of Knowledge	2
p-value A	N/A
p-value B	N/A
p-value C	N/A
p-value D	N/A
Option Annotations	<p>A. The diagram shows a new moon.</p> <p>B. During a new moon, the shaded side of the Moon faces Earth.</p> <p>C. Key: During a solar eclipse, the Moon blocks the view of the Sun at a specific location on Earth.</p> <p>D. A lunar eclipse occurs when Earth is between the Sun and the Moon.</p>

8. Use the diagram below to answer the question.

Model of a Moon in Orbit

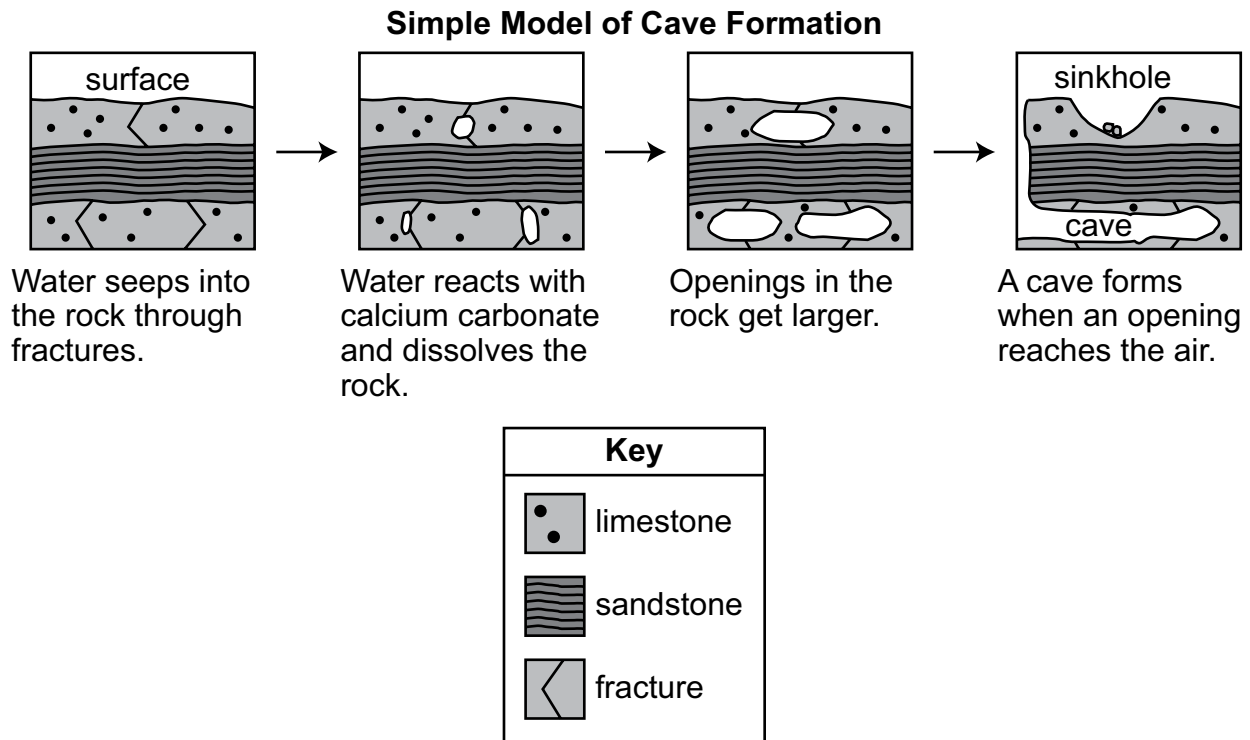


A student made a model to show a moon in orbit around a planet. Which statement describes an error in the model?

- Ⓐ The moon is traveling too slowly relative to its size.
- Ⓑ The force of gravity is shown acting in the wrong direction.
- Ⓒ The orbital path should be shown as straight instead of curved.
- Ⓓ The labels for “speed” and “orbital path” should switch positions.

Category	Item-Specific Information
Alignment	3.3.6-8.B
Answer Key	B
Depth of Knowledge	2
p-value A	N/A
p-value B	N/A
p-value C	N/A
p-value D	N/A
Option Annotations	<p>A. The scenario does not describe the orbital speed of the moon in relation to the planet.</p> <p>B. Key: The force of the planet’s gravity keeps the moon in its orbit.</p> <p>C. The circular path of the orbiting moon is correct.</p> <p>D. The labels for “speed” and “orbital path” are in the correct positions.</p>

