

# Science Standards of Learning Curriculum Framework 2010



## Kindergarten

Board of Education  
Commonwealth of Virginia

Copyright © 2010

by the

Virginia Department of Education  
P.O. Box 2120  
Richmond, Virginia 23218-2120  
<http://www.doe.virginia.gov>

All rights reserved. Reproduction of these materials for instructional purposes in public school classrooms in Virginia is permitted.

**Superintendent of Public Instruction**

Patricia I. Wright, Ed.D.

**Assistant Superintendent for Instruction**

Linda M. Wallinger, Ph.D.

**Office of Standards, Curriculum, and Instruction**

Mark R. Allan, Ph.D., Director  
Barbara P. Young, Science Specialist  
Paula J. Klonowski, Science Coordinator

**NOTICE**

The Virginia Department of Education does not discriminate on the basis of race, sex, color, national origin, religion, age, political affiliation, veteran status, or against otherwise qualified persons with disabilities in its programs or activities.

The 2010 *Science Curriculum Framework* can be found in PDF and Microsoft Word file formats on the Virginia Department of Education's Web site at <http://www.doe.virginia.gov>.

## **Virginia Science Standards of Learning Curriculum Framework 2010**

### **Introduction**

The *Science Standards of Learning Curriculum Framework* amplifies the *Science Standards of Learning for Virginia Public Schools* and defines the content knowledge, skills, and understandings that are measured by the Standards of Learning tests. The Science Curriculum Framework provides additional guidance to school divisions and their teachers as they develop an instructional program appropriate for their students. It assists teachers as they plan their lessons by identifying essential understandings and defining the essential content knowledge, skills, and processes students need to master. This supplemental framework delineates in greater specificity the minimum content that all teachers should teach and all students should learn.

School divisions should use the *Science Curriculum Framework* as a resource for developing sound curricular and instructional programs. This framework should not limit the scope of instructional programs. Additional knowledge and skills that can enrich instruction and enhance students' understanding of the content identified in the Standards of Learning should be included as part of quality learning experiences.

The Curriculum Framework serves as a guide for Standards of Learning assessment development. Assessment items may not and should not be a verbatim reflection of the information presented in the Curriculum Framework. Students are expected to continue to apply knowledge and skills from Standards of Learning presented in previous grades as they build scientific expertise.

The Board of Education recognizes that school divisions will adopt a K–12 instructional sequence that best serves their students. The design of the Standards of Learning assessment program, however, requires that all Virginia school divisions prepare students to demonstrate achievement of the standards for elementary and middle school by the time they complete the grade levels tested. The high school end-of-course Standards of Learning tests, for which students may earn verified units of credit, are administered in a locally determined sequence.

Each topic in the *Science Standards of Learning Curriculum Framework* is developed around the Standards of Learning. The format of the Curriculum Framework facilitates teacher planning by identifying the key concepts, knowledge and skills that should be the focus of instruction for each standard. The Curriculum Framework is divided into two columns: Understanding the Standard (K-5); Essential Understandings (middle and high school); and Essential Knowledge, Skills, and Processes. The purpose of each column is explained below.

#### *Understanding the Standard (K-5)*

This section includes background information for the teacher. It contains content that may extend the teachers' knowledge of the standard beyond the current grade level. This section may also contain suggestions and resources that will help teachers plan instruction focusing on the standard.

#### *Essential Understandings (middle and high school)*

This section delineates the key concepts, ideas and scientific relationships that all students should grasp to demonstrate an understanding of the Standards of Learning.

#### *Essential Knowledge, Skills and Processes (K-12)*

Each standard is expanded in the Essential Knowledge, Skills, and Processes column. What each student should know and be able to do in each standard is outlined. This is not meant to be an exhaustive list nor a list that limits what is taught in the classroom. It is meant to be the key knowledge and skills that define the standard.

## **Kindergarten Science Strand**

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

This strand represents a set of systematic inquiry skills that defines what a student will be able to do when conducting activities and investigations, and represents the student understanding of the nature of science. The various skill categories are described in the “Investigate and Understand” section of the Introduction to the *Science 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 kindergarten. Across the grade levels, the skills in the first standards form a nearly continuous sequence of investigative skills and an understanding of the nature of science. It is important that the classroom teacher understand how the skills in standards 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).

