



# **Science Standards of Learning *Curriculum Framework***

Commonwealth of Virginia  
Department of Education  
Richmond, Virginia

## **Kindergarten**

**Modified to include resources for instruction by LCPS for School Year 2008-09**

**Special Thanks to:**

Elementary Teachers Serving on the Curriculum Committees



## Introduction to Loudoun County's Science Curriculum

This Curriculum Guide and Framework is a merger of the Virginia Standards of Learning (SOL) and the Science Achievement Standards of Loudoun County Public Schools. Many sections are copies or modifications of Virginia's SOL documents. Suggestions on pacing and resources represent the professional consensus of Loudoun's teachers concerning the implementation of these standards.

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## K-12 Safety

In implementing the Science Standards of Learning, students must know how to follow safety guidelines, demonstrate appropriate laboratory safety techniques, and use equipment safely while working individually and in groups.

Safety must be given the highest priority in implementing the K-12 instructional program for science. Correct and safe techniques, as well as wise selection of experiments, resources, materials, and field experiences appropriate to age levels, must be carefully considered with regard to safety precautions for every instructional activity. Safe science classrooms require thorough planning, careful management, and constant monitoring of student activities. Class enrollment should not exceed the designed capacity of the room.

Teachers must be knowledgeable of the properties, use and proper disposal of all chemicals that may be judged as hazardous prior to their use in an instructional activity. Such information is referenced through the MSDS forms (Materials Safety Data Sheets). The identified precautions involving the use of goggles, gloves, aprons, and fume hoods must be followed as prescribed.

While no comprehensive list exists to cover all situations, the following should be reviewed to avoid potential safety problems. Appropriate safety procedures should be used in the following situations:

- Observing wildlife; handling living and preserved organisms; and contact with natural hazards such as poison ivy, ticks, mushrooms, insects, spiders, and snakes
- Field activities in, near, or over bodies of water
- Handling of glass tubing, sharp objects, glassware, and labware
- Natural gas burners, Bunsen burners, and other sources of flame/heat
- Hazards associated with direct sunlight (sunburn and eye damage)
- Use of extreme temperatures and cryogenic materials
- Hazardous chemicals including toxins, carcinogens, flammable and explosive materials
- Acid/base neutralization reactions/dilutions
- Production of toxic gases or situations where high pressures are generated
- Biological cultures, their appropriate disposal, and recombinant DNA
- Power equipment/motors
- High voltage/exposed wiring
- Laser beam, UV, and other radiation

The use of human body fluids or tissues is generally prohibited for classroom lab activities. Further guidance from the following sources may be taken into account:

- OSHA (Occupational Safety and Health Administration)
- ISEF (International Science and Engineering Fair Rules)
- Public health departments and local school division protocols.

For more detailed information about safety in science, consult the *LCPS Science Safety Manual*.  
<http://www.intranet.lcps>

## **The Role of Instructional Technology in Science Education**

The use of current and emerging technologies is essential to the K-12 science instructional program.

Specifically, technology must

- Assist in improving every student's functional literacy. This includes improved communication through reading/information retrieval (the use of telecommunications), writing (word processing), organization and analysis of data (databases, spreadsheets, and graphics programs), selling one's idea (presentation software), and resource management (project management software).
- Be readily available and used regularly as an integral and ongoing part in the delivery and assessment of instruction.
- Include instrumentation oriented toward the instruction and learning of science concepts, skills, and processes. Technology, however, should not be limited to traditional instruments of science such as microscopes, labware, and data-collecting apparatus but should also include computers, robotics, interactive-optical laser discs, video-microscopes, graphing calculators, CD-ROMs, global positioning systems (GPS), probeware, on-line telecommunication, software and appropriate hardware, as well as other emerging technologies.
- Be reflected in the "instructional strategies" generally developed at the local school division level.

In most cases, the application of technology in science should remain "transparent" unless it is the actual focus of the instruction. One must expect students to "do as a scientist does" and not simply hear about science if they are truly expected to explore, explain, and apply scientific concepts, skills, and processes.

As computer/technology skills are essential components of every student's education, it is important that these skills are a shared responsibility of teachers of all disciplines and grade levels.

## Meaningful Watershed Educational Experiences

The “Stewardship and Community Engagement” Commitment of the *Chesapeake 2000* agreement clearly focuses on connecting individuals and groups to the Bay through their shared sense of responsibility and action. The goal of this Commitment formally engages schools as integral partners *to undertake initiatives* in helping to meet the Agreement.

Two objectives developed as part of this goal describe more specific outcomes to be achieved by the jurisdictions in promoting stewardship and assisting schools. These are:

*Beginning with the class of 2005, provide a meaningful Bay or stream outdoor experience for every school student in the watershed before graduation from high school.*

*Provide students and teachers alike with opportunities to directly participate in local restoration and protection projects, and to support stewardship efforts in schools and on school property.*

There is overwhelming consensus that knowledge and commitment build from firsthand experience, especially in the context of one’s neighborhood and community. Carefully selected experiences driven by rigorous academic learning standards, engendering discovery and wonder, and nurturing a sense of community will further connect students with the watershed and help reinforce an ethic of responsible citizenship.

### **Defining a Meaningful Bay or Stream Outdoor Experience**

A *meaningful* Bay or stream outdoor experience should be defined by the following.

