



Science Standards of Learning Curriculum Framework

Grade Two

Commonwealth of Virginia
Board of Education
Richmond, Virginia
© 2003

Grade Two 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 2.1 represent more specifically what a student should achieve during the course of instruction in the second grade. 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 very important that the second grade classroom teacher be familiar with the skills in the sequence leading up to standard 2.1. For example in K.1, nonstandard units are used to measure common objects, and in 1.1, standard and nonstandard units are used. In grade two, 2.1 specifies metric and English units of measure. A second grade curriculum should ensure that skills from preceding grades are continuously reinforced and developed. 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.

Strand: Scientific Investigation, Reasoning, and Logic

Standard 2.1

The student will conduct investigations in which

- a) observation is differentiated from personal interpretation, and conclusions are drawn based on observations;
- b) observations are repeated to ensure accuracy;
- c) two or more attributes are used to classify items;
- d) conditions that influence a change are defined;
- e) length, volume, mass, and temperature measurements are made in metric units (centimeters, meters, liters, degrees Celsius, grams, kilograms) and standard English units (inches, feet, yards, cups, pints, quarts, gallons, degrees Fahrenheit, ounces, pounds);
- f) pictures and bar graphs are constructed using numbered axes;
- g) unexpected or unusual quantitative data are recognized; and
- h) simple physical models are constructed.

Understanding the Standard

The skills defined in standard 2.1 are intended to define the “investigate” component of all of the other second grade standards. Standard 2.1 require students to continue developing a range of inquiry skills and achieve proficiency with those skills in the context of the concepts developed at the second grade. Standard 2.1 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 second grade standards. It is also intended that by developing these skills, students will achieve greater understanding of scientific inquiry and the nature of science as well as more fully grasp the content-related concepts.

Standard 2.1

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none">• The more times an observation is repeated, the greater the chance of ensuring the accuracy of the observation.• In order to communicate accurately, it is necessary to provide a clear description of exactly what is observed. There is a difference between what one can observe and what can be interpreted from an observation.• It is easier to see how things are related if objects are classified according to their common characteristics.• By constructing and studying simple models, it is sometimes easier to understand how real things work.• Scientific investigations require standard measures, reliable tools, and organized collection and reporting of data. The way the data are displayed can make it easier to interpret important information.	<p>In order to meet this standard, it is expected that students should be able to</p> <ul style="list-style-type: none">• conduct simple experiments, make predictions, gather data from those experiments, repeat observations to improve accuracy, and draw conclusions.• classify items, using two or more attributes such as size, shape, color, texture, and weight.• differentiate among simple observations and personal interpretations. This requires students to comprehend what an observation is and apply the term in novel situations related to second grade SOL concepts.• construct and interpret simple models (for example, weathering and erosion of land surfaces — 2.7).• analyze sets of objects, numerical data, or pictures, and create basic categories to organize the data (descriptive or numerical).• construct and interpret picture and bar graphs with numbered axes depicting the distribution of data.• use centimeters, meters, liters, degrees Celsius, grams, and kilograms in measurement.• use inches, feet, yards, quarts, gallons, degrees Fahrenheit, ounces, and pounds in measurement.

Standard 2.1 (continued)

Overview	Essential Knowledge, Skills, and Processes
	<ul style="list-style-type: none">• judge which, if any, collected data in a small set appear to be unexpected or unusual.

Grade Two 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.

Strand: Force, Motion, and Energy

Standard 2.2

The student will investigate and understand that natural and artificial magnets have certain characteristics and attract specific types of metals. Key concepts include

- a) magnetism, iron, magnetic/nonmagnetic, poles, attract/repel; and
- b) important applications of magnetism including the magnetic compass.

Understanding the Standard

This standard continues the focus on magnets. In K.3 students investigate and learn that magnets can be used to make some things move without touching them by either attracting them or repelling them. In 2.2, magnets are revisited and students investigate and understand that magnets can be artificial or natural and have certain characteristics. It is intended that students will actively develop scientific investigation, reasoning, and logic skills (2.1) in the context of the key concepts presented in this standard.