- K.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- a) basic characteristics or properties of objects are identified by direct observation;
  - b) observations are made from multiple positions to achieve different perspectives;
  - c) a set of objects is sequenced according to size;
  - d) a set of objects is separated into two groups based on a single physical characteristic;
  - e) nonstandard units are used to measure the length, mass, and volume of common objects;
  - f) observations and predictions are made for an unseen member in a sequence of objects;
  - g) a question is developed and predictions are made from one or more observations;
  - h) observations are recorded;
  - i) picture graphs are constructed;
  - j) unusual or unexpected results in an activity are recognized; and
  - k) objects are described both pictorially and verbally.

### Overview

Standard K.1 is intended to develop investigative and inquiry skills and an understanding of the nature of science. Standard K.1 describes the range of inquiry skills and the level of proficiency in using those skills students should achieve, and the components of the nature of science that should be developed and reinforced in the context of science concepts developed in kindergarten.

**Standard K.1 does not require a discrete unit be taught on scientific investigation and the nature of science because the skills that make up the standard should be incorporated in all the other kindergarten science standards.** It is also intended that by participating in activities and experiences that develop these skills, students will achieve a preliminary understanding of scientific inquiry and the nature of science and more fully grasp the content-related concepts.

<p>K.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which</p> <ul style="list-style-type: none"> <li>a) basic characteristics or properties of objects are identified by direct observation;</li> <li>b) observations are made from multiple positions to achieve different perspectives;</li> <li>c) a set of objects is sequenced according to size;</li> <li>d) a set of objects is separated into two groups based on a single physical characteristic;</li> <li>e) nonstandard units are used to measure the length, mass, and volume of common objects;</li> <li>f) observations and predictions are made for an unseen member in a sequence of objects;</li> <li>g) a question is developed and predictions are made from one or more observations;</li> <li>h) observations are recorded;</li> <li>i) picture graphs are constructed;</li> <li>j) unusual or unexpected results in an activity are recognized; and</li> <li>k) objects are described both pictorially and verbally.</li> </ul>	
<p><b>Understanding the Standard</b> (Background Information for Instructor Use Only)</p>	<p><b>Essential Knowledge, Skills, and Processes</b></p>
<ul style="list-style-type: none"> <li>• The nature of science refers to the foundational concepts that govern the way scientists formulate explanations about the natural world. The nature of science includes the following concepts:             <ul style="list-style-type: none"> <li>a) the natural world is understandable;</li> <li>b) science is based on evidence, both observational and experimental;</li> <li>c) science is a blend of logic and innovation;</li> <li>d) scientific ideas are durable yet subject to change as new data are collected;</li> <li>e) science is a complex social endeavor; and</li> <li>f) scientists try to remain objective and engage in peer review to help avoid bias.</li> </ul> <p>In kindergarten, an emphasis should be placed on concepts a, b, and e.</p> </li> <li>• Science assumes that the natural world is understandable. Scientific inquiry can provide explanations about nature. This expands students’ thinking from just a knowledge of facts to understanding how facts are relevant to everyday life.</li> <li>• Science demands evidence. Scientists develop their ideas based on evidence and they change their ideas when new evidence becomes available or the old evidence is viewed in a different way.</li> </ul>	<p>In order to meet this standard, it is expected that students will</p> <ul style="list-style-type: none"> <li>• observe objects and describe their basic properties. These properties include color, shape (circle, triangle, square, and rectangle), size (big, little, large, small), texture (rough, smooth, hard, soft), and 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, and describe what he/she sees.</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 characteristic, including color, shape, size, texture, and weight.</li> <li>• measure common objects with nonstandard units. Examples of nonstandard units include hands, pennies, and paper clips for determining length; holding and comparing two different objects for determining mass; and liquids put in drinking cups for determining volume.</li> </ul>

