### Unit Overview

**Content Area:** 5th Grade Science  
**Unit Title:** Structure and Properties of Matter  
**Unit:** 1  
**Target Course/Grade Level:** 5th Grade Science  
**Timeline:** Fall

**Unit Summary:** In this unit, students will explore properties and states of matter. They will conduct investigations involving chemical changes and mixtures.

**Primary interdisciplinary connections:** English Language Arts, Math, Technology

**21st century themes and skills:** Creative Thinking and Problem Solving, Communication and Collaboration, Life and Career Skills: -flexibility and adaptability, Initiative and Self-direction, Social Skills, Productivity and Accountability, Leadership and Responsibility

**Unit Rationale:** Matter is everything around you. Matter is anything made of atoms and molecules. Matter is anything that has mass and takes up space. If you are new to the idea of mass, it is the amount of stuff in an object. There is a difference between mass and weight. Matter is sometimes related to light and electromagnetic radiation. Even though matter can be found all over the Universe, you only find it in a few forms. As of 1995, scientists have identified five physical states of matter. Each of those states is sometimes called a phase. They may even discover one more state by the time you get old.

Students will learn about solids, liquids, gases, plasmas, and one state called the Bose-Einstein condensate (BEC). Scientists have always known about solids, liquids, and gases. Plasma was a new idea when it was noticed by William Crookes in 1879. The scientists who worked with the Bose-Einstein condensate received a Nobel Prize for their work in 1995. But what makes a state of matter? It's about the physical state of the molecules and atoms. Think about solids. They are often hard and brittle. Liquids are all fluid at room temperature. Gases are there, but you usually smell them before you can see them. You don't see them because their molecules are really far apart. The BEC is all about molecules that are really close to each other (even closer than atoms in a solid).

A chemical change happens when the atoms in a molecule are moved around or when atoms are added or taken away. Chemical changes happen when bonds between atoms are created or destroyed. Changing physical states of matter is about changing densities, pressures, temperatures, and other physical properties. The basic chemical structure does not change when there is a physical change.

### Learning Targets
Standards:

### 5. Structure and Properties of Matter

**5-PS1-1. Develop a model to describe that matter is made of particles too small to be seen.** [Clarification Statement: Examples of evidence could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.] [Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.]

**5-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 forms new substances.] [Assessment Boundary: Assessment does not include distinguishing mass and weight.]

**5-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.]

**5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.**

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### 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. (5-PS1-1)

**Planning and Carrying Out Investigations**
- 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.
  - 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. (5-PS1-4)
  - Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (5-PS1-3)

**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 scientific and engineering questions and problems. (5-PS1–3)

### Disciplinary Core Ideas

**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; the effects of air on larger particles or objects. (5-PS1-1)
  - The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (5-PS1-2)
  - 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.) (5-PS1-3)

**PS1.B: Chemical Reactions**
- When two or more different substances are mixed, a new substance with different properties may be formed. (5-PS1-4)
  - 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.) (5-PS1-2)

### Crosscutting Concepts

**Cause and Effect**
- Cause and effect relationships are routinely identified, tested, and used to explain change. (5-PS1-4)

**Scale, Proportion, and Quantity**
- Natural objects exist from the very small to the immensely large. (5-PS1-1)
  - Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. (5-PS1-2), (5-PS1-3)

### Connections to Nature of Science

**Scientific Knowledge Assumes an Order and Consistency in Natural Systems**
- Science assumes consistent patterns in natural systems. (5-PS1-2)

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### Articulation of DCIs across grade-levels:

### Common Core State Standards Connections:

**ELA/Reading – RI.1.7**
- Draw inferences from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-PS1-2)

**W.5.7**
- Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (5-PS1-2), (5-PS1-3) (5-PS1-4)

**W.5.8**
- Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase in a synthesis of the work, and provide a list of sources. (5-PS1-2), (5-PS1-3), (5-PS1-4)

**W.5.9**
- Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-PS1-2), (5-PS1-3), (5-PS1-4)

**Mathematics –**
- MP.2 Reason abstractly and quantitatively. (5-PS1-1), (5-PS1-2), (5-PS1-3)
- MP.4 Model with mathematics. (5-PS1-2), (5-PS1-3), (5-PS1-4)
- MP.5 Use appropriate tools strategically. (5-PS1-2), (5-PS1-3)
- 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 powers of 10. (5-PS1-1)
- 5.NF.B.7 Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (5-PS1-4)
- 5.MD.A.1 Convert among different-sized standard 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. (5-PS1-2)
- 5.MD.C.3 Recognize volume as an attribute of solid figures and understand concepts of volume measurement. (5-PS1-1)
- 5.MD.C.4 Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units. (5-PS1-2)
### Unit Essential Questions
- What is matter?
- How do we know if matter changes?
- Is there matter around us that we cannot see?

