Science Curriculum
Grade Four

Fair Haven Public Schools
Knollwood School
Fair Haven, New Jersey

Adopted September 2014
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<tr>
<td>4</td>
<td>Fundamental scientific concepts and principles and the links between them are more useful than discrete facts.</td>
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<td></td>
<td><strong>1-New Plants</strong></td>
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<td>4</td>
<td>Connections developed between fundamental concepts are used to explain, interpret, build, and refine explanations, models, and theories.</td>
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<td>4</td>
<td>Outcomes of investigations are used to build and refine questions, models, and explanations.</td>
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<tr>
<td>Strand</td>
<td>B. Generate Scientific Evidence Through Active Investigations: Students master the conceptual, mathematical, physical, and computational tools that need to be applied when constructing and evaluating claims.</td>
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<tr>
<td>4</td>
<td>Building and refining models and explanations requires generation and evaluation of evidence.</td>
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<tr>
<td></td>
<td>K-Animals 2 x 2</td>
</tr>
<tr>
<td>4</td>
<td>Tools and technology are used to gather, analyze, and communicate results.</td>
</tr>
<tr>
<td>4</td>
<td>Evidence is used to construct and defend arguments.</td>
</tr>
<tr>
<td></td>
<td>5.1.4.B.3 Formulate explanations from evidence.</td>
</tr>
<tr>
<td></td>
<td>3-Electricity and Magnetism</td>
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<tr>
<td>4</td>
<td>Reasoning is used to support scientific conclusions.</td>
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<tr>
<td></td>
<td>5.1.4.B.4 Communicate and justify explanations with reasonable and logical arguments.</td>
</tr>
<tr>
<td>Strand</td>
<td>C. Reflect on Scientific Knowledge: Scientific knowledge builds on itself over time.</td>
</tr>
<tr>
<td>4</td>
<td>Scientific understanding changes over time as new evidence and updated arguments emerge.</td>
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<tr>
<td></td>
<td>1-New Plants</td>
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<tr>
<td>4</td>
<td>Revise predictions or explanations on the basis of learning new information.</td>
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</tbody>
</table>
emerge that account more completely for available evidence.

<table>
<thead>
<tr>
<th>1-Pebbles</th>
<th>4-Chemical Tests</th>
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</thead>
<tbody>
<tr>
<td>4</td>
<td>Scientific knowledge is a particular kind of knowledge with its own sources, justifications, and uncertainties.</td>
</tr>
<tr>
<td>5.1.4.C.3</td>
<td>Present evidence to interpret and/or predict cause-and-effect outcomes of investigations.</td>
</tr>
<tr>
<td>1-Air and Weather</td>
<td>3-Electricity and Magnetism</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Strand</th>
<th>D. Participate Productively in Science: The growth of scientific knowledge involves critique and communication, which are social practices that are governed by a core set of values and norms.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Science has unique norms for participation. These include adopting a critical stance, demonstrating a willingness to ask questions and seek help, and developing a sense of trust and skepticism.</td>
</tr>
<tr>
<td>5.1.4.D.1</td>
<td>Actively participate in discussions about student data, questions, and understandings.</td>
</tr>
<tr>
<td>K-Balls and Ramps</td>
<td>3-Human Body</td>
</tr>
<tr>
<td>4</td>
<td>In order to determine which arguments and explanations are most persuasive, communities of learners work collaboratively to pose, refine, and evaluate questions, investigations, models, and theories (e.g., scientific argumentation and representation).</td>
</tr>
<tr>
<td>5.1.4.D.2</td>
<td>Work collaboratively to pose, refine, and evaluate questions, investigations, models, and theories.</td>
</tr>
<tr>
<td>K-Balls and Ramps</td>
<td>3-Human Body</td>
</tr>
<tr>
<td>4-Sink and Float</td>
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<tr>
<td>4</td>
<td>Instruments of measurement can be used to safely gather accurate information for making scientific</td>
</tr>
<tr>
<td>5.1.4.D.3</td>
<td>Demonstrate how to safely use tools, instruments, and supplies.</td>
</tr>
<tr>
<td>K-Balls and Ramps</td>
<td></td>
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</tbody>
</table>
| Comparisons of objects and events. | 1-Pebbles, Sand and Silt  
2-Changes  
3-Electricity and Magnetism  
4 Chemical Tests |
|---|---|
| Organisms are treated humanely, responsibly, and ethically. | 5.1.4.D.4 Handle and treat organisms humanely, responsibly, and ethically.  
K-Animals 2 x 2 |

<table>
<thead>
<tr>
<th>Content Area</th>
<th>Science</th>
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<tbody>
<tr>
<td><strong>Standard</strong></td>
<td><strong>5.2 Physical Science:</strong> All students will understand that physical science principles, including fundamental ideas about matter, energy, and motion, are powerful conceptual tools for making sense of phenomena in physical, living, and Earth systems science.</td>
</tr>
<tr>
<td><strong>Strand</strong></td>
<td><strong>A. Properties of Matter:</strong> All objects and substances in the natural world are composed of matter. Matter has two fundamental properties: matter takes up space, and matter has inertia.</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>By the end of grade</th>
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<th>Cumulative Progress Indicator (CPI)</th>
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</table>
| 2 | Living and nonliving things are made of parts and can be described in terms of the materials of which they are made and their physical properties. | 5.2.2.A.1 | Sort and describe objects based on the materials of which they are made and their physical properties.  
**1-Pebbles, Sand and Silt** |
| 2 | Matter exists in several different states; the most commonly encountered are solids, liquids, and gases. Liquids take the shape of the part of the container they occupy. Solids retain their shape regardless of the container they occupy. | 5.2.2.A.2 | Identify common objects as solids, liquids, or gases.  
**2- Changes** |
<table>
<thead>
<tr>
<th>#</th>
<th>Content</th>
<th>Standard</th>
<th>Description</th>
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<tbody>
<tr>
<td>4</td>
<td>Each state of matter has unique properties (e.g., gases can be</td>
<td>5.2.4.A.2 Plan and carry out an investigation to distinguish among solids, liquids, and gasses.</td>
<td>2-Changes</td>
</tr>
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<td>compressed, while solids and liquids cannot; the shape of a solid is</td>
<td></td>
<td>4-Chemical Tests</td>
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<td>independent of its container; liquids and gases take the shape of their</td>
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<tr>
<td></td>
<td>containers).</td>
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<td>4</td>
<td>Objects and substances have properties, such as weight and volume,</td>
<td>5.2.4.A.3 Determine the weight and volume of common objects using appropriate tools.</td>
<td>1-Air and Weather</td>
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<td>that can be measured using appropriate tools. Unknown substances</td>
<td></td>
<td>2-Balance and Motion</td>
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<td>can sometimes be identified by their properties.</td>
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<td>4</td>
<td>Objects vary in the extent to which they absorb and reflect light and</td>
<td>5.2.4.A.4 Categorize objects based on the ability to absorb or reflect light and conduct heat or</td>
<td>3-Electricity and Magnetism</td>
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<td></td>
<td>conduct heat (thermal energy) and electricity.</td>
<td>electricity.</td>
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**Strand** | **B. Changes in Matter**: Substances can undergo physical or chemical changes to form new substances. Each change involves energy.

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<th>Description</th>
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<tbody>
<tr>
<td>2</td>
<td>Some properties of matter can change as a result of processes such as</td>
<td>5.2.2.B.1 Generate accurate data and organize arguments to show that not all substances respond</td>
<td>2-Changes</td>
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<td></td>
<td>heating and cooling. Not all materials respond the same way to these</td>
<td>the same way when heated or cooled, using common materials, such as shortening or candle wax.</td>
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<td></td>
<td>processes.</td>
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<tr>
<td>4</td>
<td>Many substances can be changed from one state to another by heating or</td>
<td>5.2.4.B.1 Predict and explain what happens when a common substance, such as shortening or candle</td>
<td></td>
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<tr>
<td></td>
<td>cooling.</td>
<td>wax, is heated to melting and then cooled to a solid.</td>
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<tr>
<td>Strand</td>
<td>C. Forms of Energy: Knowing the characteristics of familiar forms of energy, including potential and kinetic energy, is useful in coming to the understanding that, for the most part, the natural world can be explained and is predictable.</td>
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<td>2</td>
<td>The Sun warms the land, air, and water.</td>
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<tr>
<td>5.2.2.C.1</td>
<td>Compare, citing evidence, the heating of different colored objects placed in full sunlight.</td>
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<tr>
<td><strong>1-Air and Weather</strong></td>
<td><strong>K-3 Art: Light and Shadows</strong></td>
<td></td>
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<tr>
<td>2</td>
<td>An object can be seen when light strikes it and is reflected to a viewer's eye. If there is no light, objects cannot be seen.</td>
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<td>5.2.2.C.2</td>
<td>Apply a variety of strategies to collect evidence that validates the principle that if there is no light, objects cannot be seen.</td>
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<tr>
<td><strong>1-Air and Weather</strong></td>
<td><strong>K-3 Art: Light and Shadows</strong></td>
<td></td>
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<tr>
<td>2</td>
<td>When light strikes substances and objects through which it cannot pass, shadows result.</td>
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<tr>
<td>5.2.2.C.3</td>
<td>Present evidence that represents the relationship between a light source, solid object, and the resulting shadow.</td>
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<td></td>
</tr>
<tr>
<td><strong>1-Air and Weather</strong></td>
<td><strong>K-3 Art: Light and Shadows</strong></td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td>Heat (thermal energy), electricity, light, and sound are forms of energy.</td>
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<tr>
<td>5.2.4.C.1</td>
<td>Compare various forms of energy as observed in everyday life and describe their applications.</td>
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<tr>
<td><strong>4-Sink and Float (Hot Water Experiment with S/F items)</strong></td>
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<tr>
<td>4</td>
<td>Heat (thermal energy) results when substances burn, when certain kinds of materials rub against each other, and when electricity flows through.</td>
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<tr>
<td>5.2.4.C.2</td>
<td>Compare the flow of heat through metals and nonmetals by taking and analyzing measurements.</td>
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</tr>
<tr>
<td><strong>4-Sink and Float (Hot Water Experiment with S/F items)</strong></td>
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</table>
wires. Metals are good conductors of heat (thermal energy) and electricity. Increasing the temperature of any substance requires the addition of energy.

| 4 | Energy can be transferred from one place to another. Heat energy is transferred from warmer things to colder things. | 5.2.4.C.3 | Draw and label diagrams showing several ways that energy can be transferred from one place to another. |
| 4 | Light travels in straight lines. When light travels from one substance to another (air and water), it changes direction. | 5.2.4.C.4 | Illustrate and explain what happens when light travels from air into water. |

| Strand | D. Energy Transfer and Conservation | The conservation of energy can be demonstrated by keeping track of familiar forms of energy as they are transferred from one object to another. |
| 2 | Batteries supply energy to produce light, sound, or heat. | 5.2.2.D.1 | Predict and confirm the brightness of a light, the volume of sound, or the amount of heat when given the number of batteries, or the size of batteries. |
| 4 | Electrical circuits require a complete loop through conducting materials in which an electrical current can pass. | 5.2.4.D.1 | Repair an electric circuit by completing a closed loop that includes wires, a battery (or batteries), and at least one other electrical component to produce observable change. |

| Strand | E. Forces and Motion | It takes energy to change the motion of objects. The energy change is understood in terms of forces. |
| 2 | Objects can move in many different ways (fast and slow, in a straight line, in a | 5.2.2.E.1 | Investigate and model the various ways that inanimate objects can move. |
|  |  |  | K-Balls and Ramps |

<p>| 5.2.4.C.3 | 4-Sink and Float (Hot Water Experiment with S/F items.) | 5.2.4.C.4 | Illustrate and explain what happens when light travels from air into water. |</p>
<table>
<thead>
<tr>
<th>2</th>
<th>A force is a push or a pull. Pushing or pulling can move an object. The speed an object moves is related to how strongly it is pushed or pulled. When an object does not move in response to a push or a pull, it is because another push or pull (friction) is being applied by the environment.</th>
<th>5.2.2.E.2</th>
<th>Predict an object’s relative speed, path, or how far it will travel using various forces and surfaces.</th>
<th>K-Balls and Ramps</th>
</tr>
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<tbody>
<tr>
<td>2</td>
<td>Some forces act by touching, while other forces can act without touching.</td>
<td>5.2.2.E.3</td>
<td>Distinguish a force that acts by direct contact with an object (e.g., by pushing or pulling) from a force that can act without direct contact (e.g., the attraction between a magnet and a steel paper clip).</td>
<td>K-Balls and Ramps</td>
</tr>
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<td>4</td>
<td>Motion can be described as a change in position over a period of time.</td>
<td>5.2.4.E.1</td>
<td>Demonstrate through modeling that motion is a change in position over a period of time.</td>
<td>4-Motion and Design</td>
</tr>
<tr>
<td>4</td>
<td>There is always a force involved when something starts moving or changes its speed or direction of motion. A greater force can make an object move faster and farther.</td>
<td>5.2.4.E.2</td>
<td>Identify the force that starts something moving or changes its speed or direction of motion.</td>
<td>K-Balls and Ramps</td>
</tr>
<tr>
<td>4</td>
<td>Magnets can repel or attract other magnets, but they attract all matter made of iron. Magnets can make some things move without being touched.</td>
<td>5.2.4.E.3</td>
<td>Investigate and categorize materials based on their interaction with magnets.</td>
<td>3-Electricity and Magnetism</td>
</tr>
</tbody>
</table>
Earth pulls down on all objects with a force called gravity. Weight is a measure of how strongly an object is pulled down toward the ground by gravity. With a few exceptions, objects fall to the ground no matter where they are on Earth.

5.2.4.E.4 Investigate, construct, and generalize rules for the effect that force of gravity has on balls of different sizes and weights.

K-Balls and Ramps

<table>
<thead>
<tr>
<th>Content Area</th>
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<tbody>
<tr>
<td>Standard</td>
<td>5.3 Life Science: All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.</td>
</tr>
<tr>
<td>Strand</td>
<td>A. Organization and Development: Living organisms are composed of cellular units (structures) that carry out functions required for life. Cellular units are composed of molecules, which also carry out biological functions.</td>
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</table>

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<tbody>
<tr>
<td>2</td>
<td>Living organisms:</td>
<td>5.3.2.A.1</td>
<td>Group living and nonliving things according to the characteristics that they share.</td>
</tr>
<tr>
<td></td>
<td>• Exchange nutrients and water with the environment.</td>
<td></td>
<td><strong>K-Animals 2 x 2</strong></td>
</tr>
<tr>
<td></td>
<td>• Reproduce.</td>
<td></td>
<td><strong>1-New Plants</strong></td>
</tr>
<tr>
<td></td>
<td>• Grow and develop in a predictable manner.</td>
<td></td>
<td><strong>2-Sea Creatures</strong></td>
</tr>
<tr>
<td>4</td>
<td>Living organisms:</td>
<td>5.3.4.A.1</td>
<td>Develop and use evidence-based criteria to determine if an unfamiliar object is living or nonliving.</td>
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</tbody>
</table>
| 4 | - Interact with and cause changes in their environment.  
- Exchange materials (such as gases, nutrients, water, and waste) with the environment.  
- Reproduce.  
- Grow and develop in a predictable manner. | | 

**K-Animals 2 x 2**

**1-New Plants**

<table>
<thead>
<tr>
<th>4</th>
<th>Essential functions required for the well-being of an organism are carried out by specialized structures in plants and animals.</th>
<th>5.3.4.A.2</th>
<th>Compare and contrast structures that have similar functions in various organisms, and explain how those functions may be carried out by structures that have different physical appearances.</th>
</tr>
</thead>
</table>
| 4 | | | **K-Animals 2 x 2**

**2-Sea Creatures**

| 4 | Essential functions of the human body are carried out by specialized systems:  
- Digestive  
- Circulatory  
- Respiratory  
- Nervous  
- Skeletal  
- Muscular  
- Reproductive | 5.3.4.A.3 | Describe the interactions of systems involved in carrying out everyday life activities. |
|---|---|---|---|
| 4 | | | **3-Human Body**

**4-Health-Human Systems**

**Strand** | **B. Matter and Energy Transformations** | Food is required for energy and building cellular materials. Organisms in an ecosystem have different ways of obtaining food, and some organisms obtain their food directly from other organisms.
A source of energy is needed for all organisms to stay alive and grow. Both plants and animals need to take in water, and animals need to take in food. Plants need light.

