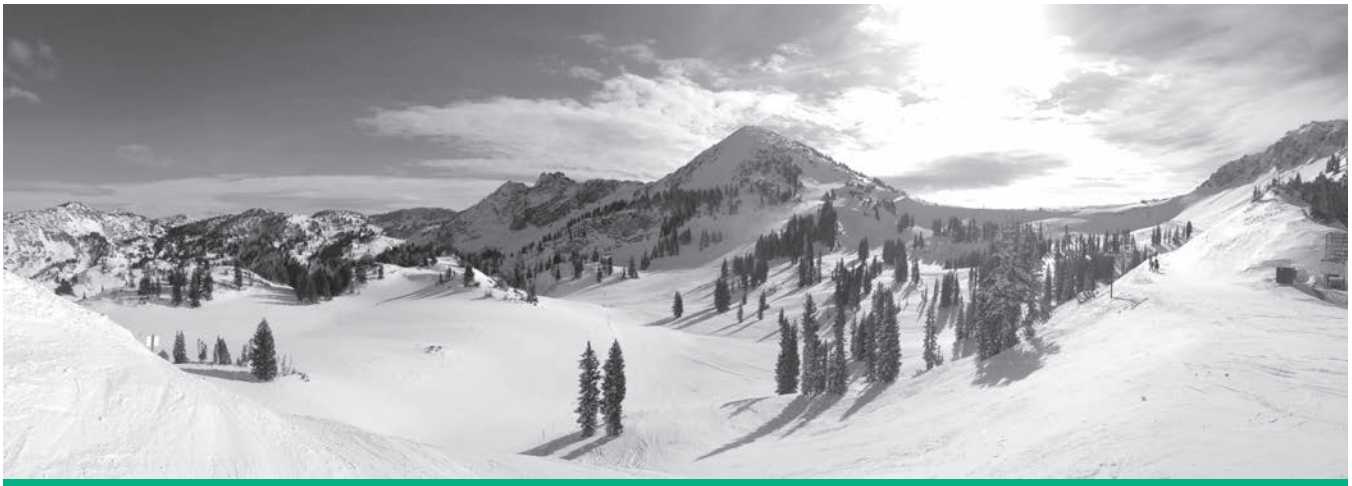
Colorado Measures of Academic Success



Grade 8 Science

Answer Key with Scoring Rubrics, Sample Responses & Annotations

Practice Resource for Students

1156852 1 2 3 4 5 A B C D E Printed in the USA ISD40128

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ITEM INFORMATION

Colorado Academic Standard (CAS) Evidence Outcome

Describes the evidence that demonstrates that a student is meeting the grade level expectation at a mastery level.

Disciplinary Core Ideas

The Disciplinary Core Ideas (DCIs) form the basis for the content that students are expected to know by the end of the grade level and are present in every item.

Science and Engineering Practices

The Science and Engineering Practices (SEPs) in the CAS are interwoven within certain items, and all SEPs are assessed according to the SEP progressions. The SEP is the first few words of the Evidence Outcome. If an SEP is not present in an item, then the item will not ask the student to demonstrate knowledge of the first part of the Evidence Outcome.

Crosscutting Concepts

Crosscutting concepts (CCCs) have applications across all domains of science. As such, they are a way of linking the different domains of science. The CCCs in the CAS are interwoven within certain items. Each CCC found in the CAS is assessed according to the CCC progressions.

Scenarios for Items

Items are driven by high-quality scenarios that are grounded in phenomena or problems. All scenarios are puzzling and intriguing and are explainable using grade appropriate integration of the three dimensions of the 2020 CAS. Scenarios are presented in three ways: simulations, clusters, and standalone items.

Simulations

Students are presented with an interactive simulation of a science model or experiment and asked to make sense of the observed phenomenon. They answer multiple two- or three-dimensional questions related to the content using their knowledge of the 2020 CAS.

Clusters

Students are presented with background information, still images, graphs, tables, and additional media and asked to make sense of the described phenomenon. Using their knowledge of the 2020 CAS, they answer multiple two- or three-dimensional questions related to the content.

Standalone Items

Students are presented with a unique phenomenon and asked to make sense of that phenomenon based on the information in the stimulus. They answer the two- or three-dimensional question using their knowledge of the 2020 CAS.

Simulation and cluster scenarios comprise the majority of the assessment as students are asked to make sense of a larger phenomenon and answer questions associated with those scenarios. Standalone items are included only to target a small number of 2020 CAS Evidence Outcomes not represented in simulation and cluster scenarios. These Evidence Outcomes rotate on an annual basis.

ITEM TYPES

Items are questions that appear on the assessments. They are presented in three different ways.

Selected Response (Multiple Choice, Multiple Response, and Fill in the Blank)

For multiple choice and multiple response items, students select a correct answer out of provided choices. For fill in the blank items, students type/write their answer in a blank box.

Technology-Enhanced (Bar Graph, Drag and Drop, Inline Choice, Hot Spot, and Match Table Grid)

Students show their answer using technology, such as by creating a bar graph using a template provided by the online testing system or on the paper-based test. Drag and drop items require students to drag answer choices into correct answer bays (draw lines or write corresponding letters for paper-based testing). Inline choice items require students to select their answer from a drop-down menu (circle answer from a list of choices for paper-based testing) to complete a sentence or sentences. Hot spot items require students to select the correct response from its location in an image (write corresponding letters or circle answer for paper-based testing). Match table grid items require students to check checkboxes in cells to indicate a match between the column and row labels.

Constructed Response

Students construct an open-ended response.

STUDENT PERFORMANCE

P Value – Selected Response and Technology-Enhanced Only

The P value represents the percentage of students who answered each selected response and technology-enhanced question correctly. For example, if the P value associated with a question is 0.64, then 64% of students responded to the question with the correct answer.

Score Point Distribution – Constructed Response Only

The score point distribution provides the percentage of students who scored at each possible score point for constructed response questions.

Sample Student Responses and Annotations – Constructed Response Only

Sample student responses are provided at each score point for constructed response items. Sample responses include annotations that provide reasoning for the score. Scoring rubrics are provided for constructed response items.

Note: P values and score point distributions are only available for released items (i.e., questions that previously appeared on CMAS assessments administered statewide). Items without this information were developed as sample items.

ANSWER KEY: ITEM SET 1

Item Set 1 – Question 1 (TEI Inline Choice)

Two students notice how quickly their cups of hot chocolate cool off. The students ask an adult to boil water. The water is 100 degrees Celsius (°C) when the adult pours it into a cup. The air temperature in the room is 20°C. After 10 minutes, the students note that the water temperature is 30°C. Explain the students' observations.

Select one correct response from each drop-down menu to complete the sentence.

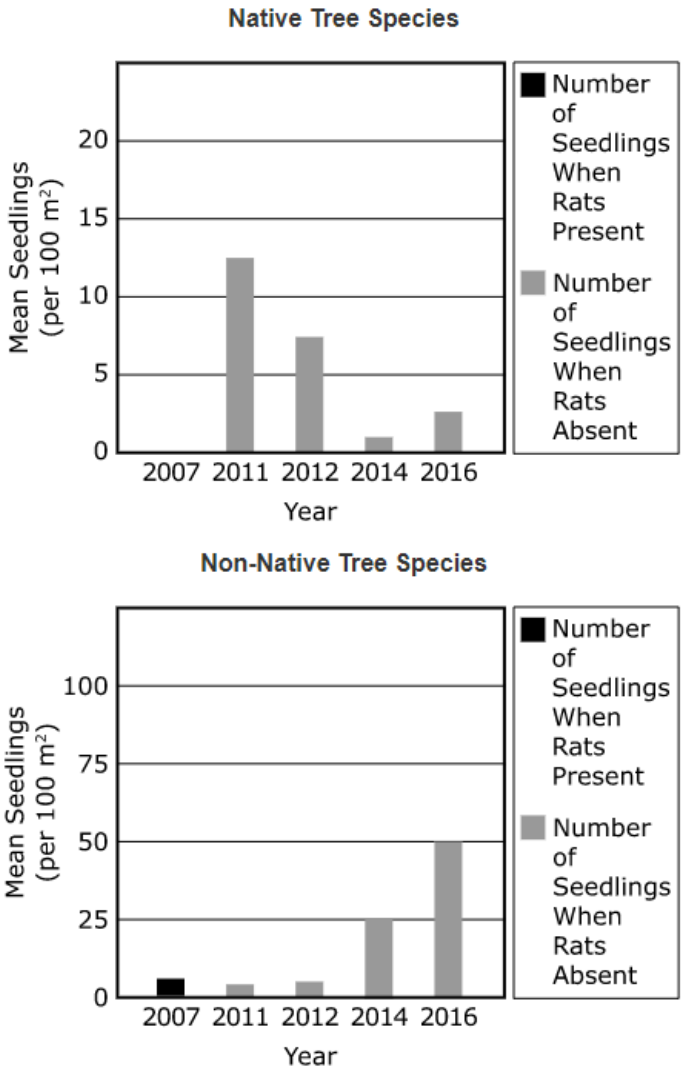
Over time, the [thermal] energy of the water [decreases] because energy flows from [warmer to cooler] matter.

Item Information

- Answer – See Image
- Standard – Physical Science
- Evidence Outcome – SC.MS.1.6.c
    - Construct, use, and present arguments to support the claim that when kinetic energy of an object changes, energy is transferred to or from the object. (MS-PS3-5) (Clarification Statement: Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.) (Boundary Statement: Does not include calculations of energy.) |SEP 7 EAE|CCC 5 EM|
- Disciplinary Core Idea – SC.MS.1.6
    - Energy changes to and from each type can be tracked through physical or chemical interactions. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter.
- Science and Engineering Practice – Not assessed in this item.
- Crosscutting Concept – Energy and Matter
- P Value – 0.631

Item Set 1 – Question 2 (Selected Response)

Rats were accidentally introduced onto an island in the Pacific Ocean in the 1940s. The rat population grew rapidly as the rats fed on eggs and small animals, as well as seeds and tree seedlings. In 2011, wildlife workers removed all rats from the island. The graphs show data for two tree species, before and after the removal of the rats.



How can these data **best** be evaluated to compare solutions to the problems faced by native tree species?

- A. Putting both graphs on the same scale would show that removing rats has aided population growth of native trees more than of non-native trees.
- B. Comparing the data and graphs shows that removing rats has had a negative effect on small animals because rat removal decreased food sources.
- C. Putting both graphs on the same scale would show that controlling non-native tree population growth is needed in addition to rat removal.
- D. Comparing the data and graphs shows that controlling the number of small animals is needed in addition to rat removal.

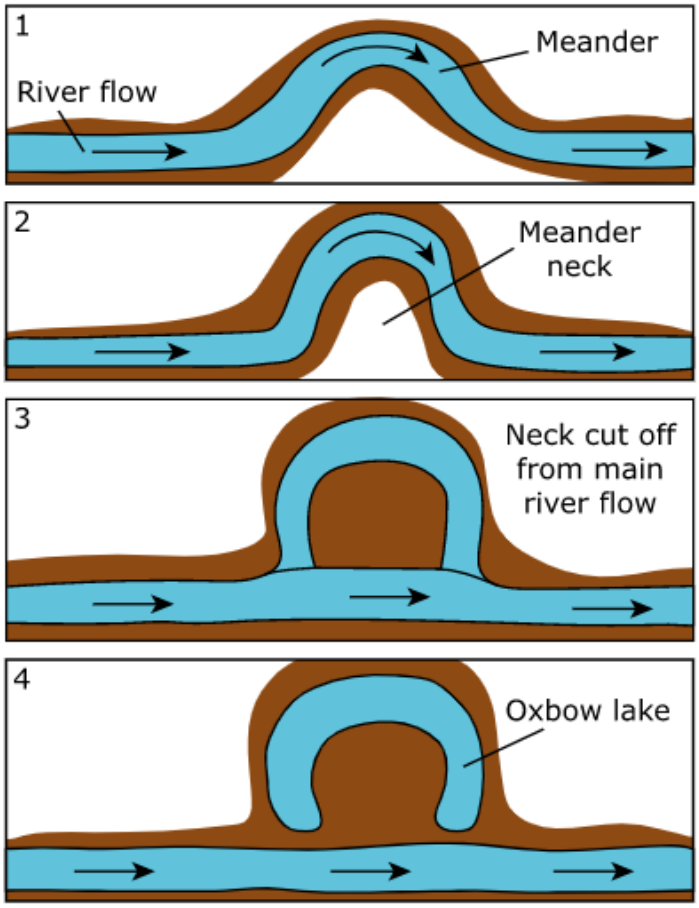
Item Information

- Answer – C
- Standard – Life Science
- Evidence Outcome – SC.MS.2.12.a
    - Evaluate competing design solutions for maintaining biodiversity and ecosystem services. **(MS-LS2-5) (Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.) |SEP 7 EAE|CCC 7 SC|**Also assessed as SC.MS.2.7.b under GLE SC.MS.2.7.
- Disciplinary Core Idea – SC.MS.2.12
    - Biodiversity is the wide range of existing life forms that have adapted to the variety of conditions on Earth, from terrestrial to marine ecosystems.
- Science and Engineering Practice – Engaging in Argument from Evidence
    - Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
- Crosscutting Concept – Stability and Change
- P Value – 0.357

Item Set 1 – Question 3 (Constructed Response)

Rivers that flow along crooked paths sometimes form extreme U-shaped bends called meanders. Through erosion and deposition of river soil and silt, these meanders can become oxbow lakes, as shown in the diagram.