### Unit Enduring Understandings
- The earth is one large mixture of molecules in gases, liquids, and solids.
- There are five states of matter.
- The particles of gas move rapidly and there are much larger spaces between them than between the particles in a liquid or solid.
- The particles of a liquid move past one another easily. They are close together, but not in a neat, even arrangement as the particles in a solid are.
- The particles of a solid are arranged in a tight, regular pattern, and move very little.
- Elements and compounds can move from one physical state to another and not change their basic atomic parts.
- There are physical changes and chemical changes.
- Measurement of a variety of properties can be used to identify materials.
- The amount of matter is conserved when it changes form.
- When two or more different substances are mixed, a new substance with different properties may be formed.
- No matter what reaction or change in properties occurs, the total mass of the substances does not change.

### Unit Learning Targets
*Students will...*
- Identify the components of the Scientific Method
- Understand and practice safety procedures for conducting scientific investigations
- Conduct experiments using the components of the Scientific Method
- Collect data and draw conclusions based on the interpretations of the data - using mean, median, mode and range
- Represent and describe data using graphs or tables
- Identify patterns in the periodic table
- Identify the parts of an atom
- Understanding functions of the parts of an atom
- Identify molecules, compounds, mixture and solutions
- Identify the properties of the five states of matter: color, hardness, reflectivity, electrical and thermal conductivity, response to magnetic forces and solubility
- Identify substances based on chemical and physical properties and changes
- Combine two or more substances to create a new substance with different properties
- Experiment to prove that the weight of a substance does not change no matter what reaction or change in properties occur- identify volume and mass
<table>
<thead>
<tr>
<th>Content Focus Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is matter?</td>
</tr>
<tr>
<td>What are the five states of matter?</td>
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<tr>
<td>What is a physical change?</td>
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<tr>
<td>What is a chemical change?</td>
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<td>What is a compound?</td>
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<tr>
<td>What is an element?</td>
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<tr>
<td>What is all around us that cannot be seen? (e.g. molecules, single elements, atoms)</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Sample Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Fizz ball</td>
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<td>• Oobleck</td>
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<tr>
<td>• Vinegar and baking soda balloon</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Teacher Instructional Resources</th>
</tr>
</thead>
</table>

Science text, probes

<table>
<thead>
<tr>
<th>Evidence of Learning</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Formative Assessments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Probes</td>
</tr>
<tr>
<td>• Science Journals</td>
</tr>
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<td>• Quizzes</td>
</tr>
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<td>• Class participation</td>
</tr>
<tr>
<td>• Anecdotal records</td>
</tr>
<tr>
<td>• Exit slips</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Summative Assessment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summative Unit Test</td>
</tr>
</tbody>
</table>
**Integration of Technology:** Smartboard, computers, netbooks, e-books

**Technology Resources:**
Click the links below to access additional resources used to design this unit:

- [http://classroom.jc-schools.net/sci-units/matter.htm](http://classroom.jc-schools.net/sci-units/matter.htm)
- [http://www.superteacherideas.com/science7-matter.html](http://www.superteacherideas.com/science7-matter.html)

Brainpop
Discovery Education

**Materials / Equipment Needed:** Probes, lab equipment, Science Notebook

**Opportunities for Differentiation:**
VAKT learning opportunities
Leveled texts
Differentiated instruction

**Teacher Notes:**
# Unit Overview

**Content Area:** 5th Grade Science  
**Unit Title:** Matter and Energy in Organisms and Ecosystems  
**Target Course/Grade Level:** 5th Grade Science  
**Unit:** 2  
**Timeline:** Fall / Winter  

**Unit Summary:** In this unit, students will explore how plants and animals are parts of ecosystems that must be balanced so that multiple species can thrive within those environments.  

**Primary interdisciplinary connections:** English Language Arts, Math, Technology  

**21st century themes and skills:** Creative Thinking and Problem Solving, Communication and Collaboration, Life and Career Skills: flexibility and adaptability, Initiative and Self-direction, Social Skills, Productivity and Accountability, Leadership and Responsibility

**Unit Rationale:** 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. Either way, they are consumers. 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 for plants to use. (Nitrogen Cycle) 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. Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, water, and minerals from the environment and release waste matter (gas, liquid, or solid) back into the environment.

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### Learning Targets
Standards:

## 5. Matter and Energy in Organisms and Ecosystems

**5.Matter and Energy in Organisms and Ecosystems**

- **5-PS3-1.** Use models to describe that 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.]
- **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 material comes mostly from air and water, not from the soil.]
- **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 into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.] [Assessment Boundary: Assessment does not include molecular explanations.]

