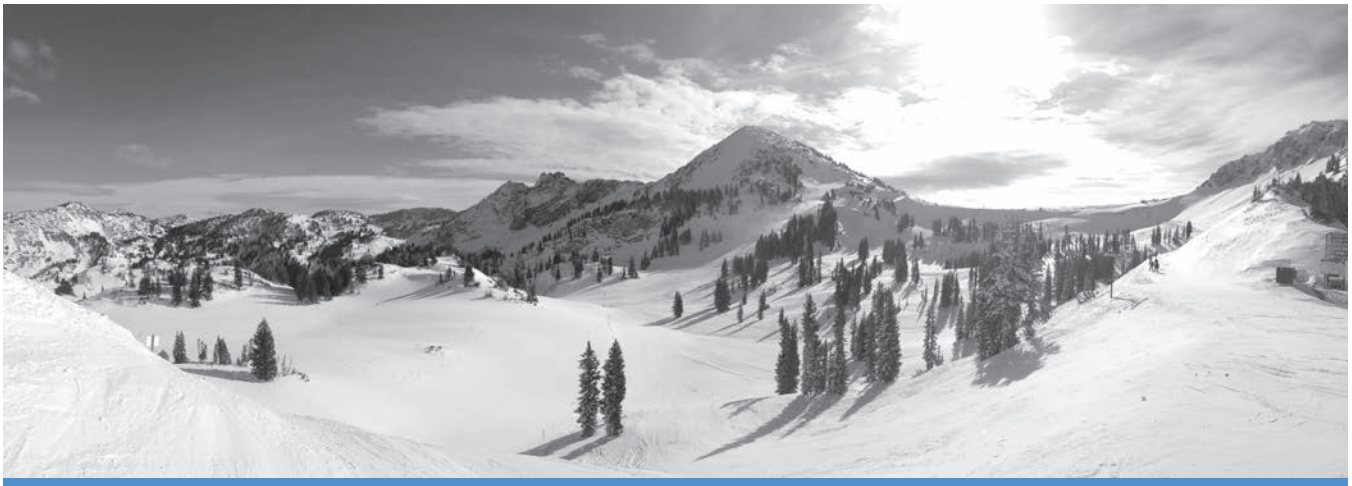
Colorado Measures of Academic Success



Grade 5 Science

Answer Key with Scoring Rubrics, Sample Responses & Annotations

Practice Resource for Students

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Table of Contents

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

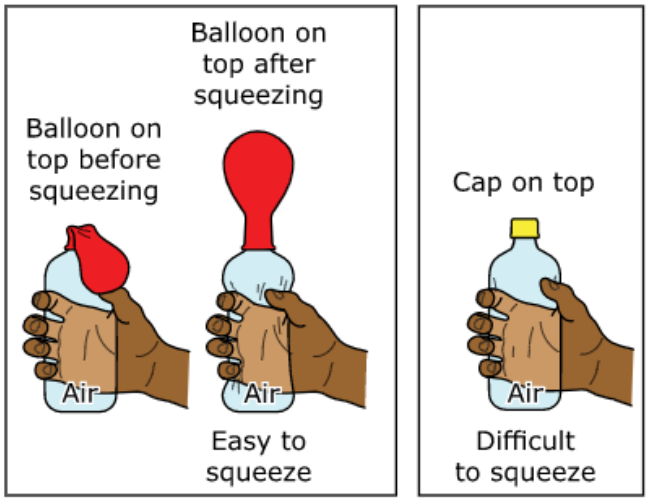
Sample student responses are provided at each score point for constructed response items. Sample responses include annotations that provide reasoning for the score. Scoring rubrics are provided for constructed response items.

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 Multiple Select)

A student investigates matter by using two identical plastic bottles. The student seals one bottle with a balloon and the other bottle with a cap. The student squeezes each bottle with the same amount of force, as shown in the diagram.



Which **two** statements correctly explain the student's results?

- [x] A. The bottle with the balloon is easy to squeeze because tiny particles of matter that make up the air inside the bottle can move into the balloon.
- [ ] B. The bottle with the cap is difficult to squeeze because the cap causes tiny particles of matter in the sides of the bottle to harden.
- [x] C. The cap holds in tiny particles of matter that take up space and fill the bottle, making it difficult to squeeze the bottle.
- [ ] D. The balloon applies force to the tiny particles of matter inside the bottle, so less force is needed to squeeze the bottle.
- [ ] E. The balloon allows space for tiny particles of matter to move as they become larger, so the bottle is easy to squeeze.

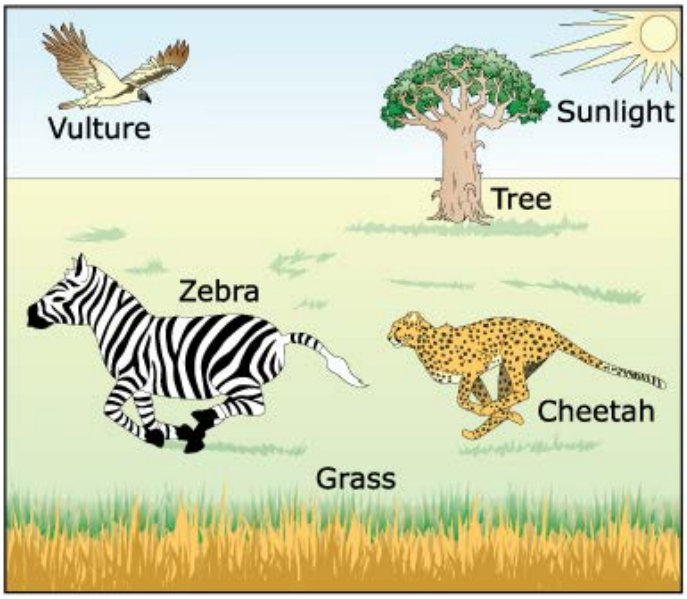
Item Information

- Answer – A, C
- Standard – Physical Science
- Evidence Outcome – SC.5.1.1.a
    - Develop a model to describe that matter is made of particles too small to be seen. (5-PS1-1) (Clarification Statement: Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water and evaporating salt water. Does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.) |SEP 2 DUM|CCC 3 SPQ|
- Disciplinary Core Idea – SC.5.1.1
    - Matter exists as particles that are too small to be seen; measurements of a variety of observable properties can be used to identify particular materials.
- Science and Engineering Practice – Developing and Using Models
    - Develop and/or use models to describe and/or predict phenomena.
- Crosscutting Concept – Scale, Proportion, and Quantity
- P Value – 0.298

Item Set 1 – Question 2 (Selected Response)

Zebras live in grassland ecosystems.

A Grassland Ecosystem



Where do zebras obtain the energy they need to escape predators, such as cheetahs?

- A. directly from the Sun by absorbing light energy and storing it as food energy
- B. indirectly from cheetahs who put pressure on the zebras to run faster
- C. by eating grass that originally receives energy from the Sun
- D. by eating other animals that prey on cheetahs

Item Information

- Answer – C
- Standard – Physical Science
- Evidence Outcome – SC.5.1.4.a
  - Use models to describe that energy in animals' food (used for body repair, growth and motion and to maintain body warmth) was once energy from the sun. (5-PS3-1) (Clarification Statement: Examples of models could include diagrams and flowcharts.) |SEP 2 DUM|CCC 5 EM|
- Disciplinary Core Idea – SC.5.1.4
  - The energy released from food was once energy from the sun.
- Science and Engineering Practice – Developing and Using Models
  - Develop and/or use models to describe and/or predict phenomena.
- Crosscutting Concept – Energy and Matter
- P Value – 0.721

Item Set 1 – Question 3 (Selected Response)

In the state of Colorado, there was an increase in recycled paper on the last day of the school year. A student wonders how the increase in recycled paper changed the total waste produced per person for that day. Which sentence **best** explains a property of matter that would explain the change observed?

- A. The total mass of matter cannot be calculated because the mass of the recyclables has changed.
- B. The total mass of matter does not change because the mass of the trash did not change.
- C. The total mass of matter decreased because the mass of the trash increased.
- D. The total mass increased because the mass of the recyclables increased.

Item Information

- Answer – D
- Standard – Physical Science
- Evidence Outcome – SC.5.1.2.a
  - Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling or mixing substances, the total weight of matter is conserved. (5-PS1-2) (Clarification Statement: Examples of reactions or changes could include phase changes, dissolving and mixing that form new substances. Does not include distinguishing mass and weight.) (Boundary Statement: Mass and weight are not distinguished at this grade level.) |SEP 5 UMCT|CCC 3 SPQ|
- Disciplinary Core Idea – SC.5.1.2
  - Chemical Reactions that occur when substances are mixed can be identified by the emergence of substances with different properties; the total mass remains the same.
- Science and Engineering Practice – Using Mathematics and Computational Thinking
  - Describe, measure, estimate, and/or graph quantities such as area, volume, weight, and time to address scientific and engineering questions and problems.
- Crosscutting Concept – Scale, Proportion, and Quantity
- P Value – 0.350

Item Set 1 – Question 4 (Selected Response)

A student wants to identify the step when the recycled plastic changes to fabric during the recycling process.

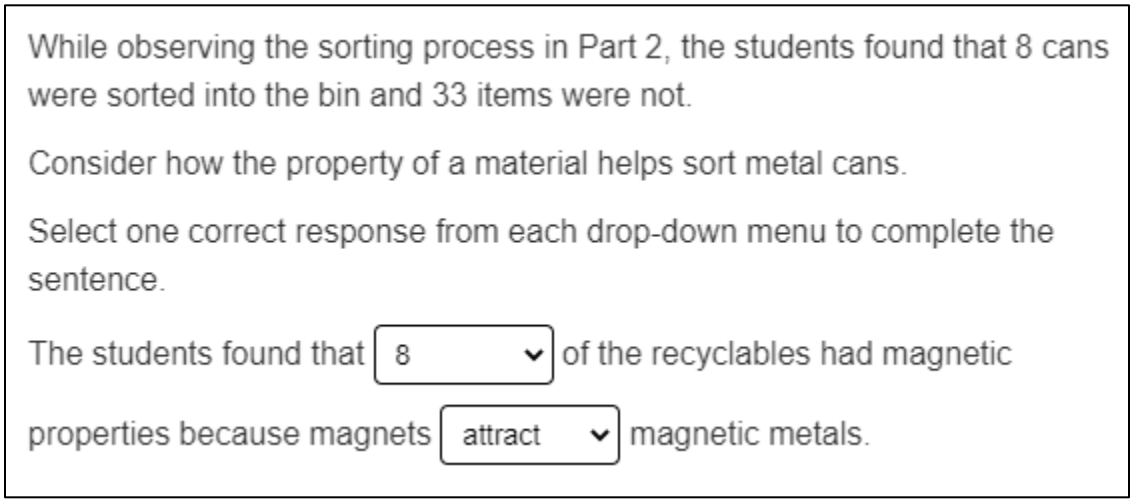
During which step shown in Figure 3 and Figure 4 is a new substance formed?

- ○ A. weaving the thread into cloth to make clothing
- ○ B. melting the plastic to make thread
- ◉ C. mixing the plastic with chemicals
- ○ D. grinding the plastic into flakes

Item Information

- Answer – C
- Standard – Physical Science
- Evidence Outcome – SC.5.1.2.b
  - Conduct an investigation to determine whether the mixing of two or more substances results in new substances. (5-PS1-4)|SEP 3 PCOI|CCC 2 CAE|
- Disciplinary Core Idea – SC.5.1.2
  - Chemical Reactions that occur when substances are mixed can be identified by the emergence of substances with different properties; the total mass remains the same.
- Science and Engineering Practice – Not assessed in this item.
- Crosscutting Concept – Cause and Effect

Item Set 1 – Question 5 (TEI Inline Choice)



Item Information

- Answer – See Image
- Standard – Physical Science
- Evidence Outcome – SC.5.1.1.b
    - Make observations and measurements to identify materials based on their properties. (5-PS1-3) (Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces and solubility; density is not intended as an identifiable property. Does not include density or distinguishing mass and weight.) (Boundary Statement: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) |SEP 3 PCOI|CCC 3 SPQ|
- Disciplinary Core Idea – SC.5.1.1
    - Matter exists as particles that are too small to be seen; measurements of a variety of observable properties can be used to identify particular materials.
- Science and Engineering Practice – Planning and Carrying Out Investigations
    - Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.
- Crosscutting Concept – Scale, Proportion, and Quantity
- P Value – 0.743

Item Set 1 – Question 6 (TEI Inline Choice)

While studying the recycling process shown in Part 3, a student wonders whether a new material was formed at the end of each process in Figure 3 and Figure 4.