Describe the requirements for the care of plants and animals related to meeting their energy needs.

K-Animals 2 x 2

1-New Plants

Animals have various ways of obtaining food and water. Nearly all animals drink water or eat foods that contain water.

Compare how different animals obtain food and water.

K-Animals 2 x 2

2-Sea Creatures

Most plants have roots to get water and leaves to gather sunlight.

Explain that most plants get water from soil through their roots and gather light through their leaves.

1-New Plants

Almost all energy (food) and matter can be traced to the Sun.

Identify sources of energy (food) in a variety of settings (farm, zoo, ocean, forest).

K-Animals 2 x 2

2-Sea Creatures

Organisms interact and are interdependent in various ways; for example, they provide food and shelter to one another.

Describe the ways in which organisms interact with each other and their habitats in order to meet basic needs.

K-Animals 2 x 2

2-Sea Creatures

A habitat supports the growth of many different plants and animals by meeting their basic needs of food, water, and

Identify the characteristics of a habitat that enable the habitat to support the growth of many different plants and animals.
Humans can change natural habitats in ways that can be helpful or harmful for the plants and animals that live there.

Organisms can only survive in environments in which their needs are met. Within ecosystems, organisms interact with and are dependent on their physical and living environment.

Some changes in ecosystems occur slowly, while others occur rapidly. Changes can affect life forms, including humans.

Plants and animals often resemble their parents.

### Strand: D. Heredity and Reproduction

Organisms reproduce, develop, and have predictable life cycles. Organisms contain genetic information that influences their traits, and they pass this on to their offspring during reproduction.
Organisms have predictable characteristics at different stages of development.

**5.3.2.D.2** Determine the characteristic changes that occur during the life cycle of plants and animals by examining a variety of species, and distinguish between growth and development.

**1-Animals 2 x 2**
**2-Sea Creatures**

Plants and animals have life cycles (they begin life, develop into adults, reproduce, and eventually die). The characteristics of each stage of life vary by species.

**5.3.4.D.1** Compare the physical characteristics of the different stages of the life cycle of an individual organism, and compare the characteristics of life stages among species.

**2-Life Cycle of Butterfly**

Variations exist within a group of the same kind of organism.

**5.3.2.E.1** Describe similarities and differences in observable traits between parents and offspring.

**1-Animals 2 x 2**
**1-New Plants**

Plants and animals have features that help them survive in different environments.

**5.3.2.E.2** Describe how similar structures found in different organisms (e.g., eyes, ears, mouths) have similar functions and enable those organisms to survive in different environments.

**2-Sea Creatures**
Individuals of the same species may differ in their characteristics, and sometimes these differences give individuals an advantage in surviving and reproducing in different environments.

Model an adaptation to a species that would increase its chances of survival, should the environment become wetter, dryer, warmer, or colder over time.

In any ecosystem, some populations of organisms thrive and grow, some decline, and others do not survive at all.

Evaluate similar populations in an ecosystem with regard to their ability to thrive and grow.

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<tbody>
<tr>
<td><strong>Standard</strong></td>
<td><strong>5.4 Earth Systems Science:</strong> All students will understand that Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.</td>
</tr>
<tr>
<td><strong>Strand</strong></td>
<td><strong>A. Objects in the Universe:</strong> Our universe has been expanding and evolving for 13.7 billion years under the influence of gravitational and nuclear forces. As gravity governs its expansion, organizational patterns, and the movement of celestial bodies, nuclear forces within stars govern its evolution through the processes of stellar birth and death. These same processes governed the formation of our solar system 4.6 billion years ago.</td>
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<th>By the end of grade</th>
<th>Content Statement</th>
<th>CPI#</th>
<th>Cumulative Progress Indicator (CPI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>The Sun is a star that can only be seen during the day. The Moon is not a star and can be seen sometimes at night and sometimes during the day. The Moon appears to have</td>
<td>5.4.2.A.1</td>
<td>Determine a set of general rules describing when the Sun and Moon are visible based on actual sky observations.</td>
</tr>
</tbody>
</table>

1-Air and Weather
2-Sun, Moon, Sky Observations
<table>
<thead>
<tr>
<th>4</th>
<th>Objects in the sky have patterns of movement. The Sun and Moon appear to move across the sky on a daily basis. The shadows of an object on Earth change over the course of a day, indicating the changing position of the Sun during the day.</th>
<th>5.4.4.A.1</th>
<th>Formulate a general description of the daily motion of the Sun across the sky based on shadow observations. Explain how shadows could be used to tell the time of day.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>The observable shape of the Moon changes from day to day in a cycle that lasts 29.5 days.</td>
<td>5.4.4.A.2</td>
<td>Identify patterns of the Moon’s appearance and make predictions about its future appearance based observational data.</td>
</tr>
<tr>
<td>4</td>
<td>Earth is approximately spherical in shape. Objects fall towards the center of the Earth because of the pull of the force of gravity.</td>
<td>5.4.4.A.3</td>
<td>Generate a model with explanatory value that explains both why objects roll down ramps as well as why the Moon orbits Earth.</td>
</tr>
<tr>
<td>4</td>
<td>Earth is the third planet from the Sun in our solar system, which includes seven other planets.</td>
<td>5.4.4.A.4</td>
<td>Analyze and evaluate evidence in the form of data tables and photographs to categorize and relate solar system objects (e.g., planets, dwarf planets, moons, asteroids, and comets).</td>
</tr>
</tbody>
</table>

**Strand**  
**B. History of Earth:** From the time that Earth formed from a nebula 4.6 billion years ago, it has been evolving as a result of geologic, biological, physical, and chemical processes.

<table>
<thead>
<tr>
<th>4</th>
<th>Fossils provide evidence about the plants and animals that lived long ago, including whether they</th>
<th>5.4.4.B.1</th>
<th>Use data gathered from observations of fossils to argue whether a given fossil is terrestrial or marine in origin.</th>
</tr>
</thead>
</table>

**2-Poricy Park/Shark River Class Trip**
<table>
<thead>
<tr>
<th>Strand</th>
<th>C. Properties of Earth Materials : Earth’s composition is unique, is related to the origin of our solar system, and provides us with the raw resources needed to sustain life.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Soils are made of many living and nonliving substances. The attributes and properties of soil (e.g., moisture, kind and size of particles, living/organic elements, etc.) vary depending on location. Describe Earth materials using appropriate terms, such as hard, soft, dry, wet, heavy, and light. 1-Pebbles, Sand and Silt</td>
</tr>
<tr>
<td>4</td>
<td>Rocks can be broken down to make soil. Create a model to represent how soil is formed. 1-Pebbles, Sand and Silt</td>
</tr>
<tr>
<td>4</td>
<td>Earth materials in nature include rocks, minerals, soils, water, and the gases of the atmosphere. Attributes of rocks and minerals assist in their identification. Categorize unknown samples as either rocks or minerals. 1-Pebbles, Sand and Silt</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strand</th>
<th>D. Tectonics : The theory of plate tectonics provides a framework for understanding the dynamic processes within and on Earth.</th>
</tr>
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<tr>
<th>Strand</th>
<th>E. Energy in Earth Systems : Internal and external sources of energy drive Earth systems.</th>
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<tr>
<td>2</td>
<td>Plants need sunlight to grow. Describe the relationship between the Sun and plant growth. 1-New Plants</td>
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Strand

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Soils are made of many living and nonliving substances. The attributes and properties of soil (e.g., moisture, kind and size of particles, living/organic elements, etc.) vary depending on location. Describe Earth materials using appropriate terms, such as hard, soft, dry, wet, heavy, and light. 1-Pebbles, Sand and Silt

Rocks can be broken down to make soil. Create a model to represent how soil is formed. 1-Pebbles, Sand and Silt

Earth materials in nature include rocks, minerals, soils, water, and the gases of the atmosphere. Attributes of rocks and minerals assist in their identification. Categorize unknown samples as either rocks or minerals. 1-Pebbles, Sand and Silt

D. Tectonics : The theory of plate tectonics provides a framework for understanding the dynamic processes within and on Earth.

E. Energy in Earth Systems : Internal and external sources of energy drive Earth systems.

Plants need sunlight to grow. Describe the relationship between the Sun and plant growth. 1-New Plants
<table>
<thead>
<tr>
<th>4</th>
<th>Land, air, and water absorb the Sun’s energy at different rates.</th>
<th>5.4.4.E.1</th>
<th>Develop a general set of rules to predict temperature changes of Earth materials, such as water, soil, and sand, when placed in the Sun and in the shade.</th>
</tr>
</thead>
</table>

**F. Climate and Weather:** Earth’s weather and climate systems are the result of complex interactions between land, ocean, ice, and atmosphere.

<table>
<thead>
<tr>
<th>2</th>
<th>Current weather conditions include air movement, clouds, and precipitation. Weather conditions affect our daily lives.</th>
<th>5.4.2.F.1</th>
<th>Observe and document daily weather conditions and discuss how the weather influences your activities for the day.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>4</th>
<th>Weather changes that occur from day to day and across the seasons can be measured and documented using basic instruments such as a thermometer, wind vane, anemometer, and rain gauge.</th>
<th>5.4.4.F.1</th>
<th>Identify patterns in data collected from basic weather instruments.</th>
</tr>
</thead>
</table>

**G. Biogeochemical Cycles:** The biogeochemical cycles in the Earth systems include the flow of microscopic and macroscopic resources from one reservoir in the hydrosphere, geosphere, atmosphere, or biosphere to another, are driven by Earth's internal and external sources of energy, and are impacted by human activity.

<table>
<thead>
<tr>
<th>2</th>
<th>Water can disappear (evaporate) and collect (condense) on surfaces.</th>
<th>5.4.2.G.1</th>
<th>Observe and discuss evaporation and condensation.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>2</th>
<th>There are many sources and uses of water.</th>
<th>5.4.2.G.2</th>
<th>Identify and use water conservation practices.</th>
</tr>
</thead>
</table>

<p>| 2 | Organisms have basic needs and they meet those needs within | 5.4.2.G.3 | Identify and categorize the basic needs of living organisms as they relate to the |</p>
<table>
<thead>
<tr>
<th></th>
<th>their environment.</th>
<th>environment.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>K-Animals 2 x 2</td>
<td>1-New Plants</td>
</tr>
<tr>
<td>2</td>
<td>The origin of everyday manufactured products such as paper and cans can be traced back to natural resources.</td>
<td>5.4.2.G.4 Identify the natural resources used in the process of making various manufactured products.</td>
</tr>
<tr>
<td></td>
<td>New Plants</td>
<td>1-Pebbles, Sand and Silt</td>
</tr>
<tr>
<td>4</td>
<td>Clouds and fog are made of tiny droplets of water and, at times, tiny particles of ice.</td>
<td>5.4.4.G.1 Explain how clouds form.</td>
</tr>
<tr>
<td></td>
<td>1-Air and Weather</td>
<td>4-Sink and Float</td>
</tr>
<tr>
<td>4</td>
<td>Rain, snow, and other forms of precipitation come from clouds; not all clouds produce precipitation.</td>
<td>5.4.4.G.2 Observe daily cloud patterns, types of precipitation, and temperature, and categorize the clouds by the conditions that form precipitation.</td>
</tr>
<tr>
<td></td>
<td>1-Air and Weather</td>
<td>4-Sink and Float</td>
</tr>
<tr>
<td>4</td>
<td>Most of Earth’s surface is covered by water. Water circulates through the crust, oceans, and atmosphere in what is known as the water cycle.</td>
<td>5.4.4.G.3 Trace a path a drop of water might follow through the water cycle.</td>
</tr>
<tr>
<td></td>
<td>4-Sink and Float</td>
<td>2-Changes</td>
</tr>
<tr>
<td>4</td>
<td>Properties of water depend on where the water is located (oceans, rivers, lakes, underground sources, and glaciers).</td>
<td>5.4.4.G.4 Model how the properties of water can change as water moves through the water cycle.</td>
</tr>
<tr>
<td></td>
<td>4-Sink and Float</td>
<td>2-Changes</td>
</tr>
</tbody>
</table>

