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<th>Answer Key</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Multiple Choice</td>
<td>Physical Science</td>
<td>Light and sound are forms of energy that behave in predictable ways.</td>
<td>A</td>
<td>1 point</td>
</tr>
<tr>
<td>2</td>
<td>Multiple Choice</td>
<td>Earth and Space Science</td>
<td>The solar system includes the sun and all celestial bodies that orbit the sun. Each planet in the solar system has unique characteristics.</td>
<td>A</td>
<td>1 point</td>
</tr>
<tr>
<td>3</td>
<td>Multiple Choice</td>
<td>Physical Science</td>
<td>Light and sound are forms of energy that behave in predictable ways.</td>
<td>C</td>
<td>1 point</td>
</tr>
<tr>
<td>4</td>
<td>Evidence-Based Selected Response</td>
<td>Life Science</td>
<td>All of the processes that take place within organisms require energy.</td>
<td>C; B</td>
<td>1 point</td>
</tr>
<tr>
<td>5</td>
<td>Matching Item</td>
<td>Earth and Space Science</td>
<td>The solar system includes the sun and all celestial bodies that orbit the sun. Each planet in the solar system has unique characteristics.</td>
<td>---</td>
<td>1 point</td>
</tr>
<tr>
<td>6</td>
<td>Multiple Choice</td>
<td>Life Science</td>
<td>Organisms perform a variety of roles in an ecosystem.</td>
<td>B</td>
<td>1 point</td>
</tr>
<tr>
<td>7</td>
<td>Matching Item</td>
<td>Earth and Space Science</td>
<td>The solar system includes the sun and all celestial bodies that orbit the sun. Each planet in the solar system has unique characteristics.</td>
<td>---</td>
<td>1 point</td>
</tr>
<tr>
<td>8</td>
<td>Multiple Choice</td>
<td>Earth and Space Science</td>
<td>The sun is one of many stars that exist in the universe.</td>
<td>C</td>
<td>1 point</td>
</tr>
<tr>
<td>Question No.</td>
<td>Item Type</td>
<td>Content Strand</td>
<td>Content Statement</td>
<td>Answer Key</td>
<td>Points</td>
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<tr>
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<td>-----------------------------------------------------------------------------------</td>
<td>------------</td>
<td>--------</td>
</tr>
<tr>
<td>9</td>
<td>Multiple Choice</td>
<td>Life Science</td>
<td>All of the processes that take place within organisms require energy.</td>
<td>B</td>
<td>1 point</td>
</tr>
<tr>
<td>10</td>
<td>Matching Item</td>
<td>Life Science</td>
<td>Organisms perform a variety of roles in an ecosystem.</td>
<td>---</td>
<td>1 point</td>
</tr>
<tr>
<td>11</td>
<td>Matching Item</td>
<td>Life Science</td>
<td>All of the processes that take place within organisms require energy.</td>
<td>---</td>
<td>1 point</td>
</tr>
<tr>
<td>12</td>
<td>Graphic Response</td>
<td>Life Science</td>
<td>All of the processes that take place within organisms require energy.</td>
<td>---</td>
<td>1 point</td>
</tr>
<tr>
<td>13</td>
<td>Matching Item</td>
<td>Life Science</td>
<td>Organisms perform a variety of roles in an ecosystem.</td>
<td>---</td>
<td>1 point</td>
</tr>
<tr>
<td>14</td>
<td>Multiple Choice</td>
<td>Earth and Space Science</td>
<td>Most of the cycles and patterns of motion between the Earth and sun are predictable.</td>
<td>A</td>
<td>1 point</td>
</tr>
<tr>
<td>15</td>
<td>Multiple Choice</td>
<td>Physical Science</td>
<td>Light and sound are forms of energy that behave in predictable ways.</td>
<td>B</td>
<td>1 point</td>
</tr>
<tr>
<td>16</td>
<td>Graphic Response</td>
<td>Physical Science</td>
<td>Light and sound are forms of energy that behave in predictable ways.</td>
<td>---</td>
<td>1 point</td>
</tr>
<tr>
<td>Question No.</td>
<td>Item Type</td>
<td>Content Strand</td>
<td>Content Statement</td>
<td>Answer Key</td>
<td>Points</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------</td>
<td>--------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>------------</td>
<td>--------</td>
</tr>
<tr>
<td>17</td>
<td>Multi-Select</td>
<td>Earth and Space Science</td>
<td>Most of the cycles and patterns of motion between the Earth and sun are predictable.</td>
<td>C, E</td>
<td>1 point</td>
</tr>
<tr>
<td>18</td>
<td>Graphic Response</td>
<td>Life Science</td>
<td>All of the processes that take place within organisms require energy.</td>
<td>---</td>
<td>2 points</td>
</tr>
<tr>
<td>19</td>
<td>Graphic Response</td>
<td>Physical Science</td>
<td>Light and sound are forms of energy that behave in predictable ways.</td>
<td>---</td>
<td>1 point</td>
</tr>
<tr>
<td>20</td>
<td>Graphic Response</td>
<td>Physical Science</td>
<td>The amount of change in movement of an object is based on the mass* of the object and the amount of force exerted.</td>
<td>---</td>
<td>1 point</td>
</tr>
<tr>
<td>21</td>
<td>Graphic Response</td>
<td>Physical Science</td>
<td>The amount of change in movement of an object is based on the mass* of the object and the amount of force exerted.</td>
<td>---</td>
<td>1 point</td>
</tr>
<tr>
<td>22</td>
<td>Multi-Select</td>
<td>Physical Science</td>
<td>The amount of change in movement of an object is based on the mass* of the object and the amount of force exerted.</td>
<td>A, D</td>
<td>1 point</td>
</tr>
<tr>
<td>23</td>
<td>Extended Response</td>
<td>Life Science</td>
<td>Organisms perform a variety of roles in an ecosystem.</td>
<td>---</td>
<td>4 points</td>
</tr>
</tbody>
</table>
# Grade 5 Science
## Spring 2016 Item Release
### Content Summary and Answer Key

<table>
<thead>
<tr>
<th>Question No.</th>
<th>Item Type</th>
<th>Content Strand</th>
<th>Content Statement</th>
<th>Answer Key</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>Multiple Choice</td>
<td>Earth and Space Science</td>
<td>Most of the cycles and patterns of motion between the Earth and sun are predictable.</td>
<td>D</td>
<td>1 point</td>
</tr>
<tr>
<td>25</td>
<td>Multiple Choice</td>
<td>Physical Science</td>
<td>Light and sound are forms of energy that behave in predictable ways.</td>
<td>C</td>
<td>1 point</td>
</tr>
<tr>
<td>26</td>
<td>Multiple Choice</td>
<td>Physical Science</td>
<td>The amount of change in movement of an object is based on the mass of the object and the amount of force exerted.</td>
<td>C</td>
<td>1 point</td>
</tr>
<tr>
<td>27</td>
<td>Graphic Response</td>
<td>Earth and Space Science</td>
<td>The sun is one of many stars that exist in the universe.</td>
<td>---</td>
<td>1 point</td>
</tr>
<tr>
<td>28</td>
<td>Multi-Select</td>
<td>Earth and Space Science</td>
<td>Most of the cycles and patterns of motion between the Earth and sun are predictable.</td>
<td>A, C, E</td>
<td>1 point</td>
</tr>
<tr>
<td>29</td>
<td>Multiple Choice</td>
<td>Earth and Space Science</td>
<td>The sun is one of many stars that exist in the universe.</td>
<td>D</td>
<td>1 point</td>
</tr>
<tr>
<td>30</td>
<td>Short Answer</td>
<td>Physical Science</td>
<td>Light and sound are forms of energy that behave in predictable ways.</td>
<td>---</td>
<td>1 point</td>
</tr>
</tbody>
</table>
Question 1

Question and Scoring Guidelines
Question 1

In tropical locations, the roofs of homes are often painted white to prevent the temperatures inside the home from getting too hot.

Which statement explains how white roofs keep the temperatures lower inside homes?

A. The white paint reflects the sunlight.
B. Sunlight refracts through the white paint.
C. Sunlight is absorbed and trapped in the white paint.
D. The white paint allows sunlight to travel through the roof.

Points Possible: 1
See Alignment for more detail.

Scoring Guidelines

Rationale for Option A: Key – The majority of the sun's energy is reflected, thereby keeping the home cooler.

Rationale for Option B: This is incorrect. Light is not refracted by solid, opaque, white-colored surfaces, since light does not travel through paint.

Rationale for Option C: This is incorrect. Light is reflected rather than absorbed by white-colored surfaces.

Rationale for Option D: This is incorrect. Light does not travel through solid, opaque surfaces.
Alignment

Content Strand
Physical Science

Content Statement
Light and sound are forms of energy that behave in predictable ways.

Content Elaboration
As light reaches a new material, it can be absorbed, refracted, reflected or it can continue to travel through the new material; one of these interactions may occur or many may occur simultaneously, depending on the material. Light can be absorbed by objects, causing them to warm. How much an object’s temperature increases depends on the material of the object, the intensity of and the angle at which the light is striking its surface, how long the light shines on the object and how much light is absorbed.

Visible light may be emitted from an object (like the sun) or reflected by an object (like a mirror or the moon). The reflected colors are the only colors visible when looking at an object. For example, a red apple looks red because the red light that hits the apple is reflected while the other colors are absorbed.

Cognitive Demand
Recalling Accurate Science (R)

Requires students to provide accurate statements about scientifically valid facts, concepts and relationships. Recall only requires students to provide a rote response, declarative knowledge or perform routine mathematical tasks. This cognitive demand refers to students’ knowledge of science fact, information, concepts, tools, procedures (being able to describe how) and basic principles.

Explanation of the Item
This item requires the student to demonstrate understanding of how light is absorbed or reflected from a surface. Light can be absorbed by objects, causing them to warm. The amount of warming caused by light absorption can be reduced by using a surface that will mostly reflect light. Because sunlight contains all colors of light, a white surface that reflects all colors will help to keep temperatures inside homes lower.
In tropical locations, the roofs of homes are often painted white to prevent the temperatures inside the home from getting too hot.

Which statement explains how white roofs keep the temperatures lower inside homes?

- The white paint reflects the sunlight.
- Sunlight refracts through the white paint.
- Sunlight is absorbed and trapped in the white paint.
- The white paint allows sunlight to travel through the roof.
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Question 2

Question and Scoring Guidelines
Question 2

Which diagram correctly shows the orbits of Earth (E), the moon (M) and the sun (S)?

Points Possible: 1
See Alignment for more detail.

Scoring Guidelines

Rationale for Option A: Key – The moon orbits Earth, and Earth orbits the sun as depicted.

Rationale for Option B: This is incorrect. Earth doesn’t revolve around the moon.

Rationale for Option C: This is incorrect. The Earth is not the center of this system. The sun does not revolve around Earth.

Rationale for Option D: This is incorrect. Earth does not revolve around the moon and the sun does not revolve around the Earth and the moon.
Alignment

Content Strand
Earth and Space Science

Content Statement
The solar system includes the sun and all celestial bodies that orbit the sun. Each planet in the solar system has unique characteristics.

Content Elaboration
The distance from the sun, size, composition and movement of each planet are unique. Planets revolve around the sun in elliptical orbits. Some of the planets have moons and/or debris that orbit them. Earth is a planet that has a moon that orbits it. The planets’ orbits are because of their gravitational attraction to the sun. Moon(s) orbit around planets because of their gravitational attraction to the planets.

Cognitive Demand
Recalling Accurate Science (R)

Requires students to provide accurate statements about scientifically valid facts, concepts and relationships. Recall only requires students to provide a rote response, declarative knowledge or perform routine mathematical tasks. This cognitive demand refers to students’ knowledge of science fact, information, concepts, tools, procedures (being able to describe how) and basic principles.

Explanation of the Item
This item requires the student to select the diagram that correctly shows the orbits of Earth (E), the moon (M) and the sun (S) in relation to one another. The sun is the center of the solar system and the Earth orbits the sun. The moon orbits Earth.
Sample Response: 1 point

Which diagram correctly shows the orbits of Earth (E), the moon (M) and the sun (S)?
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Question 3

Question and Scoring Guidelines
Question 3

A laser is pointed at a surface of water. The initial direction of the light leaving the laser is shown.

At which point will the direction of the light change?

- point W
- point X
- point Y
- point Z

Points Possible: 1
See Alignment for more detail.

Scoring Guidelines

Rationale for Option A: This is incorrect. The light will change direction once it interacts with another medium. At point W, light still travels within the same medium (air) as its origin.

Rationale for Option B: This is incorrect. The light will change direction once it interacts with another medium. At point X, light still travels within the same medium (air) as its origin.

Rationale for Option C: Key – The angle of light will change at the point in which it moves from one medium (air) to another medium (water).

Rationale for Option D: This is incorrect. The direction of light will change at Point Y and will not change again until it interacts with a different medium. At point Z, light still travels within the same medium as point Y.
Alignment

Content Strand
Physical Science

Content Statement
Light and sound are forms of energy that behave in predictable ways.

Content Elaboration
Light can travel through some materials, such as glass or water. When light travels from one location to another, it goes in a straight line until it interacts with another object or material. As light reaches a new material, it can be absorbed, refracted, reflected or it can continue to travel through the new material; one of these interactions may occur or many may occur simultaneously, depending on the material.