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

The plastic flakes formed at the end of Figure 3 [are not] a new material because their properties are [the same as] the recyclable plastic. The fabric formed at the end of Figure 4 is [a new] material because its properties are [different from] the plastic flakes.

Item Information

- Answer – See Image
- Standard – Physical Science
- Evidence Outcome – SC.5.1.2.b
    - Conduct an investigation to determine whether the mixing of two or more substances results in new substances. (5-PS1-4)|SEP 3 PCOI|CCC 2 CAE|
- Disciplinary Core Idea – SC.5.1.2
    - Chemical Reactions that occur when substances are mixed can be identified by the emergence of substances with different properties; the total mass remains the same.
- Science and Engineering Practice – Not assessed in this item.
- Crosscutting Concept – Cause and Effect
- P Value – 0.263

Item Set 1 – Question 7 (Constructed Response)

While observing the recycling process shown in Figure 1, a student wonders what types of forces move the items from the top belt to the lower belt. Explain how items from the top belt fall to the lower belt. Your response should include:

- identification of the force that causes the items to fall to the lower belt
- a reason that supports the identification of the force

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Physical Science
- Evidence Outcome – SC.5.1.3.a
  - Support an argument that the gravitational force exerted by Earth on objects is directed down. (5-PS2-1) (Clarification Statement: "Down" is a local description of the direction that points toward the center of the spherical Earth.) (Boundary Statement: Does not include mathematical representation of gravitational force). |SEP 7 EAE|CCC 2 CAE|
- Disciplinary Core Idea – SC.5.1.3
  - The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet' center.
- Science and Engineering Practice – Not assessed in this item.
- Crosscutting Concept – Cause and Effect
- Score Point Distribution
  - 17.5% of students earned 2 points.
  - 1.9% of students earned 1 point.
  - 80.6% of students earned 0 points.

Points	Attributes
2	**The student's answer should include:** • identification of the force that causes the items to fall to the lower belt • a reason that supports the identification of the force **Student responses may include but are not limited to:** The force that causes the items to fall to the lower belt is the force of gravity. The force of gravity is the force exerted by Earth to pull items down. Since the items are moving downward, the items are being pulled by the gravitational force of Earth.
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 believe what force moves objects from the higher belt to the lower belt is gravity. I think this because as the belt rotates the worker tosses the paper items while the other recyclables fall due to gravity and collect on the other belt.
- **Sample A Annotation**
  - The response gives a correct identification of the force that causes the items to collect on the lower belt (force moves objects from the higher belt to the lower belt is gravity).
  - The response provides a reason that supports the identification of the force (other recyclables fall due to gravity).
- **Sample B Response**
  - Gravity. The thing falls.
- **Sample B Annotation**
  - The response gives a correct identification of the force that causes the items to collect on the lower belt (gravity).
  - The response provides a reason that supports the identification of the force (the thing falls).

1 – Sample Response and Annotation

- **Sample A Response**
  - The force is gravity and I know that because the arrows are pointing down.
- **Sample A Annotation**
  - The response gives a correct identification of the force that causes the items to collect on the lower belt (the force is gravity).
  - No credit is awarded for element 2. The response does not provide a reason that supports the identification of the force (because the arrows are pointing down) does not show how gravity moved the objects.
- **Sample B Response**
  - Gravity.
- **Sample B Annotation**
  - The response gives a correct identification of the force that causes the items to collect on the lower belt (gravity).
  - No credit is awarded for element 2. The reason is not addressed.

0 – Sample Response and Annotation

- **Sample A Response**
  - The items on the top belt collect to the lower belt because of magnets and gravity. Gravity is when things go up, they must come down. Magnets can help as well because some things that can be recycled are magnetic.
- **Sample A Annotation**
  - No credit is awarded for element 1: The response gives both an incorrect and a correct identification for the force that causes the items to collect on the lower belt (collect to the lower belt because of magnets and gravity).
  - No credit is awarded for element 2. The response provides incorrect reasons for both the forces identified. The reason given for gravity (Gravity is when things go up, they must come down) does not explain that gravity is the force pulling down.
- **Sample B Response**
  - Magnets are used to get metals on the lower belt because you need to separate metals from paper recyclables.
- **Sample B Annotation**
  - No credit is awarded for element 1: The response gives an incorrect identification for the force that causes the items to collect on the lower belt (Magnets are used to get metals on the lower belt).

- No credit is awarded for element 2. The reason is not addressed.

Item Set 1 – Question 8 (TEI Match Table Grid)

A student studies the simulation and makes a list of observations of what the epiphyte uses for growth. Use the simulation to identify whether each observation is correct or incorrect.

Select **one** choice for each row of the table.

Observation	Correct	Incorrect
Water used by the epiphyte comes from the atmosphere.	☑	☐
Nutrients used by the epiphyte are dissolved in water.	☑	☐
Water used by the epiphyte comes from the tree.	☐	☑
Water used by the epiphyte comes from the soil.	☐	☑

Item Information

- Answer – See Image
- Standard – Life/Physical* Science
- Evidence Outcome – SC.5.2.2.a
    - Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. (5-LS2-1) (Clarification Statement: Emphasis is on the idea that matter that is not food [air, water, decomposed materials in soil] is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.) (Boundary Statement: Does not include molecular explanations.) |SEP 2 DUM|CCC 4 SSM|
- Disciplinary Core Idea – SC.5.2.2
    - Matter cycles between air and soil and among plants, animals and microbes as these organisms live and die.
- Science and Engineering Practice – Developing and Using Models
    - Develop and/or use models to describe and/or predict phenomena.
- Crosscutting Concept – Systems and System Models
- P Value – 0.229

Item Set 1 – Question 9 (Selected Response)

Look at Part 3 of the simulation. A student claims that the epiphyte benefits when an insect decomposes after falling into the epiphyte's pool.

Which statement **best** evaluates the student's claim?

- A. The claim is incorrect because the decomposition of the insect will consume nutrients from the epiphyte's pool.
- B. The claim is correct because the decomposition of the insect will release nutrients into the epiphyte's pool.
- C. The claim is incorrect because the decomposition of the insect will poison the epiphyte.
- D. The claim is correct because the decomposition of the insect will cause a bad smell.

Item Information

- Answer – B
- Standard – Life/Physical* Science
- Evidence Outcome – SC.5.2.2.a
    - Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. (5-LS2-1) (Clarification Statement: Emphasis is on the idea that matter that is not food [air, water, decomposed materials in soil] is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.) (Boundary Statement: Does not include molecular explanations.) |SEP 2 DUM|CCC 4 SSM|
- Disciplinary Core Idea – SC.5.2.2
    - Matter cycles between air and soil and among plants, animals and microbes as these organisms live and die.
- Science and Engineering Practice – Not assessed in this item.
- Crosscutting Concept – Systems and System Models
- P Value – 0.580

Item Set 1 – Question 10 (Selected Response)

A student claims that epiphytes can only grow in very dusty environments.

Why is the student's claim incorrect?

- ○ A. A dusty environment lacks nutrients.
- ○ B. A dusty environment lacks sunlight.
- ○ C. A dusty environment lacks fresh air.
- ◉ D. A dusty environment lacks rain.

Item Information

- Answer – D
- Standard – Life/Physical* Science
- Evidence Outcome – SC.5.2.1.a
  - Support an argument that plants get the materials they need for growth chiefly from air and water. (5-LS1-1) (Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.) |SEP 7 EAE|CCC 5 EM|
- Disciplinary Core Idea – SC.5.2.1
  - Plants acquire their material from growth chiefly from air and water.
- Science and Engineering Practice – Engaging in Argument from Evidence
  - Construct and/or support an argument with evidence, data, and/or a model.
- Crosscutting Concept – Energy and Matter
- P Value – 0.326

Item Set 1 – Question 11 (Constructed Response)

There are two epiphytes of the same species, age, and size growing on a living tree branch. A student removes one epiphyte and puts it on a dead, fallen tree branch. Describe the likely effect of location on the growth of the two epiphytes. Your response should include:

- a description of the materials that the two epiphytes need for growth
- an explanation of why the growth of the epiphytes **is** likely to be different or why their growth **is not** likely to be different

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Life/Physical* Science
- Evidence Outcome – SC.5.2.1.a
  - Support an argument that plants get the materials they need for growth chiefly from air and water. (5-LS1-1) (Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.) |SEP 7 EAE|CCC 5 EM|
- Disciplinary Core Idea – SC.5.2.1
  - Plants acquire their material from growth chiefly from air and water.
- Science and Engineering Practice – Engaging in Argument from Evidence
  - Construct and/or support an argument with evidence, data, and/or a model.
- Crosscutting Concept – Energy and Matter
- Score Point Distribution
  - 11.4% of students earned 2 points.
  - 30.9% of students earned 1 point.
  - 57.7% of students earned 0 points.

Points	Attributes
2	**The student's answer should include:** • a description of the materials that the two epiphytes need for growth • an explanation of why the growth of the epiphytes is likely to be different or why their growth is not likely to be different **Student responses may include but are not limited to:** The epiphytes both need air and water. The growth of the epiphytes is not likely to be different because neither soil, nor a host tree, is required for growth, and they are both exposed to the same amount of air and water.
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 epiphytes need the sunlight, air, nutrients, water, and energy. It's not likely to change/have a difference because the both of them have everything they need to grow.
- **Sample A Annotation**
  - This response describes the materials that the two epiphytes need for growth (The epiphytes need the sunlight, air, nutrients, water).
  - This response describes why the growth of the epiphytes is likely or not likely to be different (It's not likely to change/ have a difference because the both of them have everything they need to grow).
- **Sample B Response**
  - Is not likely different because every plant needs water and air.
- **Sample B Annotation**
  - This response describes the materials that the two epiphytes need for growth (plant need water and air).
  - This response describes why the growth of the epiphytes is likely or not likely to be different (is not likely different because evering plant need water and air). This response integrates the first part of the prompt to answer the second part describing how the growth will not change because the materials required for growth will still be available to both epiphytes.

1 – Sample Response and Annotation

- **Sample A Response**
  - The epiphytes need nutrients, water, and air.
- **Sample A Annotation**
  - This response describes the materials that the two epiphytes need for growth (The epiphytes need nutrients, water, and air). Note that the materials needed for growth can include the following: nutrients, dust, air, water and sunlight.
  - No credit is awarded for element 2. This response does not attempt to describe why the growth of the epiphytes is likely or not likely to be different.
- **Sample B Response**
  - The growth of the epiphyte is not likely to be different because it can still get the materials to help it grow.
- **Sample B Annotation**
  - This response describes why the growth of the epiphytes is likely or not likely to be different (The growth of the epiphyte is not likely to be different because it can still get the materials to help it grow).
  - No credit is awarded for element 1. This response does not attempt to describe two materials that epiphytes need for growth.

0 – Sample Response and Annotation

- **Sample A Response**
  - its likely that the epiphytes will die because it needs nutrients from the tree
- **Sample A Annotation**
  - No credit is awarded for element 1. This response does not attempt to describe two materials that epiphytes need for growth.
  - No credit is awarded for element 2. This response does not attempt to describe why the growth of the epiphytes is likely or not likely to be different. This response claims that the epiphytes will die due to a lack of nutrients from the tree. This is incorrect as the epiphytes do not depend on the tree for nutrients.
- **Sample B Response**
  - water soil air and water
- **Sample B Annotation**

- No credit is awarded for element 1. This response does not attempt to describe two materials that epiphytes need for growth. This response lists soil as one of the materials needed for growth. This is incorrect as the epiphytes do not need soil for growth. Though the other materials are correct, listing soil demonstrates a lack of understanding and the response does not receive credit.
- No credit is awarded for element 2. This response does not attempt to describe why the growth of the epiphytes is likely or not likely to be different.

