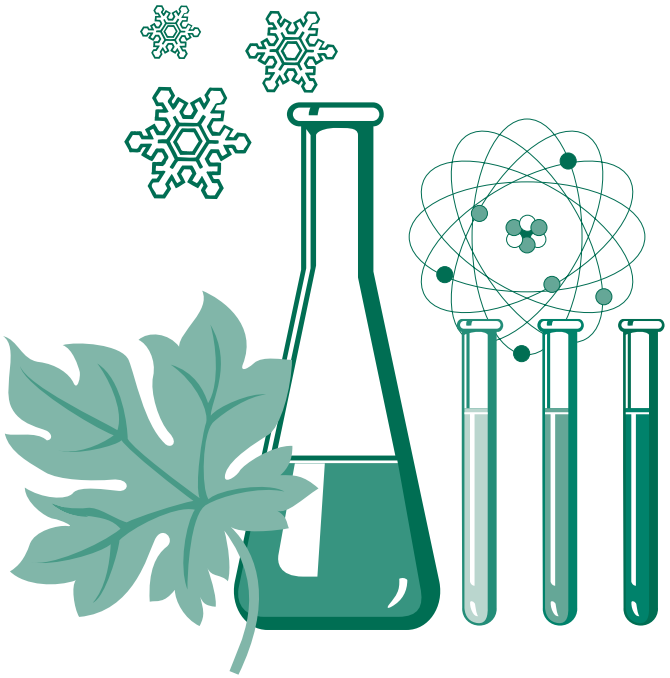

Science Standards of Learning Curriculum Framework

Kindergarten

Commonwealth of Virginia
Board of Education
Richmond, Virginia

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 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. (Please note Appendix, "Science Skills, Scope, & Sequence.") It is important that the classroom teacher understands 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). It is also important to note that 25 percent of items on the third and fifth grade SOL assessments measure the skills defined in the " Scientific Investigation, Reasoning, and Logic" strand.

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 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.

Standard K.1

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: • Observation is an important way to learn about the world. Through observation one can learn to compare, contrast, and note similarities and differences. • 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. • 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. • Picture graphs are useful ways to display and report information. • 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. • Observations about familiar objects or events often lead to the development of important questions that can spark further investigation. • Observations can be communicated through pictures and discussions. • It is important to observe the results of an investigation carefully. Results that are unexpected or unusual may be of interest for further study.	In order to meet this standard, it is expected that students should be able to • 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), and weight (heavy, light). • 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. • arrange a set of objects in sequence according to size. • separate a set of objects into two groups based on a single physical attribute, including size, color, texture, and weight. • construct picture graphs using 10 or fewer units. • measure common objects with nonstandard units. Examples of nonstandard units include hands, pennies, and paper clips. • predict an unseen member in a sequence of objects to complete a pattern. • develop a question from one or more observations. • describe objects both pictorially and verbally. • identify unusual or unexpected results in an activity.

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 (eyes, ears, nose, tongue, and skin) is associated with a sense. 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
The concepts developed in this standard include the following: • A particular sensing organ (eyes, ears, nose, tongue, and skin) is associated with each of the five senses. • Using the senses, we can make careful observations about the world and communicate those observations through descriptors.	In order to meet this standard, it is expected that students should be able to • identify and describe the five senses: taste, touch, smell, hearing, and sight. • match each sensing organ (eyes, ears, nose, tongue, and skin) with its associated sense. • match sensory descriptors with the senses (**taste**: sweet, sour, bitter, salty; **touch**: smooth, hard, soft, cold, warm, hot; **hearing**: loud, soft, high, low; **sight**: bright, dull, color, black, and white.)

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.

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 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.

Standard K.3

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: • Magnets will attract certain metals (iron-bearing, nickel, and cobalt). • Magnets have an effect on some items and can cause them to move. Some items are not affected by magnets and remain stationary. • Because some metals are attracted to magnets, magnets have many simple useful applications in the home. • The force of a magnet can move something without actually touching it. • Repulsion is the force that pushes like poles of magnets apart.	In order to meet this standard, it is expected that students should be able to • predict and test which common objects will be attracted to magnets and which will not be attracted to magnets. • classify objects as being attracted or not attracted to magnets, such as iron nail, iron-bearing paper clip, cereal, and book. • explain in their own words essential vocabulary, including the concepts of attraction/nonattraction, push/pull, attract/repel, and metal/nonmetal. • identify items in the home that contain a magnet or magnets, such as can openers, magnetized screwdrivers, magnetic games, and refrigerator magnets. • evaluate the importance and usefulness of magnets in the home.