20
### Fourth Grade Science Unit Maps

<table>
<thead>
<tr>
<th>Essential Questions</th>
<th>MOTION AND DESIGN</th>
<th>INVENTION CONVENTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>What factors create optimum motion?</em>&lt;br&gt;<em>How does design in (nature/man-made) create function?</em>&lt;br&gt;</td>
<td></td>
<td>* What does it look like to think/act like an inventor?*</td>
</tr>
<tr>
<td><strong>Guiding Questions</strong></td>
<td><em>What do scientists do?</em>&lt;br&gt;<em>How can scientists best work together to solve a problem?</em>&lt;br&gt;<em>What is the scientific method?</em>&lt;br&gt;<em>How does a scientist and/or team meet design requirements/deadlines?</em>&lt;br&gt;<em>What are the types of scientific journal entries?</em>&lt;br&gt;<em>What happens to force over distance?</em>&lt;br&gt;</td>
<td><em>What skills do inventors need?</em>&lt;br&gt;<em>What are the steps to creating a real-life problem-solving invention?</em>&lt;br&gt;* What ‘organizers’ do inventors need to accomplish their goals?*</td>
</tr>
<tr>
<td><strong>Content (standards)</strong></td>
<td><em>Objects are moved by a variety of different push/pulls or forces.</em>&lt;br&gt;<em>Force and friction work opposite each other to create motion/slowing-stopping.</em>&lt;br&gt;<em>Objects are intentionally designed with specific purposes in mind-usually to accomplish work.</em>&lt;br&gt;<em>For every action there is an opposite and equal reaction.</em>&lt;br&gt;<em>Objects which are at rest-tend to stay at rest, until acted upon by a force.</em>&lt;br&gt;<em>The greater the force-the greater the acceleration-provided the mass stays the same.</em>&lt;br&gt;<em>Technical drawings are purposeful; detailed and labeled in order that scientists can rebuild vehicles.</em>&lt;br&gt;</td>
<td><em>Inventors and their inventions have greatly changed our culture (5.2 A1/B1)</em>&lt;br&gt;<em>Scientists must identify a problem, brainstorm, revise their ideas, envision, sketch, gather materials, hypothesize, test and communicate their invention in total of the invention process (5.1 A4) (5.1 A1)</em>&lt;br&gt;<em>Field Trip to Edison’s Lab of Invention in West Orange? (5.2 A1)</em></td>
</tr>
<tr>
<td><strong>Skills (CPIs)</strong></td>
<td><strong>MOTION AND DESIGN</strong></td>
<td><strong>INVENTION CONVENTION</strong></td>
</tr>
<tr>
<td>-------------------</td>
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<tr>
<td><em>Building vehicles to various specifications (5.1 A1)</em></td>
<td><em>Brainstorming real-life problems from our everyday lives (5.1 A1)</em></td>
<td></td>
</tr>
<tr>
<td><em>Creating technical drawings from various angles in order to rebuild accurately (5.1 A2)</em></td>
<td><em>Brainstorming/Sketching/Testing/Redesigning various solutions to invention design (5.1 A4)</em></td>
<td></td>
</tr>
<tr>
<td><em>Testing various types of motion (push/pull) (5.7 A1)</em></td>
<td><em>Researching past inventors’ successes and failures (5.1 A1)</em></td>
<td></td>
</tr>
<tr>
<td><em>Testing multiple times for validity (5.1 A3)</em></td>
<td><em>Orally presenting report and I.C. ‘Booth’ talk (5.1 B2) (5.4 C1)</em></td>
<td></td>
</tr>
<tr>
<td><em>Testing with friction, load and variables (5.7 A1)</em></td>
<td><em>Meeting weekly deadlines and tracking work on checklist.</em></td>
<td></td>
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<tr>
<td><em>Brainstorming, designing, revising final design challenge vehicle (5.1 B1)</em></td>
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<table>
<thead>
<tr>
<th><strong>Assessment</strong></th>
<th></th>
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</thead>
<tbody>
<tr>
<td><em>Visual evidence of lab work</em></td>
<td><em>Invention Convention Rubric for final Invention Convention process and product.</em></td>
</tr>
<tr>
<td><em>Journal entry evidence</em></td>
<td>* Work checklist in notebook*</td>
</tr>
<tr>
<td><em>Lab teamwork rubric</em></td>
<td></td>
</tr>
<tr>
<td><em>Content assessment (short quiz) or (demonstration)</em></td>
<td></td>
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<tr>
<td><em>Sliding scales</em></td>
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<tr>
<td><em>Student self-assessment</em></td>
<td></td>
</tr>
<tr>
<td>Essential Questions</td>
<td>CHEMICAL TESTS</td>
</tr>
<tr>
<td>---------------------</td>
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</tr>
<tr>
<td><em>How do properties inform us about mystery chemicals?</em></td>
<td><em>What factors determine whether an object will sink or float?</em></td>
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<table>
<thead>
<tr>
<th>Guiding Questions</th>
<th>CHEMICAL TESTS</th>
<th>SINKING/FLOATING</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>What and where are chemicals?</em></td>
<td><em>What is buoyancy?</em></td>
<td><em>How does size and weight affect buoyancy?</em></td>
</tr>
<tr>
<td><em>Are chemicals good or bad?</em></td>
<td><em>Do objects weigh differently under water?</em></td>
<td><em>What are tips for working safely with water?</em></td>
</tr>
<tr>
<td><em>What are the properties of chemicals?</em></td>
<td></td>
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<tr>
<td><em>What are the safety steps for proper chemical handling/testing?</em></td>
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<tr>
<td><em>How do we use inductive and deductive reasoning?</em></td>
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<table>
<thead>
<tr>
<th>Content (Standards)</th>
<th>CHEMICAL TESTS</th>
<th>SINKING/FLOATING</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Common household chemicals have different physical and chemical properties</em></td>
<td><em>Several variables affect the buoyancy of an object</em></td>
<td></td>
</tr>
<tr>
<td><em>Chemicals undergo changes in form, color or texture when they are mixed together, separated or heated</em></td>
<td><em>Water pushes up on both floating and submerged objects</em></td>
<td></td>
</tr>
<tr>
<td><em>Some chemicals can be identified by their interaction with indicators</em></td>
<td><em>Objects push down on the water</em></td>
<td></td>
</tr>
<tr>
<td><em>Different types of mixtures, such as solutions/suspensions are created when solids are combined with water</em></td>
<td><em>The buoyant force on large objects is greater than the buoyant force on smaller objects</em></td>
<td></td>
</tr>
<tr>
<td><em>Evaporation and filtration are methods of separating mixtures of solids/liquids</em></td>
<td><em>The amount of water an object displaces is directly related to the object’s volume</em></td>
<td></td>
</tr>
<tr>
<td><em>Some chemicals can be classified as acids, bases or neutral substances based on their reactions with the red cabbage juice</em></td>
<td><em>Because of buoyant force, objects appear to weigh less when they are submerged</em></td>
<td></td>
</tr>
<tr>
<td><em>Field Trip to International Flavors and Fragrances?</em></td>
<td><em>Objects that weigh more than the same volume of water sink</em></td>
<td></td>
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<tr>
<td></td>
<td><em>Objects that weight less than the same volume of water float</em></td>
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<tr>
<td></td>
<td><em>Salt water weighs more than an equal amount of fresh water</em></td>
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<tr>
<td></td>
<td><em>The buoyancy of an object varies with the density of the liquid</em></td>
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<th>Skills (CPIs)</th>
<th>CHEMICAL TESTS</th>
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<tbody>
<tr>
<td><em>Recognizing physical/chemical reactions (5.6 B1)</em></td>
<td><em>Making hypothesis and test to prove or disprove (5.1 A1)</em></td>
<td></td>
</tr>
<tr>
<td><em>Demonstrating of daily safety procedures (5.1 C2/3)</em></td>
<td><em>Measuring weight under different conditions (air/water) (5.3 A2)</em></td>
<td></td>
</tr>
<tr>
<td><em>Connecting/Comparing household chemicals to solve the classroom unknowns (5.6 A1)</em></td>
<td><em>Investigating different boat designs for sink/float feasibility (5.1 A1)</em></td>
<td></td>
</tr>
<tr>
<td><em>Reading/Chunking non-fiction (how-to) texts in order to complete assigned task</em></td>
<td><em>Measuring volume (5.3 A1)</em></td>
<td></td>
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<tr>
<td></td>
<td><em>Comparing salt vs. fresh water qualities (5.3 D1)</em></td>
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<tr>
<td></td>
<td><em>Solving mystery liquids from measuring using the hydrometer (5.3 A3)</em></td>
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<tr>
<td></td>
<td>CHEMICAL TESTS</td>
<td>SINKING/FLOATING</td>
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<tr>
<td>---------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td>*Lab self-assessment checklist</td>
<td>*Observation of lab work</td>
</tr>
<tr>
<td></td>
<td>*Check 'Five unknowns' hypothesis and evidence sheets</td>
<td>*Short quiz</td>
</tr>
<tr>
<td></td>
<td>*Short answer quiz</td>
<td>*Exit interviews/cards</td>
</tr>
<tr>
<td></td>
<td>*Checklist for Science Notebook Entries</td>
<td>*Sliding scales</td>
</tr>
<tr>
<td></td>
<td>*Sliding scales</td>
<td>*Rubrics</td>
</tr>
<tr>
<td></td>
<td>*Student self-assessment</td>
<td>*Student self-assessment</td>
</tr>
</tbody>
</table>
Supplementary information: Teacher training guides:

Motion and Design

Introduction to the unit:
1. *Motion and Design* is a 16-lesson unit
   - In lesson 1 students begin to think about motion and design. They also design and build a simple vehicle.
   - In lesson 2 students build a standard vehicle from a technical drawing.
   - In lessons 3-5 students study how forces can change the movement of their standard vehicle.
   - In lessons 6-12 students investigate self-propelled vehicles and are introduced to friction.
   - In lesson 13 students are introduced to cost evaluation.
   - In lessons 14-16 students are given design specifications, then design, test, and refine their designs until they produce a vehicle that meets their specifications.

The lessons

Lesson 1 Designing Vehicles: Getting Started
1. Lesson 1 is a focus lesson
2. Go over the Background material on p. 19-21. Understanding this material is essential to understanding the rest of the unit, so time spent here will pay off later.
3. Using the Blackline Master Building Pieces for Each Group as a guide, introduce the building pieces. One way to do this is to drop the connectors one at a time onto a blank transparency sheet on the overhead projector. As you add each one, write its color on the sheet. Repeat this for the wheels/tires and the rods.
4. Show an overhead of the Blackline Master Tips on Using the Building Pieces. Using rods and connectors on the overhead projector, demonstrate the two main ways that the rods and connectors can fit together.
5. Have them pick up materials from the distribution center. After they have had time to become familiar with the connectors, etc., have them design a vehicle according to the specifications under Final Activities, p. 25. (You may want to reduce the time to less than 20 minutes. Also, you can eliminate this activity and proceed directly to constructing the standard vehicle.) While they are working, you can set out the string, jumbo paper clips, cups of small washers, large washers, and bookends. Participants can attach the paper clip hooks later.
6. Have them make a drawing of their vehicle on graph paper.

Lesson 2 Using Drawings to Record and Build
1. Direct attention to the technical drawing on p. 35 (p. 7 in the Student Activity Book). 2. Using the drawing as a guide, have the participants build the vehicle shown.
3. When the vehicles are complete, ask the questions under Final Activities step 2, p. 34.

Lesson 3 Pulling a Vehicle: Looking at Force
1. Briefly review the information about force, unbalanced forces, inertia, and friction under Background on p. 41-42. It may help to relate this to Newton’s Laws of Motion (see under Background p. 19-21).
2. Demonstrate how to attach the paper clip hooks to the string (Fig. 3-1, p. 43). Have the groups pick up materials from the distribution center.
3. Have them follow the Student Instructions for Setting up a Falling-Weight System beginning on p. 15 of the Student Activity Book (p. 47 of the Teacher’s Guide). They should fill in Record Sheet 3-A and answer the questions under Find Out for Yourself step 6 in the Student Activity Book.
Lesson 4 Testing the Motion of Vehicles Carrying a Load
1. Go over the Student Instructions for Testing the Motion of Vehicles Carrying a Load on p. 58-60 (p. 20-22 of the Student Activity Book).
2. Have the groups pick up 2 blocks of wood, a timer, and set of colored pencils.
3. When the groups have finished, discuss the results and how to interpret the graph on Record Sheet 4-A (see under Background, p. 52).

Lesson 5 Designing Vehicles to Meet Requirements
If time allows, let the teams do the design activity. You may need to reduce the allotted time from 30 to 20 minutes or less. If pushed for time, do as a talk-through.

Lesson 6 Evaluating Vehicle Design: Looking at Rubber Band Energy
1. Go over the Background material on p. 73-74.
2. Have the participants pick up rubber bands and safety goggles.
3. Have them complete Record Sheet 6-A.

Lesson 7 Testing the Effects of Rubber Band Energy
1. Go over the Student Instructions for Collecting Data on Rubber Band Energy on p. 86-87 (p. 34-35 of the Student Activity Book).
2. Teams will need a 4-m (13-ft) strip of adding machine tape and 3 each of red, blue, and green dots.
3. Have the teams complete the exercise.
4. If possible, have the teams display their results as suggested on p. 83, Fig. 7-1. (It will help if the teams write their names on the strip of tape.) Use some of the questions under Final Activities step 2 to help the participants evaluate the results of this activity.

Lesson 8 Evaluating Vehicle Design for Friction
Do as a talk-through.
“Newton’s first law of motion states that an object at rest remains at rest and an object in motion remains in motion in a straight line, unless acted on by a force” (Background, p. 19). In our everyday experience, objects do not remain in motion for very long unless a constant force is applied. Why? Because in our ordinary world, motion is always opposed by the force of friction. Reducing and overcoming friction is a constant challenge to the designers of machines. Consider a contemporary automobile with its many lubricants, bearings, and aerodynamic design. However, without friction (usually referred to as traction) between the tires and the road, the automobile could not move. (See Record Sheet 8-A, “Ideas for observations.”)

Lesson 9 Designing and Building a Vehicle with a Sail, and
Lesson 10 Testing the Effects of Air Resistance on a Vehicle’s Motion
Do as a talk-through.

Lesson 11 Building a Propeller-Driven Vehicle, and
Lesson 12 Analyzing the Motion and Design of a Propeller-Driven Vehicle
1. Quickly go over the operation of a propeller (Background, p. 117-118). Relate this to Newton’s Third Law of Motion (Background, p. 19). If an electric fan is available, use this to demonstrate.
2. Participants should get experience in assembling the propeller units, so go over Fig. 11-3, p. 120, with them. Also go over the technical drawing on p. 121 (p. 48 in the Student Activity Book).
3. Have them pick up materials and begin.
4. Once the groups have had success with the propeller-driven vehicles, ask some questions such as: Why are the tires not used on the wheels for this project? What would happen if you wound the propeller in the opposite direction? See Record Sheet 12-A for other question ideas.

Lesson 13 Looking at Cost
Do as a talk-through, or allow the participants to use Record Sheet 13-A to do a total cost of either the standard vehicle or the propeller-driven vehicle.

Lesson 14 Planning our Final Design Challenge
Lesson 15 Refining Our Design, and
Lesson 16 Presenting Our Final Design Challenge
Go over the Design Challenge Cards and brainstorm some possible designs for meeting the requirements.

Chemical Tests

Introduction to the unit:
1. Chemical Tests is a 16-lesson unit
   □ Lesson 1 is a brainstorming session in which students share what they know about chemicals.
   □ Students are introduced to a mystery solid in lesson 2. They also begin to assemble the materials they will need to solve the mystery of the solids identity.
   □ In lesson 3, and lessons 7-10, students investigate some physical and chemical properties of five unknown solids.
   □ In lessons 4-6, students make water mixtures with the five solids. They find that these mixtures can be separated by evaporation and filtration.
   □ Students analyze their observations in lessons 11-12 and identify the five solids.
   □ In lesson 13 they identify the mystery solid as being one of the five solids they have investigated.
   □ In lesson 14, students apply their knowledge to identify the components of a mixture made from two of the solids.
   □ In lesson 15, students classify common liquids as acids or bases.
   □ In lesson 16, students use the solids to identify unknown liquids.

The lessons
Lesson 1 Thinking about Chemicals
This is a focus lesson. If time permits, brainstorm a chart similar to that shown on p. 18. Explain that students will be exploring some chemical and physical properties of five common chemicals. Show a bag of mystery chemical and explain its purpose.

Lesson 2 Investigating Unknown Solids: Getting Ready
1. Each team should assemble a pail of the materials that they will need to do the activities. Each pail should contain the following:
   1 magnifier 1 plastic dropper
   30 toothpicks 5 coffee filters
   1 dropper bottle of water
   1 dropper bottle of vinegar
   1 dropper bottle of iodine
   1 dropper bottle of red cabbage juice
1 set of 5 jars and lids with 10 large colored dots
1 bag of 5 measuring spoons and 5 small colored dots
5 graduated cups with 5 small colored dots

2. Each team should also pick up a Student Activity Book, a set of Record Sheets, a Test Mat, and six sheets of waxed paper.

Lesson 3 Exploring the Five Unknown Solids,
and
Lesson 4 Testing Unknown Solids with Water
1. Refer participants to p. 44 for instructions for taking samples of the powders and placing them on the Test Mat. Note: With adults in a workshop, it is usually not necessary to cut the Test Mats and waxed paper sheets to size and place them in the tray. Not doing so saves a lot of time.
2. Instruct participants to use their senses (other than taste) to explore the powders. They should record their observations on a Class Properties Table.
3. Refer participants to p. 55 for instructions on doing the water test. (It is not necessary for them to make a new set of test samples.) They should fill in Record Sheet 4-A.

Lesson 5 Exploring Water Mixtures
1. Go over the **Background** on p. 59-60. Briefly explain how this relates to the activity that follows.
2. Refer participants to the instructions on p. 65 and let them begin. They should record results in column 2 of Record Sheet 4-A. Ask them, based on their results, to classify the water mixtures as solutions or suspensions.

Lesson 6 Discovering Crystals
Unless you are able to prepare dishes of crystals ahead of time, this will have to be a talkthrough. The main point is that dissolved solids can be recovered by evaporation.

Lesson 7 Testing Unknown Solids with Vinegar
1. Go over the **Background** on p. 83. You may wish to omit revealing the expected results at this time.
2. Refer participants to p. 88 for instructions. They record observations on Record Sheet 7-A.
3. After they finish, explain that the giving off of a gas (fizzing) indicates that a chemical change is taking place.

Lesson 8 Testing Unknown Solids with Iodine
1. Have participants do the iodine test and record the results in the second column of Record Sheet 7-A. If you have not previously gone over cautions regarding iodine, see the **Safety Note** and **Additional Notes** on p. 94.
2. Explain that a color change is another indicator that a chemical change has occurred.

Lesson 9 Testing Unknown Solids with Red Cabbage Juice
1. Go over the **Background** information about red cabbage juice on p. 99. Recommend that they refrigerate the juice when it is not being used.
2. Have them perform the test and record the results in the first column of Record Sheet 9-A.
3. While the participants are working, set up the heat test station as shown on p. 109. (You may wish to do this as part of the On-site Preparation.)