Item Set 1 – Question 12 (Constructed Response)

Most epiphytes live in tropical rain forests. Tropical rain forests experience more clouds, fog, and rain than other habitats. Using the model in Part 1 of the simulation, explain why tropical rain forests are the most suitable location for epiphytes. Your response should include an explanation of:

- why most epiphytes live in tropical rain forests
- how the weather in tropical rain forests affects the growth of epiphytes

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Life/Physical* Science
- Evidence Outcome – SC.5.2.1.a
  - Support an argument that plants get the materials they need for growth chiefly from air and water. (5-LS1-1) (Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.) |SEP 7 EAE|CCC 5 EM|
- Disciplinary Core Idea – SC.5.2.1
  - Plants acquire their material from growth chiefly from air and water.
- Science and Engineering Practice – Engaging in Argument from Evidence
  - Use data to evaluate claims about cause and effect.
- Crosscutting Concept – Energy and Matter
- Score Point Distribution
  - 27.2% of students earned 2 points.
  - 51.0% of students earned 1 point.
  - 21.8% of students earned 0 point.

Points	Attributes
2	**The student's answer should include:** • why most epiphytes live in tropical rain forests. • how the weather in tropical rain forests affects the growth of epiphytes. **Student responses may include but are not limited to:** Most epiphytes live in rain forests because they need water from rain and air. They do not have roots to take water from the soil. Water is necessary for growth, so the wet weather in tropical rain forests allows epiphytes to grow better than if they were in drier conditions.
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**
  - They live in tropical rainforests because there is air and water there. If there is more water then they will grow more.
- **Sample A Annotation**
  - This response describes why most epiphytes live in tropical rainforests (*because there is air and water there*)
  - This response describes how the weather in tropical rainforests affects the growth of epiphytes (*if there is more water then they will grow more*).
- **Sample B Response**
  - If there are more clouds then there is more water in the air and epiphytes need water in the air to grow. So that's why they grow better there.
- **Sample B Annotation**
  - This response describes why most epiphytes live in tropical rainforests (*more clouds…there is more water in the air*)
  - This response describes how the weather in tropical rainforests affects the growth of epiphytes (*epiphytes need water in the air to grow*).

1 – Sample Response and Annotation

- **Sample A Response**
  - Rainforests are wet so epiphytes live there.
- **Sample A Annotation**
  - This response describes why most epiphytes live in tropical rainforests (*rainforests are wet*).
  - No credit is awarded for Element 2, this response does not describe how the weather in tropical rainforests affects the growth of epiphytes.
- **Sample B Response**
  - Epiphytes need rain to grow.
- **Sample B Annotation**
  - No credit is awarded for Element 1, this response does not describe why most epiphytes live in tropical rainforests.
  - This response describes how the weather in tropical rainforests affects the growth of epiphytes (*epiphytes need rain to grow*).

0 – Sample Response and Annotation

- **Sample A Response**
  - Rainforests are pretty so they live there. Things grow better when they're pretty.
- **Sample A Annotation**
  - No credit is awarded for Element 1, this response does not describe why most epiphytes live in tropical rainforests.
  - No credit is awarded for Element 2, this response does not describe how the weather in tropical rainforests affects the growth of epiphytes.
- **Sample B Response**
  - Soil is in a lot of rainforests and they need that so I think it's good. Also a lot of downed trees are in rainforests so that will help too.
- **Sample B Annotation**
  - No credit is awarded for Element 1, this response does not describe why most epiphytes live in tropical rainforests.
  - No credit is awarded for Element 2, this response does not describe how the weather in tropical rainforests affects the growth of epiphytes.

Item Set 1 – Question 13 (Constructed Response)

A student claims epiphytes can grow without soil because epiphytes get everything they need from sunlight. Explain why the student's claim is incorrect. Your response should:

- explain why sunlight alone is not enough for an epiphyte to grow
- describe evidence from the simulation that supports your answer

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Life/Physical* Science
- Evidence Outcome – SC.5.2.1.a
  - Support an argument that plants get the materials they need for growth chiefly from air and water. (5-LS1-1) (Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.) |SEP 7 EAE|CCC 5 EM|
- Disciplinary Core Idea – SC.5.2.1
  - Plants acquire their material from growth chiefly from air and water.
- Science and Engineering Practice – Engaging in Argument from Evidence
  - Construct and/or support an argument with evidence, data, and/or a model.
- Crosscutting Concept – Energy and Matter
- Score Point Distribution
  - 20.5% of students earned 2 points.
  - 35.1% of students earned 1 point.
  - 44.4% of students earned 0 points.

Points	Attributes
2	**The student's answer should include:** • An explanation of why sunlight alone is not enough for an epiphyte to grow • A description of evidence from the simulation that supports their answer **Student responses may include but are not limited to:** Sunlight provides energy but no materials or matter for growth. The simulation shows that an epiphyte needs water for growth. **Note**: "Nutrients" instead of "water" is not sufficient; "water and nutrients" is sufficient.
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**
  - Sunlight alone is not enough for an epiphyte to grow because energy from sun isn't the only thing that plants need to grow. But we need energy and other stuff to grow. Stuff like water like in the pictures.
- **Sample A Annotation**
  - This response explains why sunlight alone is not enough for an epiphyte to grow (*because energy from the sun isn't the only thing plants need to grow*).
  - This response describes evidence from the simulation that supports the student's answer (*stuff like water in the pictures*).
- **Sample B Response**
  - Plants use sun energy to make food, but it's not the only thing. They need water and nutrients too like in the simulation.
- **Sample B Annotation**
  - This response explains why sunlight alone is not enough for an epiphyte to grow (*plants use sun energy to make food, but it's not the only thing*).
  - This response describes evidence from the simulation that supports the student's answer (*they need water and nutrients too like in the simulation*).

1 – Sample Response and Annotation

- **Sample A Response**
  - Plants need energy and the sun gives them energy but they need more stuff too. Nutrients in the pictures.
- **Sample A Annotation**
  - This response explains why sunlight alone is not enough for an epiphyte to grow (*plants need energy and the sun gives them energy but they need more stuff too*).
  - No credit is awarded for element 2, this response does not describe sufficient evidence from the simulation that supports the student's answer, see note in rubric.
- **Sample B Response**
  - The sun is good. Plants need things to grow like water. The simulation shows that.
- **Sample B Annotation**
  - No credit is awarded for element 1, this does not explain why sunlight alone is not enough for an epiphyte to grow.
  - This response describes evidence from the simulation that supports the student's answer (*Plants need things to grow like water. The simulation shows that*).

0 – Sample Response and Annotation

- **Sample A Response**
  - Sunlight should be enough. I don't think this question is right. Because in the picture it shows the nutrients drowning in the water so sunlight will evaporate them and that will work.
- **Sample A Annotation**
  - No credit is awarded for element 1, this does not explain why sunlight alone is not enough for an epiphyte to grow.
  - No credit is awarded for element 2, this response does not describe sufficient evidence from the simulation that supports the student's answer.
- **Sample B Response**
  - Soil is what plants need not the sun, but they both start with s so that should be what the plants need. They need nutrients and that's what's in the pictures.
- **Sample B Annotation**
  - No credit is awarded for element 1, this does not explain why sunlight alone is not enough for an epiphyte to grow.
  - No credit is awarded for element 2, this response does not describe sufficient evidence from the

simulation that supports the student's answer, see note in rubric.

Item Set 1 – Question 14 (Selected Response)

A student plans to create a model showing one example of how Earth's atmosphere interacts with the geosphere.

Which model would **best** demonstrate this interaction?

- A. a clay mountain with cotton balls at the top representing clouds
- B. a fan gently blowing across a tray containing soil and rocks
- C. water being poured over a pile of sand
- D. plastic ducks floating in a tray of water

Item Information

- Answer – B
- Standard – Earth and Space Science
- Evidence Outcome – SC.5.3.3.a
  - Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere and/or atmosphere interact. (5-ESS2-1) (Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.) (Boundary Statement: Limited to the interactions of two systems at a time.) |SEP 2 DUM|CCC 4 SSM|
- Disciplinary Core Idea – SC.5.3.3
  - Earth's major systems interact in multiple ways to affect Earth's surface materials and processes.
- Science and Engineering Practice – Developing and Using Models
  - Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.
- Crosscutting Concept – Systems and System Models
- P Value – 0.677

ANSWER KEY: ITEM SET 2

Item Set 2 – Question 1 (Selected Response)

A student places two seeds on a wet sponge. The student adds water to the sponge each day. After three days, the student observes a root growing out of one seed.

Which claim does this evidence support?

- A. Plants can grow if they have fertilizer and air.
- B. Plants can grow if they have air and water.
- C. Plants need soil and fertilizer to grow.
- D. Plants need soil and water to grow.

Item Information

- Answer – B
- Standard – Life/Physical* Science
- Evidence Outcome – SC.5.2.1.a
    - Support an argument that plants get the materials they need for growth chiefly from air and water. (5-LS1-1) (Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.) |SEP 7 EAE|CCC 5 EM|
- Disciplinary Core Idea – SC.5.2.1
    - Plants acquire their material from growth chiefly from air and water.
- Science and Engineering Practice – Engaging in Argument from Evidence
    - Compare and refine arguments based on an evaluation of the evidence presented.
- Crosscutting Concept – CCC Not Assessed
- P Value – 0.733

Item Set 2 – Question 2 (Constructed Response)

Rabbits eat grass. A teacher makes an incomplete model to show the transfer of energy in the rabbit's food.

Energy in a Rabbit's Food

To complete the model, show where the energy comes from. Your answer should include:

- what the student should put in the box to complete the model
- an explanation of how energy is transferred from the source in the box to the rabbit

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Physical Science
- Evidence Outcome – SC.5.1.4.a
  - Use models to describe that energy in animals' food (used for body repair, growth and motion and to maintain body warmth) was once energy from the sun. (5-PS3-1) (Clarification Statement: Examples of models could include diagrams and flowcharts.) |SEP 2 DUM|CCC 5 EM|
- Disciplinary Core Idea – SC.5.1.4
  - The energy released from food was once energy from the sun.
- Science and Engineering Practice – Developing and Using Models
  - Develop and/or use models to describe and/or predict phenomena.
- Crosscutting Concept – Energy and Matter
- Score Point Distribution
  - 42.6% of students earned 2 points.
  - 27.7% of students earned 1 point.
  - 29.8% of students earned 0 points.

Points	Attributes
2	**The student's answer should include:** • What the student should put in the first box to complete the model. • An explanation of how energy is transferred from the source in the first box to the rabbit. **Student responses may include but are not limited to:** • The box should be filled with the Sun to complete the model. • The Sun produces light, which the grass uses to make food. Then the stored energy in the grass is transferred to the rabbit when the rabbit eats the grass.
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 sun should be in the box because sunlight gives energy to the plant. The rabbit gets energy by eating the plant. And then a fox will eat the rabbit and the energy will go to the fox.
- **Sample A Annotation**
  - The response states what the student should put in the first box to complete the model (*The sun*).
  - The response provides an explanation of how energy is transferred from the source in the first box to the rabbit (*The rabbit gets energy by eating the plant*). The extraneous information given (*fox will eat the rabbit and the energy will go to the fox*) is correct and does not affect the score for the response.
- **Sample B Response**
  - The sun shines on the grass and the grass makes the energy into food. The rabbit eats the grass for energy so it can grow and survive.
- **Sample B Annotation**
  - The response states what the student should put in the first box to complete the model (*The sun shines on the grass*). It is acceptable that the student did not state that the sun should be in the box. It is clear that the sun is the source of energy.
  - The response provides an explanation of how energy is transferred from the source in the first box to the rabbit (*The rabbit eats the grass for energy so it can grow and survive*).

1 – Sample Response and Annotation

- **Sample A Response**
  - The student should put sun in the first block because the grass gets its energy from the sun.
- **Sample A Annotation**
  - The response states what the student should put in the first box to complete the model (*grass gets its energy from the sun*).
  - The response does not address how energy is transferred from the source in the first box to the rabbit.
- **Sample B Response**
  - The energy for the plant is the dirt because a lot of plants can't live without it and after the rabbit eats the plants it absorbs the nutrients of the plant making it strong.
- **Sample B Annotation**
  - The response provides an explanation of how energy is transferred from the source in the first box to the rabbit (*the rabbit eats the plants it absorbs the nutrients of the plant*). Energy is not specifically mentioned in this response, but "absorbs the nutrients" is considered sufficient.
  - The response incorrectly states that the soil is the source of energy.