**Standard K.1**

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

<p>K.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which</p> <ul style="list-style-type: none"> <li>a) basic characteristics or properties of objects are identified by direct observation;</li> <li>b) observations are made from multiple positions to achieve different perspectives;</li> <li>c) a set of objects is sequenced according to size;</li> <li>d) a set of objects is separated into two groups based on a single physical characteristic;</li> <li>e) nonstandard units are used to measure the length, mass, and volume of common objects;</li> <li>f) observations and predictions are made for an unseen member in a sequence of objects;</li> <li>g) a question is developed and predictions are made from one or more observations;</li> <li>h) observations are recorded;</li> <li>i) picture graphs are constructed;</li> <li>j) unusual or unexpected results in an activity are recognized; and</li> <li>k) objects are described both pictorially and verbally.</li> </ul>	
<p style="text-align: center;"><b>Understanding the Standard</b> (Background Information for Instructor Use Only)</p>	<p style="text-align: center;"><b>Essential Knowledge, Skills, and Processes</b></p>
<ul style="list-style-type: none"> <li>• Science is a complex social endeavor. It is a complex social process for producing knowledge about the natural world. Scientific knowledge represents the current consensus as to what is the best explanation for phenomena in the natural world. This consensus does not arise automatically, since scientists with different backgrounds from all over the world may interpret the same data differently. To build a consensus, scientists communicate their findings to other scientists and attempt to replicate one another’s findings. In order to model the work of professional scientists, it is essential for kindergarten students to engage in frequent discussions with peers about their understanding of their investigations.</li> <li>• Observation is an important skill that enables us to learn about the world. Observations are expressed as descriptive statements about natural phenomena that are accessible to the senses either directly or with the use of technology. 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</li> </ul>	<ul style="list-style-type: none"> <li>• predict an unseen member in a sequence of objects to complete a pattern.</li> <li>• develop a question from one or more observations about the natural world.</li> <li>• make a prediction based on observations.</li> <li>• record observations using pictures.</li> <li>• construct picture graphs using 10 or fewer units.</li> <li>• identify unusual or unexpected results in an activity.</li> <li>• describe objects both pictorially and verbally.</li> </ul>

**Standard K.1**

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

<p>K.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which</p> <ul style="list-style-type: none"> <li>a) basic characteristics or properties of objects are identified by direct observation;</li> <li>b) observations are made from multiple positions to achieve different perspectives;</li> <li>c) a set of objects is sequenced according to size;</li> <li>d) a set of objects is separated into two groups based on a single physical characteristic;</li> <li>e) nonstandard units are used to measure the length, mass, and volume of common objects;</li> <li>f) observations and predictions are made for an unseen member in a sequence of objects;</li> <li>g) a question is developed and predictions are made from one or more observations;</li> <li>h) observations are recorded;</li> <li>i) picture graphs are constructed;</li> <li>j) unusual or unexpected results in an activity are recognized; and</li> <li>k) objects are described both pictorially and verbally.</li> </ul>	
<p style="text-align: center;"><b>Understanding the Standard</b> (Background Information for Instructor Use Only)</p>	<p style="text-align: center;"><b>Essential Knowledge, Skills, and Processes</b></p>
<p>related. A sequence can illustrate incremental changes over time.</p> <ul style="list-style-type: none"> <li>• A nonstandard 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 nonstandard unit to be most useful, it should be consistent and easily applied.</li> <li>• Sequenced objects or events can show patterns over time. Occasionally, items are missing in a sequence, but observations of patterns in the sequence can offer clues to predict the item(s) that are missing.</li> <li>• Observations about familiar objects or events often lead to the development of predictions and important questions that can spark further investigation.</li> <li>• Observations that are made can be recorded in a variety of ways. Picture graphs are useful ways to display and report information.</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> <li>• Observations can be communicated through pictures and discussions.</li> </ul>	



K.2	The student will investigate and understand that humans have senses that allow them to seek, find, take in, and react or respond to information in order to learn about their surroundings. Key concepts include a) the five senses and corresponding sensing organs; and b) sensory descriptors used to describe common objects and phenomena.
-----	---

**Overview**

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

**Standard K.2**

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

<p>K.2 The student will investigate and understand that humans have senses that allow them to seek, find, take in, and react or respond to information in order to learn about their surroundings. Key concepts include</p> <ul style="list-style-type: none"> <li>a) the five senses and corresponding sensing organs; and</li> <li>b) sensory descriptors used to describe common objects and phenomena.</li> </ul>	
<p style="text-align: center;"><b>Understanding the Standard</b> (Background Information for Instructor Use Only)</p>	<p style="text-align: center;"><b>Essential Knowledge, Skills, and Processes</b></p>
<ul style="list-style-type: none"> <li>• A particular sensing organ (eye, ear, nose, tongue, and skin) is associated with each of the five senses.</li> <li>• Using the senses, we can make careful observations about the world.</li> <li>• To communicate what is observed, descriptors should be used.</li> </ul>	<p>In order to meet this standard, it is expected that students will</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 (eye, ear, nose, tongue, and skin) with its associated sense.</li> <li>• match sensory descriptors with the senses (<b>taste</b>: sweet, sour, bitter, salty; <b>touch</b>: rough, smooth, hard, soft, cold, warm, hot; <b>hearing</b>: loud, soft, high, low; <b>sight</b>: bright, dull, color, black, white; <b>smell</b>: strong, faint, bad, and good.)</li> </ul>

## **Kindergarten Science Strand**

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

This strand focuses on student 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.