When light passes from one material to another, it is often refracted at the boundary between the two materials and travels in a new direction through the new material (medium).

Cognitive Demand
Recalling Accurate Science (R)

Requires students to provide accurate statements about scientifically valid facts, concepts and relationships. Recall only requires students to provide a rote response, declarative knowledge or perform routine mathematical tasks. This cognitive demand refers to students’ knowledge of science fact, information, concepts, tools, procedures (being able to describe how) and basic principles.

Explanation of the Item
This item requires the student to recall that when light passes from one material into another, refraction can occur at the boundary between the two materials. The student must recognize that the boundary between the air and the water is the surface of the water, and therefore the light will change direction at the surface (point Y).
Sample Response: 1 point

A laser is pointed at a surface of water. The initial direction of the light leaving the laser is shown.

At which point will the direction of the light change?

- point W
- point X
- point Y
- point Z
Question 4

The following question has two parts. First, answer Part A. Then, answer Part B.

**Part A**

The table shows the feeding habits of four organisms in an ecosystem.

<table>
<thead>
<tr>
<th>Organism</th>
<th>Feeding Habits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cucumber beetles</td>
<td>Cucumber, pumpkin and other seedlings</td>
</tr>
<tr>
<td>Barn owls</td>
<td>Voles, shrews and other small mammals</td>
</tr>
<tr>
<td>Brown bats</td>
<td>Stinkbugs, cucumber beetles and other insects</td>
</tr>
<tr>
<td>Voles</td>
<td>Plant seeds, grains and grasses</td>
</tr>
</tbody>
</table>

Which statement describes the flow of energy through this ecosystem?

- A. Barn owls get energy from cucumber beetles.
- B. Cucumber beetles provide energy to the voles.
- C. Herbivores provide energy to barn owls and brown bats.
- D. Producers get energy from cucumber beetles and voles.

**Part B**

Which food chain supports your answer in Part A?

- A. Grains → Barn Owls → Voles
- B. Plant Seeds → Voles → Barn Owls
- C. Barn Owls → Brown Bats → Stinkbugs
- D. Brown Bats → Cucumber Beetles → Pumpkin Seedlings

**Points Possible: 1**

See Alignment for more detail.
Scoring Guidelines

Part A
Rationale for Option A: This is incorrect. Neither barn owls nor their prey feed on cucumber beetles.

Rationale for Option B: This is incorrect. Voles are herbivores that eat seeds, grains and grasses.

Rationale for Option C: Key – The herbivores such as the vole and cucumber beetles are eaten by the barn owl and brown bat.

Rationale for Option D: This is incorrect. The producers such as the pumpkin and squash seedlings get energy from the sun.

Part B
Rationale for Option A: This is incorrect. Barn owls get energy from voles.

Rationale for Option B: Key – Energy flows from the plant seeds to the voles to the barn owls.

Rationale for Option C: This is incorrect. Barn owls are not prey for brown bats.

Rationale for Option D: This is incorrect. The energy in the food chain should go in the opposite direction.

Alignment

Content Strand
Life Science

Content Statement
All of the processes that take place within organisms require energy.

Content Elaboration
Energy flows through an ecosystem in one direction, from photosynthetic organisms to consumers (herbivores, omnivores to carnivores) and decomposers. The exchange of energy that occurs in an ecosystem can be represented as a food web. The exchange of energy in an ecosystem is essential because all processes of life for all organisms require a continual supply of energy.
Cognitive Demand
Interpreting and Communicating Science Concepts (C)

Requires students to use subject-specific conceptual knowledge to interpret and explain events, phenomena, concepts and experiences using grade-appropriate scientific terminology, technological knowledge and mathematical knowledge. Communicate with clarity, focus and organization using rich, investigative scenarios, real-world data and valid scientific information.

Explanation of the Item
This item requires the student to interpret data on the feeding habits of organisms in an ecosystem to determine the flow of energy. Herbivores (plant eaters) provide energy to brown bats and barn owls. The food chain that best illustrates this energy flow is plant seeds to voles to barn owls.

Sample Response: 1 point

The following question has two parts. First, answer Part A. Then, answer Part B.

**Part A**

The table shows the feeding habits of four organisms in an ecosystem.

<table>
<thead>
<tr>
<th>Organism</th>
<th>Feeding Habits</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Brown bats</td>
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<tr>
<td>Voles</td>
<td>Plant seeds, grains and grasses</td>
</tr>
</tbody>
</table>

Which statement describes the flow of energy through this ecosystem?

A. Barn owls get energy from cucumber beetles.
B. Cucumber beetles provide energy to the voles.
C. Herbivores provide energy to barn owls and brown bats.
D. Producers get energy from cucumber beetles and voles.

**Part B**

Which food chain supports your answer in Part A?

A. Grains → Barn Owls → Voles
B. Plant Seeds → Voles → Barn Owls
C. Barn Owls → Brown Bats → Stinkbugs
D. Brown Bats → Cucumber Beetles → Pumpkin Seedlings
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Science
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Question 5

Question and Scoring Guidelines
Question 5

Students study two planets: Planet X and Planet Y. The table shows the characteristics of the two unknown planets.

<table>
<thead>
<tr>
<th>Characteristics of Unknown Planets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Composition</strong></td>
</tr>
<tr>
<td>Planet X: Rocky</td>
</tr>
<tr>
<td>Planet Y: Gaseous</td>
</tr>
<tr>
<td><strong>Revolution Period</strong></td>
</tr>
<tr>
<td>Planet X: Shorter</td>
</tr>
<tr>
<td>Planet Y: Longer</td>
</tr>
<tr>
<td><strong>Size</strong></td>
</tr>
<tr>
<td>Planet X: Smaller</td>
</tr>
<tr>
<td>Planet Y: Larger</td>
</tr>
</tbody>
</table>

Select the boxes to classify each of the four planets as having the same characteristics as Planet X or Planet Y.

<table>
<thead>
<tr>
<th>Jupiter</th>
<th>Mercury</th>
<th>Saturn</th>
<th>Venus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Planet X</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Planet Y</td>
<td></td>
</tr>
</tbody>
</table>

Points Possible: 1

See Alignment for more detail.

Scoring Guidelines

For this item, a full-credit response (1 point) includes:

- “Mercury” AND “Venus” selected for “Planet X”;
  AND
- “Jupiter” AND “Saturn” selected for “Planet Y” (1 point).
Alignment

Content Strand
Earth and Space Science

Content Statement
The solar system includes the sun and all celestial bodies that orbit the sun. Each planet in the solar system has unique characteristics.

Content Elaboration
Eight major planets in the solar system orbit the sun. The planets’ orbits are because of their gravitational attraction to the sun. General information regarding planetary positions, orbital patterns, planetary composition and recent discoveries and projects (e.g., missions to Mars) are included in this content.

Cognitive Demand
Recalling Accurate Science (R)

Requires students to provide accurate statements about scientifically valid facts, concepts and relationships. Recall only requires students to provide a rote response, declarative knowledge or perform routine mathematical tasks. This cognitive demand refers to students’ knowledge of science fact, information, concepts, tools, procedures (being able to describe how) and basic principles.

Explanation of the Item
This item requires the student to identify which characteristics of two unknown planets match the characteristics of planets found in our solar system. Jupiter and Saturn match Planet Y’s gaseous composition, longer revolution and larger size. Mercury and Venus match Planet X’s rocky composition, shorter revolution period and smaller size.
Students study two planets: Planet X and Planet Y. The table shows the characteristics of the two unknown planets.

<table>
<thead>
<tr>
<th></th>
<th>Composition</th>
<th>Revolution Period</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planet X</td>
<td>Rocky</td>
<td>Shorter</td>
<td>Smaller</td>
</tr>
<tr>
<td>Planet Y</td>
<td>Gaseous</td>
<td>Longer</td>
<td>Larger</td>
</tr>
</tbody>
</table>

Select the boxes to classify each of the four planets as having the same characteristics as Planet X or Planet Y.

<table>
<thead>
<tr>
<th></th>
<th>Jupiter</th>
<th>Mercury</th>
<th>Saturn</th>
<th>Venus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planet X</td>
<td>[ ]</td>
<td>[✓]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Planet Y</td>
<td>[✓]</td>
<td>[ ]</td>
<td>[✓]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>
Grade 5
Science
Spring 2016 Item Release

Question 6

Question and Scoring Guidelines
Question 6

Hummingbirds feed on the nectar of flowering plants. In this process, they also pollinate the plants.

Which symbiotic relationship does this represent?

A  predation
B  mutualism
C  parasitism
D  commensalism

Points Possible: 1
See Alignment for more detail.

Scoring Guidelines

Rationale for Option A: This is incorrect. Predation is an interaction in which one organism kills another for food.

Rationale for Option B: Key – Mutualism is an interaction in which both species benefit.

Rationale for Option C: This is incorrect. Parasitism is an interaction in which one species benefits and the other is harmed.

Rationale for Option D: This is incorrect. Commensalism is an interaction between two species in which one benefits and the other is neither helped nor harmed.
Alignment

Content Strand
Life Science

Content Statement
Organisms perform a variety of roles in an ecosystem.

Content Elaboration
Organisms have symbiotic relationships in which individuals of one species are dependent upon individuals of another species for survival. Symbiotic relationships can be categorized as mutualism, where both species benefit; commensalism, where one species benefits and the other is unaffected; and parasitism, where one species benefits and the other is harmed.

Cognitive Demand
Recalling Accurate Science (R)

Requires students to provide accurate statements about scientifically valid facts, concepts and relationships. Recall only requires students to provide a rote response, declarative knowledge or perform routine mathematical tasks. This cognitive demand refers to students' knowledge of science fact, information, concepts, tools, procedures (being able to describe how) and basic principles.

Explanation of the Item
This item requires the student to recognize that the symbiotic relationship between hummingbirds and plants is mutualism because both organisms benefit. Hummingbirds get energy from the plants. In the feeding process, the hummingbird pollinates the plant species.
Sample Response: 1 point

Hummingbirds feed on the nectar of flowering plants. In this process, they also pollinate the plants. Which symbiotic relationship does this represent?

A  predation
B  mutualism
C  parasitism
D  commensalism
Grade 5
Science
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Question 7

Question and Scoring Guidelines
Question 7

Planet L is an inner planet and Planet R is an outer planet. Both planets are located in our solar system. Compare the possible characteristics of each planet.

Select the boxes to identify the possible characteristics of each planet.

<table>
<thead>
<tr>
<th>Orbits the sun</th>
<th>Planet L (Inner)</th>
<th>Planet R (Outer)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Closer to the sun</th>
<th>Planet L (Inner)</th>
<th>Planet R (Outer)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Likely to have rings</th>
<th>Planet L (Inner)</th>
<th>Planet R (Outer)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mostly composed of gas</th>
<th>Planet L (Inner)</th>
<th>Planet R (Outer)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mostly composed of rock</th>
<th>Planet L (Inner)</th>
<th>Planet R (Outer)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Likely to have less than 5 moons</th>
<th>Planet L (Inner)</th>
<th>Planet R (Outer)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Likely to have more than 10 moons</th>
<th>Planet L (Inner)</th>
<th>Planet R (Outer)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

Points Possible: 1

See Alignment for more detail.

Scoring Guidelines

For this item, a full-credit response (1 point) includes:

- “Orbits the sun” identified as “Planet L” AND “Planet R”; AND
- “Closer to the sun” identified as “Planet L”; AND
- “Likely to have rings” identified as “Planet R”; AND
- “Mostly composed of gas” identified as “Planet R”; AND
- “Mostly composed of rock” identified as “Planet L”; AND
- “Likely to have less than 5 moons” identified as “Planet L”; AND
- “Likely to have more than 10 moons” identified as “Planet R” (1 point).
Alignment

Content Strand
Earth and Space Science

Content Statement
The solar system includes the sun and all celestial bodies that orbit the sun. Each planet in the solar system has unique characteristics.

Content Elaboration
Eight major planets in the solar system orbit the sun. Some of the planets have a moon or moons that orbit them. Earth is a planet that has a moon that orbits it. The planets' orbits are because of their gravitational attraction to the sun. Moons orbit around planets because of their gravitational attraction to the planets. General information regarding planetary positions, orbital patterns, planetary composition and recent discoveries and projects (e.g., missions to Mars) are included in this content. Tools and technology are an essential part of understanding the workings within the solar system.

Cognitive Demand
Recalling Accurate Science (R)

Requires students to provide accurate statements about scientifically valid facts, concepts and relationships. Recall only requires students to provide a rote response, declarative knowledge or perform routine mathematical tasks. This cognitive demand refers to students’ knowledge of science fact, information, concepts, tools, procedures (being able to describe how) and basic principles.

Explanation of the Item
This item requires the student to select the characteristics that belong to Planet L, an inner planet, and Planet R, an outer planet. Planet L would be a rocky planet that is close to and orbits the sun. Inner planets usually have less than five moons. Planet R is most likely a gaseous planet that orbits the sun, and it may have rings and more than 10 moons.
Sample Response: 1 point

Planet L is an inner planet and Planet R is an outer planet. Both planets are located in our solar system. Compare the possible characteristics of each planet.

Select the boxes to identify the possible characteristics of each planet.