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, 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 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.

Standard K.4

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: • An object may have many properties that can be observed and described. • Objects can be described readily in terms of color, shape, and texture. • An object can be described according to its position relative to another object and according to its motion. • Two different objects can have some of the same physical properties and some different physical properties.	In order to meet this standard, it is expected that students should be able to • 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. • identify and name a circle, triangle, square, and rectangle. • compare and contrast objects that are flexible, stiff, straight, and curved. • compare and contrast objects that are rough, smooth, hard, and soft. • compare objects using the concepts of heavy/light, long/short, wide/thin, big/little, and large/small. • measure objects, using nonstandard units. • identify the position of an object, using position words *over/under, in/out, above/below,* and *left/right.* • group objects according to their speed — fast or slow.

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 scientific 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
The concepts developed in this standard include the following: • Water can be a solid, liquid, or gas. • The state of water can be changed by heating or cooling it. • The natural flow of water is from a higher to a lower level. • Some objects float in water, while others do not.	In order to meet this standard, it is expected that students should be able to • identify examples of the different states of water (solid, liquid, and gas). • classify examples of different states of matter as solid, liquid, or gas. • describe the natural flow of water. • predict where a stream of water will flow. • predict whether items will float or sink when placed in water. Items to use include wood, metal, fruits, paper, and plastics.

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, and 4.4.

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 they 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 to 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
The concepts developed in this standard include the following: • Plants and animals change as they grow. • Plants and animals need food, water, and gases in the air to live. (Many animals and plants that live in water use the gases that are dissolved in the water.) • Plants and animals live and die. This is part of the life cycle. • Many offspring of plants and animals are like their parents but not identical to them.	In order to meet this standard, it is expected that students should be able to • describe the life needs of animals and plants. The life needs are food, water, and air. • predict what will happen to animals and plants if life needs are not met. • 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. • compare and contrast young plants and animals with their parents, using pictures and/or live organisms.

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.

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 shadows are produced 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

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: • A shadow is an image of an object created when light is blocked by that object. • Shadows can occur whenever light is present. • People can make shadows. • Living and nonliving things can make shadows.	In order to meet this standard, it is expected that students should be able to • identify a shadow or variety of shadows. • describe how to make a shadow. • identify and describe sources of light — sun, electric lights, and flashlights — that can produce shadows. • match objects with the shadow they would create. • analyze how shadows change as the direction of the light source changes.

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, 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.

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
The concepts developed in this standard include the following: • 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. • As animals and plants grow, they get larger according to a pattern. • Natural objects such as leaves, seeds, and cones have patterns we can see. • Home and school routines frequently follow a pattern.	In order to meet this standard, it is expected that students should be able to • observe and identify daily weather conditions — sunny, rainy, cloudy, snowy, windy, warm, hot, cool, and cold. • predict daily weather based on basic observable conditions. • chart daily weather conditions. • identify simple patterns in natural objects — veins in a leaf, spiral patterns in cones, shapes and colors of common seeds. • identify and describe patterns in their daily schedule at home. • identify and describe patterns in their daily schedule at school. • distinguish between the patterns in home activities and those in school activities. • describe how animals and plants change as they grow. (Related to K.6.)

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 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.9

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: • Change occurs over time. • Change can be fast or slow depending upon the object and conditions. • As people grow, they change. • Not all things change at a rate that can be observed easily. • Many changes can be measured.	In order to meet this standard, it is expected that students should be able to • identify some changes that people experience over time — e.g., height, weight, and color of hair. • predict how their own height and weight will change over the school year. • describe how people cause things to change — e.g., demolition of buildings, construction of buildings, cutting down trees, planting trees, and building highways. • describe how things change naturally. This includes seasonal changes, the growth in seeds and common plants, common animals, including the butterfly, and the weather. • 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.

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.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
The concepts developed in this standard include the following: • Natural resources such as water and energy should be conserved. • 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. • 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. • Recycling, reusing, and conserving helps preserve resources for future use. • Resources will last longer if we recycle, reuse, and reduce consumption.	In order to meet this standard, it is expected that students should be able to • give examples of objects, such as paper, plastic containers, and glass containers, that can be recycled. • identify materials that can be reused. • describe the difference between recycle and reuse. • name ways to conserve water and energy. • describe how to recycle a given material — paper, oil, aluminum, glass and plastics. • predict what would happen if recycling and reusing were not practiced.