9. Use the model below to answer the question.

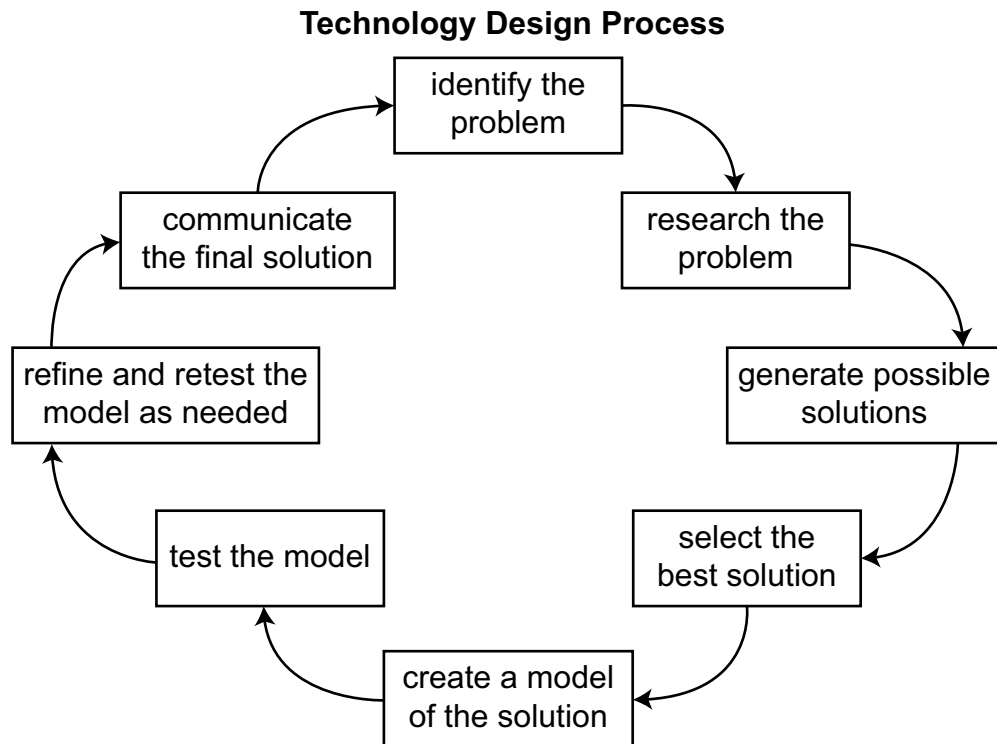


The model shows how a cave can form in areas with limestone rock layers. Which statement **best** explains the speed of this type of cave formation?

- Ⓐ The cave forms slowly because water must flow through rock layers many times for the rock to dissolve.
- Ⓑ The cave forms slowly because solid rock layers at the surface prevent water from seeping into the layers underground.
- Ⓒ The cave forms quickly because large amounts of water enter the opening when a sinkhole forms at the surface.
- Ⓓ The cave forms quickly because fast-moving water erodes rock rapidly and causes rock fractures to increase in size.

Category	Item-Specific Information
Alignment	3.3.6-8.E
Answer Key	A
Depth of Knowledge	2
p-value A	N/A
p-value B	N/A
p-value C	N/A
p-value D	N/A
Option Annotations	<p>A. Key: Water moving into the ground from above will slowly dissolve the carbonate rock over time.</p> <p>B. The rock in the ground is not fully solid but contains fractures, allowing water to move through.</p> <p>C. The sinkhole will form over a long time first, just like the caverns in the rock.</p> <p>D. The water moves slowly over time.</p>

10. Use the model below to answer the question.



The model shows a process used by engineers. How would the process for designing a new computer **best** compare to the process for designing a new bridge?

- Ⓐ The “identify the problem” step would be different because it is not possible to identify problems within computers.
- Ⓑ The “generate possible solutions” step would be different because this step is not needed for a bridge.
- Ⓒ The “create a model of the solution” step would be different because it is not possible to build a model of a bridge.
- Ⓓ The “test the model” step would be different because bridges and computers do not work the same way.

Category	Item-Specific Information
Alignment	3.5.6-8.LL
Answer Key	D
Depth of Knowledge	2
p-value A	N/A
p-value B	N/A
p-value C	N/A
p-value D	N/A
Option Annotations	<p>A. It is possible to identify problems within computers.</p> <p>B. The processes of designing both computers and bridges would benefit from this step.</p> <p>C. Models of bridges are typically built before the actual bridge is constructed.</p> <p>D. Key: Testing the models would be different because of the different functions of bridges and computers.</p>

11. Use the table below to answer the question.

Two Technologies That Generate Electricity from Renewable Energy

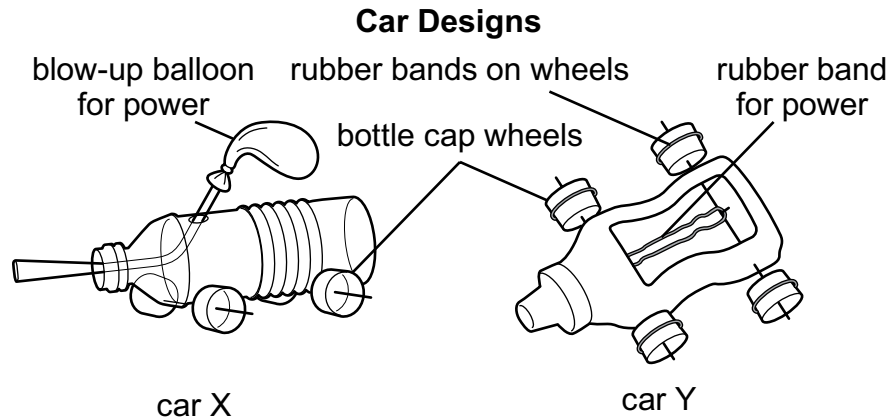
Solar Panels	Wind Turbines
<ul style="list-style-type: none"> • do not use moving parts because their power comes from the Sun • do not need to be maintained regularly • can only generate electricity during the day • can be installed in urban or rural areas • require open spaces to capture sunlight 	<ul style="list-style-type: none"> • use moving parts because their power comes from the wind • require regular maintenance • can generate electricity anytime the wind is blowing enough to turn the turbines • must be placed away from trees and buildings • may have harmful effects on wildlife

The table compares two technologies that use renewable energy sources to generate electricity: solar panels and wind turbines. Which statement **best** compares these different technologies?