Oxbow Lake Formation



Explain the processes that change river paths to form oxbow lakes. Your response should include an explanation of:

- how erosion and deposition can change the path of the river to form the oxbow lake
- how flooding could change the timeline of an oxbow lake's formation

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Earth and Space Science
- Evidence Outcome – SC.MS.3.4.b
    - Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. **(MS-ESS2-2) (Clarification Statement: Emphasis is on how processes change Earth's surface at time and spatial scales that can be large [such as slow plate motions or the uplift of large mountain ranges] or small [such as rapid landslides or microscopic geochemical reactions], and how many geoscience processes [such as earthquakes, volcanoes, and meteor impacts] usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.) |SEP 6 CEDS|CCC 3 SPQ|**Also assessed as SC.MS.3.6.a under GLE SC.MS.3.6.
- Disciplinary Core Idea – SC.MS.3.4
    - Energy flows and matter cycles within and among Earth's systems, including the sun and Earth's interior as primary energy sources. Plate tectonics is one result of these processes.
- Science and Engineering Practice – Constructing Explanations and Designing Solutions
    - Construct an explanation using models or representations.
- Crosscutting Concept – Scale, Proportion, and Quantity.
- Score Point Distribution
    - 10.3% of students earned 2 points.
    - 21.8% of students earned 1 point.
    - 67.9% of students earned 0 points.

Points	Attributes
2	**The student's response should include an explanation of:** • how erosion and deposition can change the path of the river to form the oxbow lake • how flooding could change the timeline of an oxbow lake's formation **Student responses may include but are not limited to:** Soil erodes from one part of the river and is deposited in other parts of the river. The soil erodes from the outside edge of the curves and piles up on the inside edge, changing the shape and path of the river. Flooding can speed the process of oxbow lake formation by increasing erosion and changing the location of deposition. This is due to a higher water flow during the flood.
1	Student demonstrates a partial understanding of the task. The student correctly responds to **one** of the two prompts.
0	Student response does not demonstrate an understanding of the task.

Item Set 1 – Question 4 (Selected Response)

The location of the Grand Ethiopian Renaissance Dam is shown in Figure 1. Operation of this dam may change geologic processes in the area. Which change will **most likely** occur as a result of the operation of the dam?

A. Water released from the dam will flood the area to the north with water and sediment.

B. The area to the south of the dam that holds the water will contain more sediment.

C. Water released from the dam will cause erosion of land to the south.

D. Eroded material from south of the dam will be carried to the north.

Item Information

- Answer – B
- Standard – Earth and Space Science
- Evidence Outcome – SC.MS.3.6.a
    - Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. **(MS-ESS2-2) (Clarification Statement: Emphasis is on how processes change Earth's surface at time and spatial scales that can be large [such as slow plate motions or the uplift of large mountain ranges] or small [such as rapid landslides or microscopic geochemical reactions], and how many geoscience processes [such as earthquakes, volcanoes, and meteor impacts] usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.) |SEP 6 CEDS|CCC 3 SPQ|**Also assessed as SC.MS.3.4.b under GLE SC.MS.3.4.
- Disciplinary Core Idea – SC.MS.3.6
    - Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features.
- Science and Engineering Practice – Constructing Explanations and Designing Solutions
    - Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real-world phenomena, examples, or events.
- Crosscutting Concept – CCC Not Assessed
- P Value – 0.294

Item Set 1 – Question 5 (Selected Response)

Based on the data in Part 2, during which months should people living along the Blue Nile expect potential flooding events?

- ○ A. October and November
- ○ B. January and February
- ◉ C. July and August
- ○ D. April and May

Item Information

- Answer – C
- Standard – Earth and Space Science
- Evidence Outcome – SC.MS.3.9.a
    - Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. (MS-ESS3-2) (Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes, such as earthquakes and volcanic eruptions, surface processes, such as mass wasting and tsunamis, or severe weather events, such as hurricanes, tornadoes, and floods. Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global, such as satellite systems to monitor hurricanes or forest fires, or local, such as building basements in tornado-prone regions or reservoirs to mitigate droughts.) |SEP 4 AID|CCC 1 P|
- Disciplinary Core Idea – SC.MS.3.9
    - Mapping the history of natural hazards in a region and understanding related geological forces.
- Science and Engineering Practice – Analyzing and Interpreting Data
    - Analyze data to define an optimal operational range for a proposed object, tool, process or system that best meets criteria for success.
- Crosscutting Concept – Patterns
- P Value – 0.863

Item Set 1 – Question 6 (Selected Response)

The table shows population data for Egypt, Ethiopia, and Sudan.

Population Data

Country	Population in 2020 (millions)	Projected Population in 2060 (millions)
Egypt	104	190
Ethiopia	108	225
Sudan	46	104

Based on the information provided and the Population Data table, select the statement that **best** supports the claim that these changes in population will negatively affect ecosystems in Egypt.

- ○ A. More flooding and soil erosion will occur as the volume of water in the Nile River increases.
- ○ B. Less water will flow through the Nile River in winter months than in summer months.
- ○ C. The volume of water in the Nile River will increase as humans use more water.
- ◉ D. Soil will become less fertile as the Nile River transports less sediment.

Item Information

- Answer – D
- Standard – Earth and Space Science
- Evidence Outcome – SC.MS.3.10.b
    - Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. (MS-ESS3-4) (Clarification Statement: Examples of evidence include grade-appropriate databases on human populations and the rates of consumption of food and natural resources [such as freshwater, mineral, and energy]. Examples of impacts can include changes to the appearance, composition, and structure of Earth's systems as well as the rates at which they change. The consequences of increases in human populations and consumption of natural resources are described by science, but science does not make the decisions for the actions society takes.) |SEP 7 EAE|CCC 2 CAE|
- Disciplinary Core Idea – SC.MS.3.10
    - Human activities have altered the biosphere, sometimes damaging it, although changes to environments can have different impacts for different living things.
- Science and Engineering Practice – Engaging in Argument from Evidence
    - Make an oral or written argument that supports or refutes the advertised performance of a device, process, or system, based on empirical evidence concerning whether or not the technology meets relevant criteria and constraints.
- Crosscutting Concept – Cause and Effect
- P Value – 0.326

Item Set 1 – Question 7 (Selected Response)

Based on the data in Part 2, in which month and year would a dam with a large reservoir **most likely** benefit Ethiopian water supply?

- (●) A. November 1985
- ( ) B. November 2003
- ( ) C. August 1992
- ( ) D. August 2010

Item Information

- Answer – A
- Standard – Earth and Space Science
- Evidence Outcome – SC.MS.3.9.a
    - Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. (MS-ESS3-2) (Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes, such as earthquakes and volcanic eruptions, surface processes, such as mass wasting and tsunamis, or severe weather events, such as hurricanes, tornadoes, and floods. Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global, such as satellite systems to monitor hurricanes or forest fires, or local, such as building basements in tornado-prone regions or reservoirs to mitigate droughts.) |SEP 4 AID|CCC 1 P|
- Disciplinary Core Idea – SC.MS.3.9
    - Mapping the history of natural hazards in a region and understanding related geological forces.
- Science and Engineering Practice – Analyzing and Interpreting Data
    - Analyze data to define an optimal operational range for a proposed object, tool, process, or system that best meets criteria for success.
- Crosscutting Concept – Patterns
- P Value – 0.335

Item Set 1 – Question 8 (Constructed Response)

> Prior to construction of dams along the Nile River, rainfall patterns had a larger effect on local agriculture. Use the information provided to explain how rainfall patterns affected soil availability and fertility:
>
> - in the Nile River valley in Ethiopia
> - in the Nile River valley in Egypt

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Earth and Space Science
- Evidence Outcome – SC.MS.3.8.a
    - Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. (MS-ESS3-1) (Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum [locations of the burial of organic marine sediments and subsequent geologic traps], metal ores [locations of past volcanic and hydrothermal activity associated with subduction zones], and soil locations of active weathering and/or deposition of rock.) |SEP 6 CEDS|CCC 2 CAE|
- Disciplinary Core Idea – SC.MS.3.8
    - Humans depend on Earth's land, ocean, atmosphere, and biosphere for different resources, many of which are limited or not renewable. Resources are distributed unevenly around the planet as a result of past geologic processes.
- Science and Engineering Practice – Constructing Explanations and Designing Solutions
    - Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real-world phenomena, examples, or events.
- Crosscutting Concept – Cause and Effect
- Score Point Distribution
    - 1.0% of students earned 2 points.
    - 4.4% of students earned 1 point.
    - 94.6% of students earned 0 points.

Points	Attributes
2	**The student's response should explain how rainfall patterns affected soil availability and fertility:** • in the Nile River valley in Ethiopia • in the Nile River valley in Egypt **Student responses may include but are not limited to:** Heavy rainfall along the Nile in Ethiopia caused flooding. Floodwaters eroded fertile soil and transported it away, reducing both available soil and its fertility in the Nile River valley in Ethiopia. Floodwaters flowed to the north, slowed down, and deposited the sediments in Egypt. The transported sediments increased the available soil and its fertility in the Nile River valley in Egypt.
1	Student demonstrates a partial understanding of the task. The student correctly responds to **one** of the two prompts.
0	Student response does not demonstrate an understanding of the task.

Sample Student Reponses

Sample student responses are not representative of all correct answers for an item and are provided only as a guide to assist teachers with scoring.

Points – Sample Response and Annotation

2 – Sample Response and Annotation

- **Sample A Response**
  - Before the construction of Dams along the Nile River local agriculture relied greatly on rainfall. This was a grave issue in Ethiopia's Nile River Valley. Due to heavy summer rains, Ethiopia's Nile River Valley flooded destroying crops, this also likely caused soil erosion, the fertility was also taken away with the soil. Due to erosion Egypt's Nile River Valley's soil must've been great due to good fertile soil being caried to Egypt from Ethiopia.
- **Sample A Annotation**
  - The response explains how rainfall patterns affected soil availability and fertility in the Nile River valley in Ethiopia (*caused soil erosion, the fertility was also taken away with the soil*).

    The response explains how rainfall patterns affected soil availability and fertility in the Nile River valley in Egypt (*soil must've been great due to good fertile soil being caried to Egypt from Ethiopia*).
- **Sample B Response**
  - In the Nile River VAlley in Ethiopia, soil's availiblity and fetility was decreased because the river, flowing north, took the sediment with it. The Nile River Valley in Egypt, though, gained this soil so it's availibilty and fertility was increased
- **Sample B Annotation**
  - The response explains how rainfall patterns affected soil availability and fertility in the Nile River valley in Ethiopia (*decreased because the river, flowing north, took the sediment with it*).

    The response explains how rainfall patterns affected soil availability and fertility in the Nile River valley in Egypt (*Egypt, though, gained this soil so it's availibilty and fertility was increased*).

1 – Sample Response and Annotation

- **Sample A Response**
  - Dams solved the problem of large amounts of water flooding areas along the Nile. If too much water were to flow to Ethiopia the soil would be washed with it and lack of soil would cause fertility to decrease. Egypt is already located in an area where the soil isn't as fertile. An increase in rainfall would only make it harder to grow things because sand becomes washed away easier. That means it was likely harder to grow things during July and Agust when the rainfall was at its highest.
- **Sample A Annotation**
  - The response explains how rainfall patterns affected soil availability and fertility in the Nile River valley in Ethiopia (*If too much water were to flow to Ethiopia the soil would be washed with it and lack of soil would cause fertility to decrease*).

    The response incorrectly describes the effect on the Nile River Valley in Egypt (*harder to grow things because sand becomes washed away easier. That means it was likely harder to grow things during July and Agust when the rainfall was at its highest)*.
- **Sample B Response**
  - In the Nile River valley in Ehtiopia rainfall paterns would make there be less fertile soil and in the Nile River valley in Egypt there would have been more fertile soil.
- **Sample B Annotation**

  The response addresses the fertility of the soil for both locations, but does not address the movement of the soil (*there be less fertile soil and in the Nile River valley in Egypt there would have been more fertile soil*).

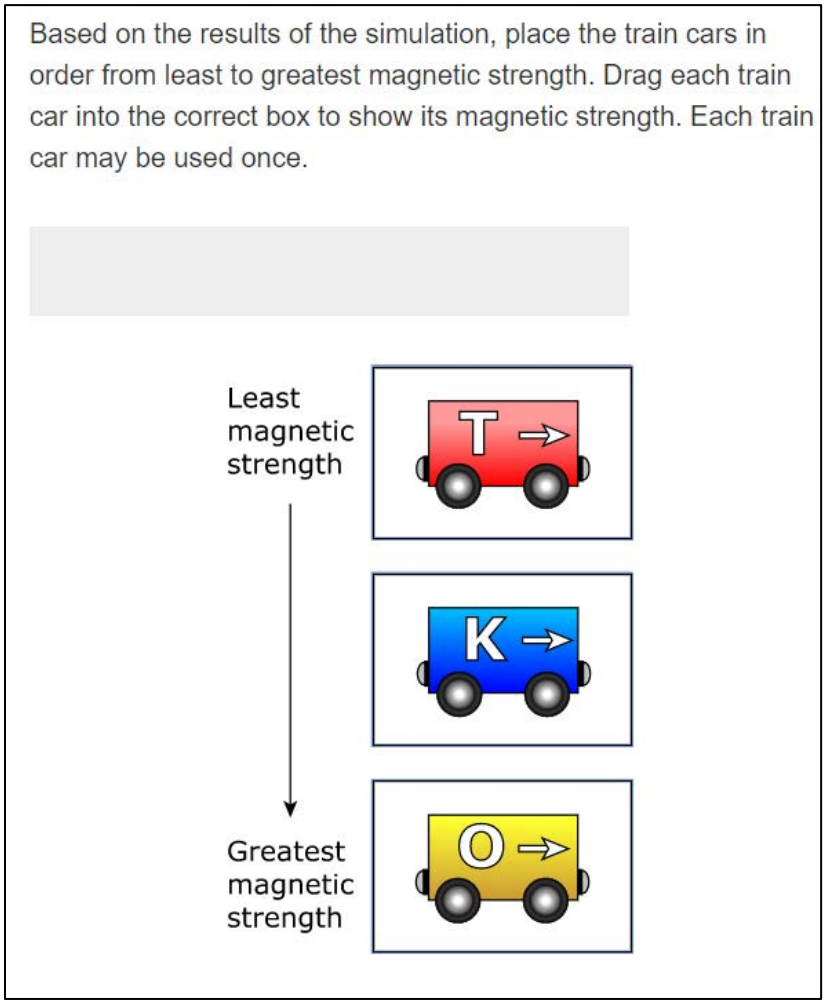
0 – Sample Response and Annotation

- **Sample A Response**
  - When there is more rain the river floods more and caries more sediments down river. The soil carried down stream in the river is fertile and makes it easeir to grow plants.
- **Sample A Annotation**

- The response describes sedimentation caused by rivers in general terms, but does not apply the statement to either location.

