### 5. Structure and Properties of Matter

<table>
<thead>
<tr>
<th>Performance Expectation</th>
<th>Disciplinary Core Ideas</th>
<th>Science and Engineering Practices</th>
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</tr>
</thead>
</table>
| PS1-1. Develop a model to describe that matter is made of particles too small to be seen. | PS1.A: Structure and Properties of Matter  
- Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. | Developing and Using Models  
Modeling in 3-5 builds on K-2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.  
- Develop a model to describe phenomena. | Scale, Proportion, and Quantity  
- Natural objects exist from the very small to the immensely large. |

#### Learning Targets:
- I can…
  - collect evidence that matter is made of particles too small to be seen. [Teacher Note: Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.]  
  - develop a model to show the particles in matter. [Teacher Note: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.]

#### Teaching Resources:
- basketball  
- syringe  
- sugar  
- water  
- cups  
- salt  
- heat source

#### Vocabulary:
- Science and Engineering Practices/Crosscutting Concepts  
  - model
- Discipline-Specific  
  - particle  
  - solid  
  - liquid  
  - gas

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**ELA/Math Connections:**
- RI.5.7 - Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.  
- MP.2 - Reason abstractly and quantitatively.  
- MP.4 - Model with mathematics.  
- 5.NBT.A.1 - Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote power of 10.  
- 5.MD.C.3 - Recognize volume as an attribute of solid figures and understand concepts of volume measurement.  
- 5.MD.C.4 - Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.
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| S-PS1.2. Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved. [Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.] [Assessment Boundary: Assessment does not include distinguishing mass and weight.] | PS1.A: Structure and Properties of Matter  
- The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish.  
PS1.B: Chemical Reactions  
- No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.) | Using Mathematics and Computational Thinking  
Mathematical and computational thinking in 3-5 builds on K-2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.  
- Measure and graph quantities such as weight to address specific and engineering questions and problems. | Scale, proportion, and Quantity  
- Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.  
| Connections to Nature of Science  
Scientific Knowledge Assumes an Order and Consistency in Natural Systems  
- Science assumes consistent patterns in natural systems. |

**Learning Targets:**  
I can...  
- provide evidence about the weight of matter when substances are mixed together through the measurement and graphing of quantities  
- provide evidence about the weight of matter when it is heated or cooled by measuring and graphing quantities  
- recall real-life information to demonstrate understanding of the structure and properties of matter.

**Teaching Resources:**  
- Beakers  
- Digital scales  
- Various experiment materials, such as, sand, pebbles, ice cubes, Kool-Aid, water  
- Video clips

**Vocabulary:**  
Science and Engineering Practices/Crosscutting Concepts  
scale  
proportion  

**Discipline-Specific**  
chemical reaction  
dissolving  
mixture  
solubility  
substance  
mass  
weight

**MP.2** Reason abstractly and quantitatively.  
**MP.4** Model with mathematics.  
**MP.5** Use appropriate tools strategically.  
5.MD.A.1 - Convert among different-sized standards measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real-world problems.
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<tbody>
<tr>
<td>S-PS1-3. Make observations and measurements to identify materials based on their properties. [Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property.] [Assessment Boundary: Assessment does not include density or distinguishing mass and weight.]</td>
<td>PS1.A: Structure and Properties of Matter - Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.)</td>
<td>Planning and Carrying Out Investigations - Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.</td>
<td>Scale, proportion, and Quantity - Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.</td>
<td>W.5.7. - Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. W.5.8. - Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. W.5.9. - Draw evidence from literary or informational texts to support analysis, reflection, and research. MP.2. - Reason abstractly and quantitatively. MP.4. - Model with mathematics. MP.5. - Use appropriate tools strategically.</td>
</tr>
</tbody>
</table>

Learning Targets: I can…
- observe and compare the properties of different substances. [Teacher Note: Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property. Assessment does not include density or distinguishing mass and weight.]
- make observations and measurements to identify substances by their properties. [Teacher Note: Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids.]