#### **Experiences are investigative or project oriented.**

Experiences include activities where questions, problems, and issues are investigated by the collection and analysis of data, both mathematical and qualitative. Electronic technology, such as computers, probeware, and GPS equipment, is a key component of these kinds of activities and should be integrated throughout the instructional process.

The nature of these experiences is based on learning standards and should include the following kinds of activities.

- Investigative or experimental design activities where students or groups of students use equipment, take measurements, and make observations for the purpose of making interpretations and reaching conclusions.
- Project-oriented experiences, such as restoration, monitoring, and protection projects, that are problem solving in nature and involve many investigative skills.

**Experiences are richly structured and based on high-quality instructional design.**

**Experiences are an integral part of the instructional program.**

**Experiences are part of a sustained activity.**

**Experiences consider the watershed as a system.**

**Experiences involve external sharing and communication.**

**Experiences are enhanced by natural resources personnel.**

**Experiences are for all students.**

Experiences such as tours, gallery visits, simulations, demonstrations, or “nature walks” may be instructionally useful, but alone do not constitute a *meaningful* experience as defined here.

*The preceding text contains excerpts from:*

*Chesapeake Bay Program Education Workgroup*

**STEWARDSHIP AND MEANINGFUL WATERSHED EDUCATIONAL EXPERIENCES**

[http://www.chesapeakebay.net/pubs/doc-c2k\\_meaningful\\_bay\\_experience.pdf](http://www.chesapeakebay.net/pubs/doc-c2k_meaningful_bay_experience.pdf)

The link is found in the Virginia Department of Education Instructional Resources for Science:

<http://www.doe.virginia.gov/VDOE/Instruction/Science/>

Each LCPS K-12 Science Pacing Guide indicates where the Meaningful Watershed Educational Experiences fit into the Virginia Standards of Learning. Resources for these experiences are cited in the *Resources* section of each standard.

Many of the resources are from *Lessons from the Bay* and *Virginia's Water Resources a Toolkit for Teachers*. These and other watershed resources are posted on the LCPS intranet at:

<http://www.intranet.lcps>

## **Investigate and Understand**

Many of the standards in the Science Standards of Learning begin with the phrase “Students will investigate and understand.” This phrase was chosen to communicate the range of rigorous science skills and knowledge levels imbedded in each standard. Limiting a standard to one observable behavior such as “describe” or “explain” would have narrowed the interpretation of what was intended to be a rich, highly rigorous, and inclusive content standard.

“Investigate” refers to scientific methodology and implies systematic use of the following inquiry skills:

- Observing
- Classifying and sequencing
- Communicating
- Measuring
- Predicting
- Hypothesizing
- Inferring
- Defining, controlling, and manipulating variables in experimentation
- Designing, constructing, and interpreting models
- Interpreting, analyzing, and evaluating data

“Understand” refers to various levels of knowledge application. In the Science Standards of Learning these knowledge levels include the ability to

- Recall or recognize important information, key definitions, terminology, and facts
- Explain the information in one’s own words, comprehend how the information is related to other key facts, and suggest additional interpretations of its meaning or importance
- Apply the facts and principles to new problems or situations, recognizing what information is required for a particular situation, explaining new phenomena with the information, and determining when there are exceptions
- Analyze the underlying details of important facts and principles, recognizing the key relations and patterns that are not always readily visible
- Arrange and combine important information, facts, and principles to produce a new idea, plan, procedure, or product
- Make judgments about information in terms of accuracy, precision, consistency, or effectiveness.

Therefore, the use of “investigate and understand” allows each content standard to become the basis for a broad range of teaching objectives, which the local school division will develop and refine to meet the intent of the Science Standards of Learning.

## **Science Standards of Learning**

### Goals

The purpose of scientific investigation and discovery are to satisfy humankind's quest for knowledge and understanding and to preserve and enhance the quality of the human experience. Therefore, as a result of science instruction, students will be able to:

1. Develop and use an experimental design in scientific inquiry
2. Use the language of science to communicate understanding
3. Investigate phenomena using technology
4. Apply scientific concepts, skills, and processes to everyday experiences
5. Experience the richness and excitement of scientific discovery of the natural world through the historical and collaborative quest for knowledge and understanding.
6. Make informed decisions regarding contemporary issues taking into account the following:
  - public policy and legislation
  - economic costs/benefits
  - validation from scientific data and the use of scientific reasoning and logic
  - respect for living things
  - personal responsibility
  - history of scientific discovery
7. Develop scientific dispositions and habits of mind including:
  - curiosity
  - demand for verification
  - respect for logic and rational thinking
  - consideration of premises and consequences
  - respect for historical contributions
  - attention to accuracy and precision
  - patience and persistence
8. Explore science-related careers and interest.

# Kindergarten Science Strand

## Scientific Investigation, Reasoning, and Logic

This strand represents a set of systematic inquiry skills that defines what a student should be able to do when conducting activities and investigations. The various skill categories are described in the “Investigate and Understand” section of the *Standards of Learning*, and the skills in science standard K.1 represent more specifically what a student should achieve during the course of instruction in the kindergarten. Across the grade levels the skills in the first standards form a near continuous sequence of investigative skills. (Please note Appendix, “Science Skills, Scope, & Sequence.”) It is important that the classroom teacher understands how the skills in standard K.1 and K.2 are a key part of this sequence (i. e., 1.1, 2.1, 3.1, 4.1, 5.1, and 6.1). It is also important to note that 25% of items on the 3<sup>rd</sup> and 5<sup>th</sup> grade SOL assessments measure the skills defined in the “Scientific Investigation, Reasoning, and Logic” strand.