Lesson 10 Testing Unknown Solids with Heat
1. Refer participants to Fig. 10-2 on p. 109. Explain that this setup is for fire safety and to protect the worktop from burns. Go over the **Safety Notes** on p. 110.
2. Go over to your heat station and demonstrate how to do the heat test. Explain that the chemical must be held directly above the candle flame, but not so low as to snuff out the flame. Be sure to show that the hot bake cups go into the foil-lined trays at the completion of each test.

3. Refer the participants to the directions on p. 112. Let them begin. Results are recorded in the second column of Record Sheet 9-A.

Lesson 11 Reviewing the Evidence
In this lesson students summarize the information they have gathered. Do as a talk through.

Lesson 12 Identifying the Unknown Solids
Refer participants to Record Sheet 12-A. Using the information they have gathered, they should identify the unknowns.

Lesson 13 Identifying the “Mystery Bag Chemical”
In this lesson, students apply their knowledge to identify the mystery chemical introduced in lesson 1. If you are rushed for time, or when working with an advanced group, do this as a talk-through. If time permits, or if the group needs the experience, give out Record Sheet 13-A and let them solve the mystery.

Lesson 14 Testing Mixtures of Two Unknown Solids
1. Show a sample of the unknown mixture. Explain to the participants that you have mixed equal quantities of two of the solids.
2. Ask them to discuss how they might test the mixture to determine which two solids make up the mixture. They should realize that the mixture will show the characteristics of two of the solids.
3. Once you are confident that they have developed a strategy for testing the mixture, give out the samples of the unknown mixture and allow them to proceed. Results are recorded on Record Sheet 14-A.

Lesson 15 Testing Household Liquids with Red Cabbage Juice
1. Go over the Background information on p. 149 and the Safety Notes on p. 150.
2. Have the teams prepare labeled dropper bottles of lemon juice, detergent, alcohol, and ammonia. They are to test these liquids plus water and vinegar with red cabbage juice.
3. Refer participants to the directions on p. 156. They can record the results on Record Sheet 15-A.

Lesson 16 Using the Known Solids to Identify Unknown Liquids
1. Go over step 2 under Preparation on p. 164.
2. Explain that in this activity students will use the (now) known solids to identify the (now) unknown liquids.
3. Let the group discuss the strategy for identifying the liquids. (Refer to the points under Background on p. 163.)

Floating and Sinking

Introduction to the unit:
1. Floating and Sinking is a 16-lesson unit for fifth-graders.
   - In lessons 1–5, students make and test predictions about which objects will float and sink.
   - In lessons 9–12 students investigate the floating force.
   - In lessons 13–15, students investigate the floating or sinking of objects in salt water.
In lesson 16, students use what they have learned to predict whether or not a “mystery cylinder” will float.

The lessons
Lesson 1 What Do We Know about Floating and Sinking?
1. Do brainstorming on “Why do some things float and others sink?”
2. Do demonstration of beads in fresh water and salt water. Ask, “Why does the bead float in one cylinder and sink in the other?”

Lesson 2 Making and Testing Predictions about Familiar Objects
This lesson requires the students to bring materials from home to test for floating and sinking. Skip entirely or talk through.

Lesson 3 Which Things Float? Which Things Sink?
1. Have the teams order the objects from lightest to heaviest. (This is mostly subjective.)
2. Have one team paste or tape up the drawings of the individual objects (cut from the copies of the blackline masters) in order from lightest to heaviest. (Note: Eliminate the drawings of the clay cylinder and empty cylinder for this activity.)
3. Have the teams predict whether each object will float or sink and fill in the middle column of Record Sheet 3-A.
4. Test predictions by dropping the objects in water. Finish filling in Record Sheet 3-A.

Lesson 4 Measuring Weight with a Spring Scale
Follow student instructions on p. 46 and 47 of Teacher’s Guide (Student Activity Book p. 11 and 12). Helpful hint: After adding each paper clip, tap on the side of the tube to break the friction between the coil and the side of the tube. This will make the scale much more accurate. Reminder: At the end of the workshop, remove the masking tape before storing the kit.

Lesson 5 Weighing Floaters and Sinkers
1. Have the teams weigh the objects and fill in Record Sheet 5-A. (Do only the First Measurement if you are concerned about time.)
2. Discuss variations in data and possible reasons for this. Point out that uncertainty is present in most measurements.
3. Have one or more groups make a graph as described under Background on p. 49 and 50 of the Teacher’s Guide. (Note: If you need to save time, eliminate the graph.) Have one group revise the order of the drawings of the objects based on their measurements.

Lesson 6 Making a Sinker Float;
and
Lesson 7 Investigating Boat Designs
1. Challenge each team to reshape the clay so that it will float. Point out that many students will think that changing the shape of the clay will also change its weight.
2. Go over the Background material on p. 59 of the Teacher’s Guide.
3. Ask for the characteristics of the boats that float.
4. Challenge them to design a clay boat that will float the most marbles possible.

Lesson 8 Does Size Affect Buoyancy?
1. Point out the aluminum squares. Ask each group to make boats and determine the number of marbles each will float. Have them fill in the middle column of Record Sheet 8-A before they test. Then test and fill in the last column of the sheet.
2. Ask, “What happens to the boat as you add more marbles?” (The boat sinks deeper into the water. Notice that the boat must displace the water as it does this.)
3. Ask, “What is the relationship of boat size to number of marbles floated?”
4. Have them empty all marbles from the large boat. Then, while the boat is floating, have them press down on the inside bottom with the fingertips. Ask, “What do you feel?” (“Pressure.” “It’s pushing up.”) Point out that this is the floating (buoyant) force.

Lesson 9 Measuring the Buoyant Force
1. Give out the medium and large fishing bobbers.
2. Let them float the bobbers and try to push them under water.
3. Have them fill in Record Sheet 9-A.
4. Have the teams measure the floating force according to the directions on p. 83 and 84 of the Teacher’s Guide (p. 27 of the Student Activity Book). Have them fill in Record Sheet 9-B.
5. Ask the questions under step 2 of Final Activities, p. 82 of the Teacher’s Guide.

Lesson 10 What Happens to the Water?
1. Point out that thus far most of the attention has been on the objects. Now we will investigate what happens to the water.
2. Have the teams form the lump of clay into large and small cylinders that approximate the sizes of the other cylinders.
3. Have each team place a strip of tape vertically up the side of a plastic cylinder. Mark a cm scale on the tape, beginning with zero at the bottom.
4. Have each team determine the water displacement for each object according to the directions given under Procedure on p. 91 of the Teacher’s Guide (p. 36 of the Student Activity Book). Ask, “What is the relationship of the object’s size to the amount of water displaced?”

Lesson 11 How Much Do Objects Weigh Underwater?
Have teams fill in Record Sheet 11-A. Then ask the questions under Final Activities, p. 101 of the Teacher’s Guide.

Lesson 12 How Much Does Water Weigh?
1. Have teams weigh the plastic cylinder of water. Then have a team add the drawing of the cylinder of water to the lightest-to-heaviest sequence.
2. Have them use the weights of the large cylinders as recorded on Record Sheet 5-A to complete the graph on Record Sheet 12-A. (If you are short of time, omit the graphing and show an overhead of Fig. 12-4 on p. 109.)

Lesson 13 Dissolving Salt in Water
1. The first part of this lesson involves evaporation and cannot be completed in a workshop. Talk through this part or omit.
2. Have them compare the weights of salt, water, and salt water by following the directions on p. 118 and 119 in the Teacher’s Guide (p. 45 of the Student Activity Book). They should fill in Record Sheet 13-A as they work.

Lesson 14 How Is Salt Water Different from Fresh Water?
1. Ask, “If you take the objects you tested for floating and sinking in fresh water and test them again in salt water, do you think you will get the same results?”
2. Have the teams test the objects for floating or sinking in the cup of salt water they made in lesson 13. Discuss the results.

Lesson 15 Constructing a Hydrometer
1. Have the teams construct a hydrometer according to the instructions in the Student Activity Book on p. 49 and 50.
2. Ask the teams to predict how the hydrometer will float in salt water and give some reasons. Then let them test their prediction.

Lesson 16 Working with Mystery Cylinders
1. Show the mystery cylinders. Ask, “How could you predict whether or not these cylinders will float in fresh water?” Wait for their answers. Do not give out the mystery cylinders until they have a plan to follow.
2. Give out the mystery cylinders and allow the teams to proceed.
3. Once the teams have made their prediction, allow them to drop the mystery cylinders into the water.
Invention Convention

Timeline

Week One

- What is an invention?
- Can I create a working model?
- Brainstorm problems and solutions.
- Create Invention Booklet *It Takes All Kinds*. (Pair in groups to answer questions.
- Do worksheet *Re Use-It*.

Week Two

- Idea Selection
- Create poster board *What Bugs Me?*: *Don’t you hate it when…* (individually)
- In small groups discussing solutions: 3 Focus questions: Is this interesting to me?, Can I make a working model?, Will it be easy for me to get the materials to build my invention?
- Students select 3 invention ideas. Meet with one other person discuss 3 questions with their idea.
- Students can take list home to parents.
- Students take home *Intent to Invent* and 2nd letter to parents.

Week Three

- Final Selection
- Bring 3 inventions back to school with one selected.
- Final selection should have a brief paragraph and/or picture of what they are going to do and how they are going to do it.
- Give final ideas to teacher

Week Four

- Students work on slogan and title
- Worksheet *What’s In a Name?* And *Sell It Like It Is!*

Week Five

- Begin working on project at home
- Students will start their poster in art class.
- Students will write rough draft of *Scientific Method Card* (Title, Problem/Purpose, Materials Used, Brief Procedures describing invention construction) Worksheet *Process Card*
- Students receive *Patent Application*
- Students receive *Invention Progress Report*

Week Six

- Students turn in *Patent and Progress Report*
- Type final copy of *Scientific Method Card* in computer class.
- Learn about inventors: Play “Who Am I?”

Week Seven
- The Invention Convention is this week!
- Reminder/invitation to parent/guardian
- Last minute questions
INTENT TO INVENT FORM

Student Inventor:

(First Name) (Last Name)

Homeroom Teacher:_________________________
Date:_________________________

1. I intend to invent:
_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________
________________________________________________________________________________

2. My invention is designed to solve the following problem:
_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________

3. Here is a brief description and/or picture of my invention:

Please remember to turn this paper over----------------------
---------→
4. List the steps that will be necessary for you to complete your invention.
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

5. I will be using the following materials in my invention:
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

6. I affirm that I am the original and first inventor of my invention. I will practice science safety rules at all times.
   ___________________________________________ Student’s Signature

7. I have reviewed this form with my child and understand that this invention is due May 15, 2002 and will be constructed at home.
   ___________________________________________ Parent/Guardian Signature
May 20, 2015

Dear 4th Grade Parent/Guardian:

This year your child will be participating in a special kind of science fair called the Invention Convention. It is designed to promote your child’s problem-solving and creative-thinking skills. Your child will be following a systematic process to invent a new product or to develop a new method for doing something.

The first step in the actual invention process will be brainstorming an idea for an invention. Your child will be encouraged to find a problem that needs to be solved. He or she may ask if you have a need for something that will help you solve a problem. Your interest and encouragement at this stage will help to make the invention process a fun learning experience for your child. It should be noted that the invention process will be covered in school and that the actual construction of their invention will be done at home.

Once your child has settled on an idea and researched it to make sure that the idea has not been used before, an Intent to Invent form will be completed and brought home for your signature. Your child can then begin the planning stage. We will continue to send information and updates home.

As your child begins the actual process of the inventing, your continued interest and encouragement will be helpful. Discuss the progress he or she is making and any problems that are encountered. Remind your child that although inventors often experience failure along the way, they remain persistent and keep trying and thinking of new ideas to solve a problem.

You are invited to attend the Invention Convention ……………I would like to thank you for your continued support and interest in your child’s education. Please feel free to contact me at ……if you have any questions or concerns.

Sincerely,
INCLINED PLANE
Carry My Books

An Inclined Plane or ramp, is a flat surface with one end higher than the other end. An inclined plane lets us raise heavy things without having to lift them straight up.

Question: Which is the easier way to lift 3 books -straight up, or by using a ramp?

Materials: Board, 10 books, string, spring scale

Procedure:
1. Tie 3 books together. Stack 7 books in a pile.
2. Lift the 3 books to the top of the seven book pile with a spring scale. Record the weight.
3. Use the board and seven books to make an inclined plane.
4. Pull the 3 tied books up the ramp with the spring scale. Record the weight.

Results:
1. Which was the easier way?
2. Is that what you thought?
3. What did you learn?
Inclined Plane

Definition of Inclined Plane:

Weight of three books with OUT board:

Weight of three books using board:

Which was the easier way?

Is that what you thought?

What did you learn?
Levers

Levers have 3 parts. The part where the lever is supported is called the FULCRUM. The part from the fulcrum to the weight you want to lift is called the WEIGHT ARM. The part from the fulcrum to where you are pushing and pulling is called the FORCE ARM.

Question: Is a weight easier to move when the force arm is longer, shorter, or the same length as the weight arm?

Materials: juice can, board, books

Procedure:
1. Make a lever using the board and juice can.
2. Put four books on one end of the lever. This will be the weight you need to lift.
3. Adjust the board on the fulcrum to make the force arm shorter than the weight arm.
4. Add books one at a time to the force arm. Record how many books it takes to move the weight arm.
5. Repeat steps 3 and 4 with a longer force arm and force arm the same length (the fulcrum-juice can will be in the center)

Results:
1. Is a weight easier to move with a shorter, longer, or same length force arm?
2. Is that what you thought?
3. What did you learn?
Levers

Definition of levers:

How many books does a shorter force arm take to move the weight arm?

How many books does a longer force arm take to move the weight arm?

How many books does a force arm of the same length take to move the weight arm?

Is a weight easier to move with a shorter, longer, or same length force arm?

Is that what you thought?

What did you learn?
A Pulley

A PULLEY lets us change the direction of the force we use to do work.

Question: Can you use a pulley to help you send messages across the room?

Materials: 2 thread spools, 40 feet of string, 2 round pencils, paperclips, message

Procedure:
1. Put the pencils through the thread spool centers. Tie the ends of the string together to make a loop. Have one person hold the ends of one pencil (allowing the spool to turn freely). Have one person hold the other spool. Wrap the string around the spools to create a pulley system.
2. Write a message, attach it to the pulley with a paper clip. Have another person pull the string to move the message.

Results:
1. Did your message travel across the classroom by pulley?
2. Is that what you thought would happen?
3. What did you learn?
A Pulley

Definition of a pulley:

Did your message travel across the classroom by the pulley?

Is that what you thought would happen?

What did you learn?
Screw
Count the Turns

A SCREW is used to hold things together. It has a line that goes around it, which is called THREAD (actually a twisting inclined plane).

Question: What type of screw takes more turns to go into a block of wood – one with more or less thread?

Materials: Wood block, same size screws with different sized threads, screwdriver, masking tape

Procedure:
1. Wrap a screw driver handle with a piece of masking tape. Make a mark on the tape. YOU WILL COUNT ONE TURN EACH TIME THE MARK COMES BACK TO THE PLACE IT STARTED.
2. Place the screw driver into the slot of one screw. Watch where the mark is and start turning the screw to the right.
3. Count how many turns it takes to get the screw all the way into the wood.
4. Repeat for the other screw or screws.

Results:
1. Which screw took more turns to go all the way into the wood?
2. Is that what you thought would happen?
3. What did you learn?
Screw

Definition of screw:

Predict which screw will take the most AND the least amount of turns to go into the wood block.

How many turns does it take for the screws to go all the way into the wood block?

a. _______  b._________  c._________

d._______  e._________  f._________

Which screw took more turns to go all the way into the wood?

Is that what you thought would happen and why?

What did you learn?
A WEDGE is like two incline planes (ramps) put back-to-back. But, there is a difference in how they work. Something is moved over an inclined plane, while a wedge moves through something. A wedge is used to split, cut, or go through something.

Question: What is easier to pound into a board, a nail with a point (wedge) or a blunt nail?