- Ⓐ Solar panels should be used instead of wind turbines because they are harder to maintain.
- Ⓑ Solar panels should be used instead of wind turbines because they can generate electricity at night.
- Ⓒ Solar panels and wind turbines are both good options if the conditions are appropriate at their locations.
- Ⓓ Solar panels and wind turbines both have harmful effects on wildlife that should limit their use.

Category	Item-Specific Information
Alignment	3.5.6-8.LL
Answer Key	C
Depth of Knowledge	3
p-value A	N/A
p-value B	N/A
p-value C	N/A
p-value D	N/A
Option Annotations	<p>A. Not all conditions or locations are optimal for using solar panels, regardless of maintenance.</p> <p>B. Solar panels typically generate electricity only during daylight hours.</p> <p>C. Key: Both solar panels and wind turbines can have optimal energy generation if their locations and conditions are appropriate.</p> <p>D. The harmful effects of solar panels on wildlife are minimal compared to wind turbines and should not limit their use.</p>

12. Use the information below to answer the question.



Observations of Car Design Features

1. The balloon released air for a longer period of time than it took the rubber band to unwind.
2. The tires of car X slipped, but the tires of car Y did not.

Students designed two cars powered in different ways and repeatedly tested the distance that each car traveled. The average distance car X traveled was 5 meters. The average distance car Y traveled was 4 meters. Which design modification would **most likely** result in a car that travels farther than 5 meters?

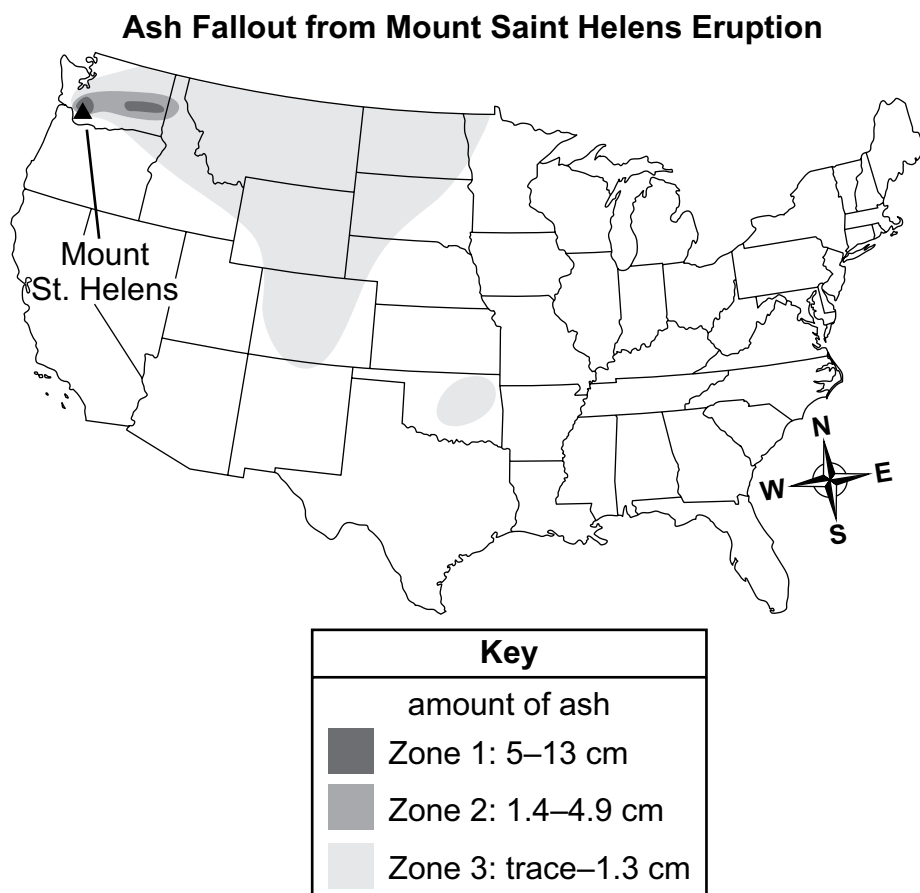
- Ⓐ moving the tires from car Y onto car X so that car X will not slip
- Ⓑ switching the bottle from car X to car Y to reduce air resistance
- Ⓒ blowing less air into the balloon on car X so the balloon will release air faster
- Ⓓ using a smaller rubber band on car Y so car Y will have a higher initial speed

Category	Item-Specific Information
Alignment	3.5.6-8.N
Answer Key	A
Depth of Knowledge	3
p-value A	N/A
p-value B	N/A
p-value C	N/A
p-value D	N/A
Option Annotations	<p>A. Key: Replacing the tires of car X with car Y's would increase the distance traveled.</p> <p>B. Switching the bottle design would not affect air resistance since both bottle types are similar in shape.</p> <p>C. Blowing less air into the balloon for car X would decrease the force of the air released.</p> <p>D. A smaller rubber band would take less time to fully unwind than a longer rubber band would.</p>

Directions: Use the information presented on page 26 to answer questions 13 through 16.