### 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. (5-PS3-1)
  - Develop a model to describe phenomena. (5-LS2-1)
- 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. (5-LS1-1)

### Disciplinary Core Ideas

<table>
<thead>
<tr>
<th>PS.3.D</th>
<th>Energy in Chemical Processes and Everyday Life</th>
</tr>
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<tbody>
<tr>
<td>- 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). (5-PS3-1)</td>
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<tr>
<td>LSI.C</td>
<td>Organization for Matter and Energy Flow in Organisms</td>
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<tr>
<td>- 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 to 5-PS3-1)</td>
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<tr>
<td>- Plants acquire their material for growth chiefly from air and water. (5-LS1-1)</td>
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<tr>
<td>LS2.A</td>
<td>Interdependent Relationships in Ecosystems</td>
</tr>
<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. (5-LS2-1)</td>
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<tr>
<td>LS2.B</td>
<td>Cycles of Matter and Energy Transfer in Ecosystems</td>
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<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. (5-LS2-1)</td>
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</table>

### Crosscutting Concepts

- Systems and System Models
  - A system can be described in terms of its components and their interactions. (5-LS2-1)
- Energy and Matter
  - Matter is transported into, out of, and within systems. (5-LS1-1)
  - Energy can be transferred in various ways and between objects. (5-PS3-1)

Connections to other DCIs in fifth grade: 5-PS1.A (5-LS1-1), 5-LS2-1, 5-ESS2.A (5-LS2-1)


Common Core State Standards Connections:

### ELA/Literacy

- **RI.5.1** Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-LS1-1)
- **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. (5-PS3-1), (5-LS2-1)
- **RI.5.9** Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-LS1-1)

### Mathematics

- **W.5.1** Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5-LS1-1)
- **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. (5-PS3-1), (5-LS2-1)

### Mathematics

- **MP.2** Reason abstractly and quantitatively. (5-LS1-1), (5-LS2-1)
- **MP.4** Model with mathematics. (5-LS1-1), (5-LS2-1)
- **MP.5** Use appropriate tools strategically. (5-LS1-1)

### Conversion of Units

- **5.MD.A.1** Convert among different-sized standard 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. (5-LS1-1)
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<th>Unit Essential Questions</th>
<th>Unit Enduring Understandings</th>
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<td>• How do organisms obtain resources?</td>
<td>• Energy is released from food and the chemical process that forms plant matter (from air and water).</td>
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<tr>
<td>• How do organisms change their environment?</td>
<td>• Organisms obtain and use the matter and energy they need to live and grow.</td>
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<tr>
<td>• How do changing environmental systems affect organisms/man?</td>
<td>• Animals and plants alike generally need to take in air and water.</td>
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<td>• Animals must take in food.</td>
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<td></td>
<td>• Plants need light and minerals.</td>
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<td>• Anaerobic life, such as bacteria in the gut, functions without air.</td>
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<td>• Food provides animals with the materials they need for body repair and growth and is digested to release the energy they need to maintain body warmth and for motion.</td>
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<td>• Plants acquire their material for growth chiefly from air and water and process matter they have formed to maintain their internal conditions (e.g., at night).</td>
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<tr>
<td></td>
<td>• Organisms interact with the living and nonliving environment to obtain matter and energy.</td>
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<td>• The food of almost any kind of animal can be traced back to plants.</td>
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<td>• Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants.</td>
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<td>• Newly introduced species can damage the balance of an ecosystem.</td>
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<td>• Organisms obtain gases, water, and minerals from the environment and release waste matter (gas, liquid, or solid) back into the environment.</td>
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**Unit Learning Targets**

*Students will ...*

- Learn how energy is released from food and the chemical process that forms plant matter (from air and water).
- Learn how organisms obtain and use the matter and energy they need to live and grow.
- Understand that animals and plants alike generally need to take in air and water, animals must take in food, and plants need light and minerals; anaerobic life, such as bacteria in the gut, functions without air.
- Understand that food provides animals with the materials they need for body repair and growth and is digested to release the energy they need to maintain body warmth and for motion.
- Understand that plants acquire their material for growth chiefly from air and water and process matter they have formed to maintain their internal conditions (e.g., at night).
- Learn how organisms interact with the living and nonliving environment to obtain matter and energy.
- Understand that 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.
- Understand the relationship with consumers, decomposers, and the Nitrogen Cycle.
- Learn how matter and energy move through the ecosystem.

**Content Focus Questions**

- What is an ecosystem?
- What is a food chain and a food web and how are the populations in these connected?
- How does energy move through an ecosystem?
- How do food webs affect us?
- How do ecosystems recycle water, carbon, and nitrogen?
- In what ways do ecosystems change?
- How do the changes affect populations?
- How are living things organized?
- What is a biome? Describe the various biomes.
Sample Activities:
Lessons -
1. Photosynthesis song
2. Link: You Tube: The Process of Photosynthesis
3. Interactive NOVA: Energy Flow
4. Interactive Photosynthesis page
5. Smart Exchange Photosynthesis Matching Game
6. Photosynthesis basics website matching game
7. Illustrate diagram/vocabulary in notebook

http://www.livebinders.com/play/play?id=393767
(Unit from NC)

WRITING PROMPTS
- Explain what a food web is. Draw a visual example of a food web. Now, describe what might happen in your food web should you remove one of its organisms. Use information to support your prediction.
- What is the most interesting animal or plant you’ve ever seen? What is special about it? Explain what the animal or plant looks like and how it survives. Describe its habitat. Explain how its habitat is important to its well-being.
- What if a hurricane destroyed part of an ecosystem near your home? Write a newspaper report telling what happened to an animal because of the hurricane.
- Which ecosystem that we have learned about is your favorite? Why?
- Describe an environmental problem you have noticed in your community. Write about a possible solution.