Materials: large nails with and without points, hammer, board, rulers

Procedure:
1. Measure the nails and record.
2. Hammer the nail with the wedge five times. Measure the part of the nail you can see and record.
3. Hammer the nail without the wedge five times. Measure the part of the nail you can see and record.

Results:
1. Which nail was easier to pound?
2. Is that what you thought?
3. What did you learn?
Wedge

Definition of a wedge:

Measure of nails:

a.__________  b.__________  c.__________

d.__________  e.__________  f.__________

Measure of hammered nails with wedge:

a.__________  b.__________  c.__________

d.__________  e.__________  f.__________

Measure of the hammered nails with OUT wedge:

a.__________  b.__________  c.__________

d.__________  e.__________  f.__________

Which nail was easier to pound and why?

Is that what you thought?

What did you learn?
Wheel and Axle
Roller Skates

A Wheel and Axle help us turn something more easily or move something across a surface more easily. That is, with a wheel and axle, you use less force.

Question: Which needs less force to be moved, a roller skate on its side or on its wheels?

Materials: 2 roller skates, 2 rubber bands the same size, yard stick

Procedure:
1. Attach rubber bands to roller skates.
2. Measure the length of the rubber bands before you pull.
3. Put the skate on its side. Measure the rubber band during the pull.
4. Pull the skate on wheels. Measure the rubber band during the pull.

Results:
1. Which skate needed less force to be moved?
2. Is that what you thought?
3. What did you learn?
Wheel and Axle

Definition of Wheel and Axle:

The measure of the rubber band before pulled is ____________.
The measure of the rubber band pulled with skate on its side is ____________.
The measure of the rubber band pulled with skate on wheels is ____________.

Which skate needed less force to be moved?

Is that what you thought?

What did you learn?
INVENTION CONVENTION

May 20, 2015

Dear 4th Grade Parent/Guardian:

The inventions have been chosen! We have completed the first step in the actual invention process in school and the students are eager to begin the construction of their inventions. The entire invention will be constructed at home and brought to school before homeroom on ……(You will receive more information on this at a later date.). The working model of your child’s invention must fit on the top of their desk. As your child begins the exciting invention process, your continued interest and encouragement will be helpful. Please continue to discuss the progress he or she is making and any problems that are encountered. Remind your child that although inventors often experience failure along the way, they remain persistent and keep trying and thinking of new ideas to solve a problem. Encourage your child to contact me or their science teacher if they need to change their invention or feel the need to start over with a new problem. Remember this process has been designed to reinforce the scientific method and to promote your child’s problem-solving and creative thinking skills.

Your child’s Intent to Invent form is attached to this letter. Please review the information on the form with them, sign #7 and have your child return it to their science teacher on _____________________.

While the invention is being constructed at home your prize inventors will be working diligently in school to come up with a slogan and name for their invention. Students will need this information to begin their invention posters in Art class during the week of ….. The students will learn about patents and write the rough draft of their Scientific Method Card, which will include their invention title, problem, material list and procedures during the week of ….. You will be able to hear the buzz of keyboard keys as students type up their Scientific Method Cards in computer class during the week of ….. Students will also turn in an Invention Progress Report and learn about all types of inventors during that week. The actual Invention Convention will be held the following week on ….. in the classroom. We look forward to seeing you there. 😊

I would like to thank you for your continued support and interest in your child’s education. Please feel free to contact me at …….. or at school if you or your child has any questions or concerns.

Sincerely,
A patent is a kind of trade agreement between the United States Government and the inventor. With this agreement, the inventor must publicize his/her invention, allowing other inventors to learn from the new invention and/or improve upon their own inventions. The government then protects the inventor by giving him or her "exclusive" permission to manufacture and sell the invention. If an inventor decides to patent an invention, he or she then applies for the patent. Fill out the patent application below. Ask two witnesses to sign it.

**Description of invention:**
(State Clearly what the invention does and how it works.)
Scale Drawing of invention: (Label invention parts.)

Front View

Side View

View
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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<td>Family Name or Surname</td>
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<td>inventor’s Signature</td>
<td>Date</td>
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53
Name:________________________       Date:_______

Inventors Name:____________________

Name of Invention:___________________
Date when invented:________________

*Please complete five (5) out of the six (6) questions.*

1. What problem did your inventor solve?

2. What problems did he or she encounter while creating the invention?

3. What simple machine was included? What other materials?

4. What were the inventor’s trademark and/or slogan?

5. How did the invention impact peoples lives?

6. What other interesting facts can you add about your inventor?
Invention Convention Materials

Board (3)
String
Spring Scale
Juice Can
Thread Spools (2)
Round Pencils (2)
Paperclips
Wood block
Screws (same size, different threads)
Screwdriver
Masking tape
Large nails
Hammer
Rulers
Roller Skates (2)
Rubber Bands
Yard Sticks
INVENTION CONVENTION

*PROGRESS REPORT*  REMEMBER YOUR INVENTION IS DUE .....

Name_____________________________________________ HR Teacher_____________________________

Invention Title:__________________________________________________________

Your invention is due in three weeks! ☺ Have you done any of the following:
(*Please note that "*" items are assignments that have not been assigned yet.)

- Found an adult to help you.
- Formalized your plan.
- Came up with a problem.
- Collected materials.
- Started to build your invention.
- ½ way through the building of your invention.
- Invention completed.
- Tested your invention.
- Built desk size working model. (This means it should function according to the purpose it is intended for.)
- Wrote title and turned it in.
- Wrote slogan and turned it in.
- *Turned in rough draft of process card. Due __________________________
  (Started in class during the week of ...)
- *Started poster (Work on in art class during the weeks of ... & ...)
- *Completed poster. Due ...!
- *Completed patent. We will start this in class during the week of ...!
- *Prepared a brief oral presentation of your invention. You should be able to explain your invention and what it does.

Please write when you plan to start and complete any items you did not check in the space below. Do not worry about "*" items. Get this paper signed and return it to your teacher on ________________________________.

**Parent/Guardian Signature:_______________________________________________
4th Grade Invention Convention Timeline
(Tentative Schedule)

Week One
✓ During this week your child will be learning about inventions. What is an invention and why are inventions made?
✓ A model for the inventor project will be presented to the students.

Week Two
✓ During this week, your child will be brainstorming ideas for an invention in class.
✓ Your child will focus on three questions... Is this interesting to me? Can I make a working model? Will it be easy for me to get the materials to build my invention?
✓ Randomly students will be picked to present their inventor to the class. Your child should be prepared to present this week.
✓ Student will take home the Intent to Invent sheet.

Week Three
DECIDE INVENTION

Week Four
✓ During this week, your child should bring 3 invention ideas back to school with one idea selected.
✓ Students learn about simple machines.
✓ Students take home 2nd letter to parents and Return Intent to Invent Form
✓ Students will present their inventor to the class

Week Five
✓ Final Selection for invention. Your child should have a brief paragraph and/or picture of what and how they are going to complete the invention
✓ Students work on slogan and title in class
✓ Students will present their inventor to the class.

Week Six
✓ During this week, your child can begin working on project at home.
✓ Their poster will be worked on in art class.
✓ Your child will write a rough draft of the Scientific Method Card and as a class discuss patents.
✓ Your child will receive Patent Application and Invention Progress Report.
✓ Students will present their inventor to the class.

Week Seven
✓ Your child will turn in Patent and Progress Report
✓ Scientific Method Card will be typed in computer class.

Week Eight
✓ The class will play the game “Who am I?”
✓ Wrap up and catch up

Week Nine
INVENTION CONVENTION is this week...
Previous NJ Science Standards and Assessment Examples

Mission: Scientific literacy encompasses the understanding of key concepts and principles of science; familiarity with the natural world for both its diversity and unity; and use of scientific knowledge and scientific ways of thinking for individual and social purposes (American Association for the Advancement of Science, Science for All Americans).

| Standard 5.1 Scientific Processes |  
|----------------------------------|----------------------------------|
| All students will develop problem-solving, decision-making and inquiry skills, reflected by formulating usable questions and hypotheses, planning experiments, conducting systematic observations, interpreting and analyzing data, drawing conclusions, and communicating results. |  

| Big Idea: Science is a way of thinking about and investigating the world in which we all live. |  
|----------------------------------|----------------------------------|
|  

<table>
<thead>
<tr>
<th>Strand A. Habits of Mind</th>
<th>Essential Questions</th>
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<tbody>
<tr>
<td>1. What constitutes evidence?</td>
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<tr>
<td>2. When do you know you have enough and the right kind of evidence?</td>
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<tr>
<td>3. How can this result be best justified and explained to others?</td>
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<tr>
<th>Strand A. Habits of Mind</th>
<th>Enduring Understandings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What constitutes evidence?</td>
<td>Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying explanations.</td>
</tr>
<tr>
<td>2. When do you know you have enough and the right kind of evidence?</td>
<td></td>
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<tr>
<td>3. How can this result be best justified and explained to others?</td>
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<tr>
<th>Areas of Focus</th>
<th>Comments and Examples</th>
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<tbody>
<tr>
<td>1. Raise questions about the world around them and be willing to seek answers through making careful observations and experimentation.</td>
<td></td>
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<tr>
<td>2. Keep records that describe observations, carefully distinguish actual observations from ideas and speculations, and are understandable weeks and months later.</td>
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<tr>
<td>3. Recognize that when a science investigation is replicated, very similar results are expected.</td>
<td></td>
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<tr>
<td>4. Know that when solving a problem it is important to plan and get ideas and help from other people.</td>
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</table>

Instructional/Assessment Focus:

- The quality of a student’s response to the question “How do you know?” is important.
- Teacher models supporting claims with reasons for students.
- Introduce reasoning by analogy. Analogies should be simple and obvious at first, and attention should focus on how the analogy is similar to or different from what is being studied.
- Scientists may have different explanations for the same set of observations which lead to making more observations to resolve the differences.

Suggested Instructional/Assessment Strategies:

Students:

- Offer reasons for their findings and consider reasons suggested by others.
- Seek better reasons for believing something other than “Everybody knows that…” or “I just know” and discount such reasons when given by others.
- Support their reasoning statements with facts found in books, articles, and electronic resources, identify the sources used, and expect others to do the same.
- Keep notebooks that describe observations (plants, class pets, aquarium, playground, etc.). Students should be able to distinguish observation from ideas and speculations about what is being observed. Students’ notes should be clear and comprehensive enough that they are understandable weeks or months after the observations are recorded.

Sample Assessment Item:

1. A geologist wrote many books on how rivers affect land. The geologist described detailed observations made over a long time.

Why do scientists record details about scientific observations?

A. to prove that scientists work hard
B. to make science books more interesting
C. to make people want to read about science
D. to provide evidence that supports conclusions
Strand B. Inquiry and Problem Solving

What makes a question scientific?

Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying explanations.

Areas of Focus

1. Develop strategies and skills for information-gathering and problem-solving, using appropriate tools and technologies.

Instruction/Assessment Focus:

- Students use simple instruments such as:
  - Rulers to measure length, height, and depth of objects and materials;
  - Thermometers to measure temperature;
  - Watches to measure time;
  - Balances and spring scales to measure weight and force, and
  - Hand lenses to observe finer details of plants, animals, rocks, and materials.
- Students also develop skills using computers, probe ware, and calculators when conducting investigations.

Suggested Instructional/Assessment Strategy:

- Recognize when comparisons might not be valid because some conditions are not kept the same.

Sample Assessment Items:

1. Mrs. Henderson’s class has five small, covered boxes. One contains perfume; another contains dried onions. There is also a box with pine needles, a box of lemon pieces, and a box with a paper towel wet with vanilla flavoring. Without opening the boxes, describe what the students should do to get the best information about what is inside each box.

2. One hot sunny day, Sally left two buckets of water out in the sun. The two buckets were the same except that one was black and one was white. At the end of the day, Sally noticed that the water in the black bucket felt warmer than the water in the white bucket. Sally wondered why this happened, so the next day, she left the buckets of water out in the hot sun again. She made sure that there was the same amount of water in each bucket. This time she carefully measured the temperature of the water in both buckets at the beginning of the day and at the end of the day. The pictures below show what Sally found.
3. A student asks, “Does the size of the wheels affect how far toy cars roll on the floor?”

The student hypothesizes that toy cars with large wheels roll farther.
- Describe how the student can set up an investigation of his hypothesis.
- Describe how the student can collect data to support his hypothesis.

---

2. Identify the evidence used in an explanation.

**Instructional/Assessment Focus:**

- The emphasis is on students' thinking as they use data to formulate explanations. Students learn what constitutes evidence and judge the merits or strengths of the data and information that will be used to make explanations.
- Students begin developing the abilities to communicate, critique, and analyze their work and the work of other students.
- Students check their explanations against scientific knowledge, experience and observations of others.
- Communication can be written, spoken, or in the form of a drawing.

**Sample Assessment Item:**

*Use the picture below to answer the following question.*

![Image of before and after pictures of plants in the sun.](attachment:image.png)

What changes do you see?
Tell why the changes happened.

![Image of plants in sand and soil.](attachment:image.png)
1. Sarah put 10 marigold seeds in a pot of sand and 10 marigold seeds in a pot of soil. She then put both pots near a window and watered them the same amount of water every few days. After three weeks, Sarah measured the height of the marigold seedlings in each pot. What was Sarah probably testing?

A. how light affects the growth of marigolds  
B. which type of marigold grows best  
C. whether marigolds grow better in soil or in sand  
D. how water affects the growth of marigolds

**Strand C. Safety**

- What does Safety First demand of us in each setting?  
- What rules are general and what are situation-specific?  
- Safety first!

<table>
<thead>
<tr>
<th>Areas of Focus</th>
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</thead>
</table>
| 1. Recognize that conducting science activities requires an awareness of potential hazards and the need for safe practices. | Instructional/Assessment Focus:  
- Students are coached in developing a proactive approach to safety.  
- Students engage safely in investigations inside and outside the classroom. |
| 2. Understand and practice safety procedures for conducting science investigations. | |

**Grade Four Unit Connections:**

The processes used for all of the units in science flow from the principles of inquiry and scientific process with the overarching understanding that safety must always be the top priority in any scientific experimentation. These principles are introduced at the beginning of the first unit and are reinforced throughout the year.

**Standard 5.2 Science and Society**

All students will develop an understanding of how people of various cultures have contributed to the advancement of science and technology, and how major discoveries and events have advanced science and technology.

**Big Idea:** Science is a human endeavor. People from many cultures have contributed to the understanding of science.

<table>
<thead>
<tr>
<th>Essential Questions</th>
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<tbody>
<tr>
<td><strong>Strand A. Cultural Contributions</strong></td>
<td>Understanding the development of scientific ideas is essential for building scientific knowledge.</td>
</tr>
<tr>
<td>What do we mean in science when we say that we stand on the shoulders of giants?</td>
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</table>

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<tr>
<th>Areas of Focus</th>
<th>Comments and Examples</th>
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</thead>
</table>
| 1. Describe how people in different cultures have made and continue to make contributions to science and technology. | Instructional/Assessment Focus:  
As students study science, they should be aware of the historical context that has impacted the development of various scientific theories and that the body of scientific knowledge is constantly changing. It is not expected that students memorize the specific contributions of individual scientists, but rather that they appreciate the context of |
Strand B. Historical Perspectives

- How do science and technology influence each other?

Technology evolves at an ever accelerating pace based on the needs and wants of society, and is influenced by cultural, political, and environmental values and constraints.

Areas of Focus

1. Hear, read, write, and talk about scientists and inventors in historical context.

Sample Assessment Item:
1. Robert Hooke was one of the first people to identify cells. Which invention did he use in order to see cells?

Grade Four Unit Connections:
Each unit touches on the foundations of the scientific knowledge within it. Through non-fiction reading supplementary reading, students gain an understanding of the historical and cultural connections to the study of that particular strand of science. In the Inventions unit the students study more deeply the particular processes of scientists in history.

Standard 5.3 Mathematical Applications

All students will integrate mathematics as a tool for problem-solving in science, and as a means of expressing and/or modeling scientific theories.