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) magnetism and its effects; and b) useful applications of magnetism.
-----	---

**Overview**

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 and 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.

<p>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</p> <ul style="list-style-type: none"> <li>a) magnetism and its effects; and</li> <li>b) useful applications of magnetism.</li> </ul>	
<p style="text-align: center;"><b>Understanding the Standard</b> (Background Information for Instructor Use Only)</p>	<p style="text-align: center;"><b>Essential Knowledge, Skills, and Processes</b></p>
<ul style="list-style-type: none"> <li>• A magnet has two ends called poles, one of which is called a north pole or north-seeking pole, and the other is called a south pole or south-seeking pole.</li> <li>• The north pole of one magnet attracts the south pole of a second magnet, while the north pole of one magnet repels the other magnet's north pole. One way to state this is that like poles repel and unlike poles attract. Repulsion is the force that pushes like poles of magnets apart.</li> <li>• A magnet creates an invisible area of magnetism all around it called a magnetic field.</li> <li>• The north end of a magnetic compass always points roughly toward Earth's North Pole and the south end of the compass needle always points toward Earth's South Pole. That is because Earth itself contains magnetic materials and behaves like a gigantic magnet.</li> <li>• If you cut a bar magnet in half, you get two new, smaller magnets, each with its own north and south pole.</li> <li>• Magnets will attract certain metals (iron-bearing, nickel, and cobalt).</li> <li>• Magnets have an effect on some items and can cause them to move. Some items are not affected by magnets and remain stationary.</li> <li>• Because some metals are attracted to magnets, magnets have many simple useful applications in the home such as can openers, magnetized screwdrivers, magnetic cabinet door latches, and magnetic games.</li> <li>• The force of a magnet can move something without actually touching it.</li> <li>• Students will be introduced to the vocabulary attract/repel, nonattraction, metal, and nonmetal in grade two. The focus of the</li> </ul>	<p>In order to meet this standard, it is expected that students will</p> <ul style="list-style-type: none"> <li>• predict and test which common objects will be attracted to magnets and which will not be attracted to magnets.</li> <li>• classify objects as being attracted or not attracted to magnets, such as an iron nail, an iron-bearing paper clip, cereal, and a book.</li> <li>• explain in their own words how an object such as an iron nail, an iron-bearing paper clip, cereal, or a book is affected by a magnet.</li> <li>• identify items in the home or school that contain a magnet or magnets, such as can openers, magnetized screwdrivers, magnetic games, magnetic cabinet door latches, refrigerator magnets, and magnetic letters.</li> </ul>

### Standard K.3

### Strand: Force, Motion, and Energy

<p>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</p> <ul style="list-style-type: none"><li>a) magnetism and its effects; and</li><li>b) useful applications of magnetism.</li></ul>	
<p style="text-align: center;"><b>Understanding the Standard</b> (Background Information for Instructor Use Only)</p>	<p style="text-align: center;"><b>Essential Knowledge, Skills, and Processes</b></p>
<p>investigations in this standard should be on the concepts, not the terminology.</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 the basic description of objects, phases of matter (solids, liquids, and gases – especially water), phase changes, mass and volume, and the structure and 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.

K.4	<p>The student will investigate and understand that the position, motion, and physical properties of an object can be described. Key concepts include</p> <ul style="list-style-type: none"><li>a) colors of objects;</li><li>b) shapes and forms of objects;</li><li>c) textures and feel of objects;</li><li>d) relative sizes and weights of objects; and</li><li>e) relative positions and speed of objects.</li></ul>
-----	--

**Overview**

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 also 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.