Teacher Instructional Resources
Science text, probes

Evidence of Learning

Formative Assessments:
- Probes
- Science Journals
- Quizzes
- Class participation
- Anecdotal records
- Exit slips

Summative Assessment
Summative unit test
**Integration of Technology:** Smartboard, computers, netbooks, e-books

**Technology Resources:**
Click the links below to access additional resources used to design this unit:

Brainpop
Discovery Education

Ecology games for Kids
http://www.sheppardsoftware.com/content/animals/kidscorner/foodchain/foodchain2.htm

Ecology Kids
http://www.eco-pros.com/ecologykids.htm

Kids Do Ecology - Learn more about ecology and how you can become an ecologist. Interdependence graphic organizer activities

Food Webs
http://www.k8science.org/resources/files/Food_05_s.pdf

In this activity, learners construct possible food webs for six different ecosystems as they learn about the roles of different kinds of living organisms.

**Materials / Equipment Needed:**
Probes, lab equipment, Science Notebook

**Opportunities for Differentiation:**
VAKT learning opportunities
Leveled texts
Differentiated instruction

**Teacher Notes:**
Unit Overview

**Content Area:** 5th Grade Science  
**Unit Title:** Earth’s Systems  
**Target Course/Grade Level:** 5th Grade Science  
**Unit:** 3  
**Timeline:** Winter / Spring

**Unit Summary:** In this unit, the students will understand the Earth’s major systems and how they interact, the roles of water in Earth’s surface processes, and the impact of human interaction on Earth’s systems.

The Earth Systems unit is designed to promote student investigations of the connections among Earth’s systems and Earth history. These systems – the atmosphere, hydrosphere, geosphere, and biosphere – interact through time to produce the Earth’s landscapes, ecology, and resources. This unit develops the explanations of phenomena fundamental to the sciences of geology and physical geography, including the early history of the Earth, plate tectonics, landform evolution, the Earth’s geologic record, and weather and climate. Instruction is focused on inquiry and development of scientific explanations, rather than mere descriptions of phenomena. Case studies, laboratory exercises, maps, technology use and data analysis are integrated into lessons. Special attention is paid to topics of current interest (e.g., recent earthquakes, volcanoes, global warming, price of resources).

**Primary interdisciplinary connections:** English Language Arts, Math, Technology

**21st century themes and skills:** Creative Thinking and Problem Solving, Communication and Collaboration, Life and Career Skills: -flexibility and adaptability, Initiative and Self-direction, Social Skills, Productivity and Accountability, Leadership and Responsibility

**Unit Rationale:**
Earth has four basic physical systems. These are the lithosphere (land), the hydrosphere (water), the atmosphere (air), and the biosphere (life). Earth’s crust, its solid, rocky surface layer, is the lithosphere. It includes the rock and soil of Earth’s landmasses, as well as the rock and sediment of the ocean floor. All of Earth’s water makes up the hydrosphere. Almost all of the hydrosphere is ocean water. People have given separate names to the oceans, such as the Pacific Ocean and the Atlantic Ocean. However, you can see on a map or globe that the oceans are all connected. Ocean water is too salty to drink. The fresh water that people use comes from other parts of the hydrosphere, such as lakes, rivers, and groundwater. The layer of gases that surrounds Earth makes up the atmosphere. Nitrogen and oxygen are the main gases in the air. The atmosphere also contains small amounts of other gases as well as small particles of dust. Most of the atmosphere’s gases are close to Earth’s surface. The concentration of gases decreases as the distance above Earth’s surface increases. Water in the atmosphere, such as the water in clouds, is part of the hydrosphere. Water vapor, carbon dioxide, and other gases in the atmosphere trap heat from the sun to warm Earth. The movement of air and water in the atmosphere causes wind and weather. The portion of the hydrosphere, atmosphere, and lithosphere where there is life is called the biosphere. All living things on Earth belong to the biosphere. People, animals, insects, trees, and bacteria are all part of the biosphere. Living things can be found on land, deep in the ocean, and high in the atmosphere. These four systems are always changing and interacting with one another. Consider an erupting volcano. It causes changes to the land, affects the living things nearby, and adds gases to the air. Or consider a rainstorm. It provides water that plants need, but a powerful storm can wash away large amounts of soil.