0 – Sample Response and Annotation

- **Sample A Response**
  - The student should put water in the empty box because rabbits and all animals need water to survive. To transfer the source of energy into the rabbit is by the rabbit drinking it.
- **Sample A Annotation**
  - The response incorrectly states that the student should put "*water*" in the first box to complete the model. While living things need water, it is not the source of energy.
  - The response does not provide an explanation of how energy is transferred from the source in the first box to the rabbit.
- **Sample B Response**
  - The energy comes from the plants. The plants make their own food meaning they grow by themselves all the fiber and stuff they need. The animals need all of that to be healthy and hydrated so that's where they get their energy from and why.
- **Sample B Annotation**
  - The response does not state what the student should put in the first box to complete the model. It incorrectly states that plants make their own energy.

- The response does not provide an explanation of how energy is transferred from the source in the first box to the rabbit.

Item Set 2 – Question 3 (TEI Inline Choice)

Based on the information provided, complete this explanation about the source of the two rivers.

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

The source of the two rivers is a [glacier or ice cap] . This type of source is the [biggest] source of [fresh water] on Earth.

Item Information

- Answer – See Image
- Standard – Earth and Space Science
- Evidence Outcome – SC.5.3.4.a
    - Describe and graph the amounts and percentages of saltwater and freshwater in various reservoirs to provide evidence about the distribution of water on Earth. (5-ESS2-2) (Boundary Statement: Limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.) |SEP 5 UMCT|CCC 3 SPQ|
- Disciplinary Core Idea – SC.5.3.4
    - Most of Earth's water is in the ocean and much of Earth's freshwater in glaciers or underground.
- Science and Engineering Practice – Not assessed in this item.
- Crosscutting Concept – Scale, Proportion, and Quantity

Item Set 2 – Question 4 (Selected Response)

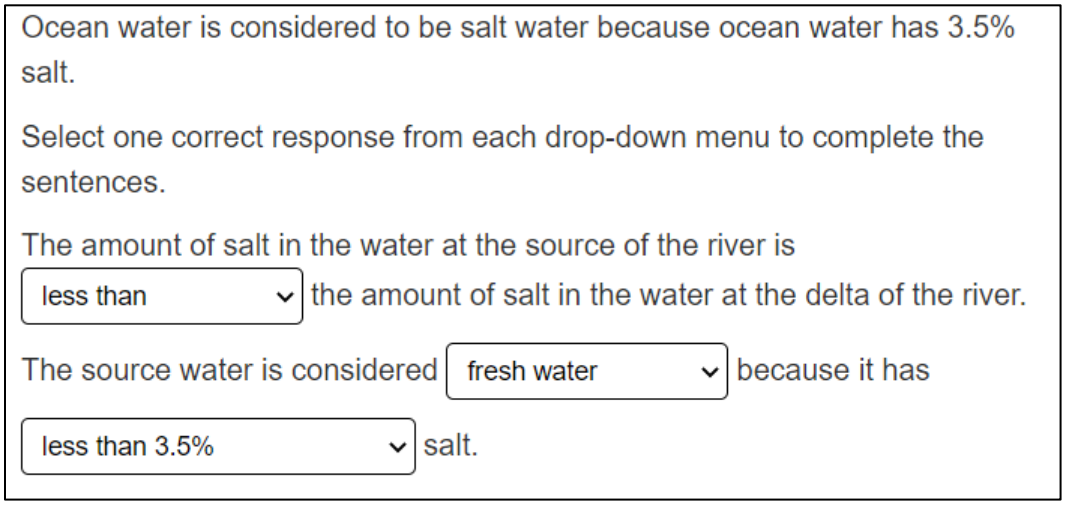
A student claims that a force moves the water away from the source of the river. Based on the model in Figure 1, which statement describes the student's claim?

- A. The claim is incorrect because forces do not affect the movement of the water.
- B. The claim is correct because air pressure resists the movement of the water.
- C. The claim is correct because the force of gravity pulls the water downward.
- D. The claim is incorrect because the weight of the water pushes it upward.

Item Information

- Answer – C
- Standard – Physical Science
- Evidence Outcome – SC.5.1.3.a
    - Support an argument that the gravitational force exerted by Earth on objects is directed down. (5-PS2-1) (Clarification Statement: "Down" is a local description of the direction that points toward the center of the spherical Earth.) (Boundary Statement: Does not include mathematical representation of gravitational force). |SEP 7 EAE|CCC 2 CAE|
- Disciplinary Core Idea – SC.5.1.3
    - The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet' center.
- Science and Engineering Practice – Engaging in Argument from Evidence
    - Construct and/or support an argument with evidence, data, and/or a model.
- Crosscutting Concept – Cause and Effect

Item Set 2 – Question 5 (TEI Inline Choice)



Item Information

- Answer – See Image
- Standard – Earth and Space Science
- Evidence Outcome – SC.5.3.4.a
    - Describe and graph the amounts and percentages of saltwater and freshwater in various reservoirs to provide evidence about the distribution of water on Earth. (5-ESS2-2) (Boundary Statement: Limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.) |SEP 5 UMCT|CCC 3 SPQ|
- Disciplinary Core Idea – SC.5.3.4
    - Most of Earth's water is in the ocean and much of Earth's freshwater in glaciers or underground.
- Science and Engineering Practice – Using Mathematics and Computational Thinking
    - Describe, measure, estimate, and/or graph quantities such as area, volume, weight, and time to address scientific and engineering questions and problems.
- Crosscutting Concept – Scale, Proportion, and Quantity

Item Set 2 – Question 6 (TEI Multiple Select)

Rivers can carry trash just like they carry rocks in Figure 2. A planning committee wants to identify places where rivers might carry trash. Based on Figure 1, identify the places where rivers could carry trash.

Select **one** box per row to identify the correct places.

Place	Yes	No
Source of the rivers	☐	☑
Delta	☑	☐

Item Information

- Answer – See Image
- Standard – Earth and Space Science
- Evidence Outcome – SC.5.3.5.a
    - Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. (5-ESS3-1)|SEP 8 OECI|CCC 4 SSM|
- Disciplinary Core Idea – SC.5.3.5
    - Societal activities have had major effects on land, ocean, atmosphere and even outer space.
- Science and Engineering Practice – Obtaining, Evaluating, and Communicating Information
    - Obtain and combine information from books and other reliable media to explain phenomena.
- Crosscutting Concept – Systems and System Models

Item Set 2 – Question 7 (Constructed Response)

A student wonders what force causes the water in the rivers to flow. Based on Figure 1, explain the force that helps the water travel from the source of the rivers toward the ocean. Your response should include:

- identification of the force that causes water to flow from the source of the rivers toward the ocean
- an explanation, based on Figure 1, of why this force affects the direction that the rivers take from their source to the ocean

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Physical Science
- Evidence Outcome – SC.5.1.3.a
    - Support an argument that the gravitational force exerted by Earth on objects is directed down. (5-PS2-1) (Clarification Statement: "Down" is a local description of the direction that points toward the center of the spherical Earth.) (Boundary Statement: Does not include mathematical representation of gravitational force). |SEP 7 EAE|CCC 2 CAE|
- Disciplinary Core Idea – SC.5.1.3
    - The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet' center.
- Science and Engineering Practice – Engaging in Argument from Evidence
    - Construct and/or support an argument with evidence, data, and/or a model.
- Crosscutting Concept – Cause and Effect

Points	Attributes
2	**The student's response should include:** • Identification of the force that causes water to flow from the source of the rivers toward the ocean. • An explanation, based on Figure 1, of why this force affects the direction that the rivers take from their source to the ocean. **Student responses may include but are not limited to:** The force of gravity causes the river water to move from its source toward the ocean. Gravity is a force that acts on an object in a downward direction. Figure 1 shows that the rivers flow downhill from their source in the mountains to the ocean because the force of gravity makes the water move from higher places to lower ones.
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**
  - Gravity makes the water move from the top of the mountains where it is stored in snow and ice down to the bottom of the mountains. This is because gravity makes everything move towards the center of the Earth. Gravity also makes the water fall out of the clouds onto the mountains.
- **Sample A Annotation**
  - The response identifies the force that causes water to flow from the source of the rivers toward the ocean (*Gravity*).
  - The response explains why this force affects the direction that the rivers take from their source to the ocean (*makes the water move from the top of the mountains where it is stored in snow and ice down to the bottom of the mountains. This is because gravity makes everything move towards the center of the Earth*).
- **Sample B Response**
  - Gravity pulls everything towards the core of the earth, so it makes the water move down from the mountains and move toward the sea.
- **Sample B Annotation**
  - The response identifies the force that causes water to flow from the source of the rivers toward the ocean (*Gravity*).
  - The response explains why this force affects the direction that the rivers take from their source to the ocean (*Gravity pulls everything towards the core of the earth, so it makes the water move down from the mountains*).

1 – Sample Response and Annotation

- **Sample A Response**
  - Gravity
- **Sample A Annotation**
  - The response identifies the force that causes water to flow from the source of the rivers toward the ocean (*Gravity*).
  - The response does not address why gravity affects the direction that the rivers take from their source to the ocean.
- **Sample B Response**
  - Momentum makes the water move from the top of the mountain to the ocean because everything goes downward.
- **Sample B Annotation**
  - The response explains why this force affects the direction that the rivers take from their source to the ocean (*makes the water move from the top of the mountain to the ocean because everything goes downward*).
  - The response incorrectly identifies the force (*Momentum*).

0 – Sample Response and Annotation

- **Sample A Response**
  - Because of the speed of the water it winds around, like if there is a rock in the way it goes around it.
- **Sample A Annotation**
  - The response incorrectly identifies the force (the speed of the water).
  - The response attempts to explain the path the water takes (water it winds around, like if there is a rock in the way it goes around it) but does not explain why it moves from its source to the ocean.
- **Sample B Response**
  - Water moves to the ocean because of the chemical reactions with the salt. The rivers are carrying the salt to the ocean to help all of the fish there.
- **Sample B Annotation**

- The response incorrectly identifies the force (the chemical reactions of the salt).
- The response does not attempt to explain why this force affects the direction that the rivers take from their source to the ocean.

Item Set 2 – Question 8 (Selected Response)

A student claims that the force of gravity can be observed during the investigation. Based on the results, which statement **best** provides evidence to support the student's claim?

- ○ A. The soap takes a different shape in the glass than it does in the spoon.
- ○ B. The baking soda and vinegar mixture produces bubbles.
- ○ C. The baking soda and vinegar mixture loses mass.
- ◉ D. The soap sinks to the bottom of the glass.

Item Information

- Answer – D
- Standard – Physical Science
- Evidence Outcome – SC.5.1.3.a
  - Support an argument that the gravitational force exerted by Earth on objects is directed down. (5-PS2-1) (Clarification Statement: "Down" is a local description of the direction that points toward the center of the spherical Earth.) (Boundary Statement: Does not include mathematical representation of gravitational force). |SEP 7 EAE|CCC 2 CAE|
- Disciplinary Core Idea – SC.5.1.3
  - The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet' center.
- Science and Engineering Practice – Engaging in Argument from Evidence
  - Construct and/or support an argument with evidence, data, and/or a model.
- Crosscutting Concept – Cause and Effect

Item Set 2 – Question 9 (Selected Response)

A student claims that a new substance forms during the investigations. Based on the investigation, which observation **best** provides evidence that a new substance forms during the investigations?

- A. The final mass of each mixture is the same as the total mass of the original substances.
- B. The colored soap turns colorless because it was stirred in the water.
- C. The balloon inflates because baking soda reacts with vinegar.
- D. The penny becomes cleaner in each mixture.

Item Information

- Answer – C
- Standard – Physical Science
- Evidence Outcome – SC.5.1.2.b
  - Conduct an investigation to determine whether the mixing of two or more substances results in new substances. (5-PS1-4)|SEP 3 PCOI|CCC 2 CAE|
- Disciplinary Core Idea – SC.5.1.2
  - Chemical Reactions that occur when substances are mixed can be identified by the emergence of substances with different properties; the total mass remains the same.
- Science and Engineering Practice – Not assessed in this item.
- Crosscutting Concept – Cause and Effect

Item Set 2 – Question 10 (TEI Inline Choice)

A student wonders why the final mass of the baking soda and vinegar mixture changed in the table in Part 2.

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

The mass in Part 2 seems to [decrease by 5] g. But the student can use the results in Part 3 as evidence that mass [stays the same] when baking soda is added to vinegar.