Mount Saint Helens

Mount Saint Helens is a volcano that erupted in 1980 and caused the largest debris landslide in United States history. Ash from the eruption, known as ash fallout, was blown high into the atmosphere and circled the globe in two weeks, sending ash debris thousands of miles away from the volcano.



The eruption rapidly changed Earth's surface. The peak of Mount Saint Helens was gone, forests were destroyed, and lakes and ponds were flooded as they filled with rock debris from the landslide. An area called the Pumice Plain formed when lava and ash covered the base of the mountain, leaving a lifeless area of light-gray rock.

Scientists studied nature's return to the Pumice Plain. Some of the first species to return were ground beetles. The beetles were able to eat other insects that had been blown into the area. Other species returned faster than scientists had expected, starting with bacteria, small mammals that survived underground, birds that ate the beetles, and some plants. Life is continuing to slowly return to the Pumice Plain.

13. Most trees in zone 1 were destroyed or damaged. Trees in zone 2 were coated with ash, and their growth rate slowed. Trees in zone 3 were coated in ash until rain washed off the ash; these trees had no change in growth.

Which statement **best** describes the process affected by the ash fallout on trees?

- Ⓐ Trees use the Sun's energy to convert oxygen and glucose into water during photosynthesis.
- Ⓑ Trees use the Sun's energy to convert oxygen and glucose into water during cellular respiration.
- Ⓒ Trees use the Sun's energy to convert water and carbon dioxide into glucose during photosynthesis.
- Ⓓ Trees use the Sun's energy to convert water and carbon dioxide into glucose during cellular respiration.

Category	Item-Specific Information
Alignment	3.1.6-8.F
Answer Key	C
Depth of Knowledge	2
p-value A	N/A
p-value B	N/A
p-value C	N/A
p-value D	N/A
Option Annotations	<p>A. Trees convert carbon dioxide and water into glucose during photosynthesis.</p> <p>B. Trees use the Sun's energy for photosynthesis, not for cellular respiration, and trees convert carbon dioxide and water into glucose during photosynthesis.</p> <p>C. Key: Photosynthesis is the process by which plants use the Sun's energy to convert carbon dioxide and water into glucose.</p> <p>D. Trees use the Sun's energy for photosynthesis, not for cellular respiration.</p>

14. Use the table below to answer the question.

Distance Traveled by Landslide Rocks

Distance from Mountain (km)	Relative Mass of Rock Debris
1–20	small
20–45	medium
45–60	large

The eruption of Mount Saint Helens caused the largest landslide ever recorded in United States history. Which statement explains how the mass of a rock affects the amount of kinetic energy the rock has when in motion?

- Ⓐ Kinetic energy increases as mass decreases, causing larger rocks to travel farther distances.
- Ⓑ Kinetic energy increases as mass increases, causing larger rocks to travel farther distances.
- Ⓒ Kinetic energy decreases as mass increases, causing larger rocks to travel shorter distances.
- Ⓓ Kinetic energy decreases as mass decreases, causing larger rocks to travel shorter distances.

Category	Item-Specific Information
Alignment	3.2.6-8.L
Answer Key	B
Depth of Knowledge	2
p-value A	N/A
p-value B	N/A
p-value C	N/A
p-value D	N/A
Option Annotations	<p>A. Kinetic energy decreases as the mass of an object decreases.</p> <p>B. Key: Larger rocks with greater masses will have more kinetic energy, causing them to travel farther than smaller rocks.</p> <p>C. Kinetic energy increases as the mass of an object increases.</p> <p>D. Larger rocks would travel farther distances.</p>

15. The area where Mount Saint Helens formed is on a continental plate next to an oceanic plate. The volcano has erupted several times during the past 40,000 years. Which statement **best** explains the process that formed Mount Saint Helens?
- Ⓐ Mountains formed from rising magma at a divergent boundary.
 - Ⓑ Earthquakes at a subduction zone caused many landslides over time, which formed mountains.
 - Ⓒ Deposition of ocean sediments built mountains as oceanic plates eroded at a divergent boundary.
 - Ⓓ Subduction of an oceanic plate at a convergent boundary caused mountains to form from uplift and rising magma.

Category	Item-Specific Information
Alignment	3.3.6-8.E
Answer Key	D
Depth of Knowledge	2
p-value A	N/A
p-value B	N/A
p-value C	N/A
p-value D	N/A
Option Annotations	<p>A. Divergent boundaries occur at areas where oceanic plates move away from each other.</p> <p>B. Landslides do not create mountain ranges.</p> <p>C. Erosion is not the primary process that builds mountain ranges.</p> <p>D. Key: An ocean plate subducting under a continental plate causes magma to rise up and form mountains near subduction zone boundaries.</p>

16. Use the chart below to answer the question.

Information about Geothermal Energy Technology

Advantages	Disadvantages
<ul style="list-style-type: none"> • has an unlimited supply of energy • does not pollute air or water during the transfer of heat to electricity • uses less space than other energy technologies • is available all year long 	<ul style="list-style-type: none"> • can be expensive to develop • has a high cost of maintaining equipment • can produce greenhouse gases when extracted from the ground • is available only in areas where geothermal energy is close to Earth's surface

The energy from Earth's core that causes volcanic eruptions can also be used as an energy source to generate electricity. The use of geothermal technology has not increased as quickly as the use of other renewable energy technologies.