Learning Targets
Standards:

**5. Earth's Systems**

Students who demonstrate understanding can:

5-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.]

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.]

5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

**Science and Engineering Practices**

**Disciplinary Core Ideas**

**Crosscutting Concepts**

**Unit Essential Questions**

- Why does the earth look the way it does and what made it look that way?

**Unit Enduring Understandings**

- All spheres effects all the other spheres.
- Change is the only constant.
- The planet is alive.
### Unit Learning Targets

*Students will ...*

- Differentiate between the different parts of the earth (atmosphere, hydrosphere, lithosphere).
- Compare and contrast the three layers of the earth (crust, mantle, core).
- Investigate how the separate continents fit together as one continent (plate tectonics).
- Interpret real-time earthquake and volcano data and to how use the information to solve a real world problem.
- Explain how examining rocks shows how the earth’s surface has changed.
- Explain and illustrate the water cycle.
- Differentiate between weather and climate.
- Explain and illustrate the greenhouse effect.
- Evaluate the relationship between water, land and climate.
- Graph the different degrees of change of each different factor – how much on a scale does water/wind erosion, glaciers/ice (rock fracture) change the earth’s surface?
- Explain how volcanoes influence climate.
- Research the cause and effect of volcanic eruptions. Create a volcano model and explain how this explain resulted in a change in climate.
- Engage in arguments and support with evidence if global warming is the cause of violent storms, severe floods and droughts.

### Content Focus Questions

- What are the Earth’s physical systems?
- What are the layers of the Earth?
- How does the Earth’s crust move?
- What changes the Earth’s surface?
Sample Activities
Musical Plates: This is an ongoing activity and can be started at the beginning of the unit http://ciese.org/curriculum/musicalplates3/en/index.shtml

Lesson 1:
1. Brainpop: Earth’s Structure Songs:  http://www.youtube.com/watch?v=IP9amNieUXc  (many more fun ones to choose from online)
Smartexchange:  http://exchange.smarttech.com/details.html?id=8d140fc6-579d-4344-8dd9-b37fa80afce (other power points available on subject)
2. Lab: Exploring a Model of the Earth’s Layers (C6-C7 Textbook)
3. Textbook pages C8-C11 (record/illustrate pertinent vocabulary in science notebook)
4. Lesson 1 Review pg. C11 can be used as formative assessment

Lesson 2:
1. Brain Pop: Plate tectonics Songs: fun ones to choose from online
Dance: Sid Shuffle/Continental Drift brainbreak http://www.youtube.com/watch?v=UMuJxdGpxo
2. Inquiry based exploration on Plate Tectonics: Wegener’s Puzzling Evidence Exercise http://volcanoes.usgs.gov/about/edu/dynamicplanet/wegener/
3. Textbook pages C14-C20 (record/illustrate pertinent vocabulary in science notebook)
http://mail.colonial.net/~hkaiter/platestectonics.html  (relevant background information/child friendly format)
4. Formative assessment  (Teacher’s Assessment Package pg. 110)

Lesson 3:
4. Textbook pages C21-27 (record/illustrate pertinent vocabulary in science notebook)
5. Formative assessment  (Teacher’s Assessment Package pg. 111)

Lesson 4:
1. Edible Introduction:  Rocks changing forms modeled with goodies (has to be modified)
http://beakersandbumblebees.blogspot.com/search?updated-min=2009-01-01T00:00:00-08:00&updated-max=2010-01-01T00:00:00-08:00&max-results=50
2. Brain Pop: Rock Cycle Songs:  http://www.youtube.com/watch?v=F5YSedeq6i0  http://www.youtube.com/watch?v=r68iEwYdbh4 (others available!)
3. Textbook pages C30-C35 (record/illustrate pertinent vocabulary in science notebook)
4. Exit ticket Lesson 4 Review pg C34 (can be used as formative assessment)
5. Lab:  Experimenting with Crystal Formation (textbook pg C35-C37)

Lesson 5:
1. There are a lot of demonstration/labs available online that model all or parts of the water cycle. I am attaching one example
http://bugandmonkeymama.blogspot.com/search?updated-min=2009-01-01T00:00:00-08:00&updated-max=2010-01-01T00:00:00-08:00&max-results=50
bill nye water cycle http://www.youtube.com/watch?v=G6FpOdSVelU
The Magic SchoolBus at the Water Works:  http://www.youtube.com/watch?v=wkmtjMz8Mw (this should be seen prior to the webquest)
Water Cycle Powerpoint http://www.teacherspayteachers.com/Product/Water-Cycle-Diagram-Interactive-PowerPoint-454910
2. Water Cycle Webquest  http://www.calschools.org/k12resource/webquest2004/waterunit/watercyclegood.html  (parts can be a formative assessment)

Lesson 6:
3. Textbook pages C84-C87 (record/illustrate pertinent vocabulary in science notebook)
4. Formative assessment possibilities: illustrate/explain greenhouse effect or  http://www.teacherspayteachers.com/Product/Weather-VS-Climate-Game-200932