Item Information

- Answer – See Image
- Standard – Physical Science
- Evidence Outcome – SC.5.1.2.a
    - Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling or mixing substances, the total weight of matter is conserved. (5-PS1-2) (Clarification Statement: Examples of reactions or changes could include phase changes, dissolving and mixing that form new substances. Does not include distinguishing mass and weight.) (Boundary Statement: Mass and weight are not distinguished at this grade level.) |SEP 5 UMCT|CCC 3 SPQ|
- Disciplinary Core Idea – SC.5.1.2
    - Chemical Reactions that occur when substances are mixed can be identified by the emergence of substances with different properties; the total mass remains the same.
- Science and Engineering Practice – Using Mathematics and Computational Thinking
    - Describe, measure, estimate, and/or graph quantities such as area, volume, weight, and time to address scientific and engineering questions and problems.
- Crosscutting Concept – Scale, Proportion, and Quantity

Item Set 2 – Question 11 (Constructed Response)

The teacher provided the students with 100 g of vinegar and asked the students to add salt to the vinegar. Based on the results in Part 2, explain how the students could measure the amount of salt that was added if the final mass of the mixture is 120 g. Your response should include a description of:

- the likely amount of salt that was added to the vinegar
- the evidence from the simulation for the likely amount of salt added to the vinegar

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Physical Science
- Evidence Outcome – SC.5.1.2.a
    - Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling or mixing substances, the total weight of matter is conserved. (5-PS1-2) (Clarification Statement: Examples of reactions or changes could include phase changes, dissolving and mixing that form new substances. Does not include distinguishing mass and weight.) (Boundary Statement: Mass and weight are not distinguished at this grade level.) |SEP 5 UMCT|CCC 3 SPQ|
- Disciplinary Core Idea – SC.5.1.2
    - Chemical Reactions that occur when substances are mixed can be identified by the emergence of substances with different properties; the total mass remains the same.
- Science and Engineering Practice – Using Mathematics and Computational Thinking
    - Describe, measure, estimate, and/or graph quantities such as area, volume, weight, and time to address scientific and engineering questions and problems.
- Crosscutting Concept – Scale, Proportion, and Quantity

Points	Attributes
2	**The student's response should include a description of:** • The likely amount of salt that was added to the vinegar. • The evidence from the simulation for the likely amount of salt added to the vinegar. **Student responses may include but are not limited to:** The students most likely added 20 g of salt to the vinegar. The table in Part 2 shows that the final mass of a salt-and-vinegar mixture is equal to the combined masses of the salt and the vinegar.
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 salt was 20 g. Nothing was created or destroyed so the total weight of 120 g is the weight of the vinegar plus the weight of the salt, just like it was 110 g in the table.
- **Sample A Annotation**
  - The response correctly determines the likely amount of salt that was added to the vinegar (*20 g*).
  - The response provides evidence from the experiment for the likely amount of salt added to the vinegar (*so the total weight of 120 g is the weight of the vinegar plus the weight of the salt, just like it was 110 g in the table*). Using the term "weight" instead of mass does not detract from the score.
- **Sample B Response**
  - The total mass of 10 g of salt and 100 g of water is 110 g so the total mass of 100 g of water and 20 g of salt is 120 g.
- **Sample B Annotation**
  - The response correctly determines the likely amount of salt that was added to the vinegar (*20 g*). Calling the vinegar "water" does not detract from the score.
  - The response provides evidence from the experiment for the likely amount of salt added to the vinegar (*The total mass of 10 g of salt and 100 g of water is 110*).

1 – Sample Response and Annotation

- **Sample A Response**
  - The mass of salt is 20 g.
- **Sample A Annotation**
  - The response correctly determines the likely amount of salt that was added to the vinegar (*20 g*).
  - The response does not provide evidence from the experiment for the likely amount of salt added to the vinegar.
- **Sample B Response**
  - In the experiment it said that 10 g of salt and 100 g of vinegar equals 110 g.
- **Sample B Annotation**
  - The response provides evidence from the experiment for the likely amount of salt added to the vinegar (*In the experiment it said that 10 g of salt and 100 g of vinegar equals 110 g*).
  - The response does not determine the likely amount of salt that was added to the vinegar.

0 – Sample Response and Annotation

- **Sample A Response**
  - It would be 10 g because that is how much salt they used in the experiment.
- **Sample A Annotation**
  - The response does not determine the likely amount of salt that was added to the vinegar.
  - The response does not provide evidence from the experiment for the likely amount of salt added to the vinegar. Since only the mass of the salt, and not the total mass, is given, this is considered to be insufficient evidence.
- **Sample B Response**
  - The salt dissolved in the vinegar and cleaned the penny.
- **Sample B Annotation**
  - The response does not determine the likely amount of salt that was added to the vinegar.
  - The response does not provide evidence from the experiment for the likely amount of salt added to the vinegar.

Item Set 2 – Question 12 (Constructed Response)

A student claims that a new substance forms only with the mixture of baking soda and vinegar. Based on the results of Part 3, explain why the student's claim is correct. Your response should include:

- a description of the evidence from Part 3 that supports the student's claim
- an explanation of how this evidence supports the student's claim

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Physical Science
- Evidence Outcome – SC.5.1.2.b
  - Conduct an investigation to determine whether the mixing of two or more substances results in new substances. (5-PS1-4)|SEP 3 PCOI|CCC 2 CAE|
- Disciplinary Core Idea – SC.5.1.2
  - Chemical Reactions that occur when substances are mixed can be identified by the emergence of substances with different properties; the total mass remains the same.
- Science and Engineering Practice – Planning and Carrying Out Investigations
  - Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.
- Crosscutting Concept – Cause and Effect

Points	Attributes
2	**The student's response should include:** • A description of the evidence from Part 3 that supports the student's claim. • An explanation of how this evidence supports the student's claim. **Student responses may include but are not limited to:** The inflating of the balloon in Part 3 shows that a new substance is produced when baking soda is mixed with vinegar. The balloon inflates because of the gas that is produced when baking soda is mixed with vinegar. The balloon only inflates for baking soda and vinegar, because the other mixtures do not produce a gas to fill it.
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 balloon inflates when the baking soda is mixed with the vinegar because they are reacting and making a new substance. So gas is released. Gas is not released in the other two because they are just mixing together, not making anything new.
- **Sample A Annotation**
  - The response includes a description of the evidence from Part 3 that supports the student's claim (*The balloon inflates … because they are reacting and making a new substance. So gas is released*).
  - The response gives an explanation of how this evidence supports the student's claim (*Gas is not released in the other two because they are just mixing together, not making anything new*).
- **Sample B Response**
  - Gas is released when they are mixed together, meaning that a chemical reaction is happening.
- **Sample B Annotation**
  - The response includes a description of the evidence from Part 3 that supports the student's claim (G*as is released when they are mixed together*). In this context, "they" is taken to mean vinegar and baking soda, since those are the ingredients mentioned in the prompt. The response does not state that the balloon inflates, but "gas is released" is sufficient.
  - The response gives an explanation of how this evidence supports the student's claim (*a chemical reaction is happening*).

1 – Sample Response and Annotation

- **Sample A Response**
  - When you mix vinegar and baking soda., it releases gas and inflates the balloon.
- **Sample A Annotation**
  - The response includes a description of the evidence from Part 3 that supports the student's claim (*it releases gas and inflates the balloon*).
  - The response does not give an explanation of how this evidence supports the student's claim.
- **Sample B Response**
  - If a new substance didn't form, then the mass of the mixture would be the same as the mass of the baking soda and the mass of the vinegar.
- **Sample B Annotation**
  - The response gives an explanation of how this evidence supports the student's claim (*If a new substance didn't form, then the mass of the mixture would be the same as the mass of the baking soda and the mass of the vinegar*).
  - The response does not include a description of the evidence from Part 3 that supports the student's claim. The prompt states that the change in mass is evidence of the formation of a new substance, so this does not receive credit.

0 – Sample Response and Annotation

- **Sample A Response**
  - I do not believe that the balloon is evidence that a new substance didn't form in the other experiments. There could be other evidence.
- **Sample A Annotation**
  - The response does not include a description of the evidence from Part 3 that supports the student's claim, or how this evidence supports the student's claim.
- **Sample B Response**
  - They put helium in the third bottle and that made the balloon float.
- **Sample B Annotation**
  - The response does not include a description of the evidence from Part 3 that supports the student's claim, or how this evidence supports the student's claim.

Item Set 2 – Question 13 (Constructed Response)

A student has a sample of 10 g of cooking oil that looks similar to the soap in Part 2. Properties of cooking oil and soap are shown in the table.

Properties of Cooking Oil and Soap

Material	Observation When Stirred in Water	Color in Water
cooking oil	forms drops that float	light tan
soap	disappears	light tan

Explain how a property of cooking oil would allow filter paper to separate the oil from water. Your response should include:

- identification of the property that causes the difference observed when the materials are stirred in water
- an explanation of why filter paper can only use this property to separate oil and water, not soap and water

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Physical Science
- Evidence Outcome – SC.5.1.1.b
    - Make observations and measurements to identify materials based on their properties. (5-PS1-3) (Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces and solubility; density is not intended as an identifiable property. Does not include density or distinguishing mass and weight.) (Boundary Statement: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) |SEP 3 PCOI|CCC 3 SPQ|
- Disciplinary Core Idea – SC.5.1.1
    - Matter exists as particles that are too small to be seen; measurements of a variety of observable properties can be used to identify particular materials.
- Science and Engineering Practice – Planning and Carrying Out Investigations
    - Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.
- Crosscutting Concept – CCC Not Assessed

Points	Attributes
2	**The student's response should include:** • Identification of the property that causes the difference observed when the materials are stirred in water. • An explanation of why filter paper can only use this property to separate oil and water, not soap and water. **Student responses may include but are not limited to:** The property is solubility in water. The cooking oil will not pass through the filter paper because it does not dissolve in water, while the soap does dissolve in water and will pass through the filter paper. Note: For B1, student may also say ability to dissolve in water. For B2, student may say the drops are too large to pass through the filter paper.
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 difference is observed because the soap dissolves in water and the oil stays separate. If you put the soapy water through filter paper the soap will stay dissolved and stay with the water, but the oil is separate so it will stick to the filter paper.
- **Sample A Annotation**
  - The response identifies the property that causes the difference observed when the materials are stirred in water (*soap dissolves in water and the oil stays separate*).
  - The response explains why filter paper can only use this property to separate oil and water, not soap and water (*the soap will stay dissolved and stay with the water, but the oil is separate so it will stick to the filter paper*).
- **Sample B Response**
  - The property is solubility. The soap goes through the filter paper with the water, but the oil is too thick and it can't get through.
- **Sample B Annotation**
  - The response identifies the property that causes the difference observed when the materials are stirred in water (*The property is solubility*).
  - The response explains why filter paper can only use this property to separate oil and water, not soap and water (*The soap goes through the filter paper with the water, but the oil is too thick and it can't get through*).

1 – Sample Response and Annotation

- **Sample A Response**
  - The soap dissolves in water and the oil doesn't. You could use filter paper to filter out the soap and the oil and then you would have clean water.
- **Sample A Annotation**
  - The response identifies the property that causes the difference observed when the materials are stirred in water (The soap dissolves in water and the oil doesn't).
  - The response incorrectly states that the soap could be filtered out using the filter paper and does not explain how solubility affects this process.
- **Sample B Response**

- The oil won't go through the filter paper because it's thicker than water.

- **Sample B Annotation**
  - The response explains why filter paper can only use this property to separate oil and water, not soap and water (The oil won't go through the filter paper because it's thicker than water).
  - The response does not identify the property that causes the difference observed when the materials are stirred in water.