- **Sample B Response**
  - Rainfall paterns affect soil availabilty and fertility in Ethiopia and Egypt, but why? Well this is because the Nile River brings sand with it from the Sahara to Ethiopia. And in Egypt because the Nile River is running all along the Sahara.
- **Sample B Annotation**
  - The response incorrectly describes the availabilty and fertility of soil being carried by the Nile River (*brings sand with it from the Sahara to Ethiopia. And in Egypt because the Nile River is running all along the Sahara*).

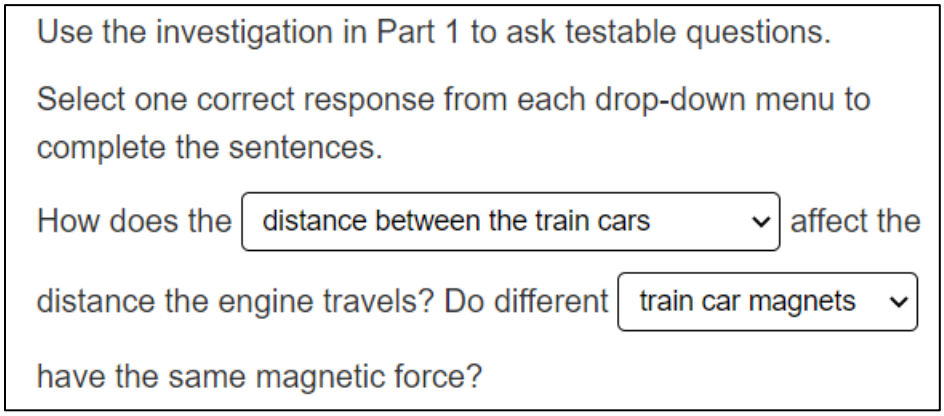
Item Set 1 – Question 9 (TEI Drag and Drop)



Item Information

- Answer – See Image
- Standard – Physical Science
- Evidence Outcome – SC.MS.1.4.a
    - Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. (MS-PS2-3) (Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.) (Boundary Statement: Limited to questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.) |SEP 1 AQDP|CCC 2 CAE|
- Disciplinary Core Idea – SC.MS.1.4
    - Forces that act a distance (gravitational, electric, and magnetic) can be explained by force fields that extend through space and can be mapped by their effect on a test object.
- Science and Engineering Practice – Not assessed in this item.
- Crosscutting Concept – Cause and Effect
- P Value – 0.647

Item Set 1 – Question 10 (TEI Inline Choice)



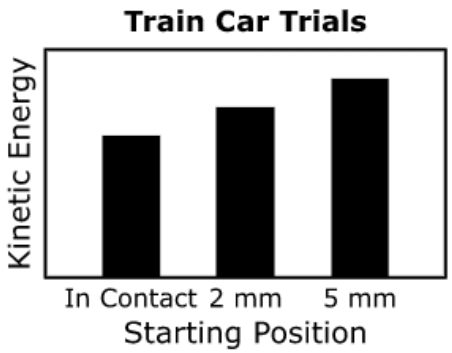
Item Information

- Answer – See image
- Standard – Physical Science
- Evidence Outcome – SC.MS.1.4.a
    - Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. (MS-PS2-3) (Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.) (Boundary Statement: Limited to questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.) |SEP 1 AQDP|CCC 2 CAE|
- Disciplinary Core Idea – SC.MS.1.4
    - Forces that act a distance (gravitational, electric, and magnetic) can be explained by force fields that extend through space and can be mapped by their effect on a test object.
- Science and Engineering Practice – Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information.
    - Ask questions to determine relationships between independent and dependent variables and relationships in models.
- Crosscutting Concept – Cause and Effect
- P Value – 0.454

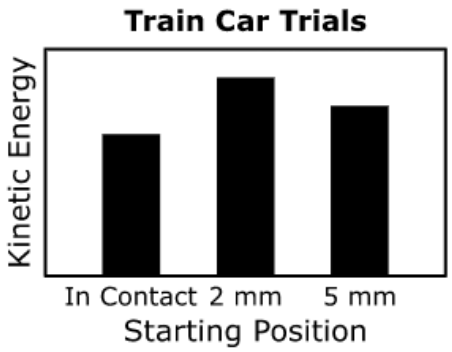
Item Set 1 – Question 11 (Selected Response)

Which graph shows the correct comparison of the kinetic energy that resulted from each starting position during the train car trials in Part 1?

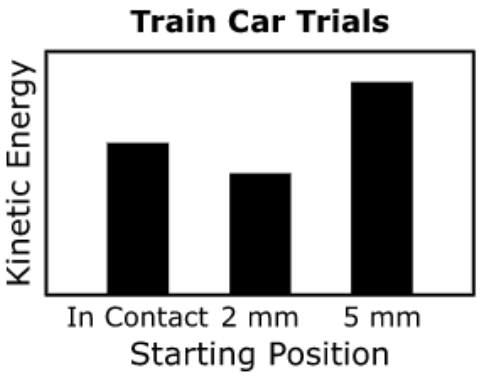
○ A.



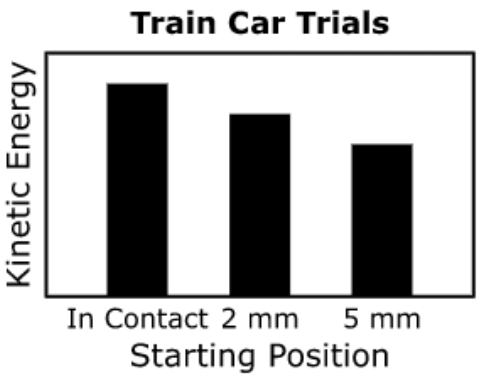
○ B.



○ C.



◉ D.



Item Information

- Answer – D
- Standard – Physical Science
- Evidence Outcome – SC.MS.1.5.a
    - Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and the speed of an object. (MS-PS3-1) (Clarification Statement: Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a wiffle ball versus a tennis ball.) |SEP 4 AID|CCC 3 SPQ|
- Disciplinary Core Idea – SC.MS.1.5
    - Kinetic energy can be distinguished from the various forms of potential energy.
- Science and Engineering Practice – Analyzing and Interpreting Data
    - Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships.
- Crosscutting Concept – Scale, Proportion, and Quantity
- P Value – 0.588

Item Set 1 – Question 12 (Constructed Response)

Write a question about the strength of the train car magnets that is answered by the iron filings investigation in Part 2. Your response should include:

- a question about the strength of the magnet as it relates to the iron filings investigation
- an explanation of how the results in Part 2 answer the question

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Physical Science
- Evidence Outcome – SC.MS.1.4.a
    - Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. (MS-PS2-3) (Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.) (Boundary Statement: Limited to questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.) |SEP 1 AQDP|CCC 2 CAE|
- Disciplinary Core Idea – SC.MS.1.4
    - Forces that act a distance (gravitational, electric, and magnetic) can be explained by force fields that extend through space and can be mapped by their effect on a test object.
- Science and Engineering Practice – Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information.
    - Ask questions that require sufficient and appropriate empirical evidence to answer.
- Crosscutting Concept – Cause and Effect
- Score Point Distribution
    - 11.3% of students earned 2 points.
    - 21.8% of students earned 1 point.
    - 67.0% of students earned 0 points.

Points	Attributes
2	**The student's response should include:** • a question about the strength of the magnet as it relates to the iron filings investigation • an explanation of how the results in Part 2 answer the question **Student responses may include but are not limited to:** A question about the strength of the train car magnets is, "How can the movement of iron filings be used to find out the strength of a magnet?" A stronger magnet pushes or pulls with more force, so it will make the filings move more. A weaker magnet will make the filings move less.
1	Student demonstrates a partial understanding of the task. The student correctly responds to **one** of the two prompts.
0	Student response does not demonstrate an understanding of the task.

Sample Student Reponses

Sample student responses are not representative of all correct answers for an item and are provided only as a guide to assist teachers with scoring.

Points – Sample Response and Annotation

2 – Sample Response and Annotation

- **Sample A Response**
  - Why do the magnets create different sizes of pattern on magnetic filling? All 3 magnets have a diffrent strength to them. Car O has the strongest magnet,Car K has a medium strength magnet, and Car T has a the weakest magnet. When the magnet makes contact with the iron it varies how much of that iron it can collect and because Cae O has a stronger magnet it collects the most and it makes a bigger circle than the others. So it all depends on how strng the magnet is.
- **Sample A Annotation**
  - The response provides a question about the strength of the magnet as it relates to the iron filings investigation (*Why do the magnets create different sizes of pattern on magnetic filling?*).

    The response gives an explanation of how the results in Part 2 answer the question (*When the magnet makes contact with the iron it varies how much of that iron it can collect and because Cae O has a stronger magnet it collects the most and it makes a bigger circle than the others*).
- **Sample B Response**
  - Question: Which magnet is the strongest? How does the iron filings prove this? Answer/Explanation: Magnet O is the strongest. I know this because magnet O pulled the most of the iron filings towards itself.
- **Sample B Annotation**
  - The response provides a question about the strength of the magnet as it relates to the iron filings investigation (*Which magnet is the strongest? How does the iron filings prove this?*). The hypothesis is divided into two separate questions, but this is acceptable.

    The response gives an explanation of how the results in Part 2 answer the question (*I know this because magnet O pulled the most of the iron filings towards itself*).

1 – Sample Response and Annotation

- **Sample A Response**
  - Does the strength of the train car magnet determine the amount of iron fillings it'll move? In Part 1 it showed that train car O has the stongest magnet, but in Part 2 it shows that they all have the same amount of iron fillings.
- **Sample A Annotation**
  - The response provides a question about the strength of the magnet as it relates to the iron filings investigation (D*oes the strength of the train car magnet determine the amount of iron fillings it'll move?*).

    The response incorrectly states the results of the trials in Part 2 (*train car O has the stongest magnet, but in Part 2 it shows that they all have the same amount of iron fillings*).
- **Sample B Response**
  - the bigger the pile of the iron filings shows how strong a magnet is and the results show car O being strongest because it has the biggest force and biggest pile of iron filings
- **Sample B Annotation**
  - Although the response does not provide a question, it does explain how the results in Part 2 would show a relationship between the strength of a magenet and the results of the iron filings experiment (*results show car O being strongest because it has the biggest force and biggest pile of iron filings*).

0 – Sample Response and Annotation

- **Sample A Response**
  - it shows that car o is the stongest with car t being the weakest.
- **Sample A Annotation**
  - The response does not provide a question or explain how the results of the iron filings experiment relate to the strength of the magnets.

- **Sample B Response**
  - How does the distance traveled measure the magnetic stregth The stronger the magnet is in Part 2 the farther it pushes the traincar in part 1
- **Sample B Annotation**
  - The question and results given are from Part 1, not Part 2, and therefore do not relate the strength of the magnets to the effect on the iron filings.

Item Set 1 – Question 13 (Constructed Response)

Use the investigations in Part 1 and Part 2 to consider whether the two investigations are designed well enough to show that fields exist and exert forces even when the objects are not in contact. Then choose one investigation and explain why it is designed well enough to show evidence about fields that exert forces. Your response should include:

- an explanation of how the design of the investigation tests for the presence of a magnetic field
- evidence from the investigation that shows the magnetic field produces a force at a distance

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Physical Science
- Evidence Outcome – SC.MS.1.4.c
    - Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact. (MS-PS2-5) (Clarification Statement: Examples of this phenomenon could include the interactions of magnets, electrically charged strips of tape, and electrically charged pith balls. Examples of investigations could include firsthand experiences or simulations.) (Boundary Statement: Assessment is limited to electric and magnetic fields and limited to qualitative evidence for the existence of fields.) |SEP 3 PCOI|CCC 2 CAE|
- Disciplinary Core Idea – SC.MS.1.4
    - Forces that act a distance (gravitational, electric, and magnetic) can be explained by force fields that extend through space and can be mapped by their effect on a test object.
- Science and Engineering Practice – Planning and Carrying Out Investigations
    - Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation.
- Crosscutting Concept – Cause and Effect
- Score Point Distribution
    - 14.7% of students earned 2 points.
    - 20.2% of students earned 1 point.
    - 65.1% of students earned 0 points.

Points	Attributes
2	**The student's response should include:** • an explanation of how the design of the investigation tests for the presence of a magnetic field • evidence from the investigation that shows the magnetic field produces a force at a distance **Student responses may include but are not limited to:** Evidence from the Part 1 investigation is designed to test for the presence of a magnetic field because it uses trains equipped with magnets that repel each other and the distance travelled can be used to determine how strong the forces between them are. The fact that the magnets repel each other even when they aren't touching shows that the magnetic field produces force at a distance, since no other force is acting on the trains to make them move. **-OR-** Evidence from the Part 2 investigation is designed to test for the presence of a magnetic field because it uses iron filings that are attracted to a magnet. The fact that the magnets attract the filings even before the magnet touches the plate shows that the magnetic field produces force at a distance, since no other force is acting on the filings to make them move.
1	Student demonstrates a partial understanding of the task. The student correctly responds to **one** of the two prompts.
0	Student response does not demonstrate an understanding of the task.

Sample Student Reponses

Sample student responses are not representative of all correct answers for an item and are provided only as a guide to assist teachers with scoring.