Which statement describes a challenge of using geothermal energy technology?

- Ⓐ Geothermal energy technology has a limited supply of energy.
- Ⓑ Geothermal energy is not accessible in certain areas of the world.
- Ⓒ Geothermal energy is not available during certain times of the year.
- Ⓓ Geothermal energy technology harms the environment due to drilling in the ground.

Category	Item-Specific Information
Alignment	3.5.6-8.D
Answer Key	B
Depth of Knowledge	2
p-value A	N/A
p-value B	N/A
p-value C	N/A
p-value D	N/A
Option Annotations	<p>A. Geothermal energy technology has an unlimited supply of energy.</p> <p>B. Key: Only certain areas around the world are in direct contact with zones of geothermal energy.</p> <p>C. Geothermal energy is available year-round to use.</p> <p>D. Extensive drilling is not needed to access areas of geothermal energy.</p>

Open-Ended Item

17. Students have 10 identical plants. The students put 5 plants on a sunny windowsill in their classroom and 5 plants in a dark closet. After 24 hours, they test one leaf from each plant for the presence of starch. Starch is a chemical made of sugar molecules.

Results

Plant Location	Starch in Leaves
windowsill	yes
closet	no

Part A: Identify the location of the plants that completed photosynthesis.

Part B: Describe the evidence that supports your response in Part A.

17. **Continued.** Please refer to the previous page for task explanation.

Part C: Explain what the results show about the flow of energy in an ecosystem.

Item-Specific Scoring Guideline

#17 Item Information

Category	Item-Specific Information
Alignment	3.1.6-8.F
Depth of Knowledge	2
Mean Score	N/A

Item-Specific Scoring Guideline

Score	Description
3	<p>The response demonstrates a <i>thorough</i> understanding of constructing a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms by</p> <ul style="list-style-type: none"> identifying the location of the plants that completed photosynthesis AND describing the evidence that supports the response in Part A AND explaining what the results show about the flow of energy in an ecosystem. <p>The response is clear, complete, and correct.</p>
2	<p>The response demonstrates a <i>partial</i> understanding of constructing a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms by fulfilling two of the bullets listed under the 3-point response.</p> <p>The response may contain some work that is incomplete or unclear.</p>
1	<p>The response demonstrates a <i>minimal</i> understanding of constructing a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms by fulfilling one of the bullets listed under the 3-point response.</p> <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:**Part A (1 point):**

- The plants that completed photosynthesis were in the windowsill.

Part B (1 point):

- The plants in the windowsill had starch in their leaves. Starch is made of sugar molecules, which are a product of photosynthesis.
- The plants in the closet did not have starch in their leaves, which is evidence that photosynthesis was not performed.
- The plants in the windowsill had more starch than the plants in the closet.

Part C (1 point):

- Energy from sunlight in the windowsill is used as an input in photosynthesis, which produces sugars as a product of the reaction.
- If plants do not have light energy, photosynthesis will not occur and there will be less energy flowing in the ecosystem.
- Light energy is converted to chemical energy in plants.
- Plants use light energy to help make sugars, and the sugars are energy for other organisms in the ecosystem.
- Plants help the flow of energy through an ecosystem because they can use light energy to help make food for other organisms in the ecosystem.

STUDENT RESPONSE

Response Score: 3 points

17. Students have 10 identical plants. The students put 5 plants on a sunny windowsill in their classroom and 5 plants in a dark closet. After 24 hours, they test one leaf from each plant for the presence of starch. Starch is a chemical made of sugar molecules.

Results

Plant Location	Starch in Leaves
windowsill	yes
closet	no

Part A: Identify the location of the plants that completed photosynthesis.

Windowsill

Part B: Describe the evidence that supports your response in Part A.

The windowsill plants had starch in their leaves.

17. **Continued.** Please refer to the previous page for task explanation.

Part C: Explain what the results show about the flow of energy in an ecosystem.

Sunlight energy is a part of photosynthesis which
produces sugar.

The response demonstrates a thorough understanding of constructing a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. In Part A, the response correctly identifies the location of the plants that completed photosynthesis (*Windowsill*). In Part B, the response correctly describes the evidence that supports the response in Part A (*The windowsill plants had starch in their leaves*). In Part C, the response correctly explains what the results show about the flow of energy in an ecosystem (*Sunlight energy is a part of photosynthesis which produces sugar*). The response is clear, complete, and correct.

STUDENT RESPONSE

Response Score: 2 points

17. Students have 10 identical plants. The students put 5 plants on a sunny windowsill in their classroom and 5 plants in a dark closet. After 24 hours, they test one leaf from each plant for the presence of starch. Starch is a chemical made of sugar molecules.

Results

Plant Location	Starch in Leaves
windowsill	yes
closet	no

Part A: Identify the location of the plants that completed photosynthesis.

The location was the windowsill.

Part B: Describe the evidence that supports your response in Part A.

It says that starch is made of sugars and photosynthesis makes sugar.

17. **Continued.** Please refer to the previous page for task explanation.