Lesson 7:
1. Inquiry lab:  Island in warm water (textbook page C90 TE)  watch weather channel or weather reports
2. Textbook pages C 90-97 (record/illustrate pertinent vocabulary in science notebook)
3. Guess the climate:  Group Enrichment activity pg. 97 (could be modified for all learners)
4. Exit ticket:  Lesson 3 Review Text page C97  (possible formative assessment)

Lesson 8:
1. http://www.uen.org/Lessonplan/preview/?LpId=2695  (invitation to learn is a great opener)  http://www.weatherwizkids.com/weather-volcano.htm
2. Brain Pop:  Volcanoes/ Global Warming
4. Read C98-C101
5. Global Climate Change Expedition:  http://www.epa.gov/climatechange/kids/  www.globalwarmingkids.net  Have students explore site
6. Value line/4corners discussion/arguments Is global warming the cause of violent storms, severe floods, and droughts?
7. Wrap up….1/2 room write a cause/ ½ room write effect….toss in center of room on floor.  Call out each (different hand motion for cause/effect) check understanding
8. Formative assessment:  Global Warming PROBE, model volcano explaining how it can influence climate

Lesson 9:
1. Pre-Probe:  Where Would It Fall
2. Introduction Lab/Demonstration:  Investigating Water Pollution C54 Textbook or Inquiry activity page C48 Textbook
3. Textbook pages C48-C53 (record pertinent vocabulary in science notebook)
4. Formative assessment possibility:  Lesson 2 Review questions 1-2 pg C53

5. http://app.discoveryeducation.com/techbook2/concept/view/guidConceptId/7130246-935e-4a47-be27-76f606d00e06/guidUnitId/7000cf7-0014-
**Teacher Instructional Resources:**
Scott Foresman Science Textbook
Brain Pop
probes

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**Evidence of Learning**

**Formative Assessments:**
- Pre-Probes: Where Would it Fall?, Global Warming
- **Listed in red (see above)**
- Science Journal
- Class participation
- Anecdotal records
- Exit slips

**Summative Assessment**
- Summative Unit Test

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**Integration of Technology:** Smartboard, Computers, Netbooks, e-books

**Technology Resources:**
Click the links below to access additional resources used to design this unit:
- Brain Pop
- Discovery Education
- Smart Exchange

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**Materials / Equipment Needed:**
Science Notebook, Probes, lab equipment

**Opportunities for Differentiation:**
VAKT learning opportunities
Leveled texts
Differentiated instruction

**Teacher Notes:**
## Unit Overview

<table>
<thead>
<tr>
<th><strong>Content Area:</strong></th>
<th>5th Grade Science</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit Title:</strong></td>
<td>Stars and Our Solar System</td>
</tr>
<tr>
<td><strong>Target Course/Grade Level:</strong></td>
<td>5th Grade Science</td>
</tr>
<tr>
<td><strong>Unit:</strong></td>
<td>4</td>
</tr>
<tr>
<td><strong>Timeline:</strong></td>
<td>Spring</td>
</tr>
</tbody>
</table>

**Unit Summary:** In this unit, students will recognize that a galaxy consists of gas, dust, and many stars, including any objects orbiting the stars. They will identify the basic components of a galaxy and identify our home galaxy as the Milky Way. They will also explore how stars can be different. They will recognize the major common characteristics of all planets and compare/contrast the properties planets. They will also distinguish among the following objects of the Solar System—Sun, planets, moon, asteroids, and comets.

**Primary interdisciplinary connections:** English Language Arts, Math, Technology

**25th century themes and skills:** Creative Thinking and Problem Solving, Communication and Collaboration, Life and Career Skills: -flexibility and adaptability, Initiative and Self-direction, Social Skills, Productivity and Accountability, Leadership and Responsibility

**Unit Rationale:**

With all of the changes in the understanding of the solar system being made lately, it is becoming important to teach the correct information that is up to date. [www.solarsystem.nasa.gov](http://www.solarsystem.nasa.gov) encourages students in grades five through eight to learn about the concept of dwarf planets and why Pluto is no longer considered a planet in our solar system. This unit allows for students to understand that "The Sun is the central and most massive body in our solar system, which includes eight planets and their moons, dwarf planets, asteroids, and comets." They will also learn that "The Sun’s gravity holds planets and other objects in the solar system in orbit, and planets’ gravity holds moons in orbit" along with several additional key concepts.

## Learning Targets
Standards:

5. Space Systems: Stars and the Solar System

Unit Essential Questions:

- In what ways does Earth move?
- How can we describe the parts of the solar system?
- What is known about the Moon?
- How do gravitational forces affect us?
- Do different stars have different brightnesses?
- How do the Earth, Moon, and Sun interact?
- Why do some stars look bigger and brighter than others?
- Why is cold in the winter and warm in the summer?