Points – Sample Response and Annotation

2 – Sample Response and Annotation

- **Sample A Response**
  - The investigation tests shows the presence of a magnetic feild because it shows us how the carts move when there at different distances from each other. The investigation shows the magnetic field produces a force at a distance beause when the cars were at a distance from each other they still moved away from eaching from the force of the magnets. Although the force wasn't as strong as when they were touching, there was still a magentic field.
- **Sample A Annotation**
  - The response provides an explanation of how the design of the investigation tests for the presence of a magnetic field (*it shows us how the carts move when there at different distances from each other... Although the force wasn't as strong as when they were touching, there was still a magentic field*).

    The response provides evidence from the investigation that shows the magnetic field produces a force at a distance (*when the cars were at a distance from each other they still moved away from eaching from the force of the magnets*). Although this is not as specific as "when they were 5 mm away fron each other, it is still considered to be evidence from the investigation.
- **Sample B Response**
  - The investigation in Part 2 is designed for testing the presence of a magnetic field because the iron fillings were affected from far away by the magnetic field of all three cars, thus being moved by a force no other than magnets, proving that the magnetic field produces force at a distance.
- **Sample B Annotation**
  - The response provides an explanation of how the design of the investigation tests for the presence of a magnetic field (being moved by a force no other than magnets, proving that the magnetic field produces force at a distance).

The response provides evidence from the investigation that shows the magnetic field produces a force at a distance (*the iron fillings were affected from far away by the magnetic field of all three cars*).

1 – Sample Response and Annotation

- **Sample A Response**
  - The tests are designed well enough to show magnetic fields because the objects aren't physically touching, but they can show movement between the two objects, since there is a magnetic field between them. Even though the objects aren't physically touching, people can still see that the magnetic field is strong enough to show both objects and how they effect each other.
- **Sample A Annotation**
  - The response provides an explanation of how the design of the investigation tests for the presence of a magnetic field *(the objects aren't physically touching, but they can show movement between the two objects, since there is a magnetic field between them*).

    The response does not provide evidence from the investigation, since the descriptions are too vague to determine whether the trains or the iron filings are being referenced (*Even though the objects aren't physically touching, people can still see that the magnetic field is strong enough to show both objects and how they effect each other*).
- **Sample B Response**
  - The design ofthe simulation shows you the different magnetic fields for each of theses occurences. The investigation proves that thier is force at a distance because at 5mm thier is still force being collided with each other causing it too move.
- **Sample B Annotation**
  - The response provides evidence from the investigation that shows the magnetic field produces a force at a distance (*because at 5mm thier is still force being collided with each other causing it too move*).

    The response does not evaluate how well the investigation is designed to show the presence of a magnetic field.

0 – Sample Response and Annotation

- **Sample A Response**
  - It shows if it pushes or pulls based on the strength. K= in contact, 10.6 in 2 mm, 7.8 and finally 5 mm, 3.6 O= in conatact, 12.8 in 2 mm, 11.7 and finally 5 mm, 4.1 T= in conatact, 9.0 in 2 mm, 6.0 and finally 5 mm, 3.5
- **Sample A Annotation**
  - The response does not evaluate the design of the experiment for its success in proving the existence of a magnetic field and also does not give evidence from the investigation showing that the field produces a force at a distance. The response repeats the data provided in the investigation but does not make an attempt to interpret the data.
- **Sample B Response**
  - The two investigations are designed well enough to show that feild exsist and how they work. They also show how magnets work well and how they can push each other away easily.
- **Sample B Annotation**
  - The response does not address the presence of a magnetic field and does not show how the investigation proves that fields produce force at a distance.

ANSWER KEY: ITEM SET 2

Item Set 2 – Question 1 (Selected Response)

The skunk cabbage is a plant that usually grows in wet areas.

Characteristics of this plant include:

- blooms in early spring
- produces heat in flower buds to protect against freezing temperatures
- smells like rotting meat
- has leaves that decompose quickly

Certain characteristics of the skunk cabbage increase its chances for successful reproduction. Which statement **best** identifies those characteristics?

○ A. The leaves decompose quickly so that there is less plant matter on the ground.

○ B. Deer and other herbivores eat the flowers and leaves in early spring.

◉ C. The smell of the plant attracts insects that can pollinate the flowers.

○ D. The flower structure provides a hiding place for spiders.

Item Information

- Answer – C
- Standard – Life Science
- Evidence Outcome – SC.MS.2.2.a
    - Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. (MS-LS1-4) (Clarification Statement: Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.) |SEP 7 EAE|CCC 2 CAE|
- Disciplinary Core Idea – SC.MS.2.2
    - Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring.
- Science and Engineering Practice – Not assessed in this item.
- Crosscutting Concept – Cause and Effect
- P Value – 0.559

Item Set 2 – Question 2 (Constructed Response)

When a student bites into a slice of lemon, muscles in the student's face begin to contract. The student learns that the muscles contract after acid in the lemon activates sensory receptors on the tongue. A week later, the student sees a lemon and notices that the same face muscles contract, even though the student did not bite into the lemon. Explain how a similar response occurs when the student bites into the lemon slice and when the student sees a lemon. Your response should include an explanation of:

- how information is transferred as the student bites into the lemon slice
- why the muscles in the student's face contract after seeing a lemon

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Life Science
- Evidence Outcome – SC.MS.2.4.a
  - Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. (MS-LS1-8) (Boundary Statement: Does not include mechanisms for the transmission of this information.) |SEP 8 OECI|CCC 2 CAE|
- Disciplinary Core Idea – SC.MS.2.4
  - Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain.
- Science and Engineering Practice – Obtaining, Evaluating, And Communicating Information
  - Communicate scientific and/or technical information (e.g., about a proposed object, tool, process, system) in writing and/or through oral presentations.
- Crosscutting Concept – Cause and Effect
- Score Point Distribution
  - 14.9% of students earned 2 points.
  - 34.6% of students earned 1 point.
  - 50.5% of students earned 0 points.

Points	Attributes
2	**The student's response should include an explanation of:** • How information is transferred as the student bites into the lemon slice. • Why the muscles in the student's face contract after seeing a lemon. **Student responses may include but are not limited to:** As the student bit into the lemon slice, the sensory receptors on the tongue sent information to the brain to be processed. The student's brain told the muscles in the face to contract, and the sensory input was stored in a memory. When the student saw the lemon a week later, the memory caused the brain to tell the muscles in the face to contract.
1	Student response demonstrates a partial understanding of the task.
0	Student response does not demonstrate an understanding of the task.

Sample Student Reponses

Sample student responses are not representative of all correct answers for an item and are provided only as a guide to assist teachers with scoring.

Points – Sample Response and Annotation

2 – Sample Response and Annotation

- **Sample A Response**
  - The information is transferred as the student bites into the lemon slice because when the acid in the lemon triggers receptors on the tongue, they send a signal that travels to the brain and the brain activates the facial muscles. The student's brain remembers what the lemon looks like, tastes like and etc. When the student sees the lemon again, the brain remembers what the lemon tastes like, and the facial muscles contracted again.
- **Sample A Annotation**
  - The response explains how information is transferred as the student bites into the lemon slice (*the acid in the lemon triggers receptors on the tongue, they send a signal that travels to the brain and the brain activates the facial muscles*).
  - The response explains why the muscles in the student's face contract after seeing a lemon (*The student's brain remembers what the lemon looks like, tastes like and etc. When the student sees the lemon again, the brain remembers what the lemon tastes like, and the facial muscles contracted again*).
- **Sample B Response**
  - The information that lemons are bitter and do not taste good is gathered by the student's taste buds on his tongue. This information is sent up through his nervous system to his brain where it remembers that lemons do not in fact taste good and therefore shouldn't be eaten. Because of this he has a memory that lemons are not to be eaten. Therefore when he sees a lemon he remembers that bad experience and because of muscle memory his face clenches back up.
- **Sample B Annotation**
  - The response explains how information is transferred as the student bites into the lemon slice (*The information ... is gathered by the student's taste buds on his tongue. This information is sent up through his nervous system to his brain*).
  - The response explains why the muscles in the student's face contract after seeing a lemon (*Because of this he has a memory that lemons are not to be eaten. Therefore when he sees a lemon he remembers that bad experience and because of muscle memory his face clenches back up*).

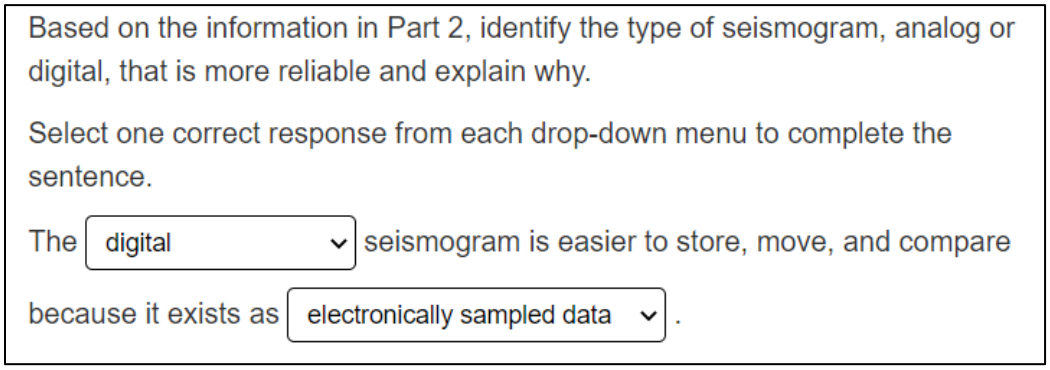
1 – Sample Response and Annotation

- **Sample A Response**
  - The taste receptors on the tongue can tell that the lemon is sour and sends signals to the brain which causes the face muscles to retract because of the sourness.
  - When the student looks at the lemon his face is getting prepared for him to bite it because his tongue sends signals to the brain to be prepared.
- **Sample A Annotation**
  - The response explains how information is transferred as the student bites into the lemon slice (*The taste receptors on the tongue can tell that the lemon is sour and sends signals to the brain which causes the face muscles to retract because of the sourness*).
  - The response gives an incorrect reason why the muscles contract (*his tongue sends signals to the brain to be prepared*). It is the memory of the taste, not the receptors in the tongue, that are causing the muscle contractions in the later scenario.
- **Sample B Response**
  - The information from the first time the student bites into the lemon is stored in their brain. When they see the lemon again, the brain reminds them of what happened the first time. Muscle memory makes the student's face contract after seeing a lemon.
- **Sample B Annotation**
  - The response explains why the muscles in the student's face contract after seeing a lemon (*When they see the lemon again, the brain reminds them of what happened the first time. Muscle memory makes the student's face contract after seeing a lemon*). To satisfy this element, the student must explain that the facial contraction is a result of a stored memory.
  - The response does not explain how information is transferred as the student bites into the lemon slice.

0 – Sample Response and Annotation

- **Sample A Response**
  - The student may be thinking of how the lemon already tastes so they make a certain face.
- **Sample A Annotation**
  - The response does not explain how information is transferred as the student bites into the lemon slice. The information given (*The student may be thinking of how the lemon already tastes*) is not specific enough to indicate understanding of the taste receptors sending signals to the brain which stores a memory.
  - The response does not explain why the muscles in the student's face contract after seeing a lemon. Any explanation stating that the muscle contraction is voluntary is incorrect.
- **Sample B Response**
  - Information is transferred as the student bites into the lemon slice
- **Sample B Annotation**
  - The response does not explain how information is transferred as the student bites into the lemon slice. The statement is a repeat of the prompt and does not give specific information of how the signal travels.
  - The response does not attempt an explanation of why the facial muscles contract.

Item Set 2 – Question 3 (TEI Inline Choice)



Item Information

- Answer – See image
- Standard – Physical Science
- Evidence Outcome – SC.MS.1.10.a
    - Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals. (MS-PS4-3) (Clarification Statement: Emphasis is on a basic understanding that waves can be used for communication purposes. Examples could include using fiber optic cable to transmit light pulses, radio wave pulses in Wi-Fi devices, and conversion of stored binary patterns to make sound or text on a computer screen.) (Boundary Statement: Does not include binary counting or the specific mechanism of any given device.) |SEP 8 OECI|CCC 6 SF|
- Disciplinary Core Idea – SC.MS.1.10
    - Designed technologies can transmit digital information as wave pulses.
- Science and Engineering Practice – Not assessed in this item.
- Crosscutting Concept – Structure and Function

Item Set 2 – Question 4 (TEI Inline Choice)

Based on the seismogram in Figure 7, compare the energy of the wave when it peaks at 47 seconds to the energy of the wave when it peaks at 36 seconds.

Select one correct response from each drop-down menu to complete the sentence.

The energy at 47 seconds will be [four times] as great because the [amplitude] is [twice] as great.

Item Information

- Answer – See image
- Standard – Physical Science
- Evidence Outcome – SC.MS.1.8.a
    - Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in the wave. (MS PS4-1) (Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking.) (Boundary Statement: Does not include electromagnetic waves and is limited to standard repeating waves.) |SEP 5 UMCT|CCC 1 P |
- Disciplinary Core Idea – SC.MS.1.8
    - A simple wave model has a repeating pattern with specific wavelength, frequency, and amplitude and mechanical waves need a medium through which they are transmitted. This model can explain many phenomena which include light and sound.
- Science and Engineering Practice – Using Mathematics and Computational Thinking
    - Apply mathematical concepts and/or processes (such as ratio, rate, percent, basic operations, and simple algebra) to scientific and engineering questions and problems.
- Crosscutting Concept – No CCC Alignment

Item Set 2 – Question 5 (Selected Response)

Figure 5 shows that a spring is included between the weight and the arm of the seismograph, which allows the pen to remain stationary as the drum moves beneath it. Which property of waves **best** explains why this spring is included?