<table>
<thead>
<tr>
<th></th>
<th>Planet L (Inner)</th>
<th>Planet R (Outer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orbits the sun</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Closer to the sun</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Likely to have rings</td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Mostly composed of gas</td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Mostly composed of rock</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Likely to have less than 5 moons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likely to have more than 10 moons</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Grade 5
Science
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Question 8

Question and Scoring Guidelines
Question 8

Stars close to Earth include the sun, Alpha Centauri, and Barnard’s star. How is the sun different from Alpha Centauri and Barnard’s star?

A. The sun orbits Earth.
B. The sun gives off light.
C. The sun is in our solar system.
D. The sun is made up of gases.

Points Possible: 1
See Alignment for more detail.

Scoring Guidelines

Rationale for Option A: This is incorrect. Earth orbits the sun. The sun does not orbit Earth.

Rationale for Option B: This is incorrect. All stars emit light.

Rationale for Option C: Key – There are many stars in the universe, but the sun is the only star in our solar system.

Rationale for Option D: This is incorrect. Stars are made up of hot, glowing gases.
**Alignment**

**Content Strand**
Earth and Space Science

**Content Statement**
The sun is one of many stars that exist in the universe.

**Content Elaboration**
The sun is the closest star to Earth. Scaled models (3-D or virtual) and graphics can be used to show the vast difference in size between the sun and Earth. The sun is a medium-sized star and is the only star in our solar system. There are many other stars of different sizes in the universe. Stars appear in patterns called constellations, which can be used for navigation. Because they are so far away, they do not appear as large as the sun.

**Cognitive Demand**
Recalling Accurate Science (R)

Requires students to provide accurate statements about scientifically valid facts, concepts and relationships. Recall only requires students to provide a rote response, declarative knowledge or perform routine mathematical tasks. This cognitive demand refers to students’ knowledge of science fact, information, concepts, tools, procedures (being able to describe how) and basic principles.

**Explanation of the Item**
This item requires the student to recall that the sun is the only star in our solar system but that there are other stars in the universe that we can see. Students should understand general characteristics of stars and the size and distance of the sun in relation to Earth.
Sample Response: 1 point

Stars close to Earth include the sun, Alpha Centauri, and Barnard’s star.

How is the sun different from Alpha Centauri and Barnard’s star?

A. The sun orbits Earth.
B. The sun gives off light.
C. The sun is in our solar system.
D. The sun is made up of gases.
Question and Scoring Guidelines
Question 9

Grasshoppers, cactus plants, lizards, and rattlesnakes are organisms found in a desert ecosystem. Which activity in a desert ecosystem increases the amount of energy available to living things?

A. Rattlesnakes search for small rodents and mammals for food.
B. Cactus plants change sunlight into food and grow larger.
C. Lizards feed on the ants that crawl out of ant holes.
D. Grasshoppers sit in the sunlight and chirp.

Points Possible: 1
See Alignment for more detail.

Scoring Guidelines

Rationale for Option A: This is incorrect. While many species eat other organisms for energy, hunting small rodents does not increase the energy available to other living things.

Rationale for Option B: Key – Producers, such as cactus plants, change the energy in sunlight into forms that other organisms can use through photosynthesis. Cactus plants grow using the energy they get from the sun. Some of this energy is stored in their fruit, which animals eat.

Rationale for Option C: This is incorrect. While many species eat other organisms for energy, feeding on ants does not increase the energy available to other living things.

Rationale for Option D: This is incorrect. Chirping grasshoppers produce sound energy, which is no longer available to other living things.
Alignment

Content Strand
Life Science

Content Statement
All of the processes that take place within organisms require energy.

Content Elaboration
Energy flows through an ecosystem in one direction, from photosynthetic organisms to consumers (herbivores, omnivores to carnivores) and decomposers. The exchange of energy that occurs in an ecosystem can be represented as a food web. The exchange of energy in an ecosystem is essential because all processes of life for all organisms require a continual supply of energy.

Cognitive Demand
Interpreting and Communicating Science Concepts (C)

Requires students to use subject-specific conceptual knowledge to interpret and explain events, phenomena, concepts and experiences using grade-appropriate scientific terminology, technological knowledge and mathematical knowledge. Communicate with clarity, focus and organization using rich, investigative scenarios, real-world data and valid scientific information.

Explanation of the Item
This item requires the student to interpret a food web to determine which activity from a list would increase the amount of energy available to living things. Photosynthesis occurs in producers, and they are the foundation of all food webs. Any activity that increases the amount of photosynthesis will increase the amount of available energy. If cactus plants grow larger and produce fruit as they mature, animals will be able to consume that energy. All consumers reduce the amount of available energy for use in the ecosystem.
Grasshoppers, cactus plants, lizards, and rattlesnakes are organisms found in a desert ecosystem. Which activity in a desert ecosystem increases the amount of energy available to living things?

A. Rattlesnakes search for small rodents and mammals for food.
B. Cactus plants change sunlight into food and grow larger.
C. Lizards feed on the ants that crawl out of ant holes.
D. Grasshoppers sit in the sunlight and chirp.
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Question 10

Question and Scoring Guidelines
Question 10

A table containing diet and population information about organisms within a river ecosystem is shown.

<table>
<thead>
<tr>
<th>Population Size</th>
<th>Organism</th>
<th>Diet</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>Fish</td>
<td>Insects, plants</td>
</tr>
<tr>
<td>250</td>
<td>Frog</td>
<td>Insects</td>
</tr>
<tr>
<td>5</td>
<td>Heron</td>
<td>Fish, frogs</td>
</tr>
<tr>
<td>5,000</td>
<td>Insect</td>
<td>Plants</td>
</tr>
<tr>
<td>5</td>
<td>Otter</td>
<td>Fish, frogs</td>
</tr>
</tbody>
</table>

Select the boxes to describe how the populations of the organisms would change if the otter moves out of the ecosystem.

<table>
<thead>
<tr>
<th></th>
<th>Decrease</th>
<th>Increase</th>
<th>Stays the Same</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Frog</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Heron</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Points Possible: 1
See Alignment for more detail.

Scoring Guidelines

For this item a full credit response (1 point) includes:

- “Increase” selected for “Fish”;
  
AND

- “Increase” selected for “Frog”;
  
AND

- “Increase” OR “Stays the Same” selected for “Heron” (1 point).
Alignment

Content Strand
Life Science

Content Statement
Organisms perform a variety of roles in an ecosystem.

Content Elaboration
The content statements for fifth-grade life science are each partial components of a larger concept. It is important that the ecological role of organisms is interwoven with a clear understanding that all living things require energy. Food chains and webs are schematic representations of real-world interactions. Investigations of locally threatened or endangered species must be conducted and include considerations of the effects of remediation programs, species loss and the introduction of new species on the local environment.

Cognitive Demand
Interpreting and Communicating Science Concepts (C)

Requires students to use subject-specific conceptual knowledge to interpret and explain events, phenomena, concepts and experiences using grade-appropriate scientific terminology, technological knowledge and mathematical knowledge. Communicate with clarity, focus and organization using rich, investigative scenarios, real-world data and valid scientific information.

Explanation of the Item
This item requires the student to interpret the relationship of organisms in a river ecosystem based on their diet and population size. If the otter population moves out of the ecosystem, the student is asked to predict the impact on fish, frogs and herons. Otters eat fish and frogs, so with the otters removed from the ecosystem, the populations of fish and frogs should increase. The heron also eats frogs and fish, so the heron’s numbers could increase or remain the same.
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Science
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Question 10

Sample Responses
Sample Response: 1 point

A table containing diet and population information about organisms within a river ecosystem is shown.

<table>
<thead>
<tr>
<th>Population Size</th>
<th>Organism</th>
<th>Diet</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>Fish</td>
<td>Insects, plants</td>
</tr>
<tr>
<td>250</td>
<td>Frog</td>
<td>Insects</td>
</tr>
<tr>
<td>5</td>
<td>Heron</td>
<td>Fish, frogs</td>
</tr>
<tr>
<td>5,000</td>
<td>Insect</td>
<td>Plants</td>
</tr>
<tr>
<td>5</td>
<td>Otter</td>
<td>Fish, frogs</td>
</tr>
</tbody>
</table>

Select the boxes to describe how the populations of the organisms would change if the otter moves out of the ecosystem.

<table>
<thead>
<tr>
<th></th>
<th>Decrease</th>
<th>Increase</th>
<th>Stays the Same</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Frog</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heron</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes on Scoring

This response earns full credit (1 point) for correctly noting that with the removal of the otters, all three populations could increase. The fish and frogs have fewer predators and the herons have an increased energy source, which could increase their numbers.
Sample Response: 1 point

A table containing diet and population information about organisms within a river ecosystem is shown.

<table>
<thead>
<tr>
<th>Population Size</th>
<th>Organism</th>
<th>Diet</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>Fish</td>
<td>Insects, plants</td>
</tr>
<tr>
<td>250</td>
<td>Frog</td>
<td>Insects</td>
</tr>
<tr>
<td>5</td>
<td>Heron</td>
<td>Fish, frogs</td>
</tr>
<tr>
<td>5,000</td>
<td>Insect</td>
<td>Plants</td>
</tr>
<tr>
<td>5</td>
<td>Otter</td>
<td>Fish, frogs</td>
</tr>
</tbody>
</table>

Select the boxes to describe how the populations of the organisms would change if the otter moves out of the ecosystem.

<table>
<thead>
<tr>
<th></th>
<th>Decrease</th>
<th>Increase</th>
<th>Stays the Same</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Frog</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Heron</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

Notes on Scoring

This response earns full credit (1 point) for correctly noting that with the removal of the otters, the fish and frog populations could increase. The heron population also eats fish and frogs, so their population could remain the same or increase. Either choice earns credit.
Sample Response: 0 points

A table containing diet and population information about organisms within a river ecosystem is shown.

<table>
<thead>
<tr>
<th>River Ecosystem</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Population Size</strong></td>
</tr>
<tr>
<td>250</td>
</tr>
<tr>
<td>250</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>5,000</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>

Select the boxes to describe how the populations of the organisms would change if the otter moves out of the ecosystem.

<table>
<thead>
<tr>
<th></th>
<th>Decrease</th>
<th>Increase</th>
<th>Stays the Same</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish</td>
<td></td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>Frog</td>
<td></td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>Heron</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes on Scoring

This response earns no credit (0 points). It correctly notes that with the removal of the otters, the fish and frog populations could increase; however, it incorrectly indicates that the heron population decreases. The herons also eat fish and frogs, so their population could remain the same or increase, not decrease.
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Question 11

Question and Scoring Guidelines
Question 11

A disease that only harms the health of arctic cod fish in an ecosystem causes a decline in the arctic cod population. A partial arctic food web is shown.

Select the boxes to identify how the amount of energy transferred to each organism changes immediately after this severe decline in the arctic cod population.

<table>
<thead>
<tr>
<th></th>
<th>Increases</th>
<th>Decreases</th>
<th>No Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jellyfish</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harp Seal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harbor Seal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phytoplankton</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humpback Whale</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Points Possible: 1
See Alignment for more detail.

Scoring Guidelines

For this item, a full-credit response (1 point) includes:

- Only “Increases” selected for “Jellyfish”;
  AND
- Only “Decreases” selected for “Harp Seal”;
  AND
- Only “Decreases” selected for “Harbor Seal”;
  AND
- Only “Decreases” OR “No Change” selected for “Phytoplankton”;
  AND
- Only “Increases” OR “No Change” selected for “Humpback Whale” (1 point).
Alignment

Content Strand
Life Science

Content Statement
All of the processes that take place within organisms require energy.

Content Elaboration
The content statements for fifth-grade life science are each partial components of a larger concept. It is important that the ecological role of organisms is interwoven with a clear understanding that all living things require energy. Food chains and webs are schematic representations of real-world interactions. Investigations of locally threatened or endangered species must be conducted and include considerations of the effects of remediation programs, species loss and the introduction of new species on the local environment.

Cognitive Demand
Interpreting and Communicating Science Concepts (C)

Requires students to use subject-specific conceptual knowledge to interpret and explain events, phenomena, concepts and experiences using grade-appropriate scientific terminology, technological knowledge and mathematical knowledge. Communicate with clarity, focus and organization using rich, investigative scenarios, real-world data and valid scientific information.

Explanation of the Item
This item requires the student to interpret the immediate impact on the energy flow of organisms in a food web when the Arctic cod population declines due to a disease. The Arctic cod serves as the energy source for the harbor and harp seal populations. If the Arctic cod declines, the energy flow for both seal populations will also decline. The Arctic cod consumes jellyfish for energy. With the decline in the Arctic cod, the jellyfish population will have an increase in energy, which may cause an increase in energy flow for the humpback whale population or it could remain the same. Either answer receives credit. With the increase in jellyfish, there may be a decrease in the phytoplankton population, which would decrease the amount of energy flow in the ecosystem. The phytoplankton population would experience no change of energy.
Sample Response: 1 point

A disease that only harms the health of Arctic cod fish in an ecosystem causes a decline in the Arctic cod population. A partial Arctic food web is shown.