## **Strand: Scientific Investigation, Reasoning, and Logic**

### **Standard K.1**

The student will conduct investigations in which

- a) basic properties of objects are identified by direct observation;
- b) observations are made from multiple positions to achieve different perspectives;
- c) objects are described both pictorially and verbally;
- d) a set of objects is sequenced according to size;
- e) a set of objects is separated into two groups based on a single physical attribute;
- f) nonstandard units are used to measure common objects;
- g) a question is developed from one or more observations;
- h) picture graphs are constructed using 10 or fewer units;
- i) an unseen member in a sequence of objects is predicted; and
- j) unusual or unexpected results in an activity are recognized.

### **Understanding the Standard**

The skills defined in K.1 are intended to develop the investigative and inquiry components of all of the other kindergarten standards (i.e., K.2 –K.10). Standard K.1 describes the range of inquiry skills and the level of proficiency in using those skills that students should achieve in the context of science concepts developed in kindergarten. Standard K.1 does not require a discrete unit on scientific investigation because the inquiry skills that make up the standard should be incorporated in all the other kindergarten standards. It is also intended that by participating in activities and experiences that develop these skills, students will achieve a precursor understanding of scientific inquiry and the nature of science, and more fully grasp the content-related concepts.

## Standard K.1

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none"><li>• Observation is an important way to learn about the world. Through observation one can learn to compare, contrast, and note similarities and differences.</li><li>• An object can appear very different depending on how it is oriented. To describe an object fully and accurately, it should be observed from several different positions.</li><li>• Putting objects in a sequence allows one to understand how things are related. A sequence can show how things can change a little at a time.</li><li>• Picture graphs are useful ways to display and report information.</li><li>• A non-standard unit of measure, such as the length of a paper clip, can be used to describe and communicate the dimensions of an object. For the non-standard unit to be most useful, it should be consistent and easily applied.</li></ul>	<p>In order to meet this standard, it is expected that students should be able to:</p> <ul style="list-style-type: none"><li>• observe objects and describe their basic properties. These include: color, shape (circle, triangle, square, and rectangle), size (big, little, large, small), texture (rough, smooth, hard, soft), weight (heavy, light).</li><li>• observe an object or objects from multiple positions to achieve different perspectives. In order to accomplish this, the student should look at the object from top, bottom, front and back.</li><li>• arrange a set of objects in sequence according to size.</li><li>• separate a set of objects into two groups based on a single physical attribute including size, color, texture, and weight.</li><li>• construct picture graphs using 10 or fewer units.</li><li>• measure common objects with nonstandard units. Examples of nonstandard units include hands, pennies, and paper clips.</li><li>• predict an unseen member in a sequence of objects to complete a pattern.</li></ul>

**Standard K.1 (continued)**

<b>Overview</b>	<b>Essential Knowledge, Skills, and Processes</b>
<ul style="list-style-type: none"><li>• Observations about familiar objects or events often lead to the development of important questions that can spark further investigation.</li><li>• Observations can be communicated through pictures and discussions.</li><li>• It is important to observe the results of an investigation carefully. Results that are unexpected or unusual may be of interest for further study.</li></ul>	<ul style="list-style-type: none"><li>• develop a question from one or more observations.</li><li>• describe objects both pictorially and verbally.</li><li>• identify unusual or unexpected results in an activity.</li></ul>

## **Strand: Scientific Investigation, Reasoning, and Logic**

### **Standard K.2**

Students will investigate and understand that humans have senses that allow one to seek, find, take in, and react or respond to information in order to learn about one's surroundings. Key concepts include

- a) five senses and corresponding sensing organ (taste-tongue, touch-skin, smell-nose, hearing-ears, and sight-eyes); and
- b) sensory descriptors (sweet, sour, bitter, salty, rough/smooth, hard/soft, cold, warm, hot, loud/soft, high/low, bright/dull).

### **Understanding the Standard**

The second standard at the kindergarten level is very closely related to the inquiry skill of observation developed in K.1. This standard focuses on the senses – sight, smell, hearing, touch, and taste. Standard K.2 focuses on student understanding that each sensing organ is associated with a sense (eyes, ears, nose, tongue, and skin). It is important to emphasize that one should never taste, touch, or sniff something when the identity is unknown or has any potential danger.

## Standard K.2

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none"><li>• A particular sensing organ is associated with each of the five senses (eyes, ears, nose, tongue, and skin).</li><li>• Using the senses we can make careful observations about the world and communicate those observations through descriptors.</li></ul>	<p>In order to meet this standard, it is expected that students should be able to:</p> <ul style="list-style-type: none"><li>• identify and describe the five senses (taste, touch, smell, hearing, and sight).</li><li>• match each sensing organ with its associated sense (eyes, ears, nose, tongue, and skin).</li><li>• match sensory descriptors with the senses (<b>taste</b>: sweet, sour, bitter, salty; <b>touch</b>: smooth, hard, soft, cold, warm, hot; hearing: loud, soft, high, low; <b>sight</b>: bright, dull, color, black and white.)</li></ul>