- (●) A. Waves can be absorbed, and the spring stretches so that the vibrations move everything but the weight and pen.
- ( ) B. Waves can be reflected, and the spring reverses vibrations from the arm before they reach the pen.
- ( ) C. Waves can be amplified, and the spring increases the vibrations as they reach the weight and pen.
- ( ) D. Waves can be transmitted, and the spring transfers the wave energy from the weight to the pen.

Item Information

- Answer – A
- Standard – Physical Science
- Evidence Outcome – SC.MS.1.8.b
    - Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. **(MS-PS4-2) (Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.) (Boundary Statement: Limited to qualitative applications pertaining to light and mechanical waves.) |SEP 2 DUM|CCC 6 SF|**Also assessed as SC.MS.1.9.a under GLE SC.MS.1.9.
- Disciplinary Core Idea – SC.MS.1.8
    - A simple wave model has a repeating pattern with specific wavelength, frequency, and amplitude and mechanical waves need a medium through which they are transmitted. This model can explain many phenomena which include light and sound.
- Science and Engineering Practice – Not assessed in this item.
- Crosscutting Concept – Structure and Function

Item Set 2 – Question 6 (Selected Response)

Some seismic waves are pressure waves. Pressure waves can cause the density of the substance they are passing through to change. Based on this information and the information in Part 1, which statement **best** explains why light from the laser is distorted and scattered when a seismic wave disturbs the cable?

- (●) A. The change in density of the glass changes the way light is transmitted through it.
- ( ) B. Light responds to the change in pressure by traveling in the opposite direction.
- ( ) C. The change in density of the cable changes the amplitude of the light.
- ( ) D. Light responds to the change in pressure by changing frequencies.

Item Information

- Answer – A
- Standard – Physical Science
- Evidence Outcome – SC.MS.1.9.a
    - Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. **(MS-PS4-2) (Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.) (Boundary Statement: Limited to qualitative applications pertaining to light and mechanical waves.) |SEP 2 DUM|CCC 6 SF|**Also assessed as SC.MS.1.8.b under GLE SC.MS.1.8.
- Disciplinary Core Idea – SC.MS.1.9
    - A wave model of light is useful to explain how light interacts with objects through a variety of properties.
- Science and Engineering Practice – Not assessed in this item.
- Crosscutting Concept – Structure and Function

Item Set 2 – Question 7 (Constructed Response)

Explain why the two seismographs in Figure 4 would record different amplitudes for the earthquake. Your response should include an explanation of:

- why distance from the epicenter affects the amplitude of the seismic waves
- which seismograph would record a higher amplitude and how that amplitude is related to the energy in the wave

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Physical Science
- Evidence Outcome – SC.MS.1.8.a
    - Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in the wave. (MS PS4-1) (Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking.) (Boundary Statement: Does not include electromagnetic waves and is limited to standard repeating waves.) |SEP 5 UMCT|CCC 1 P |
- Disciplinary Core Idea – SC.MS.1.8
    - A simple wave model has a repeating pattern with specific wavelength, frequency, and amplitude and mechanical waves need a medium through which they are transmitted. This model can explain many phenomena which include light and sound.
- Science and Engineering Practice – Using Mathematics and Computational Thinking
    - Use mathematical representations to describe and/or support scientific conclusions and design solutions.
- Crosscutting Concept – Patterns

Points	Attributes
2	**The student's response should include an explanation of:** • Why distance from the epicenter affects the amplitude of the seismic waves. • Which seismograph would record a higher amplitude and how that amplitude is related to the energy in the wave. **Student responses may include but are not limited to:** At distances farther from the epicenter, the amplitude is smaller because seismic waves lose energy as they travel. Seismograph 1 will show a greater amplitude and higher energy.
1	Student response demonstrates a partial understanding of the task.
0	Student response does not demonstrate an understanding of the task.

Sample Student Reponses

Sample student responses are not representative of all correct answers for an item and are provided only as a guide to assist teachers with scoring.

Points – Sample Response and Annotation

2 – Sample Response and Annotation

- **Sample A Response**
  - As waves travel away from the epicenter of the earthquake, they begin to lose energy. When they lose energy, the amplitude of the waves decreases. Therefore, the closer seismograph, number 1, will record higher wave amplitudes than the further one. This is confirmed by the statement that "Seismograph 1 records a maximum amplitude of 75 microns, while a maximum amplitude of 37 microns is recorded at Seismograph 2."
- **Sample A Annotation**
  - The response explains why distance from the epicenter affects the amplitude of the seismic waves (*As waves travel away from the epicenter of the earthquake, they begin to lose energy. When they lose energy, the amplitude of the waves decreases*).
  - The response explains which seismograph would record a higher amplitude and how that amplitude is related to the energy in the wave (*When they lose energy, the amplitude of the waves decreases. Therefore, the closer seismograph, number 1, will record higher wave amplitudes than the further one*).
- **Sample B Response**
  - The waves would be taller when they had more energy, right after the earthquake. So, by the time they travelled to the further seismograph, #2, they would have lost some energy and would be shorter.
- **Sample B Annotation**
  - The response explains why distance from the epicenter affects the amplitude of the seismic waves (*The waves would be taller when they had more energy, right after the earthquake…they would have lost some energy and would be shorter*). "Taller" is an acceptable term to represent the amplitude, but when the term "shorter" is used. It must be determined that the student is referring to amplitude and not wave length.
  - The response explains which seismograph would record a higher amplitude and how that amplitude is related to the energy in the wave (*So, by the time they travelled to the further seismograph, #2, they would have lost some energy and would be shorter*). It is equally acceptable to say that seismograph 1 would measure higher amplitudes or that seismograph 2 would measure shorter amplitudes.

1 – Sample Response and Annotation

- **Sample A Response**
  - The waves start out really big when they are produced by the earthquake, but they lose amplitude as they travel farther away.
- **Sample A Annotation**
  - The response explains why distance from the epicenter affects the amplitude of the seismic waves (The waves start out really big when they are produced by the earthquake, but they lose amplitude as they travel farther away). Although discussing losing energy would be a better way to answer the question, this response is acceptable and demonstrates partial understanding of the standard.
  - The response does not explain which seismograph would record a higher amplitude and how that amplitude is related to the energy in the wave.
- **Sample B Response**
  - The waves would have the most amount of energy when they hit seismograph 1.
- **Sample B Annotation**
  - The response explains which seismograph would record a higher amplitude and how that amplitude is related to the energy in the wave (most amount of energy when they hit seismograph 1). Even though the response does not indicate that the waves would also have the highest amplitude at seismograph 1, this is sufficient to demonstrate partial understanding of the standard.
  - The response does not explain why distance from the epicenter affects the amplitude of the seismic waves.

0 – Sample Response and Annotation

- **Sample A Response**

- Seismograph 1 because it says 75 microns.

- **Sample A Annotation**
  - The response does not explain why distance from the epicenter affects the amplitude of the seismic waves.
  - The response does not explain which seismograph would record a higher amplitude and how that amplitude is related to the energy in the wave. Citing the data without making a comparison to the other seismograph does not demonstrate understanding of what the data means.
- **Sample B Response**
  - Seismograph 2 because that location is using fiber optic cables.
- **Sample B Annotation**
  - The response does not explain why distance from the epicenter affects the amplitude of the seismic waves.
  - The response does not explain which seismograph would record a higher amplitude and how that amplitude is related to the energy in the wave. It is not reasonable to assume that the technologies of the two seismographs vary, since they are being used in a way which requires comparison of the data.

Item Set 2 – Question 8 (Selected Response)

A student claims that less algae would grow in the pond if people living near the pond stopped using fertilizer. Based on the information in Part 2, which statement **best** provides evidence to support the student's claim?

- ○ A. The growth of algae stopped after eight days in the sample with 2 mL of fertilizer.
- ○ B. The sample with 0 mL of fertilizer showed an increase in algae after eight days.
- ○ C. The smallest amount of algae was found in the sample with the darkest water.
- ◉ D. The samples with less fertilizer resulted in less growth of algae.

Item Information

- Answer – D
- Standard – Life Science
- Evidence Outcome – SC.MS.2.7.a
  - Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. (MS-LS2-4) (Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.) |SEP 7 EAE|CCC 7 SC|
- Disciplinary Core Idea – SC.MS.2.7
  - Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all of its populations.
- Science and Engineering Practice – Engaging in Argument from Evidence
  - Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
- Crosscutting Concept – Stability and Change

Item Set 2 – Question 9 (Selected Response)

Based on the information, which statement **best** describes how the aquatic plants were affected by the algae bloom?

A. Photosynthesis by the aquatic plants increased because the algae on the surface allowed sunlight to pass through the water.

B. Respiration by the aquatic plants increased because the algae on the surface allowed sunlight to pass through the water.

C. Photosynthesis by the underwater aquatic plants decreased because the algae on the surface blocked the sunlight.

D. Respiration by the aquatic plants decreased because the algae on the surface blocked the sunlight.

Item Information

- Answer – C
- Standard – Life Science
- Evidence Outcome – SC.MS.2.3.a
    - Construct 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. (MS-LS1-6) (Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.) (Boundary Statement: Does not include the biochemical mechanisms of photosynthesis.) |SEP 6 CEDS|CCC 5 EM|
- Disciplinary Core Idea – SC.MS.2.3
    - Sustaining life requires substantial energy and matter inputs.
- Science and Engineering Practice – Constructing Explanations and Designing Solutions
    - Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena.
- Crosscutting Concept – Energy and Matter

Item Set 2 – Question 10 (TEI Multiple Select)

Based on the information in parts 2 and 3, determine how each component of the pond ecosystem changed between late August and late September.

Select **one** box per row.

Component	Increased	Decreased	Remained the Same
amount of carbon dioxide released by the fish	☐	☑	☐
amount of oxygen released by the algae	☑	☐	☐
amount of energy stored in sugars by the plants	☐	☑	☐

Item Information

- Answer – See Image
- Standard – Life Science
- Evidence Outcome – SC.MS.2.6.a
    - Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. (MS-LS2-3) (Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.) (Boundary Statement: Assessment does not include the use of chemical reactions to describe the processes.) |SEP 2 DUM|CCC 5 EM|
- Disciplinary Core Idea – SC.MS.2.6
    - Ecosystems are sustained by the continuous flow of energy, originating primarily from the sun, and the recycling of matter and nutrients within the system.
- Science and Engineering Practice – Not assessed in this item.
- Crosscutting Concept – Energy and Matter

Item Set 2 – Question 11 (Constructed Response)

Based on the information in Part 2, explain why the water samples were placed next to the window. Your response should include an explanation of:

- why the water samples were placed next to the window
- how the water samples would look different if placed in a dark room throughout the investigation

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Life Science
- Evidence Outcome – SC.MS.2.3.a
  - Construct 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. (MS-LS1-6) (Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.) (Boundary Statement: Does not include the biochemical mechanisms of photosynthesis.) |SEP 6 CEDS|CCC 5 EM|
- Disciplinary Core Idea – SC.MS.2.3
  - Sustaining life requires substantial energy and matter inputs.
- Science and Engineering Practice – Constructing Explanations and Designing Solutions
  - Construct an explanation using models or representations.
- Crosscutting Concept – Energy and Matter

Points	Attributes
2	**The student's response should include an explanation of:** • Why the water samples were placed next to the window. • How the water samples would look different if placed in a dark room throughout the investigation. **Student responses may include but are not limited to:** The water samples were placed next to the window because the algae need sunlight to perform photosynthesis. If the samples were placed in a dark room, the water samples would be less green (clearer). This is because the algae would be less able to perform photosynthesis and grow.
1	Student response demonstrates a partial understanding of the task.
0	Student response does not demonstrate an understanding of the task.

Sample Student Reponses

Sample student responses are not representative of all correct answers for an item and are provided only as a guide to assist teachers with scoring.

Points – Sample Response and Annotation

2 – Sample Response and Annotation

- **Sample A Response**
  - The glasses needed to be near the window because the algae uses the sunlight to get energy to go through photosynthesis. Without the sunlight the algae would not be able to convert carbon dioxide into other molecules to help it grow. If you put it in a dark room it would grow very slowly and the water wouldn't look as dark.
- **Sample A Annotation**
  - The response explains why the water samples were placed next to the window (*the algae uses the sunlight to get energy to go through photosynthesis*).
  - The response explains how the water samples would look different if placed in a dark room throughout the investigation (*If you put it in a dark room it would grow very slowly and the water wouldn't look as dark*).
- **Sample B Response**
  - The algae needs the sunlight for energy. If it was in a dark room it would have less green stuff floating in it.
- **Sample B Annotation**
  - The response explains why the water samples were placed next to the window (*needs the sunlight for energy*). This is a minimal, but acceptable, response, since it does not connect the intake of energy to photosynthesis.
  - The response explains how the water samples would look different if placed in a dark room throughout the investigation (*would have less green stuff floating in it*). Any description of the glass that indicates a slower rate of increase of the algae is acceptable, including lighter in color, less murky, and less plant matter.

1 – Sample Response and Annotation

- **Sample A Response**
  - The plant needs sunlight to turn CO_2 into O_2.
- **Sample A Annotation**
  - The response explains why the water samples were placed next to the window (*The plant needs sunlight to turn CO_2 into O_2*). This is a simplified explanation of photosynthesis, which is a process by which the plant takes in carbon dioxide and water and releases oxygen as a by-product.
  - The response does not address how the water samples would look different if placed in a dark room.
- **Sample B Response**
  - The plant needs sunlight so if it was in a dark room it would sink to the bottom and die.
- **Sample B Annotation**
  - The response explains how the water samples would look different if placed in a dark room throughout the investigation (*it would sink to the bottom and die*). This is acceptable, since it is referring to the picture in the simulation that shows decaying algae at the bottom of the pond.
  - The response does not explain why the water samples were placed next to the window. The statement given (*The plant needs sunlight*) is too vague and does not demonstrate any understanding of why plants need sunlight – for energy for photosynthesis.