Select the boxes to identify how the amount of energy transferred to each organism changes immediately after this severe decline in the Arctic cod population:

<table>
<thead>
<tr>
<th></th>
<th>Increases</th>
<th>Decreases</th>
<th>No Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jellyfish</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harp Seal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harbor Seal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phytoplankton</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humpback Whale</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes on Scoring

This response earns full credit (1 point) for correctly selecting how the energy transfer to each organism will change immediately after the decline in the Arctic cod.
Sample Response: 0 points

A disease that only harms the health of arctic cod fish in an ecosystem causes a decline in the arctic cod population. A partial arctic food web is shown.

Select the boxes to identify how the amount of energy transferred to each organism changes immediately after this severe decline in the arctic cod population.

<table>
<thead>
<tr>
<th></th>
<th>Increases</th>
<th>Decreases</th>
<th>No Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jellyfish</td>
<td>✔</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harp Seal</td>
<td></td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Harbor Seal</td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Phytoplankton</td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Humpback Whale</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes on Scoring

This response earns no credit (0 points) for incorrectly selecting how the energy transfer to each organism will change immediately after the decline in the Arctic cod. The response correctly identifies that the jellyfish would increase and that both the harbor and harp seals would decrease due to the reduction in the Arctic cod population; however, it incorrectly selects that the humpback whale would decrease.
Grade 5
Science
Spring 2016 Item Release

Question 12

Question and Scoring Guidelines
Question 12

A student observes and identifies the feeding habits of some of the animals in a wetland ecosystem. The student identifies sandhill cranes as omnivores, mice as herbivores and snakes as carnivores.

Move each organism into a blank box to model the flow of energy in a wetland ecosystem food web.

- Move only one organism into each blank box.
- There may be more than one correct answer.

Points Possible: 1
See Alignment for more detail.

Scoring Guidelines

For this item, a full-credit response (1 point) includes:

- The “Berries” in the bottom-right OR bottom-left box;  
AND
- The “Grains” in the bottom-right OR bottom-left box;  
AND
- The “Mouse” in the left box (one up from the bottom);  
AND
- The “Snake” in the left box (two up from the bottom);  
AND
- The “Sandhill crane” in the right-top box (1 point).
Alignment

Content Strand
Life Science

Content Statement
All of the processes that take place within organisms require energy.

Content Elaboration
Energy flows through an ecosystem in one direction, from photosynthetic organisms to consumers (herbivores, omnivores to carnivores) and decomposers. The exchange of energy that occurs in an ecosystem can be represented as a food web. The exchange of energy in an ecosystem is essential because all processes of life for all organisms require a continual supply of energy.

Cognitive Demand
Interpreting and Communicating Science Concepts (C)

Requires students to use subject-specific conceptual knowledge to interpret and explain events, phenomena, concepts and experiences using grade-appropriate scientific terminology, technological knowledge and mathematical knowledge. Communicate with clarity, focus and organization using rich, investigative scenarios, real-world data and valid scientific information.

Explanation of the Item
This item requires the student to complete a wetland food web based on the energy flow relationship between five organisms. The foundation of the food web are producers, so grains and berries should be placed on the bottom, in any order. The mouse will eat the producers. The snake will eat the mouse, and the Sandhill crane will eat everything.
Grade 5 Science
Spring 2016 Item Release

Question 12

Sample Responses
Sample Response: 1 point

A student observes and identifies the feeding habits of some of the animals in a wetland ecosystem. The student identifies sandhill cranes as omnivores, mice as herbivores and snakes as carnivores.

Move each organism into a blank box to model the flow of energy in a wetland ecosystem food web.

- Move only one organism into each blank box.
- There may be more than one correct answer.

Notes on Scoring

This response earns full credit (1 point) for correctly showing the energy relationships among the five given organisms.
Sample Response: 1 point

A student observes and identifies the feeding habits of some of the animals in a wetland ecosystem. The student identifies sandhill cranes as omnivores, mice as herbivores and snakes as carnivores.

Move each organism into a blank box to model the flow of energy in a wetland ecosystem food web.

- Move only one organism into each blank box.
- There may be more than one correct answer.

Notes on Scoring

This response earns full credit (1 point) for correctly showing the energy relationships among the five given organisms.
Sample Response: 0 points

A student observes and identifies the feeding habits of some of the animals in a wetland ecosystem. The student identifies sandhill cranes as omnivores, mice as herbivores and snakes as carnivores.

Move each organism into a blank box to model the flow of energy in a wetland ecosystem food web.

- Move only one organism into each blank box.
- There may be more than one correct answer.

Notes on Scoring

This response earns no credit (0 points) for incorrectly showing the energy relationships among the five given organisms. The Sandhill crane should be the top of the food web shown. The snake does not receive energy from every organism represented in the web. It does receive energy from the mouse, but not from the other organisms.
Question 13

Scoring Guidelines

For this item, a full-credit response (1 point) includes:

- “Carnivore” selected for “Snake” AND “Sparrow”;
- “Herbivore” selected for “Caterpillar”;
- “Omnivore” selected for “Mouse” (1 point).
Alignment

Content Strand
Life Science

Content Statement
Organisms perform a variety of roles in an ecosystem.

Content Elaboration
Energy flows through an ecosystem in one direction, from photosynthetic organisms to consumers (herbivores, omnivores to carnivores) and decomposers. The exchange of energy that occurs in an ecosystem can be represented as a food web. The exchange of energy in an ecosystem is essential because all processes of life for all organisms require a continual supply of energy.

Cognitive Demand
Interpreting and Communicating Science Concepts (C)

Requires students to use subject-specific conceptual knowledge to interpret and explain events, phenomena, concepts and experiences using grade-appropriate scientific terminology, technological knowledge and mathematical knowledge. Communicate with clarity, focus and organization using rich, investigative scenarios, real-world data and valid scientific information.

Explanation of the Item
This item requires the student to interpret the relationships in a partial food web to determine each organisms' role in the ecosystem. The arrows in the web demonstrate the direction of the flow of energy. The tip of the arrow indicates the organism that receives energy. The mouse receives energy from grass and crickets. The mouse provides energy to the snake and fungi. Omnivores eat everything—plants and animals. The mouse fits into this category. The carnivores to be selected in the table are the sparrow and snake. The caterpillar is classified as an herbivore.
Sample Response: 1 point

A partial field food web is shown.

Select the boxes to identify each organism’s role in the ecosystem.

<table>
<thead>
<tr>
<th></th>
<th>Carnivore</th>
<th>Herbivore</th>
<th>Omnivore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caterpillar</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
</tr>
<tr>
<td>Mouse</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>Snake</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Sparrow</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
Grade 5
Science
Spring 2016 Item Release

Question 14

Question and Scoring Guidelines
Question 14

Which movement causes Earth to have day and night?

- (A) Earth’s rotation on its axis
- (B) Earth’s orbit around the sun
- (C) the sun’s rotation on its axis
- (D) the sun’s orbit around Earth

Points Possible: 1
See Alignment for more detail.

Scoring Guidelines

**Rationale for Option A: Key** – Earth’s rotation on its axis into and out of sunlight results in the cycle of day and night.

**Rationale for Option B:** This is incorrect. Earth’s orbit about the sun is responsible for the length of an Earth year.

**Rationale for Option C:** This is incorrect. The rotation of the sun on its axis does not affect whether Earth will experience night or day.

**Rationale for Option D:** This is incorrect. The sun does not orbit around Earth.
**Alignment**

**Content Strand**
Earth and Space Science

**Content Statement**
Most of the cycles and patterns of motion between the Earth and sun are predictable.

**Content Elaboration**
Earth’s revolution around the sun takes approximately 365 days. Earth completes one rotation on its axis in a 24-hour period, producing day and night. This rotation makes the sun, stars and moon appear to change position in the sky. Models, interactive websites and investigations are required to illustrate the predictable patterns and cycles that lead to the understanding of day and night, seasons, years and the amount of direct sunlight Earth receives.

**Cognitive Demand**
Recalling Accurate Science (R)

Requires students to provide accurate statements about scientifically valid facts, concepts and relationships. Recall only requires students to provide a rote response, declarative knowledge or perform routine mathematical tasks. This cognitive demand refers to students’ knowledge of science fact, information, concepts, tools, procedures (being able to describe how) and basic principles.

**Explanation of the Item**
This item requires the student to correctly recall that day and night are caused by the rotation of Earth on its axis.

**Sample Response: 1 point**
Grade 5
Science
Spring 2016 Item Release

Question 15

Question and Scoring Guidelines
Question 15

Several students are trying to determine which material would be best to use to cover the outside of the classroom windows so the sun does not heat up the room. They shine a beam of light at different materials and they record the path of the light for each material.

Which diagram shows the material they should use on the classroom windows?

![Diagram of materials](image)

**Points Possible:** 1

See Alignment for more detail.

**Scoring Guidelines**

**Rationale for Option A:** This is incorrect. This material lets light pass directly through it. It would not make a good covering for the windows.

**Rationale for Option B:** Key – Light is reflected by this material. It would be useful for the windows.

**Rationale for Option C:** This is incorrect. This material bends, or refracts, light. It does not stop it from passing through the window.

**Rationale for Option D:** This is incorrect. This material spreads light apart, like a prism might. It does not reflect it away from the inside of the building.
Alignment

Content Strand
Physical Science

Content Statement
Light and sound are forms of energy that behave in predictable ways.

Content Elaboration
When light travels from one location to another, it goes in a straight line until it interacts with another object or material. As light reaches a new material, it can be absorbed, refracted, reflected or it can continue to travel through the new material; one of these interactions may occur or many may occur simultaneously, depending on the material.

Cognitive Demand
Designing Technological/Engineering Solutions Using Science Concepts (T)

Requires students to solve science-based engineering or technological problems through application of scientific inquiry. Within given scientific constraints, propose or critique solutions, analyze and interpret technological and engineering problems, use science principles to anticipate effects of technological or engineering design, find solutions using science and engineering or technology, consider consequences and alternatives, and/or integrate and synthesize scientific information.

Explanation of the Item
This item requires the student to demonstrate understanding of how light is absorbed or reflected from a surface. Light can be absorbed by objects, causing them to warm. The amount of warming caused by light absorption can be reduced by using a material that will mostly reflect light. In this item, only one material (option B) reflects the light. All of the other materials allow the light to pass through into the room, which would cause the interior of the room to warm. Therefore, the reflective material in option B will be most effective in keeping the room cooler.
Several students are trying to determine which material would be best to use to cover the outside of the classroom windows so the sun does not heat up the room. They shine a beam of light at different materials and they record the path of the light for each material.

Which diagram shows the material they should use on the classroom windows?
Grade 5
Science
Spring 2016 Item Release

Question 16

Question and Scoring Guidelines
Question 16

A student wants to set up a demonstration to show how white light can be refracted.

Move a tool into the blank box to correctly set up a white light refraction demonstration.

- Move only one tool into the blank box.
- You do not need to use all of the tools.

Points Possible: 1

See Alignment for more detail.

Scoring Guidelines

For this item, a full-credit response (1 point) includes:

- Only the “Prism” in the middle box (1 point).
Content Strand
Physical Science

Content Statement
Light and sound are forms of energy that behave in predictable ways.

Content Elaboration
Light can travel through some materials, such as glass or water. When light travels from one location to another, it goes in a straight line until it interacts with another object or material. As light reaches a new material, it can be absorbed, refracted, reflected or it can continue to travel through the new material; one of these interactions may occur or many may occur simultaneously, depending on the material.

When light passes from one material to another, it is often refracted at the boundary between the two materials and travels in a new direction through the new material (medium). For example, a magnifying lens bends light and focuses it toward a single point. A prism bends white light and separates the different colors of light. Experiment with prisms and magnifying lenses are used to observe the refraction of light.

Cognitive Demand
Recalling Accurate Science (R)

Requires students to provide accurate statements about scientifically valid facts, concepts and relationships. Recall only requires students to provide a rote response, declarative knowledge or perform routine mathematical tasks. This cognitive demand refers to students' knowledge of science fact, information, concepts, tools, procedures (being able to describe how) and basic principles.

Explanation of the Item
This item requires the student to recall that a prism bends light by refraction. When light strikes the surface of the prism, it continues to move through the prism, but it travels in a different direction. Light striking a mirror will also change direction, but it does so by reflection, not refraction. If the width of the small slit in the paper is small enough, light may bend around the edges of the slit, but it does this by diffraction, not refraction. The large slit is too wide to effectively bend light around the edges.
Grade 5
Science
Spring 2016 Item Release

Question 16

Sample Responses
Sample Response: 1 point

A student wants to set up a demonstration to show how white light can be refracted.

Move a tool into the blank box to correctly set up a white light refraction demonstration.

- Move only one tool into the blank box.
- You do not need to use all of the tools.

Notes on Scoring

This response earns full credit (1 point) because it correctly identifies that the prism bends light by refraction.
Sample Response: 0 points

A student wants to set up a demonstration to show how white light can be refracted.

Move a tool into the blank box to correctly set up a white light refraction demonstration.

- Move only one tool into the blank box.
- You do not need to use all of the tools.

Notes on Scoring

This response earns no credit (0 points) because it does not correctly identify the tool that will bend light by refraction. If the slit is narrow enough, the slit may bend light around the edges of the slit, but it does this by diffraction, not refraction.
Grade 5
Science
Spring 2016 Item Release

Question 17

Question and Scoring Guidelines
Question 17

The seasons change on Earth because of predictable patterns. Select the two statements that explain why the seasons change on Earth.