5. Space Systems: Stars and the Solar System

Students who demonstrate understanding can:

5-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.]

5-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 Earth. [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].

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.]

Science and Engineering Practices

Analyzing and Interpreting Data
- 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.

- Support in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. (5-ESS1-2)

Enacting 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. (5-PS2-1),(5-ESS1-1)

Disciplinary Core Ideas

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. (5-PS2-1)

ESS1.A: The Universe and Its Stars
- 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. (5-ESS1-1)

ESS1.B: Earth and the Solar System
- The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These 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. (5-ESS1-2)

Crosscutting Concepts

Patterns
- Similarities and differences in patterns can be used to sort, classify, communicate, and analyze simple rates of change for natural phenomena. (5-ESS1-2)

Cause and Effect
- Cause and effect relationships are routinely identified and used to explain changes. (5-PS2-1)

Scale, Proportion, and Quantity
- Natural objects exist from the very small to the immensely large. (5-ESS1-1)

Connections to other DCIs in fifth grade: N/A

Articulation of DCIs across grade-levels: 1ESS1.A (5-ESS1-2); 1ESS1.B (5-ESS1-2); 3PS2.A (5-PS2-1),(5-ESS1-2); 3PS2.B (5-PS2-1); MS-ESS1.A (5-ESS1-1),(5-ESS1-2); MS-ESS1.B (5-PS2-1),(5-ESS1-1),(5-ESS1-2); MS-ESS2.C (5-PS2-1)

Common Core State Standards Connections:

ELA/Literacy –
- RI.5.1: Quote accurately from a text when explaining what the text says explicitly and what drawing inferences from the text. (5-PS2-1),(5-ESS1-1)
- RI.5.7: Draw on expertise to provide evidence for effectiveness. (5-ESS1-1)
- RI.5.8: Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s). (5-ESS1-1)
- RI.5.9: Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-PS2-1),(5-ESS1-1)
- W.5.1: Write arguments to support claims with clear reasons and relevant evidence. (5-ESS1-1)
- 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. (5-ESS1-2)

Mathematics –
- MP.2: Reason abstractly and quantitatively. (5-ESS1-1),(5-ESS1-2)
- MP.4: Model with mathematics. (5-ESS1-1),(5-ESS1-2)
- 5.NBT.A.2: 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 powers of 10. (5-ESS1-1)
- 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. (5-ESS1-2)

Unit Enduring Understandings:

- The gravitational force of the earth acting on an object near the Earth’s surface pulls that object toward the planet’s center.
- Earth and the Moon move in predictable ways.
- Earth’s tilt and movement cause seasonal changes.
- Changes in the relative positions of the Sun, the Moon, and Earth cause changes to what we see from Earth.
- Our solar system is made up of many things.
Unit Learning Targets

Students will...

- Develop an understanding of patterns in data from experiments supporting gravitational force exerted by Earth on objects is directed down.
- Gain an understanding of the brightness of stars is due to their relative distance from the Earth.
- Develop an understanding of patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.
- Understand how gravitational forces effect Earth.
- Understand how stars range greatly in their distance from the Earth.
- Explore how stars vary in brightness.
- Explore the observable patterns of the Earth, moon, and other planets in our solar system.

Content Focus Questions

- Does the Earth tilt on its own axis as it rotates and revolves around the Sun?
- What causes changes in season, length of day, and energy available?
- Does the angle that the rays of the Sun strike the surface of the Earth determine the amount of energy received?
- What is the effect of the tilt of the Earth on polar climates?
- How do the planets differ in size, characteristics, and composition?
- What else is a part of our solar system?
- What are the phases of the moon?
- How are the tides effected?
- What causes day and night?
- What caused us to have different seasons?
- Why can you sometimes see the moon during the day?
- Why can you only see the stars at night?
- Are the Earth, moon, and Sun planets? If not, what are they?
- Why do you see the Sun at different places during the day?
- How far apart are the Earth, moon, and Sun?
Sample Activities

Types of Interactions - Gravity –
Types of Interactions: The gravitational force of earth acting on an object near the earth’s surface pulls that object towards the planets center.

Probes:
- Dropping Balls

Textbook pages:
- B56 – 59 How does gravity affect motion?

BrainPop and other videos:
- Gravity – Bill Nye
- Schoolhouse Rock – A Victim of Gravity http://www.youtube.com/watch?v=yHFtk6Si0Fk

The Universe and Its Stars - Sun, stars, size & distance -
The Universe and Its Stars: 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.

Probes:
- Objects in the Sky
- Where Do Stars Go?

Textbook Pages:
- C118-125 What is known about stars?

BrainPop and other videos:
- The Sun – Bill Nye

Earth & the Solar System: The orbits of Earth around the sun and of the moon around the earth, together with the rotation of the axis between its North and South Poles, cause observable patterns. These 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.