0 – Sample Response and Annotation

- **Sample A Response**
  - Without sunlight the plant will die.
- **Sample A Annotation**
  - The response does not explain why the water samples were placed next to the window. To receive credit the student must explain why the plants need sunlight.
  - The response does not explain how the water samples would look different if placed in a dark room. The student must give a physical description of the sample, such as the water is clearer.
- **Sample B Response**
  - I think they put it by the window because it is warmer there and the water won't freeze. If they put it in

a dark room the plant would grow more, like mildew does.

- **Sample B Annotation**
  - The response does not correctly explain why the water samples were placed next to the window. The sun does provide heat, which is a form of energy. However, this response does not demonstrate understanding that the plant is taking in the energy from the sun and using it.
  - The response does not explain how the water samples would look different if placed in a dark room. The statement that the algae would grow more is incorrect.

Item Set 2 – Question 12 (Constructed Response)

Based on the information, explain how resource availability affects populations in the pond between late August and late September. Your response should include an explanation of how during each of the two time periods:

- the plant population is affected by resource availability
- the fish population is affected by resource availability

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Life Science
- Evidence Outcome – SC.MS.2.5.a
    - Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. (MS-LS2-1) (Clarification Statement: Emphasis is on cause - and - effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.) |SEP 4 AID|CCC 2 CAE|
- Disciplinary Core Idea – SC.MS.2.5
    - Organisms and populations of organisms are dependent on their environmental interactions both with other living things and with nonliving factors.
- Science and Engineering Practice – Not assessed in this item.
- Crosscutting Concept – Cause and Effect

Points	Attributes
2	**The student's response should include an explanation of how during each of the two time periods:** • The plant population is affected by resource availability. • The fish population is affected by resource availability. **Student responses may include but are not limited to:** Between late August and late September, the plant population receives less sunlight due to the growth of the algae on the surface of this pond. Because sunlight becomes more scarce, the plants are less able to perform photosynthesis and the plant population decreases. The fish depend on the plants to provide resources such as sugars and oxygen. As the plant population decreases, the resources available to the fish decrease and the fish population decreases.
1	Student response demonstrates a partial understanding of the task.
0	Student response does not demonstrate an understanding of the task.

Sample Student Reponses

Sample student responses are not representative of all correct answers for an item and are provided only as a guide to assist teachers with scoring.

Points – Sample Response and Annotation

2 – Sample Response and Annotation

- **Sample A Response**
  - The resources the plants need are sunlight, carbon dioxide and water, so they can perform photosynthesis and make food for themselves. In early August they have all of those things, but by the end of September they are not getting enough sunlight so they start to die off because the algae is blocking the sun. The fish need to get their food from the plants. If the plants die, the herbivorous fish can't eat and they die and the whole food chain suffers.
- **Sample A Annotation**
  - The response explains how during each of the two time periods the plant population is affected by resource availability (*In early August they have all of those things, but by the end of September they are not getting enough sunlight so they start to die off*).
  - The response explains how during each of the two time periods the fish population is affected by resource availability (*The fish need to get their food from the plants. If the plants die, the herbivorous fish can't eat and they die*). The response receives credit even though it does not mention oxygen.
- **Sample B Response**
  - The sunlight isn't getting to the plants under the water in late September, so they stop growing and the fish eat all of the plants so they run out of food and their population can't grow.
- **Sample B Annotation**
  - The response explains how during each of the two time periods the plant population is affected by resource availability (*The sunlight isn't getting to the plants under the water in late September, so they stop growing*). The response is minimal, but acceptable. Although it doesn't explain how the resources change from August to September, it does acknowledge that the sunlight is the resource that is limited in the later time frame.
  - The response explains how during each of the two time periods the fish population is affected by resource availability (*fish eat all of the plants so they run out of food and their population can't grow*). The population dying out or not growing are equally acceptable response to how the population is affected.

1 – Sample Response and Annotation

- **Sample A Response**
  - Because the plants are not getting sunlight, they are not making food so they don't grow. This has an effect on the fish and the snails and everything that lives in the pond.
- **Sample A Annotation**
  - The response explains how during each of the two time periods the plant population is affected by resource availability (*Because the plants are not getting sunlight, they are not making food so they don't grow*).
  - The response does not explain how during each of the two time periods the fish population is affected by resource availability. The statement given (*This has an effect on the fish*) is too vague and does not explain how the fish are affected.
- **Sample B Response**
  - When the algae starts to expand and covers more of the pond, the fish have fewer plants to eat and it is colder and therefore they go into hibernation.
- **Sample B Annotation**
  - The response explains how during each of the two time periods the fish population is affected by resource availability (*fish have fewer plants to eat and it is colder and therefore they go into hibernation*). This is a reasonable explanation of how the fish population could be affected by limited resource availability.
  - The response does not address how during each of the two time periods the plant population is affected by resource availability. Stating that there are fewer plants does not provide information on how the reduction in plants is related to the resources the plants need.

0 – Sample Response and Annotation

- **Sample A Response**
  - The algae blocks the sun from getting to the pond.
- **Sample A Annotation**
  - The response does not explain how during each of the two time periods either the plant population or the fish population is affected by resource availability. It is true that less of the resource is available, but the impact is not addressed.
- **Sample B Response**
  - The algae makes oxygen for the fish.
- **Sample B Annotation**
  - The response does not address how during each of the two time periods the plant population is affected by resource availability.
  - The response does not correctly explain how during each of the two time periods the fish population is affected by resource availability. The algae does produce oxygen, but the response does not connect the resource to the effect on the population.

Item Set 2 – Question 13 (Constructed Response)

Based on the information, explain how populations in the pond could change during the following winter and spring. Your response should include an explanation of:

- how the amount of sunlight reaching the pond during the winter could change the algae population
- how this change in the algae population could affect the plant population during the spring

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Life Science
- Evidence Outcome – SC.MS.2.7.a
    - Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. (MS-LS2-4) (Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.) |SEP 7 EAE|CCC 7 SC|
- Disciplinary Core Idea – SC.MS.2.7
    - Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all of its populations.
- Science and Engineering Practice – Engaging in Argument from Evidence
    - Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
- Crosscutting Concept – Stability and Change

Points	Attributes
2	**The student's response should include an explanation of:** • How the amount of sunlight reaching the pond during the winter could change the algae population. • How this change in the algae population could affect the plant population during the spring. **Student responses may include but are not limited to:** Less sunlight will reach the pond during the winter. So, the algae will be less able to perform photosynthesis and grow, and the algae population will likely decrease during the winter. In the spring, more sunlight will be able to pass through the water. So, the plants will be more able to perform photosynthesis and grow, and the plant population will likely increase during the spring.
1	Student response demonstrates a partial understanding of the task.
0	Student response does not demonstrate an understanding of the task.

Sample Student Reponses

Sample student responses are not representative of all correct answers for an item and are provided only as a guide to assist teachers with scoring.

Points – Sample Response and Annotation

2 – Sample Response and Annotation

- **Sample A Response**
  - I think that the algae would grow less in the winter because the sunlight is less direct and the sunlight gives the algae energy to grow. If the algae stops growing and some of it dies out, there will be clearer water and the sunlight can reach the plants at the bottom of the pond better when spring comes. This will be good for the plants because they are starting to grow again and can use the sunlight to produce food and grow.
- **Sample A Annotation**
  - The response explains how the amount of sunlight reaching the pond during the winter could change the algae population (*I think that the algae would grow less in the winter because the sunlight is less direct and the sunlight gives the algae energy to grow*).
  - The response explains how this change in the algae population could affect the plant population during the spring (*If the algae stops growing and some of it dies out, there will be clearer water and the sunlight can reach the plants at the bottom of the pond better when spring comes. This will be good for the plants because they are starting to grow again and can use the sunlight to produce food and grow*). The response does not state that the population will increase, but indicating that the plants can grow is sufficient.
- **Sample B Response**
  - In the winter the sun does not shine directly on that part of the Earth, so the pond will freeze and the algae will die. This allows the plants to start growing again in the spring when everything thaws out, because the sunlight can reach the plants.
- **Sample B Annotation**
  - The response explains how the amount of sunlight reaching the pond during the winter could change the algae population (*the sun does not shine directly on that part of the Earth, so the pond will freeze and the algae will die*).
  - The response explains how this change in the algae population could affect the plant population during the spring (*This allows the plants to start growing again in the spring when everything thaws out, because the sunlight can reach the plants*).

1 – Sample Response and Annotation

- **Sample A Response**
  - I predict that the algae would still get some sunlight during the winter because it is at the top of the pond, so it could still grow and do photosynthesis, so it wouldn't all die. People would have to remove it from the pond in the spring because it will affect the plants and fish.
- **Sample A Annotation**
  - The response explains how the amount of sunlight reaching the pond during the winter could change the algae population (*algae would still get some sunlight during the winter because it is at the top of the pond, so it could still grow and do photosynthesis, so it wouldn't all die*). Since the prompt does not specify how harsh the winter at this pond is, this is a reasonable prediction for the population [no change], correctly supported by the influence of the sun.
  - The response provides only a partial explanation of how this change in the algae population could affect the plant population during the spring (*People would have to remove it from the pond in the spring because it will make the plants sick*), since it does not specify how the algae makes the plants "sick.".
- **Sample B Response**
  - If there is less algae, there is more plants and more fish and snails.
- **Sample B Annotation**
  - The response explains how this change in the algae population could affect the plant population during the spring (*If there is less algae, there is more plants and more fish and snails*).
  - The response does not explain how the amount of sunlight reaching the pond during the winter could

change the algae population.

0 – Sample Response and Annotation

- **Sample A Response**
  - The plants and the algae both grow when it is spring because that is when it starts to warm up.
- **Sample A Annotation**
  - The response does not explain how the amount of sunlight could change the algae population or how the amount of algae affects the plants. Saying that the algae grows when it is warmer does not sufficiently address the relationship between the amount of growth and the amount of sunlight.
- **Sample B Response**
  - They are fertilizing the grass and the fertilizer gets into the pond and makes the algae grow.
- **Sample B Annotation**
  - The response does not explain how the amount of sunlight reaching the pond during the winter could change the algae population. The algae in the simulation does grow better when it has more fertilizer, but this does not show understanding of how the algae population will change in the winter and does not relate the population change to sunshine.
  - The response does not address how this change in the algae population could affect the plant population during the spring.

Item Set 2 – Question 14 (TEI Inline Choice)

A student learns that total lunar eclipses occur in some years and not in others. The student remembers that there was no total lunar eclipse in the year 2020.

Select one correct response from each drop-down menu to complete the sentences.

During 2020, Earth was never positioned directly between the two other celestial bodies.

As a result, the shadow of Earth never covered the Moon .

Item Information

- Answer – See image
- Standard – Earth and Space Science
- Evidence Outcome – SC.MS.3.2.c
    - Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. **(MS-ESS1-1) (Clarification Statement: Examples of models can be physical, graphical, or conceptual.) |SEP 2 DUM|CCC 1 P |**Also assessed as SC.MS.3.1.a under GLE SC.MS.3.1.
- Disciplinary Core Idea – SC.MS.3.2
    - The solar system contains many varied objects held together by gravity. Solar system models explain and predict eclipses, lunar phases, and seasons.
- Science and Engineering Practice – Developing and Using Models
    - Develop and/or use a model to predict and/or describe phenomena.
- Crosscutting Concept – CCC Not Assessed
- P Value – 0.17

ANSWER KEY: ITEM SET 3

Item Set 3 – Question 1 (Selected Response)

Curtains in theaters prevent sound waves from being reflected as echoes. Which model best explains why curtains prevent echoes?

- ○ A. A ball thrown toward a surface will come in contact faster with a soft surface than with a hard surface.
- ○ B. A ball thrown at a surface will hit with a greater force on a soft surface than on a hard surface.
- ○ C. A ball rolled across a surface will roll more quickly on a hard surface than on a soft surface.
- ◉ D. A ball dropped on a surface will bounce more on a hard surface than on a soft surface.

Item Information

- Answer – D
- Standard – Physical Science
- Evidence Outcome – SC.MS.1.8.b
  - Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
- Disciplinary Core Idea – SC.MS.1.8
  - A simple wave model has a repeating pattern with specific wavelength, frequency, and amplitude and mechanical waves need a medium through which they are transmitted. This model can explain many phenomena which include light and sound.
- Science and Engineering Practice – Developing and Using Models
  - Develop and/or use a model to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales.
- Crosscutting Concept – CCC Not Assessed

Item Set 3 – Question 2 (TEI Inline Choice)

In the scenario described in Part 1, the student pushes down on the globe and lets it go. Then the globe returns to its original stable position.

Select one correct response from each drop-down menu to complete the sentence.

After the globe is let go, it will return to a stable position when the [magnetic] force equals the [gravitational] force.

Item Information

- Answer – See image
- Standard – Physical Science
- Evidence Outcome – SC.MS.1.3.b
    - Plan an investigation to provide evidence that the change in an objects motion depends on the sum of the forces on the object and the mass of the object
- Disciplinary Core Idea – SC.MS.1.3
    - Motion is described relative to a reference frame that must be shared with others and is determined by the sum of the forces acting on it. The greater the mass of the object, the greater the force needed to achieve the same change in motion.
- Science and Engineering Practice – Planning and Carrying Out Investigations
    - Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation.
- Crosscutting Concept – Stability and Change

Item Set 3 – Question 3 (TEI Inline Choice)

The student completed the ring magnet investigation to help explain the interaction between the two sets of magnets described in Part 2.

Select one correct response from each drop-down menu to complete the sentences.

The investigation was designed to show that [magnetic fields] exist between the upper and lower sets of magnets. The results provide evidence that the magnets exert forces on each other because the upper magnet set [does not touch] the lower set when it is dropped.