- The distance from Earth to the sun changes.
- The distance from Earth to the moon changes.
- Different places on Earth get different amounts of direct sunlight.
- The amount of heat given off by the sun changes with the seasons.
- Earth’s tilt causes the sun to be higher or lower in the sky as the seasons change.

Points Possible: 1

See Alignment for more detail.

Scoring Guidelines

Rationale for First Option: This is incorrect. The distance between the sun and Earth does change slightly as Earth revolves around the sun, but this does not cause the change of seasons.

Rationale for Second Option: This is incorrect. The position of Earth’s moon relative to the sun changes in a predictable manner, but this does not produce changes in seasons.

Rationale for Third Option: Key – The amount of direct sunlight determines the seasons.

Rationale for Fourth Option: This is incorrect. The amount of heat generated by the sun is relatively constant and does not affect the changing seasons.

Rationale for Fifth Option: Key – The tilt of Earth in relation to the sun determines the seasons. The hemisphere tilted toward the sun experiences summer.
Alignment

Content Strand
Earth and Space Science

Content Statement
Most of the cycles and patterns of motion between the Earth and sun are predictable.

Content Elaboration
Models, interactive websites and investigations are required to illustrate the predictable patterns and cycles that lead to the understanding of the day and night, seasons, years and the amount of direct sunlight Earth receives. Three-dimensional models should be used to demonstrate that the tilt of Earth’s axis is related to the amount of direct sunlight received and seasonal temperature changes.

Cognitive Demand
Recalling Accurate Science (R)

Requires students to provide accurate statements about scientifically valid facts, concepts and relationships. Recall only requires students to provide a rote response, declarative knowledge or perform routine mathematical tasks. This cognitive demand refers to students’ knowledge of science fact, information, concepts, tools, procedures (being able to describe how) and basic principles.

Explanation of the Item
This item requires the student to identify two explanations for why the seasons change on Earth. Earth’s revolution around the sun takes approximately 365 days. Earth’s axis is tilted at an angle of 23.5°. This tilt, along with the Earth’s revolution around the sun, affects the amount of direct sunlight that the Earth receives in a single day and throughout the year. The average daily temperature is related to the amount of direct sunlight received. Changes in average temperature throughout the year are identified as seasons.
Sample Response: 1 point

The seasons change on Earth because of predictable patterns.

Select the two statements that explain why the seasons change on Earth.

☐ The distance from Earth to the sun changes.

☐ The distance from Earth to the moon changes.

☑ Different places on Earth get different amounts of direct sunlight.

☐ The amount of heat given off by the sun changes with the seasons.

☑ Earth’s tilt causes the sun to be higher or lower in the sky as the seasons change.
Grade 5
Science
Spring 2016 Item Release

Question 18

Question and Scoring Guidelines
American beech trees in Ohio provide food and shelter to many small mammals. Squirrels and opossums use the hollow trunks for dens. Chipmunks and foxes eat the seeds. People also use the trees. Wood from the beech tree is used to make furniture and paper.

A. Click on an area in Ohio to show where you would expect to find the greatest number of small mammals feeding on American beech tree seeds.

B. Move the direction label into the blank box to show how an opossum population living in that area would change if the trees were cut down.

- Move only one direction label into the blank box.
- There may be more than one correct answer.

Points Possible: 2
See Alignment for more detail.

Scoring Guidelines
For this item, a full-credit (2 point) response includes:
- Highlighting one of the dark green or dark brown areas in Ohio;
  AND
- Placing the “Decreases” arrow in the “Opossums” box (2 points).

For this item, a partial-credit (1 point) response includes:
- Highlighting one of the dark green or dark brown areas in Ohio (1 point):
  OR
- Placing the “Decreases” arrow in the “Opossums” box (1 point).
Alignment

Content Strand
Life Science

Content Statement
All of the processes that take place within organisms require energy.

Content Elaboration
The content statements for fifth-grade life science are each partial components of a larger concept. The parts have been isolated to call attention to the depth of knowledge required to build to one of biology’s foundational theories: dynamic relationships within ecosystems. It is recommended that the content statements be combined and taught as a whole. For example, it is important that the ecological role of organisms is interwoven with a clear understanding that all living things require energy. The exchange of energy in an ecosystem is essential because all processes of life for all organisms require a continual supply of energy.

Cognitive Demand
Interpreting and Communicating Science Concepts (C)

Requires students to use subject-specific conceptual knowledge to interpret and explain events, phenomena, concepts and experiences using grade-appropriate scientific terminology, technological knowledge and mathematical knowledge. Communicate with clarity, focus and organization using rich, investigative scenarios, real-world data and valid scientific information.

Explanation of the Item
This item requires the student to interpret data for beech trees in order to select which identified section of Ohio one would expect to find the greatest number of small animals feeding on American beech tree seeds. Students also need to be able to predict how the opossum population would change if the trees were cut down in that selected area.
Grade 5
Science
Spring 2016 Item Release

Question 18

Sample Responses
American beech trees in Ohio provide food and shelter to many small mammals. Squirrels and opossums use the hollow trunks for dens. Chipmunks and foxes eat the seeds.

People also use the trees. Wood from the beech tree is used to make furniture and paper.

A. Click on an area in Ohio to show where you would expect to find the greatest number of small mammals feeding on American beech tree seeds.

B. Move the direction label into the blank box to show how an opossum population living in that area would change if the trees were cut down.

• Move only one direction label into the blank box.
• There may be more than one correct answer.

### Notes on Scoring

This response earns full credit (2 points) for correctly identifying an area on the Ohio map that represents a high number of beech trees, which would produce the seeds that support small mammals. If beech trees were removed from the selected area, the student correctly showed that the opossum population would decrease because their habitat would be destroyed.
Sample Response: 2 points

American beech trees in Ohio provide food and shelter to many small mammals. Squirrels and opossums use the hollow trunks for dens. Chipmunks and foxes eat the seeds.

People also use the trees. Wood from the beech tree is used to make furniture and paper.

A. Click on an area in Ohio to show where you would expect to find the greatest number of small mammals feeding on American beech tree seeds.

B. Move the direction label into the blank box to show how an opossum population living in that area would change if the trees were cut down.

• Move only one direction label into the blank box.
• There may be more than one correct answer.

<table>
<thead>
<tr>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Few Beech Trees</td>
</tr>
<tr>
<td>Some Beech Trees</td>
</tr>
<tr>
<td>Many Beech Trees</td>
</tr>
<tr>
<td>Nonforest/Not Measured</td>
</tr>
</tbody>
</table>

Notes on Scoring

This response earns full credit (2 points) because it correctly identifies an area on the Ohio map that represents a high number of beech trees, which would produce the seeds that support small mammals. If beech trees were removed from the selected area, the student correctly showed that the opossum population would decrease because their habitat would be destroyed.
Sample Response: 1 point

American beech trees in Ohio provide food and shelter to many small mammals. Squirrels and opossums use the hollow trunks for dens. Chipmunks and foxes eat the seeds.

People also use the trees. Wood from the beech tree is used to make furniture and paper.

A. Click on an area in Ohio to show where you would expect to find the greatest number of small mammals feeding on American beech tree seeds.

B. Move the direction label into the blank box to show how an opossum population living in that area would change if the trees were cut down.

• Move only one direction label into the blank box.
• There may be more than one correct answer.

Notes on Scoring

This response earns partial credit (1 point) because it correctly predicts what would happen to the opossum population if the trees were removed from the selected area. Opossums use the trees for dens, and the removal of trees would decrease their population. This response does not earn the second point because it incorrectly identifies an area on Ohio’s map that one would expect to find the greatest number of small mammals feeding on beech tree seeds; the selected area is incorrect because it is denoted as a non-forested or unmeasured area.
Sample Response: 1 point

American beech trees in Ohio provide food and shelter to many small mammals. Squirrels and opossums use the hollow trunks for dens. Chipmunks and foxes eat the seeds.

People also use the trees. Wood from the beech tree is used to make furniture and paper.

A. Click on an area in Ohio to show where you would expect to find the greatest number of small mammals feeding on American beech tree seeds.

B. Move the direction label into the blank box to show how an opossum population living in that area would change if the trees were cut down.

• Move only one direction label into the blank box.
• There may be more than one correct answer.

Notes on Scoring

This response earns partial credit (1 point) for correctly identifying an area on the Ohio map that represents a high number of beech trees, which would produce the seeds that support small mammals. The response does not earn the second point because the student selected that the opossum population would increase if trees were removed. If trees were removed from the selected area, the opossum population would decrease, not increase, because their habitat would be destroyed.
Sample Response: 1 point

American beech trees in Ohio provide food and shelter to many small mammals. Squirrels and opossums use the hollow trunks for dens. Chipmunks and foxes eat the seeds.

People also use the trees. Wood from the beech tree is used to make furniture and paper.

A. Click on an area in Ohio to show where you would expect to find the greatest number of small mammals feeding on American beech tree seeds.

B. Move the direction label into the blank box to show how an opossum population living in that area would change if the trees were cut down.

- Move only one direction label into the blank box.
- There may be more than one correct answer.

Notes on Scoring

This response earns partial credit (1 point) for correctly identifying an area on the Ohio map that represents a high number of beech trees, which would produce the seeds that support small mammals. The response does not earn the second point because the student selected that the opossum population would increase if trees were removed. If trees were removed from the selected area, the opossum population would decrease, not increase, because their habitat would be destroyed.
Sample Response: 0 points

American beech trees in Ohio provide food and shelter to many small mammals. Squirrels and opossums use the hollow trunks for dens. Chipmunks and foxes eat the seeds.

People also use the trees. Wood from the beech tree is used to make furniture and paper.

A. Click on an area in Ohio to show where you would expect to find the greatest number of small mammals feeding on American beech tree seeds.

B. Move the direction label into the blank box to show how an opossum population living in that area would change if the trees were cut down.

- Move only one direction label into the blank box.
- There may be more than one correct answer.

Notes on Scoring

This response earns no credit (0 points). The response incorrectly identifies an area on the Ohio map that represents a high number of beech trees, which would produce the seeds that support small mammals. The response also fails to show the correct effect on the opossum population. If beech trees were removed from the selected area, the opossum population would decrease, not stay the same, because their habitat would be destroyed.
Notes on Scoring

This response earns no credit (0 points). The response incorrectly identifies an area on the Ohio map that represents a high number of beech trees, which would produce the seeds that support small mammals. The response also fails to show the correct effect on the opossum population. If beech trees were removed from the selected area, the opossum population would decrease, not increase, because their habitat would be destroyed.
Question 19

A student views an object in a mirror.
Move the labels into the blank boxes to show how light travels from the object to the student's eye.

Points Possible: 1
See Alignment for more detail.

Scoring Guidelines
For this item, a full-credit response (1 point) includes all of the following:

- "Object" in the top box;
  AND
- "Mirror" in the middle box;
  AND
- "Eye" in the bottom box (1 point).
Alignment

Content Strand
Physical Science

Content Statement
Light and sound are forms of energy that behave in predictable ways.

Content Elaboration
When light travels from one location to another, it goes in a straight line until it interacts with another object or material. As light reaches a new material, it can be absorbed, refracted, reflected or it can continue to travel through the new material; one of these interactions may occur or many may occur simultaneously, depending on the material.

Cognitive Demand
Recalling Accurate Science (R)

Requires students to provide accurate statements about scientifically valid facts, concepts and relationships. Recall only requires students to provide a rote response, declarative knowledge or perform routine mathematical tasks. This cognitive demand refers to students' knowledge of science fact, information, concepts, tools, procedures (being able to describe how) and basic principles.

Explanation of the Item
This item requires the student to demonstrate understanding of reflection. When light coming from the object strikes the mirror, it “bounces away” from the surface of the mirror. Because the top box shows the light moving away, it must be the object. The middle box shows the light “bouncing away,” so it must be the mirror. The bottom box must be the eye of the observer.
Grade 5
Science
Spring 2016 Item Release

Question 19

Sample Responses
Sample Response: 1 point

A student views an object in a mirror.
Move the labels into the blank boxes to show how light travels from the object to the student’s eye.

Notes on Scoring

This response earns full credit (1 point) because it correctly shows light moving away from the object, reflecting from the mirror, and moving toward the eye of the observer.
Sample Response: 0 points

A student views an object in a mirror.
Move the labels into the blank boxes to show how light travels from the object to the student's eye.

Notes on Scoring

This response earns no credit (0 points) because it does not correctly show how light is reflected toward the eye of the observer. The response may show partial understanding of how light "bounces away" from the surface of a mirror, but the student is required to show full understanding of reflection in order to receive credit.
Grade 5
Science
Spring 2016 Item Release

Question 20

Question and Scoring Guidelines
Question 20

A student is building a motorized toy truck to enter in a race. Trucks in the race must use an electric motor with a single battery and must be at least 10 kg. The student wants his truck to be able to beat Truck 1 in the race.

Move the metal blocks into Truck 2 so that it meets these requirements.

- You do not need to use all the blocks.
- You can place the blocks anywhere in the blank box.

Points Possible: 1
See Alignment for more detail.