Part C: Explain what the results show about the flow of energy in an ecosystem.

energy constantly flows in an ecosystem

The response demonstrates a partial understanding of constructing a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. In Part A, the response correctly identifies the location of the plants that completed photosynthesis (*window sill*). In Part B, the response correctly describes the evidence that supports the response in Part A (*starch is made of sugars and photosynthesis makes sugar*). In Part C, the response (*energy constantly flows in an ecosystem*) incorrectly explains what the results show about the flow of energy in an ecosystem and receives no credit.

STUDENT RESPONSE



Computer Response Score: 1 point

PART A

Question 17
Page 1 of 3

Item ID ?

Students have 10 identical plants. The students put 5 plants on a sunny windowsill in their classroom and 5 plants in a dark closet. After 24 hours, they test one leaf from each plant for the presence of starch. Starch is a chemical made of sugar molecules.

Plant Location	Starch in Leaves
windowsill	yes
closet	no

Part A: Identify the location of the plants that completed photosynthesis.

EQ

closet

6 / 100

Review/End Test Pause Flag Options Next

PART B

Question 17
Page 2 of 3

Item ID



Students have 10 identical plants. The students put 5 plants on a sunny windowsill in their classroom and 5 plants in a dark closet. After 24 hours, they test one leaf from each plant for the presence of starch. Starch is a chemical made of sugar molecules.

Results

Plant Location	Starch in Leaves
windowsill	yes
closet	no

Part B: Describe the evidence that supports your response in Part A.

EQ

Something about the molecules

29 / 500

Review/End Test

Pause

Flag

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PART C

Question 17

Page 3 of 3



Item ID



Students have 10 identical plants. The students put 5 plants on a sunny windowsill in their classroom and 5 plants in a dark closet. After 24 hours, they test one leaf from each plant for the presence of starch. Starch is a chemical made of sugar molecules.

Results

Plant Location	Starch in Leaves
windowsill	yes
closet	no

Part C: Explain what the results show about the flow of energy in an ecosystem.

EQ

Plants use sunlight to make chemical energy

43 / 500

Review/End Test

Pause

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The response demonstrates a minimal understanding of constructing a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. In Part A, the response (*closet*) incorrectly identifies the location of the plants that completed photosynthesis and receives no credit. In Part B, the response (*Something about the molecules*) incorrectly describes the evidence that supports the response in Part A and receives no credit. In Part C, the response correctly explains what the results show about the flow of energy in an ecosystem (*Plants use sunlight to make chemical energy*).

STUDENT RESPONSE

Response Score: 0 points

17. Students have 10 identical plants. The students put 5 plants on a sunny windowsill in their classroom and 5 plants in a dark closet. After 24 hours, they test one leaf from each plant for the presence of starch. Starch is a chemical made of sugar molecules.

Results

Plant Location	Starch in Leaves
windowsill	yes
closet	no

Part A: Identify the location of the plants that completed photosynthesis.

Closet

Part B: Describe the evidence that supports your response in Part A.

they weren't on the windowsill

17. **Continued.** Please refer to the previous page for task explanation.

Part C: Explain what the results show about the flow of energy in an ecosystem.

The energy flow starts with the sun and goes through the plant.

The response provides insufficient evidence to demonstrate any understanding of constructing a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. In Part A, the response (*Closet*) incorrectly identifies the location of the plants that completed photosynthesis and receives no credit. In Part B, the response (*they weren't on the windowsill*) incorrectly describes the evidence that supports the response in Part A and receives no credit. In Part C, the response (*energy flow starts with the sun and goes through the plant*) insufficiently explains what the results show about the flow of energy in an ecosystem and receives no credit.

Open-Ended Item

18. Students in a science class are investigating the forces that affect the movement of an object. The students may use any of the following materials for the investigation:

- 3 wooden blocks
- 1 wooden plank (30 cm in length)
- 1 small toy car
- 1 large toy car
- 1 meter stick
- 1 piece of carpet (30 cm in length)
- 1 piece of rough sandpaper (30 cm in length)

Part A: One student chooses a set of variables to test using the given materials. The student recorded the set of variables by using this sentence:
 “This experiment shows how _____ affects _____.”

Identify a set of variables the student likely tested by writing the completed sentence.

Part B: Another student chooses the carpet and sandpaper to conduct the investigation. Describe the **most likely** purpose of the carpet and sandpaper in the investigation.

18. **Continued.** Please refer to the previous page for task explanation.

Part C: Another student places one end of the wooden plank on one wooden block to make a ramp. The student observes the toy cars moving down the ramp. Next, the student makes the ramp steeper.

Describe how the motion of the small toy car and the large toy car will be affected by the steeper ramp height.

Item-Specific Scoring Guideline

#18 Item Information

Category	Item-Specific Information
Alignment	3.2.6-8.H
Depth of Knowledge	2
Mean Score	N/A

Item-Specific Scoring Guideline

Score	Description
3	<p>The response demonstrates a <i>thorough</i> understanding of planning an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object by</p> <ul style="list-style-type: none"> identifying a set of variables that the student likely tested <p>AND</p> <ul style="list-style-type: none"> describing the most likely purpose of the carpet and sandpaper in the investigation <p>AND</p> <ul style="list-style-type: none"> describing how the motion of the small and large toy cars will be affected by the steeper ramp height. <p>The response is clear, complete, and correct.</p>
2	<p>The response demonstrates a <i>partial</i> understanding of planning an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object by fulfilling two of the bullets listed under the 3-point response.</p> <p>The response may contain some work that is incomplete or unclear.</p>
1	<p>The response demonstrates a <i>minimal</i> understanding of planning an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object by fulfilling one of the bullets listed under the 3-point response.</p> <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:**Part A (1 point):**

- This experiment shows how the size of a toy car affects the distance the toy car travels.
- This experiment shows how the height of a ramp affects the distance a toy car travels.
- This experiment shows how the material on a ramp affects the distance a toy car travels.
- This experiment shows how the material on a floor affects the distance a toy car travels.