<p>K.4 The student will investigate and understand that the position, motion, and physical properties of an object can be described. Key concepts include</p> <ul style="list-style-type: none"> <li>a) colors of objects;</li> <li>b) shapes and forms of objects;</li> <li>c) textures and feel of objects;</li> <li>d) relative sizes and weights of objects; and</li> <li>e) relative positions and speed of objects.</li> </ul>	
<p style="text-align: center;"><b>Understanding the Standard</b> (Background Information for Instructor Use Only)</p>	<p style="text-align: center;"><b>Essential Knowledge, Skills, and Processes</b></p>
<ul style="list-style-type: none"> <li>• An object may have many properties that can be observed and described.</li> <li>• An object can be described readily in terms of color.</li> <li>• Visible light waves are the only electromagnetic waves that we can see with the naked eye. We see these waves as the colors of the rainbow. Each color has a different wavelength. Red has the longest wavelength and violet has the shortest wavelength.</li> <li>• When all the waves are seen together, they make white light. When white light shines through a prism, the white light is broken apart into colors. Water vapor in the atmosphere can act as a prism and break apart the white light, creating a rainbow.</li> <li>• The order of the colors in the visible spectrum is red, orange, yellow, green, blue, and violet. Most scientists no longer include the color indigo, which used to be included between blue and violet.</li> <li>• At the kindergarten level, violet is referred to as purple. It is not required at the kindergarten level that students know the term violet.</li> <li>• Black and white are not spectral colors, but students should recognize them by name. Black is the total absence of light and is when a material absorbs all the light. White is a reflection of all visible light together.</li> <li>• An object can be described in terms of shape, size, and texture.</li> <li>• An object can be described according to its position relative to another object and according to its motion.</li> </ul>	<p>In order to meet this standard, it is expected that students will</p> <ul style="list-style-type: none"> <li>• identify and name six basic colors, including red, orange, yellow, green, blue, and purple; and identify and name black and white.</li> <li>• identify and name a circle, triangle, square, and rectangle.</li> <li>• compare and contrast objects that are flexible, stiff, straight, and/or curved.</li> <li>• compare and contrast objects that are rough, smooth, hard, and/or 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, and direct comparisons.</li> <li>• identify the position of an object, using position words over/under, in/out, above/below, and left/right.</li> <li>• group objects according to their speed — fast or slow.</li> </ul>

**Standard K.4****Strand: Matter**

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 of objects; b) shapes and forms of objects; c) textures and feel of objects; d) relative sizes and weights of objects; and e) relative positions and speed of objects.	
<b>Understanding the Standard</b> (Background Information for Instructor Use Only)	<b>Essential Knowledge, Skills, and Processes</b>
<ul style="list-style-type: none"><li>• Two different objects can have some of the same physical properties and some different physical properties.</li></ul>	

- |     |   |
|-----|---|
| K.5 | <p>The student will investigate and understand that water flows and has properties that can be observed and tested. Key concepts include</p> <ul style="list-style-type: none"><li>a) water occurs in different phases;</li><li>b) water flows downhill; and</li><li>c) some materials float in water, while others sink.</li></ul> |
|-----|---|

**Overview**

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 phases of matter. Related standards include 1.3, 2.3, 3.3, 5.4, and 6.5. 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.

<p>K.5 The student will investigate and understand that water flows and has properties that can be observed and tested. Key concepts include</p> <ul style="list-style-type: none"> <li>a) water occurs in different phases;</li> <li>b) water flows downhill; and</li> <li>c) some materials float in water, while others sink.</li> </ul>	
<p><b>Understanding the Standard</b> (Background Information for Instructor Use Only)</p>	<p><b>Essential Knowledge, Skills, and Processes</b></p>
<ul style="list-style-type: none"> <li>• Water can be a solid, liquid, or gas.</li> <li>• The phase 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 will</p> <ul style="list-style-type: none"> <li>• classify examples of the different phases of water (solid, liquid, and 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, paper, and plastics.</li> </ul>

## **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, K.7, 1.4, 1.5, 2.4, 3.4, and 4.4.

- K.6 The student will investigate and understand the differences between living organisms and nonliving objects. Key concepts include
- a) all things can be classified as living or nonliving; and
  - b) living organisms have certain characteristics that distinguish them from nonliving objects including growth, movement, response to the environment, having offspring, and the need for food, air, and water.

**Overview**

Standard K.6 focuses on student understanding that living organisms have identifying properties that distinguish them from nonliving objects and those properties can be observed and described. This standard serves as a basis for understanding the differences between living organisms and nonliving objects, and the interactions between living and nonliving things. Related elementary standards include 1.4, 1.5, 2.5, 3.4, and 4.4. 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.