## Standard K.2

Resources	Activities
<p>The <u>Five Senses</u> by Carey Molter,</p> <p><u>Sense of Hearing</u>, <u>Sense of Touch</u>, <u>Sense of Taste</u>, <u>Sense of Smell</u>, <u>Sense of Sight</u> all by Carey Molter,</p> <p><u>Sense-able Science: Exploring and Discovering our Five Senses</u> by AIMS Educational Foundation</p> <p><i>The Five Senses: Smell</i> <i>The Five Senses: Touch</i> <i>The Five Senses: Sound</i> <i>The Five Senses: Taste</i> <i>The Five Senses: Sight</i></p> <p>Investigations from the VA Department of Education Science Enhanced Scope and Sequence – Kindergarten. <a href="http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml">http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml</a></p>	<p><b>Touch</b> - In 5 bags place objects that students can touch and identify I.e. cotton ball, pencil, silly putty, paper clip, etc. Have each student touch objects in the bag and describe how they feel using sensory words.</p> <p><b>Smell</b> - Using picnic ketchup and mustard bottles fill with objects with definite smells and let children identify i.e. coconut, onion, chocolate, vanilla, etc. Do smell sheet matching picture with correct smell jar.</p> <p><b>Hearing</b> - make a tape with noises such as slamming door, paperclips dropping, water running, etc. and let children listen to and identify.</p> <p><b>Taste test</b> - Provide students with salty pretzels, sour candy, bitter chocolate, and sweet candy. Give each student a magnifying glass. Instruct students to taste objects one at a time. After tasting each one observe neighbors tongue for tastebuds standing up. Label diagram of tongue</p> <p><b>Sight</b> - Assign each student a partner. Blindfold one of the students in each pair and let the other student lead them around the school.</p>

## **Kindergarten Science Strand**

### **Force, Motion, and Energy**

This strand "Force, Motion and Energy" focuses on students understanding of what force, motion, and energy are and how the concepts are connected. The major topics developed in this strand include magnetism, types of motion, simple and compound machines, and energy forms and transformations, especially electricity, sound, and light. This strand includes science standards K.3, 1.2, 2.2, 3.2, 4.2, 4.3, 5.2, 5.3, 6.2, and 6.3.

## **Strand: Force, Motion, and Energy**

### **Standard K.3**

The student will investigate and understand that magnets have an effect on some materials, make some things move without touching them, and have useful applications. Key concepts include

- a) attraction/nonattraction, push/pull, attract/repel, and metal/nonmetal; and
- b) useful applications (refrigerator magnet, can opener, magnetized screwdriver, and magnetic games).

### **Understanding the Standard**

Magnets have an effect on certain metals and can cause objects to move without physically touching them. Standard K.3 focuses on developing a basic understanding of magnetism that will be expanded in standards 2.2, 4.3. It is intended that students will actively develop scientific investigation, reasoning, and logic skills (K.1 and K.2) in the context of the key concepts presented in this standard.

### Standard K.3

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none"><li>• Magnets will attract certain metals (iron-bearing, nickel, and cobalt).</li><li>• Magnets have an effect on some items, causing them to move. Some items are not affected by magnets and remain stationary.</li><li>• Because some metals are attracted to magnets, they have many simple useful applications in the home.</li><li>• The force of a magnet can move something without actually touching it.</li><li>• Repulsion is the force that pushes like poles of magnets apart.</li></ul>	<p>In order to meet this standard, it is expected that students should be able to:</p> <ul style="list-style-type: none"><li>• predict and test which common objects will be attracted to magnets and objects not attracted to magnets.</li><li>• classify objects as being attracted or not attracted to magnets such as iron nail, iron-bearing paper clip, cereal, and book.</li><li>• explain in their own words essential vocabulary including the concept of attraction/nonattraction, push/pull, attract/repel, and metal/nonmetal.</li><li>• identify items in the home that contain a magnet or magnets such as can openers, magnetized screwdrivers, magnetic games, and refrigerator magnets.</li><li>• evaluate the importance and usefulness of magnets in the home.</li></ul>

### Standard K.3

Resources	Activities
<p><u>Experiments with Magnets</u> by Helen J. Challad</p> <p><u>Mostly Magnets</u> published by AIMS</p> <p><u>What Magnets Can Do</u> by Allan Fowler</p> <p><u>The Science Book of Magnets</u> by Brenda Parks</p> <p>Virginia Department of Instruction Enhanced Scope and Sequence for Science Standards of Learning <a href="http://www.pen.k12.va.us/VDOE/EnhancedSandS/science.shtml">http://www.pen.k12.va.us/VDOE/EnhancedSandS/science.shtml</a></p> <p><b><i>Magnet Madness</i></b> An Investigation from the VA Department of Education Science Enhanced Scope and Sequence – Kindergarten. <a href="http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml">http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml</a></p>	<p>Read Books that use proper terminology related to magnetism such as attract and repel.</p> <p>Do AIMS activity "To what will a magnet stick?" pg. 3 of Mostly Magnets.</p> <p>Give students objects which magnets will attract and repel from. Have them predict whether or not magnet will attract, and then have them test their predictions.</p> <p>Test strength of magnets by testing whether or not they can attract paperclips through plastic, sand, block of wood, glass, and paper.</p>

## **Kindergarten Science Strand**

### **Matter**

This strand focuses on the description, physical properties, and basic structure of matter. The major topics developed in this strand include concepts related to basic description of objects, states of matter (solids, liquids, and gases - especially water), phase changes, mass and volume, and the structure of classification of matter. This strand includes science standards K.4, K.5, 1.3, 2.3, 3.3, 5.4, 6.4, 6.5, and 6.6.