Part B (1 point):

- The purpose of the carpet and sandpaper is to change the amount of friction experienced by a toy car.
- The purpose of the carpet and sandpaper is to change the forces acting on a toy car.
- The purpose of the carpet and sandpaper is to see how a toy car's motion changes when the wheels travel on different surfaces.

Part C (1 point):

- Making the ramp steeper will make both toy cars travel a greater distance than they do on a less steep ramp.
- The large toy car will travel a greater distance on a steeper ramp than the large toy car on a less steep ramp.
- The small toy car will travel a greater distance on a steeper ramp than the small toy car on a less steep ramp.

STUDENT RESPONSE



Computer Response Score: 3 points

PARTS A and B

Question 18
Page 1 of 2

Item ID ?

Students in a science class are investigating the forces that affect the movement of an object. The students may use any of the following materials for the investigation:

- 3 wooden blocks
- 1 wooden plank (30 cm in length)
- 1 small toy car
- 1 large toy car
- 1 meter stick
- 1 piece of carpet (30 cm in length)
- 1 piece of rough sandpaper (30 cm in length)

Part A: One student chooses a set of variables to test using the given materials. The student recorded the set of variables by using this sentence: "This experiment shows how _____ affects _____."

Identify a set of variables the student likely tested by writing the completed sentence.

EQ

This experiment shows how the ramp height affects the distance of the toy car.

78 / 500

Part B: Another student chooses the carpet and sandpaper to conduct the investigation. Describe the **most likely** purpose of the carpet and sandpaper in the investigation.

EQ

Since carpet and sandpaper are two different materials, the friction would be different. They could see what effect that would have on the car.

143 / 500

Review/End Test Pause Flag Options

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PART C

Question 18

Page 2 of 2

Line Guide

Item ID ?

Students in a science class are investigating the forces that affect the movement of an object. The students may use any of the following materials for the investigation:

- 3 wooden blocks
- 1 wooden plank (30 cm in length)
- 1 small toy car
- 1 large toy car
- 1 meter stick
- 1 piece of carpet (30 cm in length)
- 1 piece of rough sandpaper (30 cm in length)

Part C: Another student places one end of the wooden plank on one wooden block to make a ramp. The student observes the toy cars moving down the ramp. Next, the student makes the ramp steeper.

Describe how the motion of the small toy car and the large toy car will be affected by the steeper ramp height.

ED

Both toy cars would go further when the ramp is on two or three blocks. They would not go as far when the ramp is only on one block.

132 / 500

Review/End Test

Pause

Flag

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Next

This response demonstrates a thorough understanding of planning an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. In Part A, the response correctly identifies a set of variables that the student likely tested (*This experiment shows how the ramp height affects the distance of the toy car*). In Part B, the response correctly describes the most likely purpose of the carpet and sandpaper in the investigation (*the friction would be different. They could see what effect that would have on the car*). In Part C, the response correctly describes how the motion of the small and large toy cars will be affected by the steeper ramp height (*Both toy cars would go further when the ramp is on two or three blocks. They would not go as far when the ramp is only on one block*). The response is clear, complete, and correct.

STUDENT RESPONSE

Response Score: 2 points

18. Students in a science class are investigating the forces that affect the movement of an object. The students may use any of the following materials for the investigation:

- 3 wooden blocks
- 1 wooden plank (30 cm in length)
- 1 small toy car
- 1 large toy car
- 1 meter stick
- 1 piece of carpet (30 cm in length)
- 1 piece of rough sandpaper (30 cm in length)

Part A: One student chooses a set of variables to test using the given materials. The student recorded the set of variables by using this sentence:
 “This experiment shows how _____ affects _____.”

Identify a set of variables the student likely tested by writing the completed sentence.

This experiment shows how 1 meter stick affects 1 wooden plank.

Part B: Another student chooses the carpet and sandpaper to conduct the investigation. Describe the **most likely** purpose of the carpet and sandpaper in the investigation.

The toy car would likely roll differently on the carpet compared to the sandpaper.

18. **Continued.** Please refer to the previous page for task explanation.

Part C: Another student places one end of the wooden plank on one wooden block to make a ramp. The student observes the toy cars moving down the ramp. Next, the student makes the ramp steeper.

Describe how the motion of the small toy car and the large toy car will be affected by the steeper ramp height.

A steeper ramp height would increase the distance either toy car would travel.

This response demonstrates a partial understanding of planning an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. In Part A, the response (*This experiment shows how 1 meter stick affects 1 wooden plank*) incorrectly identifies a set of variables that the student likely tested. These two variables do not show a force of movement, and the response does not receive any credit. In Part B, the response correctly describes the most likely purpose of the carpet and sandpaper in the investigation (*The toy car would likely roll differently on the carpet compared to the sandpaper*). In Part C, the response correctly describes how the motion of the small and large toy cars will be affected by the steeper ramp height (*A steeper ramp height would increase the distance either toy car would travel*).