Big Idea: Science cannot be practiced or learned without appreciation of the role of mathematics in discovering and expressing natural laws. Tables, graphs, and equations are alternative ways of representing information or relationships, each with advantages and disadvantages.

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<tbody>
<tr>
<td>Strands A-D: Numerical Operations, Geometry and Measurement, Patterns and Algebra, Data Analysis and Probability</td>
<td>Mathematics is a tool used to model objects, events, and relationships in the natural and designed world.</td>
</tr>
</tbody>
</table>

Areas of Focus

Comments and Examples
1. Determine the reasonableness of estimates, measurements, and computations of quantities when doing science.

**Instructional/Assessment Focus:**
- Students use estimation to determine the reasonableness of measurements, and computations, whether done using pencil and paper or calculators.

**Suggested Instructional/Assessment Strategy:**
- Incorporate estimation in measurement activities (e.g., estimate before measuring).

2. Recognize and comprehend the orders of magnitude associated with large and small physical quantities.

3. Express quantities using appropriate number formats, such as:
   - integers.
   - fractions.

**Instructional/Assessment Focus:**
- How a number is written says something about how precise the measurement was made.
- Specifying the unit of measurement is always necessary.
- These principles can be treated as general ideas and obvious examples can be provided. Teachers should not require the memorization of sophisticated rules.

1. Select appropriate measuring instruments based on the degree of precision required.

**Instructional/Assessment Focus:**
- Measurements are likely to yield slightly different numbers, even if what is being measured stays the same.

2. Use a variety of measuring instruments and record measured quantities using the appropriate units.

**Instructional/Assessment Focus:**
- When recording and reporting measurements, it is important for students to include the units. Three degrees Fahrenheit is different from three centimeters and three miles is different from three miles per hour.

**Suggested Instructional/Assessment Strategy:**
- Students use, thermometers, watches, balances, spring scales, hand lenses, probe ware and/or computers, to take and record measurements. (height of plants over time, temperature of water in an aquarium, outdoor temperature, wind speed, etc).

1. Identify patterns when observing the natural and constructed world.

**Instructional/Assessment Focus:**
- Mathematical statements using symbols are valid only when the symbols are replaced by certain numbers.

**Sample Assessment Item:**
Students at Hoover Elementary School did a survey of the eye colors of all fourth graders at their school. The results are shown in the data chart below.

<table>
<thead>
<tr>
<th></th>
<th>Blue</th>
<th>Brown</th>
<th>Green</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ms. Musso’s class</td>
<td>9</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Mr. Broussard’s class</td>
<td>2</td>
<td>10</td>
<td>4</td>
</tr>
</tbody>
</table>

1. What does the chart show about Hoover Elementary School?
1. Use tables and graphs to represent and interpret data.

Instructional/Assessment Focus:

- Tables and graphs can show how values of one quantity are related to values of another.

Suggested Instructional/Assessment Strategy:

- As an integral part of scientific investigations, students create and interpret a variety of charts, diagrams, tables, and graphs as they offer reasons for their findings.

Sample Assessment Items:

Use the graph below to answer question 1.

![Graph showing owl population and acres of land cleared over time]

The graph above shows the owl population in a large forested area over a 20 year period. The graph also shows the acres of forest that were cleared for housing developments over the same time period.

1. Why did the owl population change?

Use the graph below to answer question 2.

![Graph showing plant heights vs. light intensity]

2. Nine bean plants were grown in varying amounts of light. What conclusion can be drawn from the graph?

A. As the temperature rose, the pressure remained the same.
B. As the pressure rose, the temperature remained the same.
C. As the pressure rose, the temperature dropped.
D. As the temperature rose, the pressure dropped.

3. Look at the diagram below for the days Monday through Thursday. Which best describes the relationship between temperature and pressure for those days?
Grade Four Unit Connections:

Students use mathematics to measure and compare distance and time in the Motion and Design unit. They calculate and study cost factors in the final design challenge. In the Floating and Sinking unit the students measure weight with a spring scale, and weigh floaters and sinkers as well as the buoyancy force. They also experiment with weighing under water. The Chemical Tests unit requires students to carefully measure substances using dropper bottles and graduated cups.

**Standard 5.4 Nature And Process Of Technology**
All students will understand the interrelationships between science and technology and develop a conceptual understanding of the nature and process of technology.

**Big Idea:** The study of science and technology is interrelated, and as such, can assist in solving problems.

<table>
<thead>
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<tbody>
<tr>
<td><strong>Strand A. Science and Technology</strong></td>
<td></td>
</tr>
<tr>
<td>☐ How do science and technology influence each other?</td>
<td>☐ The development of technology and advances in science are mutually supportive in driving innovation in both fields.</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Areas of Focus</th>
<th>Comments and Examples</th>
</tr>
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<tbody>
<tr>
<td>1. Distinguish between things that occur in nature and those that have been designed to solve human problems.</td>
<td><strong>Instructional/Assessment Focus:</strong></td>
</tr>
<tr>
<td></td>
<td>☐ Through science and technology, a wide variety of materials that do not appear in nature have become available, ranging from steel to nylon to liquid crystals.</td>
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| **Strand B. Nature of Technology** | |
| ☐ Are there ways to circumvent physical and social constraints when using technology? | ☐ Physical constraints and social values play a role in limiting the use of technology to solve problems. |

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<thead>
<tr>
<th>Areas of Focus</th>
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<tbody>
<tr>
<td>1. Demonstrate how measuring instruments are used to gather information in order to design things that work properly.</td>
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</table>
Strand C. Technological Design

How is the overarching concept of systems related to design and technology?

Thinking systematically means looking for the relationships between parts.

Areas of Focus

1. Describe a product or device in terms of the problem it solves or the need it meets.

Instructional/Assessment Focus:
Students exhibit growing confidence in their ability to develop designs and analyze a product: “Does it work?” “Could I make it work better?” “Could I have used better materials?”

2. Choose materials most suitable to make simple mechanical constructions.

Instructional/Assessment Focus:
Factors such as cost, safety, appearance, environmental impact, and what will happen if the solution fails must be considered in technological design. There is no perfect design. Designs that are best in one respect (safety or ease of use, for example) may be inferior in other ways (cost or appearance). Typically one design feature may be omitted in place of another feature.

Sample Assessment Item:
1. What could be done to make this kite fly better?

A. Add a tail.
B. Add more string.
C. Add more designs.
D. Add another side.

3. Use the design process to identify a problem, look for ideas, and develop and share solutions with others.

Grade Four Unit Connections:

The Motion and Design unit specifically addresses issues related to scientific design and technology. In the Inventions unit, students investigate historical perspectives and cultural affects on the design process as they study inventors of the past and present and move through the design process themselves.

Standard 5.5 Characteristics Of Life
All students will gain an understanding of the structure, characteristics, and basic needs of organisms and will investigate the diversity of life.

Big Idea: The natural world is defined by organisms and life processes which conform to principles regarding conservation and transformation of matter and energy. Knowledge about life processes can be applied to improving human health and well being.

Enduring Understandings

Strand A. Matter, Energy and Organization in Living Systems

All organisms transfer matter and convert energy from one form to
How is matter transformed, and energy transferred/transformed in living systems?

Areas of Focus

1. Identify the roles that organisms may serve in a food web.

Instructional/Assessment Focus:
A source of energy is needed for all organisms to stay alive and grow. Almost all kinds of an animal’s food can be traced back to plants and ultimately to sunlight. Insects and various other organisms depend on dead plant and animal material for food.

Suggested Instructional/Assessment Strategy:
Pick any food product (e.g., cookies, cereal, beef jerky) and trace the energy therein back to the sun.

Sample Assessment Items:
1. Which organisms in the pond ecosystem break down dead plants and animals?
   A. green algae
   B. bacteria
   C. water lily
   D. frogs

2. Tell why it is important for dead animals and plants in the pond ecosystem to be broken down.

3. Recognize that plants and animals are composed of different parts performing different functions and working together for the well being of the organism.

Instructional/Assessment Focus:
Each plant and animal has different structures that serve different functions in growth, survival, and reproduction.

Suggested Instructional/Assessment Strategies:
Compare and contrast structures that have similar functions in various organisms (e.g., eyes, ears, mouths). Explain that the function of the structure is similar although the structures may have different physical appearances (e.g., compare eyes of an owl with the eyes of a crayfish). Observe and identify structures of plants and describe the function of each structure.

Sample Assessment Items:
1. How do most fish get the oxygen they need to survive?
A. They take in water and break it down into hydrogen and oxygen.  
B. Using their gills, they take in oxygen that is dissolved in water.  
C. They get their oxygen from the food they eat.  
D. They come to the surface every few minutes to breathe air into their lungs.  

*Look at the pictures of deer below to answer question 2.*

2. Look at the picture above. Name one feature about the deer's body that helps it to survive and tell how the feature helps it to survive.

3. Nathan is creating a diagram to show photosynthesis. In addition to leaves, which plant part would be BEST to include in his diagram?

A. bark, because it protects the stem  
B. roots, because they bring in water  
C. soil, because it holds the plant down  
D. bacteria, because they provide nitrogen

4. Which bird beak would be most helpful for a bird that eats insects in the bark of trees?

A. A.  
B. B.  
C. C.  
D. D.

5. Describe the basic functions of the major systems of the human body including, but not limited to: digestive system, circulatory system, respiratory system, nervous system, skeletal system, muscular system, reproductive system.
1. Look at the picture above, which shows some of the organs that can be found inside the human body. What is the main job of the organ labeled 1?

A. carrying air  
B. carrying food  
C. carrying blood  
D. carrying messages from the brain

2. Which other system works with the skeletal system to provide physical support for the body?

A. muscular  
B. digestive  
C. circulatory  
D. respiratory

3. Julio wanted to know how his pulse rate changed when he ran very fast. He measured his pulse rate before he started running, while he was running, and two minutes after he stopped running. Which graph best shows how Julio’s pulse rate changed?

A. 
B. 
C. 
D. 

---

**Strand B. Diversity and Biological Evolution**

- How are organisms of the same kind different from each other?
- How does this help them reproduce and survive?
- Organisms are grouped in nature based upon similarities.

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</table>
1. Develop a simple classification scheme for grouping organisms.

**Instructional/Assessment Focus:**
- Living things can be sorted into groups in many ways using various features to decide which things belong to which group.
- Features used for grouping depend on the purpose of the grouping.

**Suggested Instructional/Assessment Strategy:**
- Given a selection of fruits and vegetables, develop a way to classify them by using their features. Explain the classification scheme used.

**Sample Assessment Item:**
1. Which group of living things shares the most characteristics?

A. [Images of Cat, Dog, Rabbit]
B. [Images of Fish, Crab, Crayfish]
C. [Images of Bird, Butterfly, Bat]
D. [Images of Spider, Grasshopper, Worm]

2. Recognize that individuals vary within every species, including humans.

**Instructional/Assessment Focus:**
Individuals of the same kind differ in their characteristics, and sometimes differences give individuals an advantage in surviving and reproducing.

**Suggested Instructional/Assessment Strategy:**
Select two parents from known breeds of dogs, which if used for breeding, would potentially produce a mix of desired traits, such as a dog that herds and fetches.

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**Strand C. Reproduction and Heredity**

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<thead>
<tr>
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</table>
| 1. Identify different stages in the lives of various organisms. | **Instructional/Assessment Focus:**
Over the entire earth, organisms are growing, dying, and decaying and new organisms are being produced by the older ones. Plants and animals have life cycles that may include being born, developing into adults, reproducing, and eventually dying. The details of a life cycle are different for different organisms. Some likenesses between children and parents are inherited, others are learned or acquired. |
Suggested Instructional/Assessment Strategies:
Construct the life cycle of a bean plant through the use of diagrams
Describe the plant in different stages of its life cycle from seed, to seedling, to mature plant, to death, and explain how the structures of the plant change over time.
Research the life cycle of an organism. Model the life cycle of the organism and describe how the organism changes over time. Compare the life cycle of this organism to the life cycle of various other organisms.

Sample Assessment Items:
1. Diagram 1 shows a frog's life cycle with two missing stages. Diagram shows the two stages that are missing from the frog's life cycle in diagram 1. They are labeled A and B.
Complete the frog's life cycle in Diagram 1 by writing A in the empty circle where stage A belongs and B in the empty circle where stage B belongs. Explain why you placed the letters A and B where you did.

2. An adult toad lays 6,000 eggs at a time in a pond. Which graph shows the number of tadpoles and toads that will most likely result in the pond from these eggs?

A. ![Graph A](image)
B. ![Graph B](image)
C. ![Graph C](image)
D. ![Graph D](image)
Grade Four Unit Connections:

While not directly connected with any unit of study in fourth grade, this standard will be addressed during the NJASK review conducted during the year.

<table>
<thead>
<tr>
<th>Standard 5.6 Physical Science - Chemistry</th>
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<tbody>
<tr>
<td>All students will gain an understanding of the structure and behavior of matter.</td>
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</table>

**Big Idea:** Materials exist throughout our physical world. The structures of materials influence their physical properties, chemical reactivity and use.

<table>
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<tbody>
<tr>
<td>© How do properties of materials determine their use?</td>
<td>© The atomic structures of materials determine their properties.</td>
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<tbody>
<tr>
<td>1. Sort materials based on physical characteristics that can be seen by using magnification.</td>
<td><strong>Instructional/Assessment Focus:</strong> Objects have many observable properties, including size, weight, shape, color, temperature, and the ability to react with other substances. Those properties can be measured using tools, such as rulers, balances, and thermometers. Materials may be composed of parts that are too small to be seen without magnification. <strong>Suggested Instructional/Assessment Strategies:</strong> Use a hand lens to observe objects to reveal more than can be seen with the unaided eye (salt, talcum powder, sugar cubes, etc.). Sort objects using unaided eyes according to the materials from which they are made or their physical properties, and give a reason why each object belongs to a specific group. Repeat the sorting activity using a hand lens then compare and contrast the observations.</td>
</tr>
<tr>
<td>2. Observe that water can be a liquid or a solid and can change from one form to the other and the mass remains the same.</td>
<td><strong>Instructional/Assessment Focus:</strong> Water can be a liquid or a solid and can go back and forth from one form to the other. If water is turned into ice and then the ice is allowed to melt, the amount of water is the same as it was before freezing.</td>
</tr>
</tbody>
</table>
| 3. Recognize that water, as an example of matter, can exist as a solid, liquid or gas and can be transformed from one state to another by heating or cooling. | **Instructional/Assessment Focus:** When liquid water disappears, it turns into a gas (vapor) in the air and can reappear as a liquid when cooled, or a solid, if cooled below the freezing point of water. **Suggested Instructional/Assessment Strategy:** Observe water in its various forms and change the state by heating or cooling. **Sample Performance Task:** As a technician for FEMA, you have been given the job of designing a simple strategy that homeowners can use to convert salt water into drinking water in the event of a long term power outage. Create a multimedia presentation that describes the strategy and explains how it works. **Sample Assessment Item:** Use the following data table to answer question 1. **How Temperature Affects Air in a Balloon**

<table>
<thead>
<tr>
<th>How Temperature Affects Air in a Balloon</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>How Temperature Affects Air in a Balloon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conditions of Balloon</td>
</tr>
<tr>
<td>-----------------------</td>
</tr>
<tr>
<td>Balloon after coming out of the freezer</td>
</tr>
<tr>
<td>Balloon at room temperature</td>
</tr>
<tr>
<td>Balloon after being warmed for 2 minutes</td>
</tr>
<tr>
<td>Balloon after being warmed for 4 minutes</td>
</tr>
</tbody>
</table>

1. A student conducted an experiment to find out how temperature affects air in a balloon. He drew a line around the center of the balloon and measured the length of the line around the balloon. According to the chart, what conclusion can be made about how temperature affects air in a balloon?

A. The warmer the balloon gets, the more it expands.
B. The balloon bursts after being warmed for 4 minutes.
C. The colder the balloon gets, the faster the gas moves.
D. The balloon is unaffected by changes in temperature.