Vocabulary:
- Science and Engineering Practices/Crosscutting Concepts
  - scale
  - proportion
  - observe
  - compare
  - variables
  - data
  - evidence
  - phenomenon
  - physical quantities
- Discipline-Specific properties
  - mass
  - weight
  - density

Teaching Resources:
- science notebook
- thermometers
- baking soda
- salt
- flour
- corn starch
- powdered sugar
- hot plate
- plastic cups
- spoons
- digital scales (not included on assessment)
- magnifying glass
- cylinders/beakers
- stop watch
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<tbody>
<tr>
<td>S-PS1.4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.</td>
<td>PS1.B: Chemical Reactions</td>
<td>Planning and Carrying Out Investigations</td>
<td>Cause and Effect</td>
<td>W.5.7 - Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.</td>
</tr>
<tr>
<td></td>
<td>• When two or more different substances are mixed, a new substance with different properties may be formed.</td>
<td>• When two or more different substances are mixed, a new substance with different properties may be formed.</td>
<td>• Cause and effect relationships are routinely identified, tested, and used to explain change.</td>
<td>W.5.8 - Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.</td>
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<td>Planning and carrying out investigations to answer questions or test solutions to problems in 3-5 builds on K-2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.</td>
<td>• Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.</td>
<td>W.5.9 - Draw evidence from literary or informational texts to support analysis, reflection, and research.</td>
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<td>• Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.</td>
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<tr>
<td>Learning Targets:</td>
<td>I can…</td>
<td>Teaching Resources:</td>
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<td></td>
<td>• investigate the effects of mixing substances together. [Teacher Note: When two or more different substances are mixed, a new substance with different properties may be formed.]</td>
<td>• beakers, jars</td>
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<tr>
<td></td>
<td>• gather data to determine if mixing substances results in new substances.</td>
<td>• salt</td>
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<td>• observe changes when two or more substances are mixed.</td>
<td>• pepper</td>
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<td></td>
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<td>• sugar</td>
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<td>• kool-aid</td>
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<td>• lead filings</td>
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<td></td>
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<td>• baking soda</td>
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<td>• sand</td>
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<td>• stirrers</td>
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<tr>
<td>Vocabulary:</td>
<td>Science and Engineering Practices/Crosscutting Concepts</td>
<td>Discipline-Specific chemical reaction</td>
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<tr>
<td></td>
<td>investigation</td>
<td>dissolving</td>
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<td></td>
<td>conduct</td>
<td>mixture</td>
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<td></td>
<td>cause and effect</td>
<td>particle</td>
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<td>observation</td>
<td>solubility</td>
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<td></td>
<td>variables</td>
<td>substance</td>
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<td>test</td>
<td>solution</td>
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<td>physical properties</td>
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### Performance Expectation

**5-PS3-1.** Use models to describe that the energy in animals’ food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun. [Clarification Statement: Examples of models could include diagrams, and flow charts.]

### Disciplinary Core Ideas

**PS3.D: Energy in Chemical Processes and Everyday Life**
- The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water).

**LS1.C: Organization for Matter and Energy Flow in Organisms**
- Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. (secondary)

### Science and Engineering Practices

**Developing and Using Models**
- Modeling in 3-5 builds on K-2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.
- Use models to describe phenomena.

### Crosscutting Concepts

**Energy and Matter**
- Energy can be transferred in various ways and between objects.

### ELA/Math Connections:

**RI.5.7** Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.

**SL.5.5** Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.

### Learning Targets:

**I can...**
- describe an everyday system in terms of its parts and their interactions. [Teacher Note: Examples of an everyday system could include a bike, pen, familiar animal, etc.]
- make observations to identify parts of a specific ecosystem.
- analyze how the parts of an ecosystem interact.
- use a model to trace the energy in an ecosystem. [Teacher Note: The energy released from food was once energy from the sun that was captured by plants in the chemical process that forms plant matter. Examples of models could include diagrams, and flow charts.]
- integrate information from multiple sources to describe how animals use the energy in their food. [Teacher Note: Energy in animals’ food is used for body repair, growth, motion, and to maintain body warmth.]
- write or speak knowledgeably about energy and matter in ecosystems.

### Teaching Resources:
- Argumentation activity: ‘Why is the Sun necessary for us to have cheese in the world?’
- Project Wild lessons
- Project Wet lessons

### Vocabulary:

**Science and Engineering Practices/Crosscutting Concepts**
- model
- energy and matter

**Discipline-Specific**
- bacteria
- decomposer
- producer
- consumer
- ecosystem
- food web
- fungi
- organism
- interaction/interact
**Performance Expectation**

5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water. **[Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.]**

**Disciplinary Core Ideas**

- Plants acquire their material for growth chiefly from air and water.