Scoring Guidelines

For this item, a full-credit response (1 point) includes:
- Exactly 3 metal blocks moved onto the truck (1 point).
Alignment

Content Strand
Physical Science

Content Statement
The amount of change in movement of an object is based on the mass* of the object and the amount of force exerted.

*While mass is the scientifically correct term to use in this context, the NAEP 2009 Science Framework (page 27) recommends using the more familiar term “weight” in the elementary grades with the distinction between mass and weight being introduced at the middle school level. In Ohio, students will not be assessed on the differences between mass and weight until Grade 6.

Content Elaboration
Forces cause changes in motion. If a force is applied in the same direction of an object’s motion, the speed will increase. If a force is applied in the opposite direction of an object’s motion, the speed will decrease. Generally, the more mass* an object has, the less influence a given force will have on its motion.

Cognitive Demand
Interpreting and Communicating Science Concepts (C)

Requires students to use subject-specific conceptual knowledge to interpret and explain events, phenomena, concepts and experiences using grade-appropriate scientific terminology, technological knowledge and mathematical knowledge. Communicate with clarity, focus and organization using rich, investigative scenarios, real-world data and valid scientific information.

Explanation of the Item
This item requires the student to demonstrate understanding of the relationship between force, mass and change in motion. The diagram suggests that the trucks are essentially identical, except for the amount of additional mass. The student can vary only the amount of additional mass, by adding an appropriate number of 1 kg blocks to Truck 2. The student must recognize that Truck 2 will speed up more than Truck 1 if the total mass of Truck 2 and its contents is less than the total mass of Truck 1 and its contents, given the same force from the motor. The student must also recognize that at least three 1 kg blocks must be added to Truck 2 to meet the minimum total mass requirement of 10 kg. Therefore, to meet this requirement and still be able to speed up more than Truck 1, the only possibility given the available trucks and blocks is to add exactly three 1 kg blocks to Truck 2.
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Question 20

Sample Responses
Sample Response: 1 point

A student is building a motorized toy truck to enter in a race. Trucks in the race must use an electric motor with a single battery and must be at least 10 kg. The student wants his truck to be able to beat Truck 1 in the race.

Move the metal blocks into Truck 2 so that it meets these requirements.

- You do not need to use all the blocks.
- You can place the blocks anywhere in the blank box.

Notes on Scoring

This response earns full credit (1 point) because it correctly shows that the total mass of Truck 2 and its contents is less than the total mass of Truck 1 and its contents, while still meeting the requirement for a minimum total mass of 10 kg.
Sample Response: 0 points

A student is building a motorized toy truck to enter in a race. Trucks in the race must use an electric motor with a single battery and must be at least 10 kg. The student wants his truck to be able to beat Truck 1 in the race.

Move the metal blocks into Truck 2 so that it meets these requirements.
- You do not need to use all the blocks.
- You can place the blocks anywhere in the blank box.

Notes on Scoring

This response earns no credit (0 points) because it does not demonstrate a correct understanding of the task. Although the response meets the requirement of a minimum total mass of 10 kg, the addition of five 1 kg blocks will cause Truck 2 to gain speed slower than Truck 1, not faster.
Grade 5
Science
Spring 2016 Item Release

Question 21

Question and Scoring Guidelines
Question 21

A student is running a computer simulation to learn about how objects move. Following are some details of the simulation:

- The simulation uses three boxes that are the same size.
- Each box has a different mass/weight.
- The boxes are all on the same surface.
- The same force is applied to each box over the same amount of time.

The student runs the simulation for the box with a medium mass/weight. The result of the simulation is shown.

Select the black dots to show where the lighter and heavier boxes will stop.

**Points Possible:** 1

See **Alignment** for more detail.

**Scoring Guidelines**

For this item, a full-credit response (1 point) includes:

- Selecting the farthest location to the right of the light box’s starting position;
  
  AND
  
- Selecting the first location to the right of the heavy box’s starting position
  
  OR
  
Selecting the “Start” location for the heavy box (1 point).
Alignment

Content Strand
Physical Science

Content Statement
The amount of change in movement of an object is based on the mass* of the object and the amount of force exerted.

*While mass is the scientifically correct term to use in this context, the NAEP 2009 Science Framework (page 27) recommends using the more familiar term “weight” in the elementary grades with the distinction between mass and weight being introduced at the middle school level. In Ohio, students will not be assessed on the differences between mass and weight until Grade 6.

Content Elaboration
Forces cause changes in motion. If a force is applied in the same direction of an object’s motion, the speed will increase. If a force is applied in the opposite direction of an object’s motion, the speed will decrease. Generally, the more mass* an object has, the less influence a given force will have on its motion.

Cognitive Demand
Interpreting and Communicating Science Concepts (C)

Requires students to use subject-specific conceptual knowledge to interpret and explain events, phenomena, concepts and experiences using grade-appropriate scientific terminology, technological knowledge and mathematical knowledge. Communicate with clarity, focus and organization using rich, investigative scenarios, real-world data and valid scientific information.

Explanation of the Item
This item requires the student to demonstrate understanding of the relationship between force, mass and change in motion. The applied force and the surface are the same for all three situations, and only the masses/weights of the boxes are different. When the same force is applied to the medium mass/weight box and the lighter box, the force has a greater influence on the lighter box and it will move a greater distance in the same amount of time. Likewise, the force has a lesser influence on the heavier box, and it will move the smallest distance in the same amount of time. It is also possible that the heavier box is so heavy that the applied force is not enough to overcome friction between the box and the surface, and the heavier box does not move.
Sample Response: 1 point

A student is running a computer simulation to learn about how objects move. Following are some details of the simulation.

- The simulation uses three boxes that are the same size.
- Each box has a different mass/weight.
- The boxes are all on the same surface.
- The same force is applied to each box over the same amount of time.

The student runs the simulation for the box with a medium mass/weight. The result of the simulation is shown.

Select the black dots to show where the lighter and heavier boxes will stop.

Notes on Scoring

This response earns full credit (1 point) because it correctly identifies that the lighter box will travel a greater distance and that the heavier box will travel a lesser distance, given that the same force is applied for the same amount of time.
Sample Response: 1 point

A student is running a computer simulation to learn about how objects move. Following are some details of the simulation:

- The simulation uses three boxes that are the same size.
- Each box has a different mass/weight.
- The boxes are all on the same surface.
- The same force is applied to each box over the same amount of time.

The student runs the simulation for the box with a medium mass/weight. The result of the simulation is shown.

Select the black dots to show where the lighter and heavier boxes will stop.

Notes on Scoring

This response earns full credit (1 point) because it correctly identifies that the lighter box will travel a greater distance and that the heavier box will travel a lesser distance, given that the same force is applied for the same amount of time. It is possible that the heavier box is so heavy that the applied force is not enough to overcome friction between the box and the surface, and the heavier box does not move at all.
Sample Response: 0 points

A student is running a computer simulation to learn about how objects move. Following are some details of the simulation.

- The simulation uses three boxes that are the same size.
- Each box has a different mass/weight.
- The boxes are all on the same surface.
- The same force is applied to each box over the same amount of time.

The student runs the simulation for the box with a medium mass/weight. The result of the simulation is shown.

Select the black dots to show where the lighter and heavier boxes will stop.

Notes on Scoring

This response earns no credit (0 points) because it does not demonstrate understanding of the task. The response incorrectly shows that the lighter box moves less than the medium mass/weight box, and that the heavier and lighter boxes both move the same distance from the original position.
Question 22

Students set up an experiment with different small objects and a tabletop covered in ice so that friction is not a factor. The students give each object a short push to start it moving across the top of the table and record the resulting speed of each object.

Select the two factors that have the greatest effect on the speed of the objects.

☐ force of the push
☐ shape of the object
☐ length of the tabletop
☐ mass/weight of the object
☐ time the object was sliding
☐ order in which objects are slid

Points Possible: 1

See Alignment for more detail.
Scoring Guidelines

Rationale for First Option: **Key** – The force of the push on the object affects the object’s speed.

Rationale for Second Option: This is incorrect. The shape of the object does not greatly affect the object’s speed.

Rationale for Third Option: This is incorrect. The length of the tabletop does not affect the object’s speed.

Rationale for Fourth Option: **Key** – The mass/weight of the object affects the object’s speed.

Rationale for Fifth Option: This is incorrect. The time the object slid does not affect the object’s speed.

Rationale for Sixth Option: This is incorrect. The order in which the objects slide does not affect the objects’ speed.
Alignment

Content Strand
Physical Science

Content Statement
The amount of change in movement of an object is based on the mass* of the object and the amount of force exerted.

Content Elaboration
The motion of an object can change by speeding up, slowing down or changing direction. Forces cause changes in motion. If a force is applied in the same direction of an object’s motion, the speed will increase. If a force is applied in the opposite direction of an object’s motion, the speed will decrease. Generally, the greater the force acting on an object, the greater the change in motion. Generally, the more mass* an object has, the less influence a given force will have on its motion. If no forces act on an object, the object does not change its motion and moves at a constant speed in a given direction. If an object is not moving and no force acts on it, the object will remain at rest.

Movement is measured by speed (how fast or slow the movement is). Speed is measured by time and distance traveled (how long it took the object to go a specific distance). Speed is calculated by dividing distance by time.

Cognitive Demand
Recalling Accurate Science (R)

Requires students to provide accurate statements about scientifically valid facts, concepts and relationships. Recall only requires students to provide a rote response, declarative knowledge or perform routine mathematical tasks. This cognitive demand refers to students’ knowledge of science fact, information, concepts, tools, procedures (being able to describe how) and basic principles.

Explanation of the Item
This item requires the student to recognize that mass and force are the two factors that will have the most impact on the speed of an object traveling across a table top of ice.
**Sample Response: 1 point**

Students set up an experiment with different small objects and a tabletop covered in ice so that friction is not a factor. The students give each object a short push to start it moving across the top of the table and record the resulting speed of each object.

Select the two factors that have the greatest effect on the speed of the objects:

- force of the push
- shape of the object
- length of the tabletop
- mass/weight of the object
- time the object was sliding
- order in which objects are slid
Grade 5
Science
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Question 23

Question and Scoring Guidelines
Question 23

Points Possible: 4

See Alignment for more detail.
## Scoring Guidelines

<table>
<thead>
<tr>
<th>Score Point</th>
<th>Description</th>
</tr>
</thead>
</table>
| 4 points    | The student response demonstrates a complete understanding of the task. The response is focused and relevant to the task. The response correctly:  
  - Identifies a population that declines to fewer squid  
  AND  
  - Explains why the decrease in squid causes that population to decline  
  AND  
  - Identifies a population that increases due to fewer squid  
  AND  
  - Explains why the decrease in squid causes that population to increase. |

| 3 points    | The student response demonstrates an understanding of the task. The response is focused and relevant to the task. The response correctly:  
  - Identifies a population that declines directly due to fewer squid  
  AND  
  - Explains why the decrease in squid causes that population to decline  
  AND  
  - Identifies a population that increases due to fewer squid.  
  OR  
  - Identifies a population that increases directly due to fewer squid  
  AND  
  - Explains why the decrease in squid causes that population to increase  
  AND  
  - Identifies a population that decreases directly due to fewer squid.  
  OR |
• Identifies a population that increases indirectly due to fewer squid AND
• Explains why the decrease in squid causes that population to increase AND
• Identifies a population that decreases due to fewer squid.

OR

• Identifies a population that declines indirectly due to fewer squid AND
• Explains why the decrease in squid causes that population to decrease AND
• Identifies a population that increases directly due to fewer squid.

2 points The student response demonstrates a partial understanding of the task. It is relevant to the task, but there may be gaps in focus. It provides some evidence of understanding. The response correctly:
• Identifies a population that increases directly due to fewer squid AND
• Identifies a population that decreases directly due to fewer squid.

OR

• Identifies a population that increases directly due to fewer squid AND
• Explains why the decrease in squid causes that population to increase.

OR
- Identifies a population that declines directly due to fewer squid
  AND
- Explains why the decrease in squid causes that population to decrease.

OR

- Identifies a population that increases indirectly due to fewer squid
  AND
- Explains why the decrease in squid causes that population to increase.

OR

- Identifies a population that declines indirectly due to fewer squid
  AND
- Explains why the decrease in squid causes that population to decrease.

1 point  The student response demonstrates an unclear understanding of the task. It fails to address or omits significant aspects of the task and may provide unrelated or unclear information. There is little evidence of focus. The response correctly:

- Identifies a population that declines due to fewer squid
  OR
- Identifies a population that increases due to fewer squid.

0 points  The response does not meet the criteria required to earn one point. The response indicates inadequate or no understanding of the task. It may only repeat information from the passage or prompt without any supporting information responsive to the task. The student may have written on a different topic or written “I don’t know.”
Alignment

Content Strand
Life Science

Content Statement
Organisms perform a variety of roles in an ecosystem.

Content Elaboration
It is important that the ecological role of organisms is interwoven with a clear understanding that all living things require energy.

Plants and some microorganisms are producers. They are the foundation of the food web. Producers transform energy from the sun and make food through a process called photosynthesis. Animals get their energy by eating plants and other animals that eat plants. Animals are consumers and many form predator-prey relationships.