1. Show that not all materials respond in the same way when exposed to similar conditions.

Instructional/Assessment Focus:

- The measurement of mass and other characteristics that can be seen without changing how that object looks are its physical properties. When you look at oranges, you know that they are oranges because of their color, shape, and smell. Mass, color, shape, volume, and density are some physical properties.

- Chemical properties are properties that can only be observed by changing the identity of the substance. A piece of paper burns and turns to a black substance. After the flame goes out you can no longer burn the new substance. The chemical properties have been changed.

Suggested Instructional/Assessment Strategies:

- Students determine whether various objects sink or float in water. Whether an object sinks or floats in a liquid depends mainly on two factors: density and buoyancy. However, at this level, students do not need to explain why objects sink or float. They are rather to be encouraged to observe that the same objects will sink or float every time, i.e., that there is consistency in the way the objects behave. This will help students devise their own ideas about physical properties and how they can be used to describe and categorize objects.

- Students investigate how common household materials such as cream of tartar, baking soda, laundry detergent, and Epsom salts react with water, vinegar, and litmus paper. (See Inquiry in Action: Investigating Matter through Inquiry for this and other instructional and assessment ideas.)

Strand B. Chemical Reactions

- What determines the type and extent of a chemical reaction?

- There are several ways in which elements and compounds react to form new substances and each reaction involves the flow of energy.
1. Combine two or more materials and show that the new material may have properties that are different from the original material.

Instructional/Assessment Focus:
When a new material is made by combining two or more materials, it has properties that are different from the original materials. For that reason, many different materials can be made from a small number of basic kinds of materials. (ex: antacid tablet and vinegar produce a gas)

Suggested Instructional/Assessment Strategy:
You are an educational toy maker that has been asked to design a rocket that can be safely launched in a school gymnasium. Explain why an antacid tablet and vinegar are the best choice for an engine.

Grade Four Unit Connections:
The Chemical Tests unit is one in which students study the property of matter and the interactions between materials. They study chemical reactions and mixtures and solutions.

Standard 5.7 Physics
All students will gain an understanding of natural laws as they apply to motion, forces, and energy transformations.

Big Idea: The flow of energy drives processes of change in all biological, chemical, physical and geological systems. The conservation of energy is a law that can be used to analyze and build understandings of diverse physical and biological systems.

<table>
<thead>
<tr>
<th>Essential Questions</th>
<th>Enduring Understandings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strand A. Motion and Forces</strong></td>
<td></td>
</tr>
<tr>
<td>☐ How would the universe be different if one or more of the laws of motion were suspended?</td>
<td>☐ The same basic rules govern the motion of all bodies, from planets and stars to birds and billiard balls.</td>
</tr>
</tbody>
</table>

Areas of Focus

1. Recognize that changes in the speed or direction of a moving object are caused by force and that the greater the force, the greater the change in motion will be.

Suggested Instructional/Assessment Strategy:
Observe the evidence of the push of air on objects such as pinwheels and kites. Compare how the direction and speed of moving air affects the motion of the objects.

Sample Assessment Items:
Use the picture below of Sharon pulling a wagon on a level sidewalk to answer questions 1 and 2.

1. How would the movement of the wagon be affected if she pulled harder on the wagon?

2. How would the movement of the wagon be affected if her little brother were sitting in the wagon?
3. Each horse is pulling with the same force, which direction will the rock move?

| North | West | South | East |

A. north  
B. south  
C. east  
D. west

2. Recognize that some forces can act at a distance.
- gravity
- magnetism
- static electricity

**Instructional/Assessment Focus:**
- The earth’s gravity pulls any object toward it without touching it.
- A magnet pulls on all things made of iron and either pushes or pulls on other magnets without touching them.
- Material that has been electrically charged pulls on all other materials and may either push or pull other charged materials without touching them.

**Suggested Instructional/Assessment Strategies:**
1. Using a charged rod, move small pieces of paper without touching them.
2. Explain why two bar magnets move toward or away from each.

**Sample Assessment Item:**
1. An object is placed on a table. A magnet is slowly moved toward it and the object moves away from the magnet. The object is most likely —

   A. another magnet  
   B. a piece of glass  
   C. a copper coin  
   D. an iron nail

---

### Strand B. Energy Transformations

- How do we know that things have energy?

- Energy takes many forms.
  - These forms can be grouped into types of energy that are associated with the motion of mass (kinetic energy), and types of energy associated with the position of mass and with energy fields (potential energy).

<table>
<thead>
<tr>
<th>Areas of Focus</th>
<th>Comments and Examples</th>
</tr>
</thead>
</table>
| 1. Identify sources of heat and demonstrate that heat can be transferred from one object to another. | **Instructional/Assessment Focus:**
- When warmer things are paced with cooler ones, the warmer ones lose heat and the cooler ones gain it until they are all the same temperature.
- A warmer object can warm a cooler one by contact or at a distance.
- Some materials conduct heat much better than others. Poor conductors can reduce heat loss.

**Suggested Instructional/Assessment Strategies:**
- Identify, as basic forms of energy: light, heat, sound, electrical and energy of motion. |
Observe that sunlight can be used to heat the inside of homes and other buildings by allowing sunlight to pass through windows.

**Sample Assessment Items:**
1. People wear hats when outside in the winter. How do hats help people stay warm?

   A. Hats stop heat energy from leaving their heads.
   B. Hats stop electrical energy from leaving their heads.
   C. Hats stop cold from entering their bodies through their heads.
   D. Hats slow down electrical energy from entering their bodies through their heads.

2. Three identical blocks are pushed together. The starting temperature of each is shown.

   ![Temperature Chart]

   Which traces the transfer of heat energy among the blocks?

   A. $X \leftarrow Y \rightarrow Z$
   B. $X \rightarrow Y \rightarrow Z$
   C. $X \rightarrow Y \leftarrow Z$
   D. $X \leftarrow Y \leftarrow Z$

2. Identify sources of light and demonstrate that light can be reflected from some surfaces and pass through others.

   **Instructional/Assessment Focus:**
   Light travels and tends to maintain its direction of motion until it interacts with an object or material. Light can be absorbed, redirected, bounced back, or allowed to pass through.

   **Sample Assessment Items:**
   *Use the picture below to answer the question.*

   ![Spoon in Water]

   1. The spoon appears to be broken where it enters the water because

      A. Light is reflected by the water.
      B. Light is absorbed by the water.
      C. Light is bent by the water.
      D. Light is dissolved by the water.

   2. Students bump into each other when they turn the corner in the hallway shown below.
They plan to place a mirror in the hall so that they can see one another before reaching the corner. Where should they place the mirror?

Explain your choice.

3. Use devices that show electricity producing heat, light, sound, and magnetic effects.

**Instructional/Assessment Focus:**

Things that give off light often also give off heat. Heat is produced by mechanical and electrical machines, and any time one thing rubs against something else.

Electricity in circuits can produce light, heat, sound, and magnetic effects. Electrical circuits require a complete loop through which an electrical current can pass.

**Suggested Instructional/Assessment Strategy:**

In their science and technology activities, students should be looking for things and processes that give off heat—lights, radios, television sets, the sun, sawing wood, polishing surfaces, bending things, running motors, people, animals etc., and then those that do not seem to give off heat. It is appropriate to explore how heat spreads from one place to another.

**Sample Assessment Items:**

1. What is an energy change that takes place in a light bulb?

   A. Chemical energy changes to light energy.
   B. Chemical energy changes to heat energy.
   C. Electrical energy changes to light energy.
   D. Electrical energy changes to chemical energy.

2. A copper wire with a plastic coating is placed near a compass, as shown in figure 1. When both ends of the wire are connected to a battery as shown in figure 2, the compass needle moves.

   **Figure 1**
   **Figure 2**

   Why does the compass needle move?

   A. Electricity flows from the wire to the compass.
   B. Magnetic force flows from the battery to the wire.
   C. Thermal energy flows through the wire to the compass.
   D. Electricity flows through the wire, producing magnetic force.
4. Show that differences in sound (loud or soft, high or low) can be produced by varying the way objects vibrate.

**Instructional/Assessment Focus:**
Sound is produced by vibrating objects. The pitch of the sound can be varied by changing the rate of vibration.

**Suggested Instructional/Assessment Strategy:**
Use a musical instrument to demonstrate how different vibrations produce different sounds (loud or soft, high or low).

**Sample Assessment Item:**
1. The picture below shows a musical instrument that Jamie made during science class. Each string on the instrument will produce a different sound when plucked. Which string will produce the lowest sound?

A. String 1, because it is the shortest.
B. String 2, because it is the thickest.
C. String 3, because it is centered over the hole.
D. String 4, because it is the longest.

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**Grade Four Unit Connections:**

In the Motion and Design unit students investigate the rules that govern motion and energy through experiments with vehicles which they design according to specification set forth. They also engage in some experimental design in order to further understand the role of mass and energy sources.

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**Standard 5.8 Earth Science**
All students will gain an understanding of the structure, dynamics, and geophysical systems of the earth.

**Big Idea:** Earth’s dynamic systems are made up of the geosphere, hydrosphere, atmosphere and biosphere. Interactions among these spheres have resulted in ongoing changes to the system. Some of these changes can be measured on human time scale, but others occur so slowly that they must be inferred from geological evidence.

**Essential Questions**

<table>
<thead>
<tr>
<th>Strand A. Earth Properties and Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>How does understanding the properties of Earth materials and the physical laws that govern behavior lead to prediction of Earth events?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Enduring Understandings</th>
</tr>
</thead>
<tbody>
<tr>
<td>☀ Earth systems can be broken down into individual components which have observable measurable properties.</td>
</tr>
</tbody>
</table>

**Areas of Focus**

| 1. Observe that most rocks and soils are made of several substances or minerals. |

**Instructional/Assessment Focus:**
Rock is composed of different combinations of minerals. Smaller rocks come from the breakage and weathering of bedrock and larger rocks. Soil is made partly from weathered rock, partly from plant remains – and also contains many living organisms.

**Suggested Instructional/Assessment Strategies:**
Examine rocks in order to observe their composition and describe the many components found in rocks. Observe and identify basic components of soil. Use senses to observe and then describe the physical properties of soil components.
Sample Assessment Item:

<table>
<thead>
<tr>
<th></th>
<th>Mineral A</th>
<th>Mineral B</th>
<th>Mineral C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mineral A scratches</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Mineral B scratches</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Mineral C scratches</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

1. The table above shows whether or not each mineral can scratch the other minerals. Based on the table, which mineral is the hardest? Explain your answer.

2. Observe that the properties of soil vary from place to place and will affect the soil’s ability to support life.

   Instructional/Assessment Focus:
   Soils have properties of color and texture, capacity to retain water, and ability to support the growth of many kinds of plants, including those in our food supply.

   Sample Performance Task:
   You and your classmates want to establish a vegetable garden on the school’s property. Conduct simple tests to identify three basic components of soil (sand, clay, humus) and to compare and contrast the properties of each of the components. Interpret test results (touch and roll, smear, settling, ability to absorb and retain water) and draw conclusions about a soil’s components. Record and organize the results of soil tests and explain these results through writing, drawing and discussion. Reflect on the test results and predict how plants will grow on the school grounds. Apply this knowledge to describe what you would need to do in order to successfully grow plants.

3. Recognize that fossils provide evidence about the plants and animals that lived long ago and the nature of the environment at that time.

   Instructional/Assessment Focus:
   • Different plants and animals have external features that help them thrive in different kinds of environments.
   • Fossils can be compared to one another and to living organisms according to their similarities and differences. Some organisms that lived long ago are similar to existing organisms, but some are quite different.

   Suggested Instructional/Assessment Strategy:
   • Examine a variety of fossils to determine the environmental conditions in which they lived.

   Sample Assessment Item:

   1. This rock was brought to school. The class found fossils of water plants and shells in the rock. What does this tell us about the rock?

      A. The rock needs to be washed off.
      B. The rock was once at the bottom of the sea.
      C. The rock is heavier than most rocks.
      D. The rock is gray and brown.

1. Reinforce indicators from previous grade level (included above).

Strand B. Atmosphere and Weather

- How do changes in one part of an Earth system affect other parts of the system?
- Earth’s components form systems. These systems continually interact at different rates of time affecting the Earth regionally and globally.
### Areas of Focus

1. Recognize that air is a substance that surrounds us, takes up spaces, and moves around us as wind.

   **Suggested Instructional/Assessment Strategies:**
   - Using common items such as wind mills, kites, or balloons, students create demonstrations to show that there is air all around and that the wind is moving air.
   - Use instruments to quantitatively measure wind speed and describe it using a simplified Beauford scale.

2. Recognize that most of Earth’s surface is covered by water and be able to identify the characteristics of those sources of water.
   - oceans
   - rivers
   - lakes
   - underground sources
   - glaciers

   **Instructional/Assessment Focus:**
   - Fresh water, limited in supply, is essential for life and also for most industrial processes. Rivers, lakes, and groundwater can be depleted or polluted, becoming unavailable or unsuitable for life.

   **Suggested Instructional/Assessment Strategy**
   - Create a model that illustrates the flow of water through a water cycle while the quantity of water remains constant.

3. Observe weather changes and patterns by measurable quantities such as temperature, wind direction and speed, and amounts of precipitation.

   **Instructional/Assessment Focus**
   - Large masses of air with certain properties move across the surface of the Earth.
   - The movement and interaction of these air masses is used to forecast the weather.

   **Suggested Instructional/Assessment Strategy:**
   - Keep daily records of weather conditions (wind speed and direction, type and amount of precipitation, cloud cover and type, temperature) and use these records to identify short term and seasonal patterns in New Jersey.
   - Identify and describe different types of storm systems that occur in New Jersey (i.e., tornadoes, hurricanes, thunderstorms, blizzards). From observed and gathered historical data, identify the times of the year when these storms are most likely to occur.

4. Observe that when liquid water disappears, it turns into a gas (vapor) in the air and can reappear as a liquid when cooled, or as a solid if cooled below its freezing point.

   **Suggested Instructional/Assessment Strategy:**
   - Identify and describe the mechanism that causes liquid water to turn into a vapor or a liquid into a solid.

   **Sample Assessment Items:**

   1. It rained early in the morning. A student sees a puddle of water on the sidewalk when she travels to school. The water in the puddle is gone when she travels home. What happened to the water in the puddle?
      - A. It froze.
      - B. It melted
      - C. It condens
      - D. It evaporated.

   2. The table below shows information about the weather in four cities on the same day.

<table>
<thead>
<tr>
<th></th>
<th>City 1</th>
<th>City 2</th>
<th>City 3</th>
<th>City 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High Temperature (Fahrenheit)</strong></td>
<td>65 F.</td>
<td>80 F.</td>
<td>48 F.</td>
<td>25 F.</td>
</tr>
<tr>
<td><strong>Low Temperature (Fahrenheit)</strong></td>
<td>56 F.</td>
<td>66 F.</td>
<td>38 F.</td>
<td>10 F.</td>
</tr>
<tr>
<td><strong>Precipitation-Rain or Snow (inches)</strong></td>
<td>2 in.</td>
<td>0 in.</td>
<td>1 in.</td>
<td>1 in.</td>
</tr>
</tbody>
</table>

In which city did snow most likely fall at some time during the day?

- A. city 1
- B. city 2
- C. city 3
- D. city 4
5. Observe that rain, snow, and other forms of precipitation come from clouds, but that not all clouds produce precipitation.

Instructional/Assessment Focus:
- Not all clouds produce precipitation.
- Cloud shape can be used to help forecast weather.

Suggested Instructional/Assessment Strategies:
- Keep daily records of weather conditions (wind speed and direction type and amount of precipitation, cloud cover and type, temperature) and use these records to identify short term and seasonal patterns in New Jersey.
- Using student data about cloud type and precipitation, students propose and modify as appropriate, hypothesize about the types of clouds that they observe and the likelihood that they will produce rain.

Sample Assessment Items:

1. Omar and Norma are planning to go on a picnic today. They look out of the window and see some high, thin clouds.  Is it likely it will rain on their picnic today?  Explain your answer.