**Standard K.4**

The student will investigate and understand that the position, motion, and physical properties of an object can be described. Key concepts include

- a) colors (red, orange, yellow, green, blue, purple), white, and black;
- b) shapes (circle, triangle, square, and rectangle) and forms (flexible/stiff, straight/curved);
- c) textures (rough/smooth) and feel (hard/soft);
- d) relative size and weight (big/little, large/small, heavy/light, wide/thin, long/short); and
- e) position (over/under, in/out, above/below, left/right) and speed (fast/slow).

**Understanding the Standard**

Standard K.4 focuses on student understanding that all objects have physical properties, which include color, shape or form, texture, and size. Position and speed, though not physical properties, can be observed and described. A basic understanding of physical properties provides a foundation for observing, investigating, and studying matter. It is intended that students will actively develop scientific investigation, reasoning, and logic skills (K.1 and K.2) in the context of the key concepts presented in this standard.

## Standard K.4

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none"><li>• An object may have many properties that can be observed and described.</li><li>• Objects can be described readily in terms of color, shape, and texture.</li><li>• An object can be described according to its position relative to another object and its motion.</li><li>• Two different objects can have some of the same physical properties and some different physical properties.</li></ul>	<p>In order to meet this standard, it is expected that students should be able to:</p> <ul style="list-style-type: none"><li>• identify and name eight basic colors, including red, orange, yellow, green, blue, and purple. (Indigo and violet are not required at the kindergarten level.) Black and white are not spectral colors, but students should recognize them by name.</li><li>• identify and name a circle, triangle, square, and rectangle.</li><li>• compare and contrast objects that are flexible, stiff, straight, and curved.</li><li>• compare and contrast objects that are rough, smooth, hard, and soft.</li><li>• compare objects using the concepts of heavy/light, long/short, wide/thin, big/little, and large/small.</li><li>• measure objects using nonstandard units.</li><li>• identify the position of an object using position words: over/under, in/out, above/below, left/right.</li><li>• group objects according to their speed, fast or slow.</li></ul>

**Standard K.4**

<b>Resources</b>	<b>Activities</b>
<p><u>Changing Things</u> by Robin Kerrodo,</p> <p><u>What is the World Made of? All About Solids, Liquids, and Gases</u> by KathleenWeidner Zoehfeld</p> <p><u>The World of Matter</u> by Ron Cole</p> <p>Video recording "Matter: liquids, gases, and solids" produced by Mazzarella Educational Media and 100% Educational Videos</p> <p><u>A World of Matter: Physical Science</u> by AIMS Education</p> <p><i>Animal Adventures</i> <i>Sorting</i> <i>What's Your Sport</i> Investigations from the VA Department of Education Science Enhanced Scope and Sequence – Kindergarten. <a href="http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml">http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml</a></p>	<p>Using a large bag, fill it with various objects of shape, size, color, and texture. Let the students sort and classify the objects based on different criteria.</p> <p>Make smaller bags with several objects in them. Have student groups sort and classify objects and explain to the class why they sorted as they did.</p>

**Standard K.5**

The student will investigate and understand that water flows and has properties that can be observed and tested. Key concepts include

- a) water occurs in different states (solid, liquid, gas);
- b) the natural flow of water is downhill; and
- c) some materials float in water while others sink.

**Understanding the Standard**

Standard K.5 focuses on student understanding that water has identifying properties that can be observed and described. This standard serves as a basis for understanding physical properties and states of matter. Related primary standards include 1.3, 2.3, and 3.3. It is intended that students will actively develop science investigation, reasoning, and logic skills (K.1 and K.2) in the context of the key concepts presented in this standard.

## Standard K.5

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none"><li>• Water can be a solid, liquid, or a gas.</li><li>• The state of water can be changed by heating or cooling it.</li><li>• The natural flow of water is from a higher to a lower level.</li><li>• Some objects float in water while others do not.</li></ul>	<p>In order to meet this standard, it is expected that students should be able to:</p> <ul style="list-style-type: none"><li>• identify examples of the different states of water (solid, liquid, and gas).</li><li>• classify examples of different states of matter as solid, liquid, or gas.</li><li>• describe the natural flow of water.</li><li>• predict where a stream of water will flow.</li><li>• predict whether items will float or sink when placed in water. (Items to use include wood, metal, fruits, paper, and plastics.)</li></ul>

## Standard K.5

Resources	Activities
<p><u>Floating and Sinking</u> by Terry Jennings</p> <p><u>Let's Try Out the Water</u> by Seymour Simon and Nicole Fauteux</p> <p><u>Making Things Float and Sink</u> by Gary Gibson</p> <p><u>Float and Sink</u> by Maria Gordon</p> <p><u>The Magic School Bus Ups and Downs: A Book About Floating and Sinking</u> by Joanna Cole</p> <p><u>Floating and Sinking</u> by Karen Bryant-Mole</p> <p>Project Learning Tree Environment Guide</p> <p><b><i>Sink or Float?</i></b> <b><i>Solid, Liquid, or Gas</i></b> Investigations from the VA Department of Education Science Enhanced Scope and Sequence – Kindergarten. <a href="http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml">http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml</a></p>	<p>Observe water in the three states of matter by putting ice in a pan, observe the solid turn into a liquid as it melts, and then to a gas as the water evaporates. If you use a heat source to boil the water, follow all safety precautions to prevent any accidents.</p> <p>Fill a tub with water. Choose objects that will float and sink. Drop objects in the tub one at a time and observe whether they float or sink. Have children sort and classify objects based on whether they float or sink.</p> <p>Pick different items and have students predict whether or not the objects will float or sink. Record their predictions. Test the objects and discuss the results.</p>

# **Kindergarten Science Strand**

## **Life Processes**

This strand focuses on the life processes of plants and animals and the specific needs of each. The major topics developed in the strand include basic needs and life processes of organisms, their physical characteristics, orderly changes in life cycles, behavioral and physical adaptations, and survival and perpetuation of species. This strand includes science standards K.6, 1.4, 1.5, 2.4, 3.4, 4.4.