Item Information

- Answer – See image
- Standard – Physical Science
- Evidence Outcome – SC.MS.1.4.c
    - Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
- Disciplinary Core Idea – SC.MS.1.4
    - Forces that act a distance (gravitational, electric, and magnetic) can be explained by force fields that extend through space and can be mapped by their effect on a test object.
- Science and Engineering Practice – Planning and Carrying Out Investigations
    - Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation.
- Crosscutting Concept – Cause and Effect

Item Set 3 – Question 4 (TEI Inline Choice)

The data from the investigation in Part 2 show that the final height of three magnets dropped is lower than when one magnet or two magnets are dropped.

Select one correct response from each drop-down menu to complete the sentences.

The purpose of the investigation is to show that even when downward force is increased, the magnets continue to [push each other away] . This shows that there is a field coming from [both sets of magnets] .

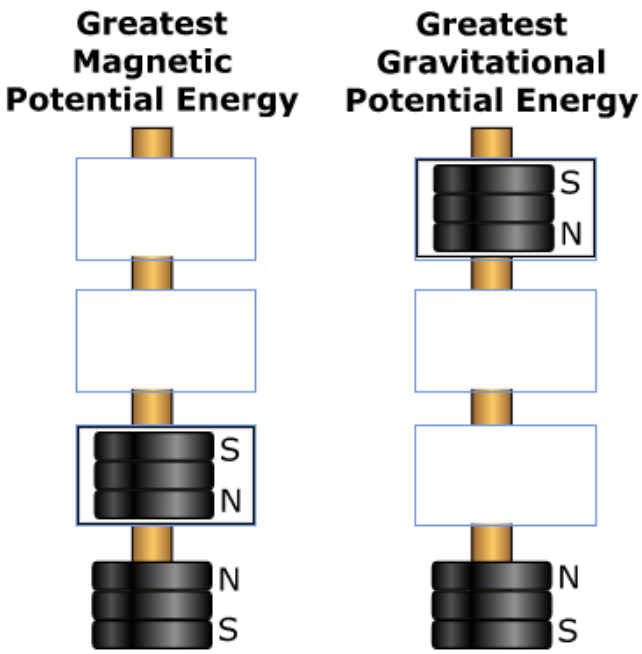
Item Information

- Answer – See image
- Standard – Physical Science
- Evidence Outcome – SC.MS.1.4.c
  - Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
- Disciplinary Core Idea – SC.MS.1.4
  - Forces that act a distance (gravitational, electric, and magnetic) can be explained by force fields that extend through space and can be mapped by their effect on a test object.
- Science and Engineering Practice – Planning and Carrying Out Investigations
  - Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation.
- Crosscutting Concept – Cause and Effect

Item Set 3 – Question 5 (TEI Drag and Drop)

The sets of magnets described in the investigation in Part 2 demonstrate two kinds of potential energy, magnetic and gravitational. Based on the investigation, show where each kind of potential energy is greatest. The north (N) pole and south (S) pole of each magnet set are specified.

Drag and drop a set of magnets to show the location of the greatest amount of each kind of potential energy. Drag only one set of magnets to the location for the greatest amount of magnetic potential energy, and drag another set to the location for the greatest amount of gravitational potential energy. Fill only one box for each type of potential energy.



Item Information

- Answer – See image
- Standard – Physical Science
- Evidence Outcome – SC.MS.1.5.b
  - Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
- Disciplinary Core Idea – SC.MS.1.5
  - Kinetic energy can be distinguished from the various forms of potential energy.
- Science and Engineering Practice – Developing and Using Models
  - Develop and/or use a model to predict and/or describe phenomena.
- Crosscutting Concept – Systems and System Models

Item Set 3 – Question 6 (Constructed Response)

In the scenario described in Part 1, the student plans to change the setup by adding mass to make the globe heavier. Explain what effect the additional mass will have on the globe. Your response should include:

- an explanation of the changed position of the heavier globe
- a description of two different forces acting on the heavier globe

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Physical Science
- Evidence Outcome – SC.MS.1.3.b
  - Plan an investigation to provide evidence that the change in an objects motion depends on the sum of the forces on the object and the mass of the object.
- Disciplinary Core Idea – SC.MS.1.3
  - Motion is described relative to a reference frame that must be shared with others and is determined by the sum of the forces acting on it. The greater the mass of the object, the greater the force needed to achieve the same change in motion.
- Science and Engineering Practice – Planning and Carrying Out Investigations
  - Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation.
- Crosscutting Concept – Stability and Change

Points	Attributes
2	**The student's response should include:** • An explanation of the changed position of the heavier globe. • A description of two different forces acting on the heavier globe. **Student responses may include but are not limited to:** Mass added to the globe will cause the globe to drop closer to the base. The gravitational force increases when the mass is greater. This brings the globe closer to the base, but the repulsive force of the magnetic base increases when the distance decreases.
1	Student response demonstrates a partial understanding of the task.
0	Student response does not demonstrate an understanding of the task.

Sample Student Reponses

Sample student responses are not representative of all correct answers for an item and are provided only as a guide to assist teachers with scoring.

Points – Sample Response and Annotation

2 – Sample Response and Annotation

- **Sample Response**
  - Mass added to the globe will cause the globe to drop closer to the base. The gravitational force increases when the mass is greater. This brings the globe closer to the base, but the repulsive force of the magnetic base increases when the distance decreases.
- **Sample Annotation**
  - This response demonstrates a complete understanding of the task. The student describes both forces acting on the globe (*The gravitational force increases when the mass is greater … but the repulsive force of the magnetic base increases when the distance decreases*) and explains the changed position of the heavier globe (*closer to the base*).

1 – Sample Response and Annotation

- **Sample Response**
  - If it is heavier, it will be lower than it was before because of its weight and gravity.
- **Sample Annotation**
  - This response demonstrates a partial understanding of the task. The student does not describe the forces acting on the globe but does correctly explain the changed position of the heavier globe (*it will be lower than it was before*).

0 – Sample Response and Annotation

- **Sample Response**
  - The mass will make it heavier.
- **Sample Annotation**
  - The response does not demonstrate an understanding of the task. There is no description of forces acting on the globe and no explanation of the changed position of the heavier globe.

Item Set 3 – Question 7 (Selected Response)

Based on the information in Part 1, which statement **best** describes a pattern in natural hazards at Longs Peak?

- (●) A. Thunderstorms are more dangerous at Station 4 than at Station 2.
- ( ) B. High temperatures are more likely at Station 3 than at Station 2.
- ( ) C. High winds are more dangerous at Station 1 than at Station 4.
- ( ) D. Snowstorms are more likely at Station 1 than at Station 3.

Item Information

- Answer – A
- Standard – Earth and Space Science
- Evidence Outcome – SC.MS.3.9.a
    - Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- Disciplinary Core Idea – SC.MS.3.9
    - Mapping the history of natural hazards in a region and understanding related geological forces.
- Science and Engineering Practice – Analyzing and Interpreting Data
    - Analyze and interpret data to provide evidence for phenomena.
- Crosscutting Concept – Patterns

Item Set 3 – Question 8 (Constructed Response)

Pico de Orizaba is a mountain in Mexico that is taller than Longs Peak. The average low temperature at the summit of Pico de Orizaba is about −2°C. The map shows its location compared to Longs Peak as well as the direction of prevailing winds at each location.

Map of Longs Peak and Pico de Orizaba

Based on this information and the information in Part 2, compare the climate around Pico de Orizaba to that around Longs Peak. Your response should include an explanation of:

- how the prevailing winds affect the climate around each mountain
- why the average low temperatures are different

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Earth and Space Science
- Evidence Outcome – SC.MS.3.7.b
    - Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
- Disciplinary Core Idea – SC.MS.3.7
    - Complex interactions determine local weather patterns and influence climate, including the role of the ocean.
- Science and Engineering Practice – Developing and Using Models
    - Develop and/or use a model to predict and/or describe phenomena.
- Crosscutting Concept – Systems and system models

Points	Attributes
2	**The student's response should include:** • How the prevailing winds affect the climate around each mountain • Why the average low temperatures are different **Student responses may include but are not limited to:** Prevailing winds come from the east at Pico de Orizaba but from the west at Longs Peak. So there will be more rainfall on the east side of Pico de Orizaba and more rainfall on the west side of Longs Peak. The average low temperature at Pico de Orizaba is higher than that at Longs Peak. This is because Pico de Orizaba is closer to the equator and receives more direct sunlight. OR Prevailing winds blowing across the Rockies make the Longs Peak climate colder and the winds blowing across the Gulf of Mexico make the Pico de Orizaba climate warmer. The average low temperature at Pico de Orizaba is higher than that at Longs Peak. This is because Pico de Orizaba is closer to the equator and receives more direct sunlight.
1	Student response demonstrates a partial understanding of the task.
0	Student response does not demonstrate an understanding of the task.

Sample Student Reponses

Sample student responses are not representative of all correct answers for an item and are provided only as a guide to assist teachers with scoring.

Points – Sample Response and Annotation

2 – Sample Response and Annotation

- **Sample Response**
  - The climate around Pico de Orizaba is proprably very humid on the east side because of the prevaling winds coming in from the east but dry on the west side. The climate around Longs Peak is probrably more humid on the west side becuse of the prevaling winds coming in from the west but dry on the east side. Pico De Orizaba is warmer because it is closer to the equator and it probrably more humid becuse it is closer to the coast.
- **Sample Annotation**
  - Element 1: The response explains how the prevailing winds affect the climate around each mountain (*The climate around Pico de Orizaba is proprably very humid on the east side because of the prevaling winds coming in from the east but dry on the west side. The climate around Longs Peak is probrably more humid on the west side becuse of the prevaling winds coming in from the west but dry on the east side*).
  - Element 2: The response tells why the average low temperatures are different (*Pico De Orizaba is warmer because it is closer to the equator*).

1 – Sample Response and Annotation

- **Sample Response**
  - The average low temperatures are different for the two mountains because they are in completly different location. Pico de Orizaba is very close to the equater, so it will be warmer over all than Longs Peak since Longs Peak is so far north. WInds ffect the climate around each mountain because on a mountin there is nothing blocking you or shielding you from feeling the wind. This is why elevation and wind are closly related, the higher the elevation, the more wind.
- **Sample Annotation**
  - Element 2: The response tells why the average low temperatures are different (*Pico de Orizaba is very close to the equater, so it will be warmer over all than Longs Peak since Longs Peak is so far north*).
  - No credit is awarded for element 1 because this response does not address how the prevailing winds affect the climate around each mountain (*WInds ffect the climate around each mountain because on a mountin there is nothing blocking you or shielding you from feeling the wind*). The phrase "feeling of the wind" is about wind chill and is not a correct response to average temperature. It is also describing how wind effects would be the same on both mountains, not different.

0 – Sample Response and Annotation

- **Sample Response**
  - Wind affects climate around both mountains because wind can make the temperature feel colder when it doesnt change many factors of temperature. The average low temperature of Pico de Orizaba is -2 Celcius, the average low temperature for Longs Peak is usually below -5 celcius, the average lows may differ because of elevation and surrounding climate, colorado is typically colder than this specific part of mexico
- **Sample Annotation**
  - No credit is awarded for element 1 this response does not address how the prevailing winds affect the climate around each mountain (*wind can make the temperature feel colder when it doesnt change many factors of temperature*). This response is addressing wind chill, which will not earn credit.

    No credit is awarded for element 2, why the average low temperatures are different (*The average low temperature of Pico de Orizaba is -2 Celcius, the average low temperature for Longs Peak is usually below -5 celcius, the average lows may differ because of elevation and surrounding climate, colorado is typically colder than this specific part of mexico*). Listing the temperatures is not a correct way to address the reason for the temperature difference. The statement that "*Colorado is typically colder"* does not indicate an understanding of why Colorado is colder. Also, elevation is not a correct answer for this prompt.

Item Set 3 – Question 9 (Constructed Response)

Describe what is happening in each area based on the data in Table 2 and Table 3. Your response should include a description of:

- the type of front that is moving into the San Luis area, using evidence from Table 2
- the type of front that is moving into the Longs Peak area, using evidence from Table 3

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Earth and Space Science
- Evidence Outcome – SC.MS.3.7.a
    - Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.
- Disciplinary Core Idea – SC.MS.3.7
    - Complex interactions determine local weather patterns and influence climate, including the role of the ocean.
- Science and Engineering Practice – Not assessed in this item.
- Crosscutting Concept – Cause and effect

Points	Attributes
2	**The student's response should include an explanation of:** • The type of front that is moving into the San Luis area, using evidence from Table 2 • The type of front that is moving into the Longs Peak area, using evidence from Table 3 **Student responses may include but are not limited to:** Table 2 shows a warm front in the San Luis area because the air temperatures increase while the air pressure decreases. Table 3 shows a cold front is moving into the Longs Peak area. This is shown because the air temperatures are decreasing while the air pressure is increasing.
1	Student response demonstrates a partial understanding of the task.
0	Student response does not demonstrate an understanding of the task.

Sample Student Reponses

Sample student responses are not representative of all correct answers for an item and are provided only as a guide to assist teachers with scoring.

Points – Sample Response and Annotation

2 – Sample Response and Annotation

- **Sample Response**
  - The temperature and wind speed in the San Luis area is increasing, while the air pressure and humidity are decreasing. This most likely is shows a low pressure warm front is moving in, due to the rising temperatures and falling air pressure. The air pressure and humidity in Longs Peak is increasing, and the temperature and wind speed are decreasing. This hints at a high pressure cold front moving in, due to the decreasing temperature and the increasing air pressure.
- **Sample Annotation**
  - This response demonstrates complete understanding.
    Element 1: The response includes the type of front that is moving into the San Luis area *(warm front; temperature… increasing; air pressure… decreasing).*
    Element 2: The response includes the type of front that is moving into the Longs Peak area (*cold front; temperature… decreasing; air pressure… increasing)*.
  - The information about changes in temperature and air pressure from the table help support the answer, but are not necessary for credit.