**Science and Engineering Practices**

Engaging in Argument from Evidence
- Engaging in argument from evidence in 3-5 builds on K-2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).
- Construct an argument with evidence, data, and/or a model.

**Crosscutting Concepts**

Energy and Matter
- Matter is transported into, out of, and within systems.

**ELA/Math Connections:**

RI.5.1 - Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.
RI.5.9 - Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.
W.5.1 - Write opinion pieces on topics or texts, supporting a point of view with reasons and information.
MP.2 - Reason abstractly and quantitatively.
MP.4 - Model with mathematics.
MP.5 - Use appropriate tools strategically.
5.MD.A.1 - Convert among different sized standard measurement units within a given measurement system (e.g., convert 5cm to 0.05cm), and use these conversions in solving multistep, real-world problems.

**Learning Targets:**

I can...
- use evidence to support an argument about where plants get their material for growth. **[Teacher Note: Plants acquire their material for growth chiefly from air and water.]**

**Teaching Resources:**

- water plants
- aerial plants
- source of light
- potting soil
- fishbowl/bucket
- magnifying glass
- supporting text

**Vocabulary:**

Science and Engineering Practices/Crosscutting Concepts
- argument
- evidence
- energy
- system

**Discipline-Specific**

- photosynthesis
- carbon dioxide
- oxygen
- sunlight
**Performance Expectation**

5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. [Clarification Statement: Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.] [Assessment Boundary: Assessment does not include molecular explanations.]

<table>
<thead>
<tr>
<th>LS2 A: Interdependent Relationships in Ecosystems</th>
</tr>
</thead>
<tbody>
<tr>
<td>● The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as “decomposers.” Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.</td>
</tr>
</tbody>
</table>

**Science and Engineering Practices**

Developing and Using Models

Modeling in 3-5 builds on K-2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.

- Develop a model to describe phenomena.

Connections to Nature of Science

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

- Science explanations describe the mechanisms for natural events.

<table>
<thead>
<tr>
<th>LS2 B: Cycles of Matter and Energy Transfer in Ecosystems</th>
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<tbody>
<tr>
<td>● Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment.</td>
</tr>
</tbody>
</table>

**Crosscutting Concepts**

Systems and System Models

- A system can be described in terms of its components and their interactions.

**ELA/Math Connections:**

RI.5.7 - Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.

SL.5.5 - Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.

MP.2 Reason abstractly and quantitatively.

MP.4 Model with mathematics.

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**Learning Targets:**

I can...

- develop a model to describe how matter flows through an ecosystem. [Teacher Note: Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food.]
- compare the characteristics of plants, animals, and decomposers and the environment.
- make observations to classify organisms according to their role in the flow of matter through an ecosystem. [Teacher Note: Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as “decomposers.”]

**Teaching Resources:**

- energy pyramid
- food web
- food chain
- Ashland Marathon Oil resources
- picture cards
- yarn
- Need Project materials

**Vocabulary:**

Science and Engineering Practices/Crosscutting Concepts

- model
- system

Discipline-Specific

- plants
- animals
- decomposers
- environment
- energy
- transfer
- ecosystems
- relationships

- consumer (1st and 2nd level)
- produces
- living/nonliving organisms
- herbivores
- carnivores
- omnivores
- energy pyramid
- Sun

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5. Earth’s Systems

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<tr>
<td>S-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. [Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.] [Assessment Boundary: Assessment is limited to the interactions of two systems at a time.]</td>
<td>ESS2.A: Earth Materials and Systems Earth’s major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth’s surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.</td>
<td>Developing and Using Models Modeling in 3-5 builds on K-2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.</td>
<td>Systems and System Models A system can be described in terms of its components and their interactions.</td>
<td>RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. 5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.</td>
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</tbody>
</table>

Learning Targets:

I can…

- provide evidence of ways in which planet Earth houses smaller systems. [Teacher Note: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere.]

- describe the basic characteristics of the four major Earth systems. [Teacher Note: The geosphere, hydrosphere, atmosphere, and biosphere are each a system. Assessment is limited to the interactions of two systems at a time.]

- investigate examples of interactions between the four major Earth systems by collecting information from multiple print or digital sources. [Teacher Note: Earth systems interact in multiple ways to affect Earth’s surface materials and processes. For example, the ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.]

- collaborate to create a model that represents interaction between two Earth systems.