Probes:
- Emmy’s Moon & Stars
- Me & My Shadow
- Darkness at Night
- Summer Talk
- Lunar Eclipse
- Solar Eclipse

BrainPop and other videos:
- The Moon – Bill Nye
**Teacher Instructional Resources**
Science text, probes

Schoolhouse Rock – A Victim of Gravity [http://www.youtube.com/watch?v=yHFtk6Si0Fk](http://www.youtube.com/watch?v=yHFtk6Si0Fk)

“Janice VanCleave’s Gravity”
by Janice VanCleave

<table>
<thead>
<tr>
<th>Evidence of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Formative Assessments:</strong></td>
</tr>
<tr>
<td>• Probes</td>
</tr>
<tr>
<td>• Science Journals</td>
</tr>
<tr>
<td>• Quizzes</td>
</tr>
<tr>
<td>• Class participation</td>
</tr>
<tr>
<td>• Anecdotal records</td>
</tr>
<tr>
<td>• Exit slips</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Summative Assessment:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Summative Unit Test</td>
</tr>
</tbody>
</table>
Integration of Technology: Smartboard, Computers, Netbooks, e-books

Technology Resources:
Click the links below to access additional resources used to design this unit:
http://vimeo.com/25193971
www.KidsAstromony.com
http://pds.jpl.nasa.gov/planets/
http://science.nationalgeographic.com/science/space/solar-system
• Earth information: http://www.school-for-champions.com/astronomy/earth.htm

• Earth information: http://www.infoplease.com/ipa/A0004443.html

• Sun information: http://www.school-for-champions.com/astronomy/Sun.htm

• Sun information: http://www.infoplease.com/ce6/sci/A0861358.html

• Moon information: http://www.school-for-champions.com/astronomy/moon.htm

• Moon information: http://www.infoplease.com/ce6/sci/A0859765.html


Zoom Astronomy: All About Space http://www.zoomschool.com/subjects/astronomy/

http://192.107.108.56/portfolios/e/ebanetti_l/Moon/moonfact.htm

www.solarsystem.nasa.gov

Materials / Equipment Needed: Probes, lab equipment, Science notebook

Opportunities for Differentiation:
VAKT learning opportunities
Leveled texts
Differentiated instruction
3-5. Engineering Design

Students who demonstrate understanding can:

3-5-ETS1-1. Define a simple design problem reflecting a need or want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Science and Engineering Practices

- Asking Questions and Defining Problems
  - Asking questions and defining problems in 3-5 builds on grades K-2 experiences and progresses to specifying qualitative relationships.
  - Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)

- Planning and Carrying Out Investigations
  - Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials is considered. (3-5-ETS1-3)

- Constructing Explanations and Designing Solutions
  - Constructing explanations and designing solutions in 3-5 builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.

Disciplinary Core Ideas

- ETS1A: Defining and Defining Engineering Problems
  - Design solutions to a problem with criteria and constraints of success and optimization in mind. (3-5-ETS1-2)

- ETS1B: Developing Possible Solutions
  - Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2)
  - At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2)
  - Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3)

- ETS1C: Optimizing the Design Solution
  - Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)

Crosscutting Concepts

- Influence of Science, Engineering, and Technology on Society and the Natural World
  - People’s needs and wants change over time, as do their demands for new and improved technologies. (3-5-ETS1-1)
  - Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5-ETS1-2)

Connections to 3-5-ETS1A: Defining and Defining Engineering Problems include:
- Fourth Grade: 4-ETS3-4
- Connections to 3-5-ETS1B: Developing Solutions to Engineering Problems include:
- Fourth Grade: 4-ETS3-2
- Connections to 3-5-ETS1C: Optimizing the Design Solution include:
- Fourth Grade: 4-ETS3-4

Articulation of CCSS across grade bands:
- K-2: ETS1A (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3); K-2ETS1B (3-5-ETS1-2); K-2ETS1C (3-5-ETS1-2),(3-5-ETS1-3); MS.ETS1A (3-5-ETS1-1); MS.ETS1B (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3); MS.ETS1C (3-5-ETS1-2),(3-5-ETS1-3)

Common Core State Standards Connections:

ELA/Literacy –
- R.L.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (3-5-ETS1-2)
- R.L.5.2 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. (3-5-ETS1-2)
- R.L.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (3-5-ETS1-2)
- W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (3-5-ETS1-1),(3-5-ETS1-3)
- W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase in own words and provide a list of sources. (3-5-ETS1-1),(3-5-ETS1-3)
- W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (3-5-ETS1-1),(3-5-ETS1-3)

Mathematics –
- MP.2 Reason abstractly and quantitatively. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)
- MP.4 Model with mathematics. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)
- MP.5 Use appropriate tools strategically. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)
- 3-5.OA Operations and Algebraic Thinking (3-5-ETS1-1),(3-5-ETS1-2)