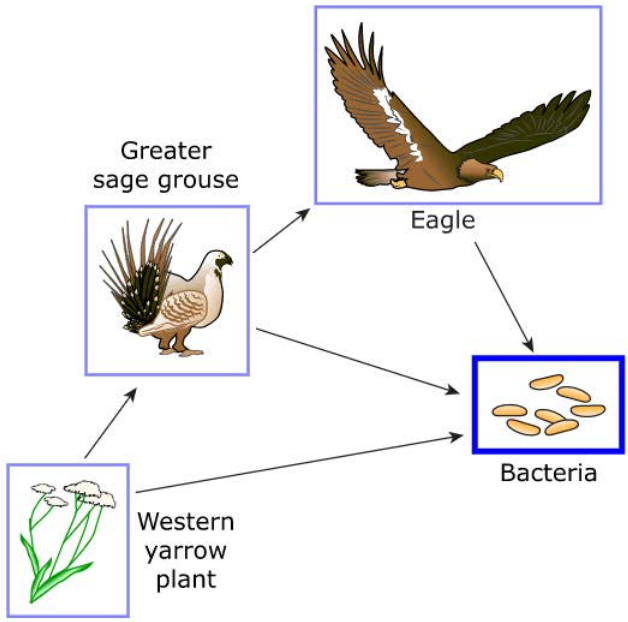
0 – Sample Response and Annotation

- **Sample A Response**
  - The property is temperature. To filter out the soap and water you just need to heat them up.
- **Sample A Annotation**
  - The response does not identify the property that causes the difference observed when the materials are stirred in water.
  - The response does not explain why filter paper can only use this property to separate oil and water, not soap and water.
- **Sample B Response**
  - You could mix the soapy water with the oily water and that would make the oil separate.
- **Sample B Annotation**
  - The response does not identify the property that causes the difference observed when the materials are stirred in water.
  - The response does not explain why filter paper can only use this property to separate oil and water, not soap and water.

Item Set 2 – Question 14 (TEI Hot Spot)

Students learn that farmers often put fertilizer in the soil. Fertilizer helps the farmers grow the fruits and vegetables people use for food. The students wonder how wild plants grow without people adding fertilizer to the soil.

Select **one** organism in the food web that would help the wild plants the same way the fertilizer helps the farmer's crops.



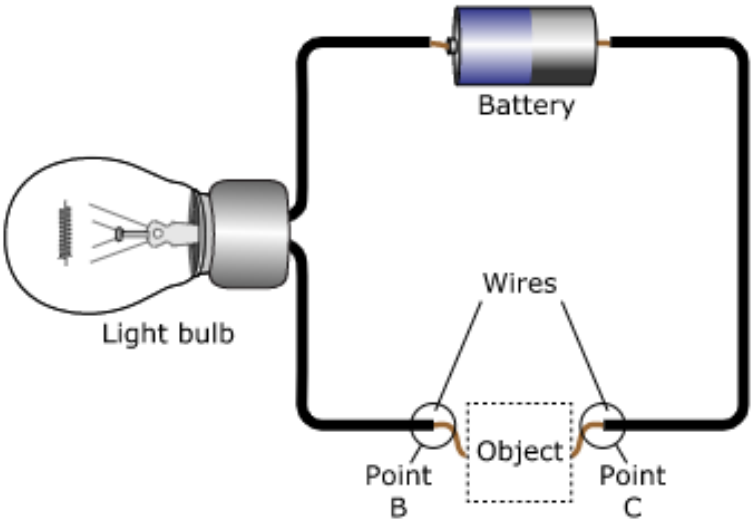
Item Information

- Answer – See Image
- Standard – Life/Physical* Science
- Evidence Outcome – SC.5.2.2.a
    - Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. (5-LS2-1) (Clarification Statement: Emphasis is on the idea that matter that is not food [air, water, decomposed materials in soil] is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.) (Boundary Statement: Does not include molecular explanations.) |SEP 2 DUM|CCC 4 SSM|
- Disciplinary Core Idea – SC.5.2.2
    - Matter cycles between air and soil and among plants, animals and microbes as these organisms live and die.
- Science and Engineering Practice – Developing and Using Models
    - Develop and/or use models to describe and/or predict phenomena.
- Crosscutting Concept – CCC Not Assessed
- P Value – 0.524

ANSWER KEY: ITEM SET 3

Item Set 3 – Question 1 (TEI Inline Choice)

Students investigate a circuit. They observe that the light bulb only turns on when certain materials are placed between points B and C.



Using their observations, they separate the materials they are testing into two groups. The table shows their groupings.

Materials

Group A	Group B
iron nail	rubber eraser
copper penny	plastic button
steel paper clip	wood stick

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

The property the students tested was whether each material [conducts electricity] . A comparison can be made between the penny and the paper clip to see which one is [the better conductor] by testing to see which one [makes the light shine brighter] .

Item Information

- Answer – See Image
- Standard – Physical Science
- Evidence Outcome – SC.5.1.1.b
    - Make observations and measurements to identify materials based on their properties. (5-PS1-3) (Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces and solubility; density is not intended as an identifiable property. Does not include density or distinguishing mass and weight.) (Boundary Statement: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) |SEP 3 PCOI|CCC 3 SPQ |
- Disciplinary Core Idea – SC.5.1.1
    - Matter exists as particles that are too small to be seen; measurements of a variety of observable properties can be used to identify particular materials.
- Science and Engineering Practice – Planning and Carrying Out Investigations
    - Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.
- Crosscutting Concept – Scale, Proportion, and Quantity

Item Set 3 – Question 2 (Selected Response)

The students plan to use a different set of materials to be models for the behavior of the oil and water used in Part 1. Which materials, if shaken, would **most** accurately be models for the behavior of the water and vegetable oil in the bottle?

A.

Science in a Bottle Setup	Model
water	clear marbles
vegetable oil	yellow marbles

B.

Science in a Bottle Setup	Model
water	salt
vegetable oil	yellow marbles

C.

Science in a Bottle Setup	Model
water	clear marbles
vegetable oil	pepper

D.

Science in a Bottle Setup	Model
water	pepper
vegetable oil	salt

Item Information

- Answer – B
- Standard – Physical Science
- Evidence Outcome – SC.5.1.1.a
    - Develop a model to describe that matter is made of particles too small to be seen. (5-PS1-1) (Clarification Statement: Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water and evaporating salt water. Does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.) |SEP 2 DUM|CCC 3 SPQ|
- Disciplinary Core Idea – SC.5.1.1
    - Matter exists as particles that are too small to be seen; measurements of a variety of observable properties can be used to identify particular materials.
- Science and Engineering Practice – Developing and Using Models
    - Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution.
- Crosscutting Concept – CCC Not Assessed

Item Set 3 – Question 3 (Selected Response)

After the tablet in the investigation in Part 2 has completely dissolved, a student unscrews the cap to the bottle. As the cap loosens, the students hear a hissing sound. What is the **most likely** explanation for the hissing sound?

- (●) A. Small particles of gaseous matter exit the bottle.
- ( ) B. Small bubbles in the bottle turn back into water.
- ( ) C. The oil and water mix to form a single layer.
- ( ) D. The food coloring dissolves into the oil.

Item Information

- Answer – A
- Standard – Physical Science
- Evidence Outcome – SC.5.1.1.a
    - Develop a model to describe that matter is made of particles too small to be seen. (5-PS1-1) (Clarification Statement: Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water and evaporating salt water. Does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.) |SEP 2 DUM|CCC 3 SPQ|
- Disciplinary Core Idea – SC.5.1.1
    - Matter exists as particles that are too small to be seen; measurements of a variety of observable properties can be used to identify particular materials.
- Science and Engineering Practice – Developing and Using Models
    - Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system.
- Crosscutting Concept – CCC Not Assessed

Item Set 3 – Question 4 (Multiple Select)

Students repeat the investigation in Part 2, but this time they weigh the tablet as well as the bottle and its contents before and after the investigation. The students do not put the cap on the bottle after the tablet is added.

Which statement predicts what the students will observe in the investigation, and which description correctly explains their observation? Select **two** correct answer choices.

- ☐ A. The mass of the bottle after the investigation was greater than the mass of the bottle and tablet before the investigation.
- ☐ B. The mass of the bottle after the investigation was the same as the mass of the bottle and tablet before the investigation.
- ☑ C. The mass of the bottle after the investigation was less than the mass of the bottle and tablet before the investigation.
- ☐ D. This is evidence that no new substance was formed as the matter in the tablet was destroyed.
- ☑ E. This is evidence that a new substance was formed and left the bottle as a gas.

Item Information

- Answer – C, E
- Standard – Physical Science
- Evidence Outcome – SC.5.1.2.b
  - Conduct an investigation to determine whether the mixing of two or more substances results in new substances. (5-PS1-4)|SEP 3 PCOI|CCC 2 CAE|
- Disciplinary Core Idea – SC.5.1.2
  - Chemical Reactions that occur when substances are mixed can be identified by the emergence of substances with different properties; the total mass remains the same.
- Science and Engineering Practice – Planning and Carrying Out Investigations
  - Make predictions about what would happen if a variable changes.
- Crosscutting Concept – Cause and Effect

Item Set 3 – Question 5 (Constructed Response)

A bottle of water and a bottle of clear oil are on a table. The students notice that the liquid in the bottles looks the same.

Use the information in Part 1 to explain how a student can use food coloring to correctly identify the oil and the water. Your response should include a description of:

- how a student can use the way that food coloring behaves in water to identify a substance as water
- how a student can use the way that food coloring behaves in oil to identify a substance as oil

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Physical Science
- Evidence Outcome – SC.5.1.1.b
    - Make observations and measurements to identify materials based on their properties. (5-PS1-3) (Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces and solubility; density is not intended as an identifiable property. Does not include density or distinguishing mass and weight.) (Boundary Statement: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.)
- Disciplinary Core Idea – SC.5.1.1
    - Matter exists as particles that are too small to be seen; measurements of a variety of observable properties can be used to identify particular materials.
- Science and Engineering Practice – Planning and Carrying Out Investigations
    - Test two different models of the same proposed object, tool, or process to determine which better meets criteria for success.
- Crosscutting Concept – CCC Not Assessed

Points	Attributes
2	**The response should include a description of:** • How a student can use the way that food coloring behaves in water to identify a substance as water. • How a student can use the way that food coloring behaves in oil to identify a substance as oil. **Student responses may include but are not limited to:** It dissolves in water. It does not dissolve in oil. Note: Swirling may be mentioned for mixing food coloring with the liquids. Students may describe the dissolving rather than naming it as dissolving.
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**

  It dissolves in water. It does not dissolve in oil.
- **Sample Annotation**
  - This response demonstrates a complete understanding of the task. The student describes the behavior of the food coloring both in the water (*It dissolves*) and in the oil (*It does not dissolve*).

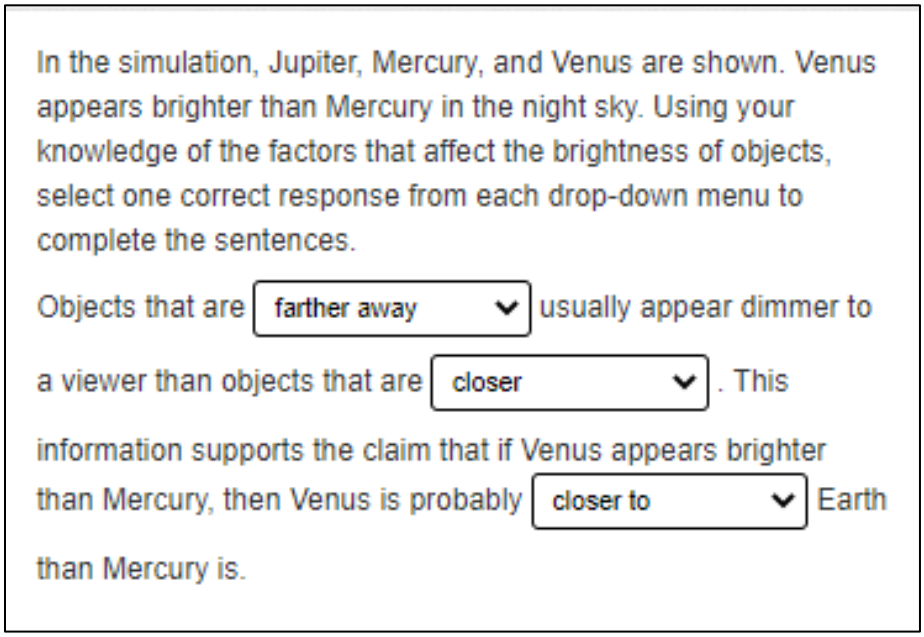
1 – Sample Response and Annotation

- **Sample Response**
  - The students can put food coloring in the bottles. The food color doesn't dissolve in the oil, it just lays at the bottom of the bottle until you swirl it around, then it just makes a bunch of little bubble in the oil, like a snow globe.
- **Sample Annotation**
  - This response demonstrates a partial understanding of the task because it is incomplete. Only the behavior of food coloring in vegetable oil is described *(The food color doesn't dissolve in the oil, it just lays at the bottom until you swirl it … makes a bunch of little bubble).* The behavior of food coloring in vegetable water is not described.