STUDENT RESPONSE

Response Score: 1 point

18. Students in a science class are investigating the forces that affect the movement of an object. The students may use any of the following materials for the investigation:

- 3 wooden blocks
- 1 wooden plank (30 cm in length)
- 1 small toy car
- 1 large toy car
- 1 meter stick
- 1 piece of carpet (30 cm in length)
- 1 piece of rough sandpaper (30 cm in length)

Part A: One student chooses a set of variables to test using the given materials. The student recorded the set of variables by using this sentence:
 “This experiment shows how _____ affects _____.”

Identify a set of variables the student likely tested by writing the completed sentence.

This experiment shows how the material on the surface affects how far a toy car can go.

Part B: Another student chooses the carpet and sandpaper to conduct the investigation. Describe the **most likely** purpose of the carpet and sandpaper in the investigation.

Carpet is soft and sandpaper is rough.

18. **Continued.** Please refer to the previous page for task explanation.

Part C: Another student places one end of the wooden plank on one wooden block to make a ramp. The student observes the toy cars moving down the ramp. Next, the student makes the ramp steeper.

Describe how the motion of the small toy car and the large toy car will be affected by the steeper ramp height.

The small toy car would be affected more than the large toy car.

This response demonstrates a minimal understanding of planning an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. In Part A, the response correctly identifies a set of variables that the student likely tested (*This experiment shows how the material on the surface affects how far a toy car can go*). In Part B, the response (*Carpet is soft and sandpaper is rough*) incorrectly describes the most likely purpose of the carpet and sandpaper in the investigation and does not receive any credit. In Part C, the response (*The small toy car would be affected more than the large toy car*) incorrectly describes how the motion of the small and large toy cars will be affected by the steeper ramp height and does not receive any credit.

STUDENT RESPONSE

Response Score: 0 points

18. Students in a science class are investigating the forces that affect the movement of an object. The students may use any of the following materials for the investigation:

- 3 wooden blocks
- 1 wooden plank (30 cm in length)
- 1 small toy car
- 1 large toy car
- 1 meter stick
- 1 piece of carpet (30 cm in length)
- 1 piece of rough sandpaper (30 cm in length)

Part A: One student chooses a set of variables to test using the given materials. The student recorded the set of variables by using this sentence:
 “This experiment shows how _____ affects _____.”

Identify a set of variables the student likely tested by writing the completed sentence.

30 cm in length, 3 wooden blocks

Part B: Another student chooses the carpet and sandpaper to conduct the investigation. Describe the **most likely** purpose of the carpet and sandpaper in the investigation.

That student thought those materials would be good to use.

18. **Continued.** Please refer to the previous page for task explanation.

Part C: Another student places one end of the wooden plank on one wooden block to make a ramp. The student observes the toy cars moving down the ramp. Next, the student makes the ramp steeper.

Describe how the motion of the small toy car and the large toy car will be affected by the steeper ramp height.

The motion won't be affected at all for either car because the ramp's length is the same.

This response provides insufficient evidence to demonstrate any understanding of planning an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. In Part A, the response (*30 cm in length, 3 wooden blocks*) incorrectly identifies a set of variables that the student likely tested. These two variables do not show a force of movement, and the response does not receive any credit. In Part B, the response (*That student thought those materials would be good to use*) incorrectly describes the most likely purpose of the carpet and sandpaper in the investigation and does not receive any credit. In Part C, the response (*The motion won't be affected at all for either car because the ramp's length is the same*) incorrectly describes how the motion of the small and large toy cars will be affected by the steeper ramp height 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	3.1.6-8.I	B	3	N/A	N/A	N/A	N/A
2	3.4.6-8.A	D	2	N/A	N/A	N/A	N/A
3	3.4.6-8.F	C	3	N/A	N/A	N/A	N/A
4	3.2.6-8.C	C	2	N/A	N/A	N/A	N/A
5	3.2.6-8.D	A	2	N/A	N/A	N/A	N/A
6	3.2.6-8.H	D	2	N/A	N/A	N/A	N/A
7	3.3.6-8.A	C	2	N/A	N/A	N/A	N/A
8	3.3.6-8.B	B	2	N/A	N/A	N/A	N/A
9	3.3.6-8.E	A	2	N/A	N/A	N/A	N/A
10	3.5.6-8.LL	D	2	N/A	N/A	N/A	N/A
11	3.5.6-8.LL	C	3	N/A	N/A	N/A	N/A
12	3.5.6-8.N	A	3	N/A	N/A	N/A	N/A
13	3.1.6-8.F	C	2	N/A	N/A	N/A	N/A
14	3.2.6-8.L	B	2	N/A	N/A	N/A	N/A
15	3.3.6-8.E	D	2	N/A	N/A	N/A	N/A
16	3.5.6-8.D	B	2	N/A	N/A	N/A	N/A

Open-Ended

Sample Number	Alignment	Points	Depth of Knowledge	Mean Score
17	3.1.6-8.F	3	2	N/A
18	3.2.6-8.H	3	2	N/A