Decomposers (primarily bacteria and fungi) are consumers that use waste materials and dead organisms for food. Decomposers also return nutrients to the ecosystem. One way ecosystem populations interact is centered on relationships for obtaining energy. Food webs are defined in many ways, including as schemes of feeding relationships, which resemble a web. This web serves as a model for feeding relationships of member species within a biological community. Members of a species may occupy different positions during their lives. Food chains and webs are schematic representations of real-world interactions. For this grade level, it is enough to recognize that food webs represent an intertwining of food chains within the same biological community.

Cognitive Demand
Interpreting and Communicating Science Concepts (C)

Requires students to use subject-specific conceptual knowledge to interpret and explain events, phenomena, concepts and experiences using grade-appropriate scientific terminology, technological knowledge and mathematical knowledge. Communicate with clarity, focus and organization using rich, investigative scenarios, real-world data and valid scientific information.

Explanation of the Item
This item requires the student to examine an Arctic food web and determine how the reduction of squid will impact the food web. Some groups of organisms will benefit and others will decline as a result of fewer squid. Those organisms that are eaten by squid will increase in number if there are fewer squid in the ecosystem, because they are not consumed. Herbivorous zooplankton, krill and some fish may increase in number as a result of fewer squid. Those organisms that feed on squid may decline as a result of fewer squid because their food source is reduced. Smaller-toothed whales, sperm whales and elephant seals consume squid as a food source, and with fewer squid, their populations may decline.
Notes on Scoring

This response earns full credit (4 points) because it correctly identifies two species that will be impacted (population increase and decrease) by the decline of the squid population and provides an explanation for why each is impacted. “If squid dies sperm whale won’t have food and their population will decrease. If squid die krill will have an increase in population because squid eat krill.”
Notes on Scoring

This response earns full credit (4 points) because it correctly identifies two species that will be impacted (population increase and decrease) by the decline of the squid population and provides an explanation for why each is impacted. “Elephant seals would decrease because they eat squid. Herbivorous Zooplankton would increase because they get eaten by squid.”
Sample Response: 4 points

Notes on Scoring

This response earns full credit (4 points) because it correctly identifies two species that will be impacted (population increase and decrease) by the decline of the squid population and provides an explanation for why each is impacted. The sperm whale is identified as a population that would decline: “… because the squid is the only thing it eats and if that population goes down then what can the sperm whale eat nothing and the sperm whale dies off.” The response also states “herbivorous zooplankton would go up then because the squid eats a lot of the population ...”.
Notes on Scoring

This response earns partial credit (3 points) because it correctly identifies two species that will be impacted (population increase and decrease) by the decline of the squid population and provides an explanation for why one species is impacted. The sperm whale population would decline because “the squid is the Sperm Whales only food source.” Herbivorous zooplankton is identified as a population that would increase, but the reason why is incorrect because the squid is not the only animal that eats it.
Sample Response: 3 points

Notes on Scoring

This response earns partial credit (3 points) because it correctly identifies two species that will be impacted (population increase and decrease) by the decline of the squid population and provides an explanation for why one species is impacted. “The population of the sperm whale would decrease because the sperm whale only eats the squid.” The response correctly identifies that krill will increase but fails to provide an explanation why.
Notes on Scoring

This response earns partial credit (3 points) because it correctly identifies two species that will be impacted (population increase and decrease) by the decline of the squid population and provides an explanation for why one species is impacted. “Elephant seals would decrease because they eat squid.” The response correctly identifies that herbivorous zooplankton will increase but fails to provide an explanation why.
Sample Response: 2 points

Notes on Scoring

This response earns partial credit (2 points) because it correctly identifies that fish will be impacted (population increase) by the decline of the squid population and provides an explanation for why fish would increase: “squids eat fish.” The response incorrectly claims that herbivorous zooplankton will decrease.
Sample Response: 2 points

Notes on Scoring

This response earns partial credit (2 points) because it correctly identifies that herbivorous zooplankton will be impacted (population increase) by the decline of the squid population and provides an explanation for why herbivorous zooplankton will increase: “because the squid would not be eating it.”
Sample Response: 2 points

Notes on Scoring

This response earns partial credit (2 points) because it correctly identifies that the elephant seal population will decrease and that the herbivorous zooplankton population will increase as a result of the decline of the squid population. However, the response provides an inaccurate explanation for the population impact. The elephant seals still have other prey to consume with the decline of the squid. The herbivorous zooplankton still have other predators if the squid decline.
Notes on Scoring

This response earns partial credit (1 point) because it correctly identifies populations that will increase as a result of the decline of the squid population: “Kril, Fish, Herbivorous Zooplankton...”. However, the response fails to provide an explanation for the increase of the identified populations. The response does not identify any populations that decline, nor does it provide an appropriate explanation for the decline.
Sample Response: 1 point

Notes on Scoring
This response earns partial credit (1 point) because it correctly identifies that the fish population would decrease as a result of a decline in the squid population. However, the explanation provided is inaccurate.
Sample Response: 1 point

Notes on Scoring

This response earns partial credit (1 point) because it correctly identifies that elephant seals would decrease, but it fails to provide an explanation for why. The identification of too many krill and zooplankton is too vague to receive credit for this item.
Sample Response: 1 point

Notes on Scoring

This response earns partial credit (1 point) because it correctly identifies elephant seals as a population that would decline, but it fails to provide an explanation for why. Nothing is provided for a population that increases.
Sample Response: 0 points

Notes on Scoring

This response earns no credit (0 points) because it incorrectly states that krill would not have any food as an explanation for why the population would be impacted by a decline in the squid population. The response also does not indicate if the krill population would increase or decrease.
Sample Response: 0 points

Notes on Scoring

This response earns no credit (0 points) because it is not responsive to the task. It does not identify two species that would be impacted (population increase and decrease) by the decline of the squid population nor does it provide an explanation for why each species is impacted.
Notes on Scoring

This response earns no credit (0 points) because it is not responsive to the task. It does not identify two species that will be impacted (population increase and decrease) by the decline of the squid population nor does it provide an explanation for why each species is impacted.
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Science
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Question 24

Question and Scoring Guidelines
Question 24

A student uses a string, a ball, and a flashlight to make the model shown. The ball makes a complete rotation every second.

Which cycle does this model show?

A. positions in orbit
B. varying lengths of day
C. the changing of the seasons
D. changing between day and night

Scoring Guidelines

Rationale for Option A: This is incorrect. This model shows Earth rotating, not revolving around the sun.

Rationale for Option B: This is incorrect. To model how and why some days have more hours of sunlight than others, the model would need to include a tilted axis.

Rationale for Option C: This is incorrect. To show the seasons, the student would need to include a tilted axis and revolution around the sun.

Rationale for Option D: Key – The flashlight represents the sun while the spinning ball represents Earth rotating which would represent a 24-hour cycle.

Points Possible: 1

See Alignment for more detail.
**Alignment**

**Content Strand**
Earth and Space Science

**Content Statement**
Most of the cycles and patterns of motion between the Earth and sun are predictable.

**Content Elaboration**
Earth’s revolution around the sun takes approximately 365 days. Earth completes one rotation on its axis in a 24-hour period, producing day and night. This rotation makes the sun, stars and moon appear to change position in the sky.

**Cognitive Demand**
Recalling Accurate Science (R)

Requires students to provide accurate statements about scientifically valid facts, concepts and relationships. Recall only requires students to provide a rote response, declarative knowledge or perform routine mathematical tasks. This cognitive demand refers to students’ knowledge of science fact, information, concepts, tools, procedures (being able to describe how) and basic principles.

**Explanation of the Item**
This item requires the student to recognize that the model shown is representative of the sun with a rotating Earth, which represents a 24-hour cycle of day and night.
A student uses a string, a ball, and a flashlight to make the model shown. The ball makes a complete rotation every second.

Which cycle does this model show?

- positions in orbit
- varying lengths of day
- the changing of the seasons
- changing between day and night
Grade 5
Science
Spring 2016 Item Release

Question 25

Question and Scoring Guidelines
Question 25

Scoring Guidelines

Rationale for Option A: This is incorrect. Vibration is a rapid back and forth movement which is a property of sound.

Rationale for Option B: This is incorrect. Reflection is the bouncing of light off a surface producing a reflected image of the object. It does not cause an object to appear bent.

Rationale for Option C: Key – Refraction is the bending of light as it travels from one medium into another.

Rationale for Option D: This is incorrect. Absorption is when light is taken into a material which will increase the temperature of the material.
Content Statement
Light and sound are forms of energy that behave in predictable ways.

Content Elaboration
Light can travel through some materials, such as glass or water. Light can also travel through empty space, like from the sun to Earth. When light travels from one location to another, it goes in a straight line until it interacts with another object or material. When light strikes objects through which it cannot pass, shadows are formed. As light reaches a new material, it can be absorbed, refracted, reflected or it can continue to travel through the new material; one of these interactions may occur or many may occur simultaneously, depending on the material.

Light can be absorbed by objects, causing them to warm. How much an object’s temperature increases depends on the material of the object, the intensity of and the angle at which the light strikes its surface, how long the light shines on the object and how much light is absorbed.

When light passes from one material to another, it is often refracted at the boundary between the two materials and travels in a new direction through the new material (medium). For example, a magnifying lens bends light and focuses it toward a single point. A prism bends white light and separates the different colors of light. Experiment with prisms and magnifying lenses to observe the refraction of light.

Cognitive Demand
Recalling Accurate Science (R)

Requires students to provide accurate statements about scientifically valid facts, concepts and relationships. Recall only requires students to provide a rote response, declarative knowledge or perform routine mathematical tasks. This cognitive demand refers to students’ knowledge of science fact, information, concepts, tools, procedures (being able to describe how) and basic principles.

Explanation of the Item
This item requires the student to explain why a thermometer looks bent in a beaker of water that is used in an investigation. As light passes from air through glass and the liquid in the beaker, light changes direction, which causes the thermometer to appear bent.
Sample Response: 1 point

Water Investigation

Students are investigating the properties of water. They pour water into a beaker and measure the temperature of the water with a thermometer. Next, the teacher puts the beaker on a heating coil, as shown.

After the investigation, students notice that the thermometer looks bent in the beaker of water.

What property of light causes the thermometer to look bent?

- vibration
- reflection
- refraction
- absorption
Grade 5
Science
Spring 2016 Item Release

Question 26

Question and Scoring Guidelines
Question 26

A delivery truck makes a trip from Akron to Columbus. The truck departs from Akron at 4:00 p.m. and arrives at Columbus at 6:00 p.m. The truck travels a distance of 120 miles.

What is the average speed of the truck during the entire journey?

<table>
<thead>
<tr>
<th>Option</th>
<th>Speed (miles per hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>20</td>
</tr>
<tr>
<td>B</td>
<td>30</td>
</tr>
<tr>
<td>C</td>
<td>60</td>
</tr>
<tr>
<td>D</td>
<td>65</td>
</tr>
</tbody>
</table>

Rationale for Option A: This is incorrect. Speed is found by dividing the distance traveled by the time. This value equals the distance 120 miles divided by 6 hours (related to 6:00 pm).

Rationale for Option B: This is incorrect. Speed is found by dividing the distance traveled by the time. This value equals the distance 120 miles divided by 4 hours (related to 4:00 pm).

Rationale for Option C: **Key** - Speed is found by dividing the distance traveled by the time. This value equals the distance 120 miles divided by 2 hours.

Rationale for Option D: This is incorrect. This value is the speed limit on many highways in Ohio.

Points Possible: 1

See Alignment for more detail.

Scoring Guidelines
Alignment
Content Strand
Physical Science

Content Statement
The amount of change in movement of an object is based on the mass of the object and the amount of force exerted.

Content Elaboration
Movement is measured by speed (how fast or slow the movement is). Speed is measured by time and distance traveled (how long it took the object to go a specific distance). Speed is calculated by dividing distance by time.

Cognitive Demand
Recalling Accurate Science (R)

Requires students to provide accurate statements about scientifically valid facts, concepts and relationships. Recall only requires students to provide a rote response, declarative knowledge or perform routine mathematical tasks. This cognitive demand refers to students' knowledge of science fact, information, concepts, tools, procedures (being able to describe how) and basic principles.

Explanation of the Item
This item requires the student to calculate the speed the delivery truck traveled on its trip from Akron to Columbus. The truck left at 4:00 p.m. and arrives at 6:00 p.m., which means the time traveled is 2 hours. The distance between Akron and Columbus is 120 miles. Speed is distance divided by time, and 120 miles divided by 2 hours is 60 miles per hour.
Sample Response: 1 point

A delivery truck makes a trip from Akron to Columbus. The truck departs from Akron at 4:00 p.m. and arrives at Columbus at 6:00 p.m. The truck travels a distance of 120 miles.

What is the average speed of the truck during the entire journey?

- 20 miles per hour
- 30 miles per hour
- 60 miles per hour
- 65 miles per hour
Grade 5
Science
Spring 2016 Item Release

Question 27

Question and Scoring Guidelines
Question 27

Three stars of different sizes are shown. Star #1 is smaller than our sun and Star #3 is bigger than our sun. The distance from Earth to the sun is shown.

A. Place the planet on the line at a distance such that Star #1 appears to be the same size as our sun when viewed from the planet.

B. Place the planet on the line at a distance such that Star #3 appears to be the same size as our sun when viewed from the planet.