<p>K.6 The student will investigate and understand the differences between living organisms and nonliving objects. Key concepts include</p> <ul style="list-style-type: none"> <li>a) all things can be classified as living or nonliving; and</li> <li>b) living organisms have certain characteristics that distinguish them from nonliving objects including growth, movement, response to the environment, having offspring, and the need for food, air, and water.</li> </ul>	
<p style="text-align: center;"><b>Understanding the Standard</b> (Background Information for Instructor Use Only)</p>	<p style="text-align: center;"><b>Essential Knowledge, Skills, and Processes</b></p>
<ul style="list-style-type: none"> <li>• Living is used to describe anything that is or has ever been alive (e.g., dog, flower, seed, log).</li> <li>• Nonliving is used to describe anything that is not now nor has ever been alive (e.g., rock, mountain, glass, wristwatch).</li> <li>• All living things grow, breathe, reproduce, excrete, respond to stimuli, and have similar basic needs like nourishment.</li> </ul>	<p>In order to meet this standard, it is expected that students will</p> <ul style="list-style-type: none"> <li>• identify and describe the basic characteristics of living things (growth, movement, response to the environment, having offspring, and the need for food, air, and water).</li> <li>• identify living organisms and nonliving objects found at home and at school.</li> <li>• classify items by living or nonliving.</li> </ul>

- K.7 The student will investigate and understand basic needs and life processes of plants and animals. Key concepts include
- a) animals need adequate food, water, shelter, air, and space to survive;
  - b) plants need nutrients, water, air, light, and a place to grow to survive;
  - c) plants and animals change as they grow, have varied life cycles, and eventually die; and
  - d) offspring of plants and animals are similar but not identical to their parents or to one another.

**Overview**

Standard K.7 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.7 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.



<p>K.7 The student will investigate and understand basic needs and life processes of plants and animals. Key concepts include</p> <ul style="list-style-type: none"> <li>a) animals need adequate food, water, shelter, air, and space to survive;</li> <li>b) plants need nutrients, water, air, light, and a place to grow to survive;</li> <li>c) plants and animals change as they grow, have varied life cycles, and eventually die; and</li> <li>d) offspring of plants and animals are similar but not identical to their parents or to one another.</li> </ul>	
<p style="text-align: center;"><b>Understanding the Standard</b> (Background Information for Instructor Use Only)</p>	<p style="text-align: center;"><b>Essential Knowledge, Skills, and Processes</b></p>
<ul style="list-style-type: none"> <li>• Plants and animals change as they grow.</li> <li>• Animals need adequate food, water, shelter, air, and space to survive.</li> <li>• Some animals are terrestrial animals, some animals are aquatic animals, and some are both. Terrestrial animals get their oxygen from the air they breathe and aquatic animals extract oxygen from water.</li> <li>• In order to survive, plants need nutrients, water, air, light, and a place that has adequate space for them to grow.</li> <li>• Plants provide food for people and animals.</li> <li>• Some plants are terrestrial plants and some are aquatic plants.</li> <li>• Plants release oxygen as a product of photosynthesis and the oxygen is then used by other living things. Carbon dioxide from the air enters a leaf through the stomata. Oxygen is produced by plants as a waste product and is released into the air through the stomata.</li> <li>• Plants and animals change as they grow and eventually die. These processes are part of their life cycles. The life cycles of plants and animals vary by species.</li> <li>• Many offspring of plants and animals are like their parents but not identical to them or to one another.</li> </ul>	<p>In order to meet this standard, it is expected that students will</p> <ul style="list-style-type: none"> <li>• describe the life needs of animals. The life needs are food, water, shelter, air, and space.</li> <li>• describe the life needs of plants. The life needs are nutrients, water, air, light, and a place that has adequate space for them to grow.</li> <li>• predict what will happen to animals and plants if life needs are not met.</li> <li>• describe some simple changes animals undergo during their life cycles. This may include changes in their body size, color, covering, or shape.</li> <li>• describe some simple changes that plants undergo during their life cycles. This may include size, presence of leaves and branches, fruits, and seeds.</li> <li>• compare and contrast young plants and animals with their parents, using pictures and/or live organisms.</li> </ul>

## **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 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.8, 1.6, 2.6, 3.7, 4.6, 5.6, and 6.8.