Standard 2.2

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none">• Magnets can attract objects made of iron or nickel.• Magnets can be artificially made from special metals or can occur naturally. Naturally occurring magnets are composed of a mineral called magnetite (lodestone).• When a magnetized metal, such as a compass needle, is allowed to swing freely, it displays the interesting property of aligning with the Earth’s magnetic fields.• Magnets have a north and a south pole.• Unlike magnetic poles attract, and like poles repel.• Magnets have important applications and uses in everyday life.	<p>In order to meet this standard, it is expected that students should be able to</p> <ul style="list-style-type: none">• predict which materials will be attracted to magnets, test the predictions, and create a chart that shows the results, classifying materials as to whether they are attracted to magnets or not.• compare natural magnets (lodestone or magnetite) and artificial magnets.• identify the north and south magnetic poles of magnets.• conduct an investigation to determine how the different poles of magnets react to the poles of other magnets.• use magnetic compasses to determine the directions of north and south poles.• identify important applications of magnets in everyday life:<ul style="list-style-type: none">- refrigerator magnets and chalkboard letters- toys- door latches- paper clip holders.• create a new application for using a magnet.

Grade Two 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 2.3

The student will investigate and understand basic properties of solids, liquids, and gases. Key concepts include

- a) mass and volume; and
- b) processes involved with changes in matter from one state to another (condensation, evaporation, melting, and freezing).

Understanding the Standard

This standard continues to focus on matter. In 2.3 students build upon the knowledge introduced in K.4 and 1.3. In K.4 physical properties of matter are investigated and the properties of water are observed and tested. In 1.3 students investigate how common materials interact with water. In 2.3 students investigate, by conducting simple experiments, the properties of solids, liquids, and gases. It is intended that students will actively develop scientific investigation, reasoning, and logic skills (2.1) in the context of the key concepts presented in this standard.

Standard 2.3

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none">• All common substances are made of matter.• <i>Matter</i> is anything that has mass and takes up space.• <i>Mass</i> is a measure of the amount of matter.• <i>Volume</i> is the measure of the amount of space occupied by matter.• Matter most commonly occurs in three states: solids, liquids, and gases.• Matter can change from one state to another.• When matter changes from one state to another, these changes are referred to as physical changes.• Changes from solid to liquid to gas require heat energy.	<p>In order to meet this standard, it is expected that students should be able to</p> <ul style="list-style-type: none">• classify materials as to whether they are liquids, solids, or gases.• measure the mass of solids and the volume of liquids in metric and standard English units.• design an investigation to determine basic factors that affect the evaporation of water.• examine and describe the transformation of matter from one state to another, i.e., solid water (ice) to liquid (water) to gas (steam).• conduct an investigation to observe the condensation of water.• describe and identify examples of condensation, evaporation, melting, and freezing of water.• identify the uses of water in the home and at school.

Grade Two 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.

Strand: Life Processes

Standard 2.4

The student will investigate and understand that plants and animals undergo a series of orderly changes in their life cycles. Key concepts include

- a) some animals (frogs and butterflies) undergo distinct stages during their lives, while others generally resemble their parents; and
- b) flowering plants undergo many changes, from the formation of the flower to the development of the fruit.

Understanding the Standard

In 2.4 students investigate and understand that plants and animals undergo change throughout their lives. This concept builds upon K.6, in which students learn about the basic needs and life processes of animals, and 1.4, in which they learn that plants have life needs and functional parts and can be classified according to certain characteristics. It is intended that students will actively develop scientific investigation, reasoning, and logic skills (2.1) in the context of the key concepts presented in this standard.

Standard 2.4

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none">• Throughout their lives, plants and animals undergo a series of orderly and identifiable changes.• Changes in living things over time occur in cycles and differ among the various plants and animals.• Some animals, such as frogs and butterflies, go through distinct stages as they mature to adults. Other animals, such as deer, resemble their parents from birth to maturity and do not have distinct stages.• An important part of the life cycle of a flowering plant is the formation of the flower to the development of the fruit.	<p>In order to meet this standard, it is expected that students should be able to</p> <ul style="list-style-type: none">• describe changes in the life cycle of a frog and a butterfly.• identify and describe changes in a plant from flower (blossom) to fruit.• compare and contrast life cycles of a frog and a butterfly.• construct and interpret models/diagrams of animal and plant life cycles.