1 – Sample Response and Annotation

- **Sample Response**
  - the type of front moving to san luis as indicated by the chart is most likey warm front due to the drop in pressure and the rise in temprature.
- **Sample Annotation**
  - This response demonstrates partial understanding.
    Element 1: The response includes the type of front that is moving into the San Luis area *(warm front; drop in pressure, rise in temperature).*
    No credit is awarded for element 2; it is not addressed.

0 – Sample Response and Annotation

- **Sample Response**
  - I can see that there was a front moving towards the San Luis area because there was increasing wind seeds and decreasing humididty. There was also decreasing air pressure and increasing temperature. There is a front heading towards the Longs Peak area because there is also an increase in air pressureand humidity. THere is a decrease in temperature and wind speed.
- **Sample Annotation**
  - This response does not demonstrate understanding.
    No credit is awarded for either element because the types of fronts are not given (*there was a front moving towards the San Luis area*).

Item Set 3 – Question 10 (Constructed Response)

Using the data in Table 5, describe the weather data that indicates a thunderstorm passed through the area overnight.
Your response should include:

- identification of the type of front that passed through the area, using evidence from Table 5
- an explanation of how the weather data indicates a thunderstorm most likely occurred

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Earth and Space Science
- Evidence Outcome – SC.MS.3.7.a
    - Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.
- Disciplinary Core Idea – SC.MS.3.7
    - Complex interactions determine local weather patterns and influence climate, including the role of the ocean.
- Science and Engineering Practice – Not assessed in this item.
- Crosscutting Concept – Cause and effect

Points	Attributes
2	**The student's response should include an explanation of:** • Identification of the type of front that passed through the area, using evidence from Table 5 • An explanation of how the weather data indicates a thunderstorm most likely occurred **Student responses may include but are not limited to:** The area likely experienced a cold front, shown by a decrease in temperatures and air pressure. The very high humidity and decreasing temperatures overnight mean that rain is likely. Also, the increasing wind speed and decreasing pressure overnight means that thunderstorms are likely.
1	Student response demonstrates a partial understanding of the task.
0	Student response does not demonstrate an understanding of the task.

Sample Student Reponses

Sample student responses are not representative of all correct answers for an item and are provided only as a guide to assist teachers with scoring.

Points – Sample Response and Annotation

2 – Sample Response and Annotation

- **Sample Response**
  - A cold ffront most likely went through that area because the temperature went straight down first day and started to rise the second. A thunderstorm most likely occured because the wind speed went up, the air pressure went down, and th humidit went up.
- **Sample Annotation**
  - This response demonstrates complete understanding.
    Element 1: The response identifies the type of front (*A cold ffront*).
    Element 2: The response explains how the weather data indicates a thunderstorm (*temperature went straight down first day and started to rise the second*; *wind speed went up*; *air pressure went down*; *humidit went up*). In addressing temperature this response gives us the changes over a two-day period, warmer then colder then warmer. They have included the key piece that it got colder the night of the storm.
  - **Note:** Correct answers are temperature decreases, wind speed increases, air pressure decreases, humidity increases.

1 – Sample Response and Annotation

- **Sample Response**
  - The weather data that can show that a thunderstorm passed through the area overnight the is the drop in temperature. If we look at table 5 in the first column it says 24 to 6 degrees. The cold weather can tell that there is something coming in. Then if you look at wind speed there was a high increase from 5 to 28. Then the air pressure stayed the same reall yonly dropped 5, then hummiditaty when from 11 to 92% which was a drastic change. This weather data can can indicate a storm because with the increasing and decreasing of certian things you can see that the weather from the morning to the night has a huge change.
- **Sample Annotation**
  - This response demonstrates partial understanding.
    Element 2: The response explains how the weather data indicates a thunderstorm (*drop in temperature*; *wind speed there was a high increase*; *air pressure … reall yonly dropped 5*). The phrase "*hummiditaty when from 11 to 92% which was a drastic change*" is true but is too vague to earn credit. It gives data points from a provided chart, which will not earn credit on its own, and "drastic change" is too vague to earn credit- it must clearly indicate increase. This will not harm or help the overall score of the response.
    No credit is awarded for element 1 because it is not addressed.

0 – Sample Response and Annotation

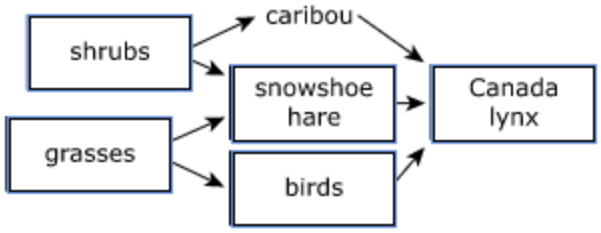
- **Sample Response**
  - There is a good chance that there will be a thunderstorm because of the evidence in the graph. It shows that there is a lot of humity and that the temperature is higher than usual. So with the temp being higher than normal there is a better chance of them getting a thunderstorm.
- **Sample Annotation**
  - This response does not demonstrate understanding.
    No credit is awarded for element 1 because it is not addressed.
    No credit is awarded for element 2 because it provides bot a correct (*there is a lot of humity*) and incorrect (*temperature is higher*) statement. The contradiction indicates a lack of understanding.

    Note: If the response contains any incorrect evidence element 2 will lose all credit. For example if the response provides three pieces of evidence and two are correct but one is incorrect, then element 2 will score a 0.

Item Set 3 – Question 11 (TEI Drag and Drop)

A student creates a food web for the organisms listed in the table from Part 1. The student learns that caribou eat shrubs, and birds eat grass seeds.

Based on this information, drag the organisms into the boxes to create a model that shows how matter and energy move through this forest ecosystem. Each organism may be used once.



Item Information

- Answer – See image
- Standard – Life Science
- Evidence Outcome – SC.MS.2.6.a
  - Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
- Disciplinary Core Idea – SC.MS.2.6
  - Ecosystems are sustained by the continuous flow of energy, originating primarily from the sun, and the recycling of matter and nutrients within the system.
- Science and Engineering Practice – Developing and Using Models
  - Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena**.**
- Crosscutting Concept – Energy and Matter

Item Set 3 – Question 12 (Selected Response)

Based on the information in Part 2, which year in the study was **most likely** associated with a decrease in available energy from plants?

- (●) A. Year 9
- ( ) B. Year 15
- ( ) C. Year 27
- ( ) D. Year 45

Item Information

- Answer – A
- Standard – Life Science
- Evidence Outcome – SC.MS.2.5.a
  - Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- Disciplinary Core Idea – SC.MS.2.5
  - Organisms and populations of organisms are dependent on their environmental interactions both with other living things and with nonliving factors.
- Science and Engineering Practice – Analyzing and Interpreting Data
  - Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships**.**
- Crosscutting Concept – Cause and Effect

Item Set 3 – Question 13 (Selected Response)

Based on the information in Part 1 and Part 2, which statement **most likely** explains the conditions between Year 15 and Year 20?

- A. A decrease in caribou population in Year 17 led to a decrease in the Canada lynx population and an increase in the snowshoe hare population in Year 20.
- B. A disease slowed the population growth of Canada lynx in Year 17, but the disease did not affect the snowshoe hare population in that same year.
- C. A new predator of snowshoe hares migrated to the area in Year 17, which led to an increase in the Canada lynx population in Year 20.
- D. A severe drought in Year 17 caused a sharp reduction in both the Canada lynx population and the snowshoe hare population.

Item Information

- Answer – D
- Standard – Life Science
- Evidence Outcome – SC.MS.2.7.a
    - Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
- Disciplinary Core Idea – SC.MS.2.7
    - Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all of its populations.
- Science and Engineering Practice – Engaging in Argument from Evidence
    - Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem**.**
- Crosscutting Concept – Stability and Change

Item Set 3 – Question 14 (TEI Inline Choice)

The maps in Part 3 show the ranges for the Canada lynx and the snowshoe hare. The scientists collected data on sightings of these animals during the study. They observed that the Canada lynx traveled outside their normal range at certain times.

Select one correct response from each drop-down menu to complete the sentence.

Based on the information in Part 1 and Part 2, the **most likely** year during the study when Canada lynx were observed outside their range is [Year 30 ▾]

because the main food source for the Canada lynx was [less abundant ▾]

during this year.

Item Information

- Answer – See Image
- Standard – Life Science
- Evidence Outcome – SC.MS.2.5.b
    - Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
- Disciplinary Core Idea – SC.MS.2.5
    - Organisms and populations of organisms are dependent on their environmental interactions both with other living things and with nonliving factors.
- Science and Engineering Practice – Constructing Explanations and Designing Solutions
    - Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena**.**
- Crosscutting Concept – Patterns

Item Set 3 – Question 15 (Constructed Response)

A disease that affects snowshoe hares may also have an effect on the ecosystem. Based on the information in Part 1, explain how a disease affecting the snowshoe hare population would affect the overall ecosystem. Your response should include:

- how the disease would cause a decrease in population of some organisms in the ecosystem
- how the disease would cause an increase in population of other organisms in the ecosystem

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Life Science
- Evidence Outcome – SC.MS.2.5.a
  - Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- Disciplinary Core Idea – SC.MS.2.5
  - Organisms and populations of organisms are dependent on their environmental interactions both with other living things and with nonliving factors.
- Science and Engineering Practice – Analyzing and Interpreting Data
  - Analyze and interpret data to provide evidence for phenomena**.**
- Crosscutting Concept – Cause and Effect

Points	Attributes
2	**The student's response should include:** • How the disease would cause a decrease in population of some organisms in the ecosystem. • How the disease would cause an increase in population of other organisms in the ecosystem. **Student responses may include but are not limited to:** Fewer snowshoe hares would cause a decrease in the number of birds because the Canada lynx would need to increase the amount of other food sources to replace their main source of prey. A decrease in snowshoe hares would cause an increase in the grasses because the grasses are one of the snowshoe hare's main food sources. (Note: Other valid approaches using organisms not in the scenario are acceptable.)
1	Student response demonstrates a partial understanding of the task.
0	Student response does not demonstrate an understanding of the task.

Sample Student Reponses

Sample student responses are not representative of all correct answers for an item and are provided only as a guide to assist teachers with scoring.

Points – Sample Response and Annotation

2 – Sample Response and Annotation

- **Sample Response**
  - Fewer snowshoe hares would cause a decrease in the number of birds because the Canada lynx would need to increase the amount of other food sources to replace their main source of prey.
    A decrease in snowshoe hares would cause an increase in the grasses because the grasses are one of the snowshoe hare's main food sources.
- **Sample Annotation**
  - This response demonstrates a complete understanding of the task. The student correctly describes how a population would decrease (*a decrease in the number of birds because the Canada lynx would need to increase the amount of other food sources*) and how a population would increase (*an increase in the grasses because the grasses are one of the snowshoe hare's main food sources*).

1 – Sample Response and Annotation

- **Sample Response**
  - The lynx population would increase because they would start catching caribou and caribou are way bigger than hares. The hare eats plants with soft stems and grass so if the hare is not there to eat them because it died of a disease there would be more of those.
- **Sample Annotation**
  - This response demonstrates a partial understanding of the task. The student correctly describes how a population would increase (*The hare eats plants with soft stems and grass so if the hare is not there to eat them because it died of a disease there would be more of those*). However, the student provides flawed logic about the connection between the lynx and the caribou populations and does not attempt to explain a decrease in any of the populations.

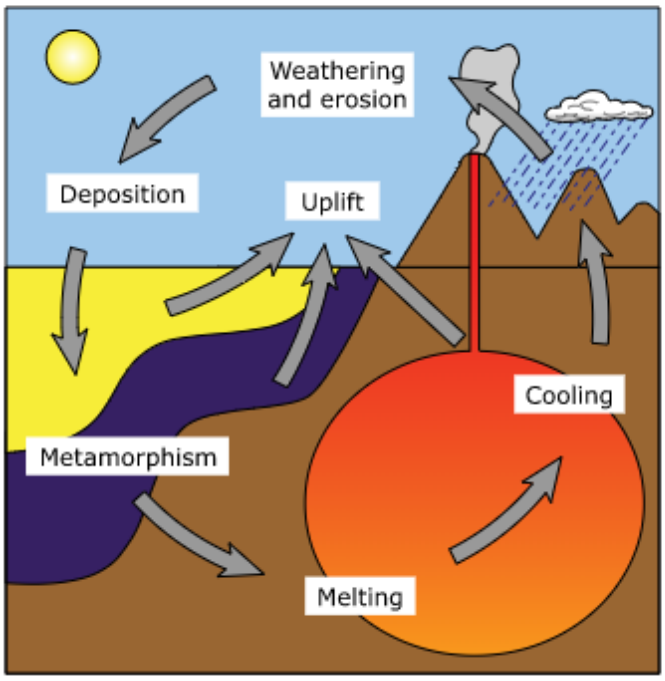
0 – Sample Response and Annotation

- **Sample Response**
  - The lynx eats the hare.
- **Sample Annotation**
  - This response does not demonstrate an understanding of the task. No population increase or decrease is described.

Item Set 3 – Question 16 (Selected Response)

This model shows interactions in one of Earth's systems.

The Rock Cycle



KEY
= sedimentary rock
= metamorphic rock
= igneous rock

How does energy from the Sun affect this cycle?

- (●) A. It causes heating of water that results in weathering and erosion.
- ( ) B. It causes heating of rocks that results in metamorphism.
- ( ) C. It causes heating of Earth that results in melting.
- ( ) D. It causes heating of the air that results in uplift.

Item Information

- Answer – A
- Standard – Earth and Space Science
- Evidence Outcome – SC.MS.3.4.a
  - Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
- Disciplinary Core Idea – SC.MS.3.4
  - Energy flows and matter cycles within and among Earth's systems, including the sun and Earth's interior as primary energy sources. Plate tectonics is one result of these processes.
- Science and Engineering Practice – Developing and Using Models
  - Develop and/or use a model to predict and/or describe phenomena.
- Crosscutting Concept – Stability and Change