• You can use the Earth-sized planet more than once.
• Place only one planet on each line.

Points Possible: 1

See Alignment for more detail.

Scoring Guidelines

For this item, a full-credit response includes:

• The Earth-sized planet is closer to Star #1 than the Earth-sun distance; AND

• The Earth-sized planet is farther from Star #3 than the Earth-sun distance (1 point).
Alignment

Content Strand
Earth and Space Science

Content Statement
The sun is one of many stars that exist in the universe.

Content Elaboration
The sun appears to be the largest star in the sky because it is the closest star to
Earth. Some stars are larger than the sun and some stars are smaller than the
sun. Scaled models (3-D or virtual) and graphics can be used to show the vast
difference in size between the sun and Earth. The sun is a medium-sized star and
is the only star in our solar system. There are many other stars of different sizes in
the universe. Stars appear in patterns called constellations, which can be used
for navigation. Because they are so far away, they do not appear as large as
the sun.

Cognitive Demand
Interpreting and Communicating Science Concepts (C)

Requires students to use subject-specific conceptual knowledge to interpret
and explain events, phenomena, concepts and experiences using grade-
appropriate scientific terminology, technological knowledge and mathematical
knowledge. Communicate with clarity, focus and organization using rich,
investigative scenarios, real-world data and valid scientific information.

Explanation of the Item
This item requires the student to use the relationship of the apparent size of the
sun to Earth to model how other planet star systems may resemble Earth and the
sun. Star #1 is smaller than the sun, so the Earth-sized planet would be closer to
the star to reflect the apparent size of the sun to Earth. Star #3 is larger than the
sun so the Earth-sized planet would be farther away from the star to reflect the
apparent size of the sun to Earth.
Grade 5
Science
Spring 2016 Item Release
Question 27
Sample Responses
Notes on Scoring

This response earns full credit (1 point) because it correctly models the positions of the Earth-sized planet to Stars #1 and #3 so that they reflect the apparent size of Earth to the sun. For Star #1, the planet is placed closer to the star so the star will appear bigger and relative in size to the sun. For Star #3, the planet is placed farther from the star making the star appear smaller and relative in size to the sun.
Sample Response: 0 points

Three stars of different sizes are shown. Star #1 is smaller than our sun and Star #3 is bigger than our sun. The distance from Earth to the sun is shown.

A. Place the planet on the line at a distance such that Star #1 appears to be the same size as our sun when viewed from the planet.

B. Place the planet on the line at a distance such that Star #3 appears to be the same size as our sun when viewed from the planet.

- You can use the Earth-sized planet more than once.
- Place only one planet on each line.

Notes on Scoring

This response earns no credit (0 points) for incorrectly modeling the position of the Earth-sized planet to Stars #1 and #3 so that they do not reflect the apparent size of Earth to the sun.
Sample Response: 0 points

Three stars of different sizes are shown. Star #1 is smaller than our sun and Star #3 is bigger than our sun. The distance from Earth to the sun is shown.

A. Place the planet on the line at a distance such that Star #1 appears to be the same size as our sun when viewed from the planet.

B. Place the planet on the line at a distance such that Star #3 appears to be the same size as our sun when viewed from the planet.

• You can use the Earth-sized planet more than once.
• Place only one planet on each line.

Notes on Scoring

This response earns no credit (0 points) for incorrectly modeling the position of the Earth-sized planet to Stars #1 and #3 so that they do not reflect the apparent size of Earth to the sun.
Grade 5
Science
Spring 2016 Item Release

Question 28

Question and Scoring Guidelines
Question 28

The table gives the angle of the sun at noon in degrees every fifty days over the course of a year for two cities.

<table>
<thead>
<tr>
<th>Day of Year</th>
<th>City 1</th>
<th>City 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35</td>
<td>80</td>
</tr>
<tr>
<td>50</td>
<td>45</td>
<td>65</td>
</tr>
<tr>
<td>100</td>
<td>65</td>
<td>50</td>
</tr>
<tr>
<td>150</td>
<td>80</td>
<td>40</td>
</tr>
<tr>
<td>200</td>
<td>70</td>
<td>35</td>
</tr>
<tr>
<td>250</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>300</td>
<td>40</td>
<td>75</td>
</tr>
<tr>
<td>350</td>
<td>35</td>
<td>80</td>
</tr>
</tbody>
</table>

Select the three conclusions that are supported by the data in the table.

- When it is summer in City 1, it is winter in City 2.
- On any given day, the seasons are the same in both cities.
- When the angle of the sun at noon is high in City 1, it is low in City 2.
- On Day 150, the amount of direct sunlight is less in City 1 than in City 2.
- Around Day 100 and Day 250, the average daily temperatures in both cities are about the same.

Points Possible: 1

See Alignment for more detail.
**Scoring Guidelines**

**Rationale for First Option:** Key – The sun appears high in the sky in City 1 on the same days when the sun appears low in the sky in City 2.

**Rationale for Second Option:** This is incorrect. The seasons depend on the amount of direct sunlight that hits Earth. The amount of direct sunlight received on Earth is directly related to the height of the sun above the horizon. The pattern seen in the table shows that when the sun is high in the sky in City 1, it is low in the sky in City 2.

**Rationale for Third Option:** Key – The table shows that when the sun is high in the sky in City 1, it is low in the sky in City 2. For example, on day 150, the height of the sun in City 1 is 80 degrees, while the height of the sun in City 2 is 40 degrees.

**Rationale for Fourth Option:** This is incorrect. The amount of direct sunlight that reaches Earth depends on how high the sun appears above the horizon at noon. On Day 150, the sun appears higher in the sky in City 1 than in City 2. Therefore, City 1 receives more direct sunlight.

**Rationale for Fifth Option:** Key – Around Day 100 and Day 250, the angle of the sun above the horizon at noon is about the same for both cities. Therefore, the average daily temperatures are about the same.
Alignment

Content Strand
Earth and Space Science

Content Statement
Most of the cycles and patterns of motion between the Earth and sun are predictable.

Content Elaboration
Earth’s revolution around the sun takes approximately 365 days. Earth’s axis is tilted at an angle of 23.5°. This tilt, along with Earth’s revolution around the sun, affects the amount of direct sunlight that Earth receives in a single day and throughout the year. The average daily temperature is related to the amount of direct sunlight received. Changes in average temperature throughout the year are identified as seasons.

Note 1: The amount of direct sunlight that Earth receives is related to the altitude of the sun, which affects the angle of the sun’s rays, and the amount of time the sun is above the horizon each day.

Note 2: Different regions around the world have seasonal changes that are not based solely on average temperature (e.g., rainy season, dry season, monsoon season).

Cognitive Demand
Interpreting and Communicating Science Concepts (C)

Requires students to use subject-specific conceptual knowledge to interpret and explain events, phenomena, concepts and experiences using grade-appropriate scientific terminology, technological knowledge and mathematical knowledge. Communicate with clarity, focus and organization using rich, investigative scenarios, real-world data and valid scientific information.

Explanation of the Item
This item requires the student to analyze the data for two cities to determine how the angle of the sun relates to the season during the year and the location of City 1 and City 2. When the angle of the sun is low, it is winter. When the angle of the sun is high and more direct, it is summer. As the days progress through the year, the angles change. The cities are located in different hemispheres because of the difference in angle size. The angles of the cities are closest in size as spring and fall approach, and then increase in size difference as one city moves into summer and the other into winter.
Sample Response: 1 point

The table gives the angle of the sun at noon in degrees every fifty days over the course of a year for two cities.

<table>
<thead>
<tr>
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</tbody>
</table>

Select the three conclusions that are supported by the data in the table.

- [ ] When it is summer in City 1, it is winter in City 2.
- [ ] On any given day, the seasons are the same in both cities.
- [x] When the angle of the sun at noon is high in City 1, it is low in City 2.
- [ ] On Day 150, the amount of direct sunlight is less in City 1 than in City 2.
- [x] Around Day 100 and Day 250, the average daily temperatures in both cities are about the same.
Question 29

Question and Scoring Guidelines
Question 29

A student compares the widths of Earth and the sun.

Which graph shows the size of Earth compared with the size of the sun?

Points Possible: 1

See Alignment for more detail.
Scoring Guidelines

Rationale for Option A: This is incorrect. The sun and Earth are not similar in size.

Rationale for Option B: This is incorrect. The width of the sun is about 100 times that of Earth.

Rationale for Option C: This is incorrect. The sun is much larger than Earth.

Rationale for Option D: Key – The width of the sun is about 100 times that of Earth.

Alignment
Content Strand
Earth and Space Science

Content Statement
The sun is one of many stars that exist in the universe.

Content Elaboration
The sun appears to be the largest star in the sky because it is the closest star to Earth. Some stars are larger than the sun and some stars are smaller than the sun. Scaled models (3-D or virtual) and graphics can be used to show the vast difference in size between the sun and Earth. The sun is a medium-sized star and is the only star in our solar system. There are many other stars of different sizes in the universe. Stars appear in patterns called constellations, which can be used for navigation. Because they are so far away, they do not appear as large as the sun.

General facts about the size and composition of the sun are introduced. Details (e.g., age of the sun, specific composition, temperature values) are above grade level. The emphasis should be on general characteristics of stars and beginning to understand the size and distance of the sun in relationship to Earth and the other planets.
Cognitive Demand
Interpreting and Communicating Science Concepts (C)

Requires students to use subject-specific conceptual knowledge to interpret and explain events, phenomena, concepts and experiences using grade-appropriate scientific terminology, technological knowledge and mathematical knowledge. Communicate with clarity, focus and organization using rich, investigative scenarios, real-world data and valid scientific information.

Explanation of the Item
This item requires the student to compare the widths of the sun and Earth and represent them in a graph. The sun is approximately 100 times larger than Earth.
Sample Response: 1 point

A student compares the widths of Earth and the sun.

Which graph shows the size of Earth compared with the size of the sun?
Grade 5
Science
Spring 2016 Item Release

Question 30

Question and Scoring Guidelines
A student places a straw into a glass of water. He notices that the straw appears to be split into two pieces.

Describe how light interacts with water to make the straw appear to be split into two pieces.

Type your answer in the space provided.

Points Possible: 1

See Alignment for more detail.
## Scoring Guidelines

<table>
<thead>
<tr>
<th>Score Point</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1 point     | The response includes at least one of the following:  
  - Light changes direction.  
  - Light slows down.  
  - Light bends.  
  - Light is bent.  
  - Light refracts.  
  - Light is refracted. |
| 0 points    | The response does not meet the criteria required to earn one point. The response indicates inadequate or no understanding of the task. It may only repeat information from the passage or prompt without any supporting information responsive to the task. The student may have written on a different topic or written “I don't know.” |
Alignment

Content Strand
Physical Science

Content Statement
Light and sound are forms of energy that behave in predictable ways.

Content Elaboration
Light can travel through some materials, such as glass or water. As light reaches a new material, it can be absorbed, refracted, reflected or it can continue to travel through the new material; one of these interactions may occur or many may occur simultaneously, depending on the material.

When light passes from one material to another, it is often refracted at the boundary between the two materials and travels in a new direction through the new material (medium).

Cognitive Demand
Interpreting and Communicating Science Concepts (C)

Requires students to use subject-specific conceptual knowledge to interpret and explain events, phenomena, concepts and experiences using grade-appropriate scientific terminology, technological knowledge and mathematical knowledge. Communicate with clarity, focus and organization using rich, investigative scenarios, real-world data and valid scientific information.

Explanation of the Item
This item requires the student to explain how light interacts with water to make the straw appear to be split in two pieces. As light travels from one medium to the next (air to water), it is refracted, or bent. The bending of light makes the straw appear to be split in two.
Grade 5
Science
2016 Spring Item Release

Question 30

Sample Responses
Sample Response: 1 point

A student places a straw into a glass of water. He notices that the straw appears to be split into two pieces.

Describe how light interacts with water to make the straw appear to be split into two pieces. Type your answer in the space provided.

Light changes direction.

Notes on Scoring

This response earns full credit (1 point) because it correctly describes how light interacts with water to make the straw appear to be split in two pieces: “Light changes direction.”
Sample Response: 1 point

A student places a straw into a glass of water. He notices that the straw appears to be split into two pieces.

Describe how light interacts with water to make the straw appear to be split into two pieces.

Type your answer in the space provided.

Light is refracted.

Notes on Scoring

This response earns full credit (1 point) because it correctly describes how light interacts with water to make the straw appear to be split in two pieces: “Light is refracted.”
Sample Response: 0 points

A student places a straw into a glass of water. He notices that the straw appears to be split into two pieces.

Describe how light interacts with water to make the straw appear to be split into two pieces. Type your answer in the space provided.

Light is reflected

Notes on Scoring

This response earns no credit (0 points) because it incorrectly describes that light is reflected. In order to describe how light interacts with water to make the straw appear to be split in two pieces, the response should say “light is refracted.”
Sample Response: 0 points

A student places a straw into a glass of water. He notices that the straw appears to be split into two pieces.

Describe how light interacts with water to make the straw appear to be split into two pieces.
Type your answer in the space provided.

The straw is split.

Notes on Scoring

This response earns no credit (0 points) because it incorrectly describes that the straw is split. In order to describe how light interacts with water to make the straw appear to be split in two pieces, the response should say “light is refracted.”