0 – Sample Response and Annotation

- **Sample Response**
  - They could pour some on their hand. If it's wet, it's water. If it feels slimy, it's oil.
- **Sample Annotation**
  - This response does not demonstrate an understanding of the task because it does not address the behavior of food coloring with either liquid. Although a tactile approach may work to differentiate water from vegetable oil, the prompt specifically asks how a student can use food coloring to correctly identify the oil and the water.

Item Set 3 – Question 6 (Inline Choice)



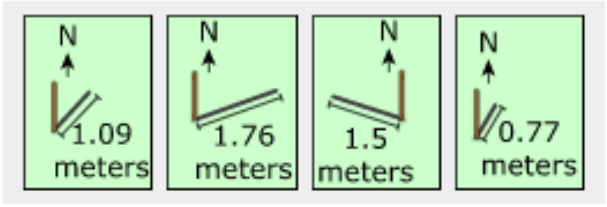
Item Information

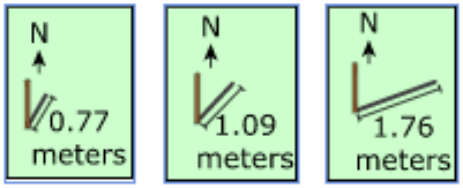
- Answer – See Image
- Standard – Earth and Space Science
- Evidence Outcome – SC.5.3.1.a
    - Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth. (5-ESS1-1) (Clarification Statement: Limited to relative distances, not sizes, of stars. Does not include other factors that affect apparent brightness [such as stellar masses, age and stage].) |SEP 7 EAE|CCC 3 SPQ|
- Disciplinary Core Idea – SC.5.3.1
    - Stars range greatly in size and distance from Earth, and this can explain their relative brightness.
- Science and Engineering Practice – Engaging in Argument from Evidence
    - Use data to evaluate claims about cause and effect.
- Crosscutting Concept – Scale, Proportion, and Quantity

Item Set 3 – Question 7 (TEI Drag and Drop)

Outside the path of the total solar eclipse, the pattern of shadows is the same as on any other day. Show how shadows change on the day of the eclipse for someone outside the path of the eclipse.

Based on the data table, drag and drop the correct shadow image into each labeled box. Each shadow may be used once, more than once, or not at all.





Shadow when partial eclipse begins

Shadow during maximum eclipse

Shadow when partial eclipse ends

Item Information

- Answer – See Image
- Standard – Earth and Space Science
- Evidence Outcome – SC.5.3.2.a
  - Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. (5-ESS1-2) (Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.) (Boundary Statement: Does not include causes of seasons.)
- Disciplinary Core Idea – SC.5.3.2
  - Earth's orbit and rotation and the orbit of the moon around Earth cause observable patterns.
- Science and Engineering Practice – Analyzing and Interpreting Data
  - Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.
- Crosscutting Concept – Patterns

Item Set 3 – Question 8 (Selected Response)

The star M45 is visible during the total solar eclipse in the night sky in the Northern Hemisphere. If the same total solar eclipse would occur during the summer, M45 would not be visible. Why would M45 not be visible in the summer?

- A. because M45 changes the amount of light it gives off during different seasons
- B. because M45 moves closer to or farther from planets during different seasons
- C. because Earth revolves around the Sun
- D. because Earth rotates on its axis

Item Information

- Answer – C
- Standard – Earth and Space Science
- Evidence Outcome – SC.5.3.2.a
    - Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. (5-ESS1-2) (Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.) (Boundary Statement: Does not include causes of seasons.)
- Disciplinary Core Idea – SC.5.3.2
    - Earth's orbit and rotation and the orbit of the moon around Earth cause observable patterns.
- Science and Engineering Practice – Not assessed in this item.
- Crosscutting Concept – Patterns

Item Set 3 – Question 9 (Constructed Response)

After observing the simulation, a student claims that the Sun is the closest star to Earth. Compare the brightness of the objects in the sky during the partial eclipse and the total eclipse to explain why the student's claim is correct. Your response should include:

- a comparison of bright objects seen during the partial solar eclipse and bright objects seen during the total solar eclipse
- an explanation of why the differences in brightness support the student's claim

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Earth and Space Science
- Evidence Outcome – SC.5.3.1.a
    - Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth. (5-ESS1-1) (Clarification Statement: Limited to relative distances, not sizes, of stars. Does not include other factors that affect apparent brightness [such as stellar masses, age and stage].) |SEP 7 EAE|CCC 3 SPQ|
- Disciplinary Core Idea – SC.5.3.1
    - Stars range greatly in size and distance from Earth, and this can explain their relative brightness.
- Science and Engineering Practice – Engaging in Argument from Evidence
    - Construct and/or support an argument with evidence, data, and/or a model.
- Crosscutting Concept – Scale, Proportion, and Quantity

Points	Attributes
2	**The student's response should include:** • A comparison of bright objects seen during the partial solar eclipse and bright objects seen during the total solar eclipse. • An explanation of why the differences in brightness support the student's claim. **Student responses may include but are not limited to:** During the partial solar eclipse, only the Sun is visible in the sky, while stars such as Hamal and M45 and planets such as Mercury, Venus, and Jupiter are visible during the total solar eclipse. The brightness of the Sun outshines the other stars during the partial solar eclipse because it is the closest star to Earth.
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**

  During the partial solar eclipse, only the Sun is visible in the sky, while stars such as Hamal and M45 and planets such as Mercury, Venus, and Jupiter are visible during the total solar eclipse. The brightness of the Sun outshines the other stars during the partial solar eclipse because it is the closest star to Earth.

- **Sample Annotation**
  - The student demonstrates a complete understanding of the task. The comparison of bright objects seen during the partial eclipse to those seen during the total eclipse is correct *(During the partial solar eclipse, only the Sun is visible in the sky, while stars such as Hamal and M45 and planets such as Mercury, Venus, and Jupiter are visible during the total solar eclipse)*. The explanation of why the differences in brightness correctly support the student's claim *(The brightness of the Sun outshines the other stars during the partial solar eclipse because it is the closest star to Earth*).

1 – Sample Response and Annotation

- **Sample Response**
  - During a partial eclipse, you can only see the bright sun in the sky. But during a total eclipse, you can see lots of stars like Hamal and M45 and some planets like Venus and Jupiter, because it's so dark, just like at night.
- **Sample Annotation**
  - The response demonstrates a partial understanding of the task. The comparison of bright objects seen during the partial eclipse to those seen during the total eclipse is correct *(During a partial eclipse, you can only see the bright sun in the sky. But during a total eclipse, you can see lots of stars like Hamal and M45 and some planets like Venus and Jupiter)*. The explanation of why the differences in brightness correctly support the student's claim *(because it's so dark, just like at night)* does not mention the sun outshining the stars during the partial eclipse to support the student's claim that the sun is the star closest to earth.

0 – Sample Response and Annotation

- **Sample Response**
  - During a total solar eclipse, the sky gets very dark, just like at night. It is so dark that you can even see stars in the sky, in the middle of the day.
- **Sample Annotation**
  - This response does not demonstrate an understanding of the task. There is no comparison of bright objects seen during the partial eclipse to those seen during the total eclipse, only a mention that stars are visible during the total solar eclipse. There is no explanation of the differences in brightness to support the student's claim.

Item Set 3 – Question 10 (Constructed Response)

Use the simulation to observe and compare how each star looks during the total solar eclipse. Your response should include:

- how the appearances of the stars compare to each other
- how comparing the stars provides evidence for the distances of stars from Earth

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Earth and Space Science
- Evidence Outcome – SC.5.3.1.a
    - Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth. (5-ESS1-1) (Clarification Statement: Limited to relative distances, not sizes, of stars. Does not include other factors that affect apparent brightness [such as stellar masses, age and stage].) |SEP 7 EAE|CCC 3 SPQ|
- Disciplinary Core Idea – SC.5.3.1
    - Stars range greatly in size and distance from Earth, and this can explain their relative brightness.
- Science and Engineering Practice – Engaging in Argument from Evidence
    - Construct and/or support an argument with evidence, data, and/or a model.
- Crosscutting Concept – Scale, Proportion, and Quantity

Points	Attributes
2	**The student response should include:** • How the appearances of the stars compare to each other. • How comparing the stars provides evidence for the distances of stars from Earth. **Student responses may include but are not limited to:** Some stars appear larger and brighter than other stars. Compared to the size of the Sun, the sizes of the other stars appear very small and their apparent brightness is much less. This provides evidence that the other stars are different distances from Earth, though they are all much farther away than the Sun.
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**

  Some stars appear larger and brighter than other stars. Compared to the size of the Sun, the sizes of the other stars appear very small and their apparent brightness is much less. This provides evidence that the other stars are different distances from Earth, though they are all much farther away than the Sun.

- **Sample Annotation**
  - The student demonstrates a complete understanding of the task. The comparison of the appearance of the stars is correct *(Some stars appear larger and brighter than other stars. Compared to the Sun, the sizes of the other stars appear very small and their apparent brightness is much less)*. The explanation of how this comparison gives evidence of the stars' distances from earth is also correct *(the other stars are different distances from Earth, though they are all much farther away than the Sun*).

1 – Sample Response and Annotation

- **Sample Response**
  - During the total solar eclipse, you can see the stars in the sky. Some look brighter and some look dimmer than the others. And some look bigger and some smaller. But none look as big or as bright as the sun.
- **Sample Annotation**
  - The response demonstrates a partial understanding of the task. The comparison of the appearance of the stars is correct (*Some look brighter and some look dimmer than the others. And some look bigger and some smaller … none look as big or as bright as the sun*). The response is incomplete because there is no explanation of how the comparison gives evidence of the stars' distances from earth because distance from the earth is not mentioned.

0 – Sample Response and Annotation

- **Sample Response**
  - The stars and the planets are just little dots of light so that means they are all about the same distance away.
- **Sample Annotation**
  - This response does not demonstrate an understanding of the task. The attempted comparison of the stars is not acceptable because it does not address relative apparent brightness or size. The supposition that the planets and stars are all about the same distance from earth is incorrect.

Item Set 3 – Question 11 (Constructed Response)

A student wonders whether the stars he saw during the total solar eclipse in the simulation would be the same stars he could see twelve hours later. Explain how the sky and the stars that are seen would change over twelve hours. Your response should include:

- a description of how the sky and the stars the student could see would look different
- why the sky would look different

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Earth and Space Science
- Evidence Outcome – SC.5.3.2.a
    - Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. (5-ESS1-2) (Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.) (Boundary Statement: Does not include causes of seasons.)
- Disciplinary Core Idea – SC.5.3.2
    - Earth's orbit and rotation and the orbit of the moon around Earth cause observable patterns.
- Science and Engineering Practice – Not assessed in this item.
- Crosscutting Concept – Patterns

Points	Attributes
2	**The student response should include:** • A description of how the sky and the stars the student could see would look different. • Why the sky would look different. **Student responses may include but are not limited to:** The current stars would move across the sky, and different stars will appear twelve hours later. This is because Earth rotates on its axis, so the point of view on Earth would be facing a different part of the sky.
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 current stars would move across the sky, and different stars will appear twelve hours later. This is because Earth rotates on its axis, so the point of view on Earth would be facing a different part of the sky.

- **Sample Annotation**
  - This response demonstrates a complete understanding of the task. The description of how the sky and stars would look different is correct *(The current stars would move across the sky, and different stars will appear),* and the explanation as to why the sky would look different is correct *(Earth rotates on its axis, so the point of view on Earth would be facing a different part of the sky*).

1 – Sample Response and Annotation

- **Sample Response**
  - They would see different stars in 12 hours because the stars move across the sky, like the sun.
- **Sample Annotation**
  - This response demonstrates a partial understanding of the task. The description of how the sky and stars would look different is correct (*because the stars move across the sky, like the sun*); however, there is no mention of the Earth rotating on its axis as the explanation why the sky would look different.

0 – Sample Response and Annotation

- **Sample Response**
  - It's going to be the same stars because they have been there for millions of years and will be for millions more.
- **Sample Annotation**
  - This response does not demonstrate an understanding of the task. The response is incorrect, as the stars visible behind the sun during the solar eclipse are not visible to that side of Earth at night. The Earth's rotation, which would expose a different part of the sky to a place on Earth over 12 hours, is not mentioned.