**Strand: Life Processes**

**Standard K.6**

The student will investigate and understand basic needs and life processes of plants and animals. Key concepts include

- a) living things change as they grow and need food, water, and air to survive;
- b) plants and animals live and die (go through a life cycle); and
- c) offspring of plants and animals are similar but not identical to their parents and one another.

**Understanding the Standard**

Standard K.6 focuses on student understanding that all living things have basic life needs and life processes. This standard introduces basic life science concepts that progress through high school biology. K.6 is very closely related to the concepts presented in 1.4 and 1.5. It is intended that students will actively develop scientific investigation, reasoning, and logic skills (K.1 and K.2) in the context of the key concepts presented in this standard.

## Standard K.6

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none"><li>• Plants and animals change as they grow.</li><li>• Plants and animals need food, water, and air (oxygen) to live. (Many animals and plants that live in water use the oxygen that is dissolved in the water.)</li><li>• Plants and animals live and die. This is part of the life cycle.</li><li>• Many offspring of plants and animals are like their parents but not identical to them.</li></ul>	<p>In order to meet this standard, it is expected that students should be able to:</p> <ul style="list-style-type: none"><li>• describe the life needs of animals and plants. The life needs are food, water, and air.</li><li>• predict what will happen to animals and plants if life needs are not met.</li><li>• describe some simple changes animals and plants undergo during the life cycle. For animals this may include changes in color, body covering, and overall size. For plants this may include size, presence of leaves and branches, and ability to produce flowers and fruits.</li><li>• compare and contrast young plants and animals with their parents, using pictures and/or live organisms.</li></ul>

**Standard K.6**

<b>Resources</b>	<b>Activities</b>
<p><u>A Seed Grows: My First Look at a Plant's Life Cycle</u> by Pamela Hickman.</p> <p><u>The Tiny Seed</u> by Eric Carle</p> <p><u>How Do Apples Grow</u> by Betsy Maestro</p> <p><u>Seeds to Plants</u> by Jeffrey Bates</p> <p><u>The Budding Botanist: Investigations with Plants</u> by AIMS Foundation</p> <p><u>From Seed to Plant</u> by Gail Gibbons</p> <p><u>What is a Life Cycle?</u> by Bobbie Kalman and Jacquelin Langile</p> <p>Project Learning Tree Environmental Education Guide</p> <p><i>Life Cycles</i> <i>Plant and Animal Needs</i> Investigations from the VA Department of Education Science Enhanced Scope and Sequence – Kindergarten. <a href="http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml">http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml</a></p>	<p>"Garden in a Glove" activity - You will need transparent food serving gloves, cotton balls, and 5 kinds of seeds. Wet the cotton ball, dip it in a kind of seed making sure a few seeds stick to the cotton ball, put in a finger of a glove. Repeat this for the other four fingers. Tape them to a window or door (they do not have to get sunlight) after a few days the seeds will sprout. You can then transplant them into soil.</p> <p>The Budding Botanist AIMS book has lots of hands on activities.</p> <p>Get various animal books from your library that show adult and baby animals. Show the pictures to your students and have a discussion as to how the adults and babies are different.</p>

## **Kindergarten Science Strand**

### **Interrelationships in Earth/Space Systems**

This strand focuses on student understanding of relationships within and among Earth and space systems. The topics developed include shadows, relationships between the sun and the Earth, weather types, patterns, and instruments, properties of soil, characteristics of the ocean environment, and organization of the solar system. This strand includes science standards K.7, 1.6, 2.6, 3.7, 4.6, 5.6, and 6.8.

## **Strand: Interrelationships in Earth/Space Systems**

### **Standard K.7**

The student will investigate and understand that shadows occur when light is blocked by an object. Key concepts include

- a) shadows occur in nature when sunlight is blocked by an object; and
- b) shadows can be produced by blocking artificial light sources.

### **Understanding the Standard**

Standard K.7 focuses on student understanding that light produces shadows when objects block light. This is a key concept for student's future understanding of more complex Earth and physical science concepts such as night and day and eclipses. Within the primary grades related concepts are found in standards 1.6 and 3.8. It is intended that students will actively develop scientific investigation, reasoning, and logic skills (K.1 and K.2) in the context of the key concepts presented in this standard.