- |     |   |
|-----|---|
| K.8 | <p>The student will investigate and understand that shadows occur when light is blocked by an object. Key concepts include</p> <ul style="list-style-type: none"><li>a) shadows occur in nature when sunlight is blocked by an object; and</li><li>b) shadows can be produced by blocking artificial light sources.</li></ul> |
|-----|---|

**Overview**

Standard K.8 focuses on student understanding that shadows are produced when objects block light. This is a key concept for students' 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.8

## Strand: Interrelationships in Earth/Space Systems

K.8      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.	
<b>Understanding the Standard</b> (Background Information for Instructor Use Only)	<b>Essential Knowledge, Skills, and Processes</b>
<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>	In order to meet this standard, it is expected that students will <ul style="list-style-type: none"><li>• identify a shadow.</li><li>• describe how shadows occur.</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>• demonstrate that shadows change as the direction of the light source changes.</li></ul>

## **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 slowly 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, our solar system, and change in Earth's surface over time. This strand includes science standards K.9, K.10, 1.7, 2.7, 3.8, 3.9, 4.7, 4.8, and 5.7.

- K.9 The student will investigate and understand that there are simple repeating 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; and
  - c) animal and plant growth.

**Overview**

Standard K.9 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.9

## Strand: Earth Patterns, Cycles, and Changes

<p>K.9 The student will investigate and understand that there are simple repeating patterns in his/her daily life. Key concepts include</p> <ul style="list-style-type: none"><li>a) weather observations;</li><li>b) the shapes and forms of many common natural objects including seeds, cones, and leaves; and</li><li>c) animal and plant growth.</li></ul>	
<p style="text-align: center;"><b>Understanding the Standard</b> (Background Information for Instructor Use Only)</p>	<p style="text-align: center;"><b>Essential Knowledge, Skills, and Processes</b></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></ul>	<p>In order to meet this standard, it is expected that students will</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>• describe how animals and plants change as they grow. (Related to K.7.)</li></ul>

- |      |  |
|------|--|
| K.10 | The student will investigate and understand that change occurs over time and rates may be fast or slow. Key concepts include<br>a) natural and human-made things may change over time; and<br>b) changes can be observed and measured. |
|------|--|

**Overview**

Almost everything changes over time. Those changes can be observed and measured. Standard K.10 focuses on student understanding of the basic aspects of change, especially in 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.10**

**Strand: Earth Patterns, Cycles, and Changes**

<p>K.10 The student will investigate and understand that change occurs over time and rates may be fast or slow. Key concepts include</p> <ul style="list-style-type: none"> <li>a) natural and human-made things may change over time; and</li> <li>b) changes can be observed and measured.</li> </ul>	
<p style="text-align: center;"><b>Understanding the Standard</b> (Background Information for Instructor Use Only)</p>	<p style="text-align: center;"><b>Essential Knowledge, Skills, and Processes</b></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 will</p> <ul style="list-style-type: none"> <li>• identify some changes that people experience over time (e.g., height, weight, and color of hair).</li> <li>• predict how their own height will change over the school year. Measure and graph the information.</li> <li>• describe how people cause things to change (e.g., demolition of buildings, construction of buildings, cutting down trees, planting trees, and building highways).</li> <li>• describe how things change naturally. This includes seasonal changes, the growth in seeds and common plants, the growth of common animals, 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>

## **Kindergarten Science Strand**

### **Earth 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 in the sixth grade to the more abstract consideration of costs and benefits. 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.11, 1.8, 2.8, 3.10, 3.11, 4.9, and 6.9.

- K.11 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 ensure resources are available for future use.

**Overview**

Standard K.11 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. Standard K.11 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.11. 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.

<p>K.11 The student will investigate and understand that materials can be reused, recycled, and conserved. Key concepts include</p> <ul style="list-style-type: none"> <li>a) materials and objects can be used over and over again;</li> <li>b) everyday materials can be recycled; and</li> <li>c) water and energy conservation at home and in school helps ensure resources are available for future use.</li> </ul>	
<p style="text-align: center;"><b>Understanding the Standard</b> (Background Information for Instructor Use Only)</p>	<p style="text-align: center;"><b>Essential Knowledge, Skills, and Processes</b></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 using 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, and reduce consumption.</li> </ul>	<p>In order to meet this standard, it is expected that students will</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 properly dispose of a given material — paper, oil, aluminum, glass and plastics — by recycling.</li> <li>• predict what would happen if recycling and reusing were not practiced.</li> </ul>