Vocabulary:

Science and Engineering Practices/Crosscutting Concepts

- model
- investigate
- interact
- patterns
- evidence
- characteristics

Discipline-Specific

- atmosphere
- biosphere
- climate
- geosphere
- hydrosphere
- landforms
- ecosystems
- weather
- sediments
- molten rock
- organisms

Teaching Resources:

- Science A to Z
- Soil
- Fans
- Hair dryer
- Pans
- Water
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</table>
| **5-ESS2-2.** Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth. [Assessment Boundary: Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.] | ESS2.C: The Roles of Water in Earth’s Surface Processes  
- Nearly all of Earth’s available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere. | Using Mathematics and Computational Thinking  
Mathematical and computational thinking in 3-5 builds on K-2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.  
- Describe and graph quantities such as area and volume to address scientific questions. | Scale, Proportion, and Quality  
- Standards units are used to measure and describe physical quantities such as weight, and volume. |

**LEARNING TARGETS:**  
I can…  
- graph data to represent the amounts and percentages of fresh and salt water on Earth. [Teacher Note: Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.]  
- describe how water is distributed in various reservoirs on Earth.

**VOCABULARY:**  
Science and Engineering Practices/Crosscutting Concepts  
scale  
proportion  
quantitative measurements  
compare  
analyze  
data  
volume  
area  
weight  
physical quantities

Discipline-Specific Environment  
reservoir  
sediment  
distribution  
trol  
water  
brackish water

**ELA/Math Connections:**  
RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.  
W.5.8 - Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.  
SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.  
MP.2 Reason abstractly and quantitatively.  
MP.4 Model with mathematics.

**TEACHING RESOURCES:**  
- Watershed activity  
- reading passages  
- globe  
- Google Earth  
- SANCO materials  
- Mentor text: The Drop of Water
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</table>
| S-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environment. | ESS3.C: Human Impacts on Earth Systems  
• Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth’s resources and environments. | Obtaining, Evaluating, and Communicating  
Obtaining, evaluating, and communicating information in 3-5 builds on K-2 experiences and processes to evaluating the merit and accuracy of ideas and methods.  
• Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. | Systems and System Models  
• A system can be described in terms of its components and their interactions.  
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Connections to Nature of Science  
Science Addresses Questions About the Natural and Material World  
• Science findings are limited to questions that can be answered with empirical evidence. | RI.5.1- Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.  
RI.5.7- Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.  
RI.5.9- Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.  
W.5.8- Recall relevant information from experiences or gather relevant information from print and digital sources.  
W.5.9- Draw evidence from literary or informational texts to support analysis, reflection, and research.  
MP.2 Reason abstractly and quantitatively.  
MP.4 Model with mathematics. |

Learning Targets:  
I can...  
• obtain and combine information from various sources about ways that communities use science ideas to protect Earth’s resources and environment.  
• Explain how human activities in agriculture, industry, and everyday life have had a major impact on the world around us. (land, vegetation, streams, ocean, air, and even outer space).  

Teaching Resources:  
• www.Eartheasy.com  
• www.dnr.wi.gov/eek/  
• enviroscape lesson/model from NKU

Vocabulary:  
Science and Engineering Practices/Crosscutting Concepts  
Model  
Impact  
Obtain  
evaluate  

Discipline-Specific  
environment  
community  
impact  
agriculture  
industry
5. Space Systems: Stars and the Solar System

<table>
<thead>
<tr>
<th>Performance Expectation</th>
<th>Disciplinary Core Ideas</th>
<th>Science and Engineering Practices</th>
<th>Crosscutting Concepts</th>
<th>ELA/Math Connections:</th>
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</thead>
<tbody>
<tr>
<td>PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down. [Clarification Statement: “Down” is a local description of the direction that points toward the center of the spherical Earth.] [Assessment Boundary: Assessment does not include mathematical representation of gravitational force.]</td>
<td>PS2.B: Types of Interactions - The gravitational force of Earth acting on an object near Earth’s surface pulls that object toward the planet’s center.</td>
<td>Engaging in Argument from Evidence - Engaging in argument from evidence in 3-5 builds on K-2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). - Support an argument with evidence, data, or a model.</td>
<td>Cause and Effect - Cause and effect relationships are routinely identified and used to explain change.</td>
<td>RI.5.1 - Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. RI.5.9 - Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. W.5.1 - Write opinion pieces on topics or texts, supporting a point of view with reasons and information.</td>
</tr>
</tbody>
</table>

**Learning Targets:**
- I can...
  - communicate observations of gravitational force on Earth.
  - provide evidence to support an argument about the direction of gravitational force on Earth. [Teacher Note: “Down” is a local description of the direction that points toward the center of the spherical Earth.]