## Standard K.7

<b>Overview</b>	<b>Essential Knowledge, Skills, and Processes</b>
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none"><li>• A shadow is an image of an object created when light is blocked by that object.</li><li>• Shadows can occur whenever light is present.</li><li>• People can make shadows.</li><li>• Living and nonliving things can make shadows.</li></ul>	<p>In order to meet this standard, it is expected that students should be able to:</p> <ul style="list-style-type: none"><li>• identify a shadow or variety of shadows.</li><li>• describe how to make a shadow.</li><li>• identify and describe sources of light – sun, electric lights, and flashlights - that can produce shadows.</li><li>• match objects with the shadow they would create.</li><li>• analyze how shadows change as the direction of the light source changes.</li></ul>

**Standard K.7**

<b>Resources</b>	<b>Activities</b>
<p><u>Shadows and Reflections</u> by Tana Hoban</p> <p><u>Shadows: Here, There, and Everywhere</u> by Ron and Nancy Goor</p> <p><u>What Makes a Shadow?</u> By Adrienne Adams</p> <p><u>Guess Whose Shadow?</u> By Stephen R. Swinburne</p> <p>"The Mailbox Kindergarten" February/March Issue 1997</p> <p><i>Sun and Shadows</i> An Investigation from the VA Department of Education Science Enhanced Scope and Sequence – Kindergarten. <a href="http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml">http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml</a></p>	<p>Put objects such as scissors, markers, blocks, magnetic letters, etc. on an over-head projector one at a time and have children guess what they are by viewing their shadows.</p> <p>Discuss how the objects are blocking the light of the overhead projector and making a shadow.</p> <p>Get an empty appliance box from an appliance store. Using flashlights let the children go in one at a time and create their own shadows using the flashlights and their hands.</p> <p>Do "Will it Cast a Shadow?" activity page 7 from Feb/March "The Mailbox"</p>

## **Kindergarten Science Strand**

### **Earth Patterns, Cycles, and Change**

This strand focuses on student understanding of patterns in nature, natural cycles, and changes that occur both quickly and over time. An important idea represented in this strand is the relationship among Earth patterns cycles and change, and their effects on living things. The topics developed include noting and measuring changes, weather and seasonal changes, the water cycle, cycles in the Earth-moon-sun system, and change in the Earth's surface over time. This strand includes science standards K.8, K.9, 1.7, 2.7, 3.8, 3.9, 4.7, and 5.7.

## **Strand: Earth Patterns, Cycles, and Change**

### **Standard K.8**

The student will investigate and understand simple patterns in his/her daily life. Key concepts include

- a) weather observations;
- b) the shapes and forms of many common natural objects including seeds, cones, and leaves;
- c) animal and plant growth; and
- d) home and school routines.

### **Understanding the Standard**

Standard K.8 focuses on student understanding of basic patterns in daily life. Careful observations of patterns help predict events. Patterns are found in weather; in natural objects including seeds, cones, and leaves; in the growth of animals and plants; and in daily routines. The basic kindergarten concepts related to patterns will be further developed in the primary grades, especially basic concepts of cycles, sequences, and rate. It is intended that students will actively develop scientific investigation, reasoning, and logic skills (K.1 and K.2) in the context of the key concepts presented in this standard.

## Standard K.8

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none"><li>• One can make simple predictions in weather patterns. On a cloudy, warm day, it may rain. On a cloudy day that is very cold, it may snow. On a clear day there most likely will be no rain or snow.</li><li>• As animals and plants grow, they get larger according to a pattern.</li><li>• Natural objects such as leaves, seeds, and cones have patterns we can see.</li><li>• Home and school routines frequently follow a pattern.</li></ul>	<p>In order to meet this standard, it is expected that students should be able to:</p> <ul style="list-style-type: none"><li>• observe and identify daily weather conditions – sunny, rainy, cloudy, snowy, windy, warm, hot, cool, and cold.</li><li>• predict daily weather based on basic observable conditions.</li><li>• chart daily weather conditions.</li><li>• identify simple patterns in natural objects – veins in a leaf, spiral patterns in cones, shapes and colors of common seeds.</li><li>• identify and describe patterns in their daily schedule at home.</li><li>• identify and describe patterns in their daily schedule at school.</li><li>• distinguish between the patterns in home activities and school activities.</li><li>• describe how animals and plants change as they grow. (Related to K.6. See resources listed for K.6)</li></ul>

## Standard K.8

<b>Resources</b>	<b>Activities</b>
<p><u>Storms</u> by Seymour Simon</p> <p><u>Weather</u> by John Farndon</p> <p><u>Sunshine Makes the Seasons</u> by Giulio Maestro</p> <p><u>Science in the Air</u>, by Sharon Nowakowski and Melissa Tucker</p> <p><u>Weather Forecasting</u> by Gail Gibbons</p> <p><u>Weather: Thematic Unit</u> by Diane Williams</p> <p><u>Hands on Projects About Weather and Climate</u> by Krista West</p> <p><u>Forecasting the Weather</u> by Alan Rodgers and Angella Streluk</p> <p><u>Earth Cycles</u> Michael Elsohn Ross</p> <p>AIMS Primarily Earth AIMS Overhead and Underfoot AIMS Matter</p> <p>Video "The Magic School Bus Kicks up a Storm"</p> <p><b><i>Beanstalk Growing</i></b> <b><i>All About Me!</i></b> <b><i>Patterns</i></b> <b><i>Weather Patterns</i></b></p> <p>Investigations from the VA Department of Education Science Enhanced Scope and Sequence – Kindergarten. <a href="http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml">http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml</a></p>	<p>Graph weather and temperature daily. Discuss how weather is always changing using these graphs.</p> <p>Make weather instruments to observe weather.</p>

## Strand: Earth Patterns, Cycles, and Change

### Standard K.9

The student will investigate and understand that change occurs over time, and rates may be fast or slow. Key concepts include

- a) natural and human-made things may change over time; and
- b) changes can be noted and measured.