Item Set 3 – Question 12 (Selected Response)

Based on the information in Table 1, which claim is supported?

- (●) A. Medium-sized dogs use more energy from the Sun than small-sized dogs use.
- ( ) B. Medium-sized dogs use more energy from water than giant-sized dogs use.
- ( ) C. Large-sized dogs use more energy from the Sun than giant-sized dogs use.
- ( ) D. Large-sized dogs use more energy from water than small-sized dogs use.

Item Information

- Answer – A
- Standard – Physical Science
- Evidence Outcome – SC.5.1.4.a
    - Use models to describe that energy in animals' food (used for body repair, growth and motion and to maintain body warmth) was once energy from the sun. (5-PS3-1) (Clarification Statement: Examples of models could include diagrams and flowcharts.)
- Disciplinary Core Idea – SC.5.1.4
    - The energy released from food was once energy from the sun.
- Science and Engineering Practice – Developing and Using Models
    - Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system.
- Crosscutting Concept – Energy and Matter

Item Set 3 – Question 13 (TEI Inline Choice)

The student finds that two medium-sized dogs require different amounts of food to maintain a healthy weight. Dog 1 requires 1,050 kcal/day, and Dog 2 requires 900 kcal/day.

Based on Figure 1, compare the energy use of the dogs. Select one correct response from each drop-down menu to complete the sentences.

Dog 1 consumes more kilocalories per day than Dog 2. The energy Dog 1 consumes from the food [originally came from the Sun] . Dog 1 is most likely [younger] than Dog 2.

Item Information

- Answer – See Image
- Standard – Physical Science
- Evidence Outcome – SC.5.1.4.a
    - Use models to describe that energy in animals' food (used for body repair, growth and motion and to maintain body warmth) was once energy from the sun. (5-PS3-1) (Clarification Statement: Examples of models could include diagrams and flowcharts.) |SEP 2 DUM|CCC 5 EM|
- Disciplinary Core Idea – SC.5.1.4
    - The energy released from food was once energy from the sun.
- Science and Engineering Practice – Developing and Using Models
    - Develop and/or use models to describe and/or predict phenomena.
- Crosscutting Concept – Energy and Matter

Item Set 3 – Question 14 (Selected Response)

Which statement is one way the model in Part 2 shows matter moving in an ecosystem?

A. The truck moving ingredients from the farm is like decomposed matter moving from soil to plants.

B. The truck moving recycled materials is like decomposed matter moving from soil to plants.

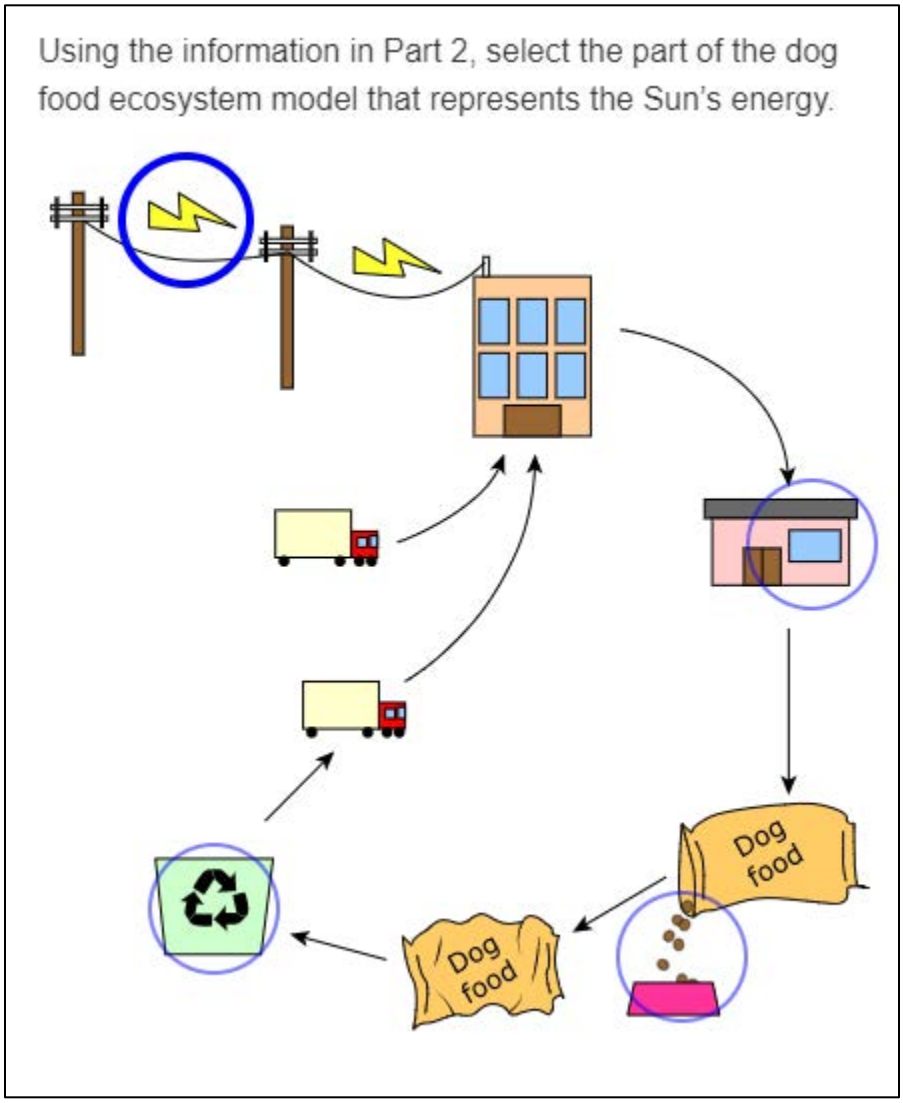
C. The truck moving ingredients from the farm is like energy traveling from the Sun to plants.

D. The truck moving recycled materials is like energy traveling from the Sun to plants.

Item Information

- Answer – B
- Standard – Life/Physical* Science
- Evidence Outcome – SC.5.2.2.a
    - Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. (5-LS2-1) (Clarification Statement: Emphasis is on the idea that matter that is not food [air, water, decomposed materials in soil] is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.) (Boundary Statement: Does not include molecular explanations.) |SEP 2 DUM|CCC 4 SSM|
- Disciplinary Core Idea – SC.5.2.2
    - Matter cycles between air and soil and among plants, animals and microbes as these organisms live and die.
- Science and Engineering Practice – Developing and Using Models
    - Develop and/or use models to describe and/or predict phenomena.
- Crosscutting Concept – Systems and System Models

Item Set 3 – Question 15 (TEI Hot Spot)



Item Information

- Answer – See Image
- Standard –Physical Science
- Evidence Outcome – SC.5.1.4.a
    - Use models to describe that energy in animals' food (used for body repair, growth and motion and to maintain body warmth) was once energy from the sun. (5-PS3-1) (Clarification Statement: Examples of models could include diagrams and flowcharts.) |SEP 2 DUM|CCC 5 EM|
- Disciplinary Core Idea – SC.5.1.4
    - The energy released from food was once energy from the sun.
- Science and Engineering Practice – Developing and Using Models
    - Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system.
- Crosscutting Concept – Energy and Matter

Item Set 3 – Question 16 (Constructed Response)

> Using the information in Part 2, explain decomposition in the ecosystem model. Your response should include:
>
> - which part of the ecosystem model represents decomposers
> - an explanation of why this part of the model represents decomposers

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Life/Physical* Science
- Evidence Outcome – SC.5.2.2.a
  - Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. (5-LS2-1) (Clarification Statement: Emphasis is on the idea that matter that is not food [air, water, decomposed materials in soil] is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.) (Boundary Statement: Does not include molecular explanations.) |SEP 2 DUM|CCC 4 SSM|
- Disciplinary Core Idea – SC.5.2.2
  - Matter cycles between air and soil and among plants, animals and microbes as these organisms live and die.
- Science and Engineering Practice – Developing and Using Models
  - Develop and/or use models to describe and/or predict phenomena.
- Crosscutting Concept – Systems and System Models

Points	Attributes
2	**The student's response should include:** • Which part of the ecosystem model represents decomposers. • An explanation of why this part of the model represents decomposers. **Student responses may include but are not limited to:** In the ecosystem model, the recycling program represents the decomposers. The recycling program and the decomposers both take waste materials and break them down to be reused.
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**

  In the ecosystem model, the recycling program represents the decomposers. The recycling program and the decomposers both take waste materials and break them down to be reused.

- **Sample Annotation**
  - This response demonstrates a complete understanding of the task. The student identifies which part of the ecosystem model represents decomposers (*the recycling program*) and explains why (*both take waste materials and break them down to be reused*).

1 – Sample Response and Annotation

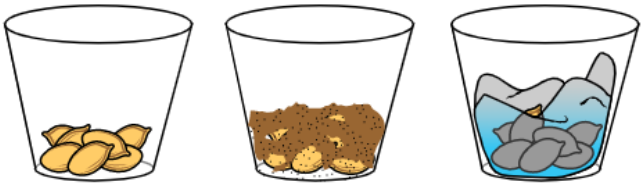
- **Sample Response**
  - Recycling is like decomposition.
- **Sample Annotation**
  - This response demonstrates a partial understanding of the task by correctly identifying which part of the ecosystem represents decomposers (*Recycling)*.

0 – Sample Response and Annotation

- **Sample Response**
  - The food that comes from the farm that is used to make new food.
- **Sample Annotation**
  - This response does not demonstrate an understanding of the task. The part of the ecosystem model which represents decomposers is not identified, and there is no explanation why any part of the model represents decomposers.

Item Set 3 – Question 17 (Constructed Response)

A student wants to see where seeds grow best. The student puts seven seeds in each of three cups and places the cups near an open window. The seeds in Cup A are left to dry. The seeds in Cup B are in dry soil, and the seeds in Cup C are wrapped in a cloth soaked with water.



Cup A, dry seeds

Cup B, seeds put in dry soil

Cup C, seeds wrapped in a cloth soaked in water

Explain what the student will observe after four days. Your answer should include:

- the changes observed in each cup after four days
- the reason for the changes observed in each cup

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Standard – Life/Physical* Science
- Evidence Outcome – SC.5.2.1.a
  - Support an argument that plants get the materials they need for growth chiefly from air and water. (5-LS1-1) (Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.) |SEP 7 EAE|CCC 5 EM|
- Disciplinary Core Idea – SC.5.2.1
  - Plants acquire their material from growth chiefly from air and water.
- Science and Engineering Practice – Engaging in Argument from Evidence
  - Compare and refine arguments based on an evaluation of the evidence presented.
- Crosscutting Concept – Energy and Matter

Points	Attributes
2	**The student response should include:** • The changes observed in each cup after four days. • The reason for the changes observed in each cup. **Student responses may include but are not limited to:** The seeds in Cup A and Cup B will show no change, but the seeds in Cup C will have roots growing out of them after four days. The seeds in cups A and B will not show any change because they did not get water and air to grow. The seeds in Cup C got water from the wet cloth and air from the surroundings and would start to 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 Response**

  The seeds in Cup A and Cup B will show no change, but the seeds in Cup C will have roots growing out of them after four days. The seeds in cups A and B will not show any change because they did not get water and air to grow. The seeds in Cup C got water from the wet cloth and air from the surroundings and would start to grow.

- **Sample Annotation**
  - This response demonstrates a complete understanding of the task. The student explains the changes observed in each cup (*Cup A and Cup B will show no change, but the seeds in Cup C will have roots growing out of them after four days*) and the reason for the changes observed (*The seeds in Cup C got water from the wet cloth and air from the surroundings*).

1 – Sample Response and Annotation

- **Sample Response**
  - Cup A no growth
  - Cup B no growth
  - Cup C grows
- **Sample Annotation**
  - This response demonstrates a partial understanding of the task. The student correctly states the observations for each cup after 4 days.

0 – Sample Response and Annotation

- **Sample Response**
  - Cup B and Cup C will grow
- **Sample Annotation**
  - This response does not demonstrate an understanding of the task. No reasons for the changes or lack of changes are given, and an incorrect proposed observation is given for Cup B.

*Refer to the "Grade 5 Science: Colorado Academic Standards 2020 Frameworks" document for an explanation of the Life/Physical Science category.