**Teaching Resources:**
- LDC module
- Tower Fall website
- CINSAM lesson

**Vocabulary:**

- Science and Engineering Practices/Crosscutting Concepts
  - argument
  - cause and effect relationship

- Discipline-Specific
  - axis
  - gravitational force
  - orbit
  - rotate/rotation
<table>
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<tr>
<th>Performance Expectation</th>
<th>Disciplinary Core Ideas</th>
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<tbody>
<tr>
<td>S-ESS1-1. Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth.</td>
<td>ESS1.A: The Universe and Its Stars</td>
<td>Engaging in Argument from Evidence</td>
<td>Scale, Proportion, and Quantity</td>
<td></td>
</tr>
<tr>
<td>[Assessment Boundary: Assessment is limited to relative distances, not sizes, of stars. Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, stage).]</td>
<td>- The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth.</td>
<td>Engaging in argument from evidence in 3-5 builds on K-2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).</td>
<td>- Natural objects exist from the very small to the immensely large.</td>
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<tr>
<td>Learning Targets:</td>
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<tr>
<td>I can...</td>
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<tr>
<td>- Describe the sun in relation to the other stars by collecting information from multiple sources. [Teacher Note: The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth.]</td>
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<tr>
<td>- support an argument about why the sun appears larger and brighter than the other stars. [Teacher Note: Assessment is limited to relative distances, not sizes, of stars.]</td>
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<tr>
<td>- describe how the Earth, sun, and moon operate as a system.</td>
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<td>Discipline-Specific</td>
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<tr>
<td>Science and Engineering Practices/Crosscutting Concepts</td>
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<td>orbit</td>
<td>constellation</td>
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<tr>
<td>cause and effect</td>
<td>solar system</td>
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<tr>
<td>evidence</td>
<td>universe</td>
<td>quantity</td>
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<tr>
<td>data</td>
<td>moon</td>
<td>proportion</td>
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<tr>
<td>model</td>
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</tbody>
</table>

Teaching Resources:
- articles
- pictures of constellations
- video clips
- models of solar system
- constellation maps
- flashlights
- blank construction paper
- styrofoam balls (different sizes)
- index cards
- rulers
- data collection chart
- skewers (to attach balls)
- Cincinnati Planetarium outreach program
- Online planetarium
- Science A to Z
### Performance Expectation

**Title:** 5-ESS1-2. Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.  
**Clarification Statement:** Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months. [Assessment Boundary: Assessment does not include causes of seasons.]  
**Teacher Note:** Examples of patterns could include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year.

<table>
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<th><strong>Science and Engineering Practices</strong></th>
<th><strong>Crosscutting Concepts</strong></th>
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<tbody>
<tr>
<td><strong>Analyzing and Interpreting Data</strong></td>
<td><strong>Patterns</strong></td>
</tr>
</tbody>
</table>
| Analyzing data in 3-5 builds on K-2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.  
  - Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. |  
  - Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena. |

### Learning Targets:

**I can...**

- make observations to identify patterns on Earth and in the sky. [Teacher Note: Examples of patterns could include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year.]
- combine information from multiple sources to explain how the Earth’s movements cause the patterns we observe on Earth and in the sky. [Teacher Note: Assessment does not include causes of seasons.]
- analyze data to identify patterns.
- represent data in a graph to reveal patterns.

### Teaching Resources:

- online planetarium
- flashlights/lamp
- globe
- outdoor classroom
- Cincinnati Planetarium outreach program

### Vocabulary:

- Science and Engineering Practices/Crosscutting Concepts
  - argument
  - cause and effect
  - relationship
  - patterns
  - data
  - graphical display
  - analyze

- Discipline-Specific
  - orbit
  - solar system
  - stars
  - universe
  - axis
  - north pole
  - south pole
  - shadow
  - rotation

### ELA/Math Connections:

**SL.5.5** - Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.

**MP.2** Reason abstractly and quantitatively.

**MP.4** Model with mathematics.

**5.G.A.2** - Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.