### Understanding the Standard

Almost everything changes over time. Those changes can be observed and measured. Standard K.9 focuses on students understanding basic aspects of change, especially those things that can be easily observed and are within the experience of kindergarten children. Change is a key concept woven into most of the science standards throughout elementary, middle, and high school. It is intended that students will actively develop scientific investigation, reasoning, and logic skills (K.1 and K.2) in the context of the key concepts presented in this standard.

## Standard K.9

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none"><li>• Change occurs over time.</li><li>• Change can be fast or slow depending upon the object and conditions.</li><li>• As people grow they change.</li><li>• Not all things change at a rate that can be observed easily.</li><li>• Many changes can be measured.</li></ul>	<p>In order to meet this standard, it is expected that students should be able to:</p> <ul style="list-style-type: none"><li>• identify some changes that people experience over time – height, weight, color of hair.</li><li>• predict how their own height and weight will change over the school year.</li><li>• describe how people cause things to change– demolition of buildings, construction of buildings, cutting down trees, planting trees, building highways.</li><li>• describe how things change naturally. This includes seasonal changes, the growth in seeds and common plants, common animals including the butterfly, and the weather.</li><li>• identify examples of fast changes and slow changes. Slow changes should be the kinds of familiar changes that occur over weeks, months, or seasons. Students are not responsible for long-term changes.</li></ul>

**Standard K.9**

<b>Resources</b>	<b>Activities</b>
<p><i>Beanstalk Growing</i> <i>All About Me!</i> Investigations from the VA Department of Education Science Enhanced Scope and Sequence – Kindergarten. <a href="http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml">http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml</a></p>	

# **Kindergarten Science Strand**

## **Resources**

This strand focuses on student understanding of the role of natural resources and how people can utilize those resources in a sustainable way. Resource management is an important idea developed within the strand. This begins with basic ideas of conservation and proceeds to the more abstract consideration of costs and benefits in the 6<sup>th</sup> grade. The topics developed include the conservation of household materials, the importance of soil and plants as resources, energy use, water, Virginia's resources, and how public policy impacts the environment. This strand includes science standards K.10, 1.8, 2.8, 3.10, 3.11, 4.8, and 6.9.

**Standard K.10**

The student will investigate and understand that materials can be reused, recycled, and conserved. Key concepts include

- a) materials and objects can be used over and over again;
- b) everyday materials can be recycled; and
- c) water and energy conservation at home and in school helps preserve resources for future use.

**Understanding the Standard**

Standard K.10 focuses on student understanding that materials can be reused, recycled, and conserved. This should include common objects and materials found in the school and home environment. K.10 establishes a foundation for increasingly advanced conservation concepts developed in the primary standards. Note that science standard 1.8 is very closely related to K.10. It is intended that students will actively develop scientific investigation, reasoning, and logic skills (K.1 and K.2) in the context of the key concepts presented in this standard.

## Standard K.10

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none"><li>• Natural resources such as water and energy should be conserved.</li><li>• Recycling helps to save our natural resources. Recycling recovers used materials. Many materials can be recycled and used again, sometimes in different forms. Examples include newspapers that are turned into writing tablets.</li><li>• Reusing materials means using them more than once. Examples include dishes and utensils that are washed after use rather than using paper plates and plastic utensils and putting them in the trash.</li><li>• Recycling, reusing, and conserving helps preserve resources for future use.</li><li>• Resources will last longer if we recycle, reuse, or reduce consumption.</li></ul>	<p>In order to meet this standard, it is expected that students should be able to:</p> <ul style="list-style-type: none"><li>• give examples of objects, such as paper, plastic containers, and glass containers, that can be recycled.</li><li>• identify materials that can be reused.</li><li>• describe the difference between recycle and reuse.</li><li>• name ways to conserve water and energy.</li><li>• describe how to recycle a given material – paper, oil, aluminum, glass and plastics.</li><li>• predict what would happen if recycling and reusing were not practiced.</li></ul>

**Standard K.10**

<b>Resources</b>	<b>Activities</b>
<p>AIMS Overhead and Underfoot</p> <p>Project Learning Tree Environmental Education Activity Guide</p> <p><u>Let's Make Something New</u>, by Christine Economos</p> <p><u>Where Does All the Garbage Go?</u> By Melvin Berger</p> <p><u>Recycle It</u> by Brenda Parks,</p> <p><u>Recycle Every Day!</u> By Nancy Wallace</p> <p><u>The Lorax</u> by Dr. Seuss</p> <p><u>Long Live the Earth</u>, by Meighan Morrison</p> <p><u>Celebrating Earth Day</u> by Janet McDonnell</p> <p><u>Earth Day</u> by Jason Cooper</p> <p><u>Recycle: A Handbook for Kids</u> by Gail Gibbons</p> <p><b>Recycling</b> An Investigation from the VA Department of Education Science Enhanced Scope and Sequence – Kindergarten. <a href="http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml">http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml</a></p>	<p>Using a child's plastic pool, create a landfill with trash covered by dirt. Place it outside and observe it over time to determine how things decompose or don't decompose. Discuss if any items placed in the landfill could have been recycled.</p> <p>Create art projects with students using objects that would normally be considered trash.</p>