2. Which type of cloud is most likely to produce heavy rain, lightning, and thunder?

   A. Tall and dark
   B. Low and gray
   C. High and broken
   D. High and wispy

6. Recognize that clouds and fog are made of tiny droplets of water and possibly tiny particles of ice.

Instructional/Assessment Focus
- Clouds and fog are made of tiny droplets of frozen crystals of water
- Clouds are shaped by winds and are made of small water droplets or ice crystals
- Cloud shape can be used to help forecast weather.

Areas of Focus | Comments and Examples
--- | ---
**Strand C. Processes that Shape the Earth**
- How do geologic events occurring today provide insight into Earth’s past?

   | Earth’s components form systems. These systems continually interact at different rates of time, affecting the shape of the Earth’s surface regionally and globally.

1. Recognize that some changes of the Earth’s surface are due to slow processes such as erosion and weathering, and some changes are due to rapid changes such as landslides, volcanic eruptions, and earthquakes.

Instructional/Assessment Focus:
- Earth is a dynamic system resulting from interactions among the geosphere, hydrosphere, atmosphere and biosphere.
- Water reshapes Earth’s land surface by eroding rock and soil in some areas and depositing them in others.
- The surface of the Earth changes constantly. Some of these changes happen slowly and are difficult to detect on a daily basis. Other changes happen quickly and result from events (i.e. major storms and volcanoes).
- The surface of the Earth is shaped in part by the motion of water and wind over very long periods of time, which act to level mountain ranges.
- The interior of the Earth is hot. Heat flow and movement of materials within the Earth cause earthquakes and volcanic eruptions and create mountains and ocean basins.

**Suggested Instructional/Assessment Strategies:**
- Use stream tables to observe the creation of landforms as water flows over and through the land. Describe changes that result from the flowing of water, using correct geographic terminology (i.e. canyon, delta, tributary). Describe changes to the water as it flows over land (i.e. color, transparency).
- Describe how fast-moving water and slow-moving water affect erosion and deposition.
- Describe how heat flow within the Earth results in earthquakes and/or volcanic eruptions.

**Sample Assessment Items:**
1. The picture shows evidence that different natural processes shape the canyon over time.
   - Identify one natural process that could have helped shape the canyon in the picture.
   - Describe evidence of this process.

2. How does freezing water cause the weathering of rocks?
   - A. It holds them in place.
   - B. It makes them longer
   - C. It cracks them.
   - D. It makes them thicker.

**Instructional/Assessment Focus:**
- Factors such as abrasion, frost/ice wedging, temperature change, and plant growth cause physical weathering of rocks.
- Erosion is the process by which materials are transported (i.e. mass movement and wind, water and ice processes).
- Sedimentary rocks are formed by the deposition of eroded materials.

**Suggested Instructional/Assessment Strategies:**
- Investigate and describe how factors such as abrasion, frost/ice wedging, temperature change, and plant growth cause physical weathering of rocks.
- Describe the environment in which the sedimentary particles were formed based on the results of weathering.
- Investigate how weathered materials are transported (i.e. mass movement and wind, water and ice processes) in the process of erosion. Explain how erosion shapes rock particles.
- Describe the process by which eroded materials can form horizontal layers of sedimentary rock.

**Sample Assessment Item:**
1. Your teacher has brought to class a sample of water that contains a mixture of small rocks, sand and silt (very fine soil) from the Delaware River. After a few hours, the sample settles. Which picture shows how the sample will settle?
Strand D. How We Study the Earth

- How does technology extend human senses and understanding of Earth?
- Technology enables us to better understand Earth’s systems and the impact of Earth’s systems on human activity.

### Areas of Focus

<table>
<thead>
<tr>
<th>1. Use maps to locate and identify physical features on the Earth.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Instructional/Assessment Focus:</strong></td>
</tr>
<tr>
<td>• Maps are constructed using common symbols and those symbols represent both natural and human constructed objects.</td>
</tr>
<tr>
<td>• Users’ needs determine the scale of the map selected.</td>
</tr>
<tr>
<td>• Some satellites allow scientists to observe over time large-scale changes in the geosphere as well as the development of short term weather events.</td>
</tr>
<tr>
<td>• Students should be introduced to GPS and GIS technology.</td>
</tr>
<tr>
<td><strong>Suggested Instructional/Assessment Strategies:</strong></td>
</tr>
<tr>
<td>• Using simple tools, construct an accurate map of a classroom and the school.</td>
</tr>
<tr>
<td>• Using a variety of maps, identify natural and human constructed features (i.e. cities, roads, oceans, rivers, lakes, mountains)</td>
</tr>
<tr>
<td>• Compare and contrast the kinds of physical features that a person can observe on a small scale map vs. a large scale map.</td>
</tr>
<tr>
<td>• Observe and interpret satellite images and weather maps.</td>
</tr>
</tbody>
</table>

### Grade Four Unit Connections:

While not directly connected with any unit of study in fourth grade, this standard will be addressed during the NJASK review conducted during the year.

**Standard 5.9 Astronomy & Space Science**

All students will gain an understanding of the origin, evolution, and structure of the universe.

**Big Idea:** Our Solar System is part of the Milky Way Galaxy, which, in turn, is one of many galaxies in the known Universe. While the composition of planets vary considerably, their components and the applicable laws of science are universal.

**Essential Questions**

- What predictable, observable patterns occur as a result of the interaction between the Earth, Moon, and Sun?

**Enduring Understandings**

- Observable, predictable patterns of movement in the Sun, Earth,
What causes these patterns?

Moon system occur because of gravitational interaction and energy from the Sun.

### Areas of Focus

1. Observe patterns that result from the Earth’s position relative to the Sun and rotation of the Earth on its axis.

### Comments and Examples

**Instructional/Assessment Focus:**
- The Sun rises and sets in different locations through the course of the year.
- The Earth’s axis of rotation is tilted.
- The Sun is much larger than the Moon. Although the Moon is closer to Earth than the Sun, the two appear to be the same size when viewed from Earth. This is because objects appear smaller as the distance from the viewer increases.

**Suggested Instructional/Assessment Strategies:**
- Observe the motion of the Sun across the sky through the course of a year.
- Observe the size of the Sun and Moon in the sky. Use models to illustrate the approximate size and distance relationship between the Sun and Moon. Explain why the Sun and Moon appear to be similar in size when observed in the sky.

**Sample Assessment Items:**

*Use the following Illustration to answer questions 1 and 2.*

![Illustration of Earth and Sun]

1. Using the picture of Earth and the Sun above, mark a spot on Earth where it is day with a “D”. Then mark a spot on Earth where it is night with an “N.”

2. New Jersey goes through a period of day and night every 24 hours. Explain what causes day and night.

3. When you are getting up to go to school in New Jersey, a student on the other side of Earth is getting ready for bed. What is the reason for this?
Use the illustrations below to answer question 4.

4. Which drawing below would best represent the flagpole’s shadow at 5:00 PM?

A.  

B.  

C.  

D.  

5. Which of the following best explains why the Sun appears to move across the sky every day?

A. The Sun rotates on its axis.
B. Earth rotates on its axis.
C. The Sun orbits around Earth.
D. Earth orbits around the Sun.

2. Recognize and describe the phases of the moon.

Instructional/Assessment Focus:
The Moon’s orbit around the Earth once in about 28 days changes which part of the Moon is lighted by the sun and how much of that part can be seen from the Earth – the phases of the moon. The appearance of the Moon changes over the period of a month. These changes are called phases. The Moon’s appearance can be classified using terms new, first quarter, full, last (third) quarter.

Suggested Instructional/Assessment Strategies:
Using actual sky observations, chart the appearance of the Moon over the course of at least 2 months. Identify the basic pattern of the Moon’s appearance. Classify using terms new, first quarter, full, last (third) quarter.

Strand B. Solar System

How are planets and other objects in the Solar System similar and different to Earth?

What implication does this have for the existence and sustaining of life?

Physical characteristics of planets depend on their distance from the Sun and their size.

Areas of Focus | Comments and Examples
1. Describe Earth as one of several planets that orbit the sun and the moon as a satellite of the Earth.

Instructional/Assessment Focus:
Earth is one of the planets in our Solar System that orbits the Sun. The Sun we see during the day is our nearest star. Stars we see at night lie outside of our Solar System. The Moon belongs to the Earth and other planets have moons.

Suggested Instructional/Assessment Strategies:
Create an inventory of objects in our Solar System. Locate a planet in the night sky.

Sample Assessment Item:
1. If all the planets started circling the sun at the same time, which one would finish the trip last?
   A. Mercury
   B. Jupiter
   C. Uranus
   D. Saturn

Strand C. Stars
- What characteristics does our Sun share with other stars?
  - The Sun is a star.

Areas of Focus

1. Observe that stars are not all the same in brightness, size, and color.

Instructional/Assessment Focus:
There are more stars in the sky than anyone can easily count, but they are not scattered evenly, and they are not all of the same brightness or color.

Suggested Instructional/Assessment Strategy:
Using direct observations with binoculars or telescopes when possible, planetariums, or web based simulations, observe the brightness and color of a variety of stars.

Strand D. Galaxies and Universe
- Is there order to the Universe?
  - The universe is made up of galaxies, each of which is composed of solar systems, having the same elements and governed by the same laws.

Areas of Focus

1. Recognized that images of celestial objects can be magnified and seen in greater detail when observed using binoculars and light telescopes.

Instructional/Assessment Focus:
Binoculars and telescopes are magnifiers that allow us to see things in more detail in the sky.

Suggested Instructional/Assessment Strategy:
Keep a record of changes in the night sky that students have observed with the naked eye or with the use of binoculars, telescopes or computer simulations.

2. Observe and record short-term and long-term changes in the night sky.

Instructional/Assessment Focus:
Changes in the night sky are observable and can be recorded in a more detailed manner through the use of technology.

Suggested Instructional/Assessment Strategy:
Keep a record of changes in the night sky that students have observed with the naked eye or with the use of binoculars or telescopes.

Grade Four Unit Connections:

While not directly connected with any unit of study in fourth grade, this standard will be addressed during the NJASK review conducted during the year.
**Standard 5.10 Environmental Studies**

All students will develop an understanding of the environment as a system of interdependent components affected by human activity and natural phenomena.

**Big Idea:** Organisms are linked to one another in an ecosystem by the flow of energy and the cycling of materials. Humans are an integral part of the natural system and human activities can alter the stability of ecosystems.

<table>
<thead>
<tr>
<th>Essential Questions</th>
<th>Enduring Understandings</th>
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<tr>
<td><strong>Strand A. Natural Systems and Interactions</strong></td>
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</table>
| 1. How can change in one part of an ecosystem affect change in other parts of the ecosystem? | 1. Organisms and their environments are interconnected.  
2. Changes in one part of the system will affect other parts of the system. |

<table>
<thead>
<tr>
<th>Areas of Focus</th>
<th>Comments and Examples</th>
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</table>
| **1. Differentiate between natural resources that are renewable and those that are not.** | **Instructional/Assessment Focus:** Resources are things that we get from living and non-living environments to meet the needs and wants of a population. Some resources are basic materials such as air, water, and soil. Other resources are produced from basic resources such as food, fuel, and building materials. Many natural resources are limited. The amount available can be made to last longer by decreasing the use of some resources or by reusing or recycling certain materials.  
**Sample Assessment Item:**  
1. Which of these is a renewable resource?  
A. wood, because trees grow again  
B. coal, because more can be made in about 100 years  
C. petroleum, because it can be refined into gasoline  
D. gold, because more can be made very easily |

| **Strand B. Human Interactions and Impact** | | |
| 1. How do humans impact the diversity and stability of ecosystems? | 2. Humans can alter the living and non-living factors within an ecosystem, thereby creating changes to the overall system. |

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</table>
| **1. Explain how meeting human requirements affect the environment.** | **Instructional/Assessment Focus:**Humans change environments in ways that can be either beneficial or detrimental for themselves and other organisms. In striving to meet their own needs, humans have had significant impact on local, regional and global environments. Moving air and water can be used to run machines. The Sun is the main source of energy for people and they use it in various ways. The energy in fossil fuels comes from plants that grew long ago. Some energy sources cost less than others and cause less pollution than others. People try to conserve energy in order to slow down the depletion of energy resources and/or to save money.  
**Suggested Instructional/Assessment Strategy:** For more easily observed sources of energy, students can relate inputs and outputs; what it takes for something to work and what the effects are. |
Sample Assessment Item:

1. Garbage is a big problem. In many cities and towns, garbage is taken away to landfills, which are often called "dumps." Some landfills are very big and may cover hundreds of acres. But even these big landfills are getting full and may have to be closed.

Here are some ideas for solving the garbage problem. Write what you think is a good point about each idea and what you think is a bad point about each idea.

<table>
<thead>
<tr>
<th>Ideas for Solving Garbage Problem</th>
<th>Good Points</th>
<th>Bad Points</th>
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</thead>
<tbody>
<tr>
<td>Recycling</td>
<td></td>
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<tr>
<td>Burning garbage</td>
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<tr>
<td>Dumping garbage in the ocean</td>
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<tr>
<td>Sending garbage to a landfill in another state</td>
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</tbody>
</table>

Grade Four Unit Connections:

While not directly connected with any unit of study in fourth grade, this standard will be addressed during the NJASK review conducted during the year.
<table>
<thead>
<tr>
<th>Grade</th>
<th>Unit</th>
<th>Standards</th>
<th>Suggested Activities</th>
</tr>
</thead>
</table>
| Kindergarten | Animals 2 by 2 (chick unit addition)     | 5.3.2.D.1 5.3.4.D.2   | • Use activity guide from farm  
• Read Alouds on life cycles |
| First      | Air and Weather (sun/moon observation)   | 5.4.2.A.1             | • Observe sun and moon  
• Record different shapes of moon |
|            | Pebbles, Sand & Silt (rocks/minerals)    | 5.4.4.C.2             | • Categorize unknown samples as either rocks or minerals  
(have children bring rock and minerals kits) |
| Extra      | (heat absorption)                         | 5.2.2.C.1             | • Different colored paper or fabric swatches on window sill |
|            | Air and Weather (temperature changes)     | 5.4.4.E.1             | • Observe and record changes in temperature of earth materials |
| Second     | Extra                                     | 5.3.4.D.1             | • Butterfly kit  
• Read Alouds |
<table>
<thead>
<tr>
<th></th>
<th>Activity</th>
<th>Grade Level</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>Third</td>
<td>Solar System (phases of the moon)</td>
<td>5.4.4.A.2</td>
<td>• Read Aloud&lt;br&gt;• Activity&lt;br&gt;• Magic School Bus video&lt;br&gt;• Sponge activity with cup</td>
</tr>
<tr>
<td>Third</td>
<td>Extra (water cycles)</td>
<td>5.4.4.G.3</td>
<td>• Use touch thermometer&lt;br&gt;• Warm water test&lt;br&gt;• Mini-activities from <em>Light</em> student guide</td>
</tr>
<tr>
<td>Third</td>
<td>Extra (light and Sound)</td>
<td>5.2.4.A.4</td>
<td></td>
</tr>
<tr>
<td>Third</td>
<td>Extra (light and shadows)</td>
<td>5.2.2.C.1</td>
<td></td>
</tr>
<tr>
<td>Fourth</td>
<td>Sink and Float (heat conduction)</td>
<td>5.2.4.C.1</td>
<td></td>
</tr>
<tr>
<td>Fourth</td>
<td>Extra (light and Sound)</td>
<td>5.2.2.C.1</td>
<td></td>
</tr>
<tr>
<td>Sickles Art</td>
<td>Extra (lights and shadows)</td>
<td>5.2.4.A.4</td>
<td></td>
</tr>
<tr>
<td>Knollwood Art</td>
<td>Extra (translucent/transparent and opaque)</td>
<td>5.2.2.C.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Extra (how light affects color)</td>
<td>5.2.2.C.1</td>
<td></td>
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