Grade Two Science Strand

Living Systems

This strand begins in second grade and builds from basic to more complex understandings of a system, both at the ecosystem level and at the level of the cell. The concept of kingdoms of living things and a general classifying of organisms are also presented. The other major topics developed in the strand include the types of relationships among organisms in a food chain, different types of environments and the organisms they support, and the relationship between organisms and their nonliving environment. This strand includes science standards 2.5, 3.5, 3.6, 4.5, 5.5, and 6.7.

Strand: Living Systems

Standard 2.5

The student will investigate and understand that living things are part of a system. Key concepts include

- a) living organisms are interdependent with their living and nonliving surroundings; and
- b) habitats change over time due to many influences.

Understanding the Standard

In K.6 students are introduced to the concept of living and nonliving. Students are introduced to living systems in 2.5 and investigate and understand that living things interact with other living things and their surroundings. The formal word *system* is introduced in this standard. The expectation is that students understand the concept in terms of the interactions between living and nonliving things. It is intended that students will actively develop scientific investigation, reasoning, and logic skills (2.1) in the context of the key concepts presented in this standard.

Standard 2.5

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none">• Living things are dependent on other living things and their nonliving surroundings for survival.• All of the interactions between and among living things and their nonliving surroundings are referred to as a <i>system</i>.• Shelter may be living (coral, tree) or nonliving (caves, houses).• The habitats of living things, such as forests, grasslands, rivers, and streams, change due to many influences. Habitats change from season to season.	<p>In order to meet this standard, it is expected that students should be able to</p> <ul style="list-style-type: none">• classify objects as to whether they are living or nonliving.• describe the nonliving components of an organism's surroundings, including water, space, and shelter. (Shelter may be living or nonliving.)• construct and interpret simple models of different kinds of habitats, including a forest and a stream.• predict and describe seasonal changes in habitat and their effects on plants and animals, for example, how trees change through the seasons and how animals respond to changes in the seasons.• describe how animals are dependent on their surroundings, for example, how squirrels and other animals are affected by the loss of forest habitat.

Grade Two Science Strand

Interrelationships in Earth/Space Systems

This strand focuses on student understanding of how Earth systems are connected and how the Earth interacts with other members of the solar system. 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 2.6

The student will investigate and understand basic types, changes, and patterns of weather. Key concepts include

- a) temperature, wind, precipitation, drought, flood, and storms; and
- b) the uses and importance of measuring and recording weather data.

Understanding the Standard

In K.8 students conduct weather observations, and in 1.6 and 1.7 students are introduced to the concept that the sun is the source of heat and light for the Earth, and to the ways heat, light, and precipitation affect people and other living things. In 2.6 students investigate and understand types of weather and weather patterns and measure and record weather data. It is intended that students will actively develop scientific investigation, reasoning, and logic skills (2.1) in the context of the key concepts presented in this standard.

Standard 2.6

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none">• The Earth’s weather changes continuously from day to day.• Changes in the weather are characterized by daily differences in wind, temperature, and precipitation. Precipitation occurs when water, previously evaporated, condenses out of the air and changes state from a gas to a liquid (rain) or to a solid (snow or sleet).• Extremes in the weather, such as too little or too much precipitation, can result in droughts or floods.• Storms have powerful winds, which may be accompanied by rain, snow, or other kinds of precipitation.• Weather data is collected and recorded using instruments. This information is very useful for predicting weather and determining weather patterns.• Weather influences human activity.	<p>In order to meet this standard, it is expected that students should be able to</p> <ul style="list-style-type: none">• observe and describe types of precipitation, including rain, snow, and ice (sleet and hail).• observe and describe precipitation in terms of evaporation and condensation of water.• observe and record daily weather conditions, such as sunny, cloudy, windy, rainy, or snowy.• describe weather in terms of temperature, wind, and precipitation.• measure and record weather data, using weather instruments, including a thermometer, rain gauge, and weather vane (standard English and metric measures).• record and interpret daily temperature, using a graph with numbered axes.• observe and describe seasonal weather patterns and local variations.• identify common types of storms. Examples include hurricanes, tornadoes, blizzards, and thunderstorms.• compare and contrast droughts and floods.• evaluate the influence of daily weather conditions on personal activities and dress.

Grade Two 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.

Strand: Earth Patterns, Cycles, and Change

Standard 2.7

The student will investigate and understand that weather and seasonal changes affect plants, animals, and their surroundings. Key concepts include

- a) effects on growth and behavior of living things (migration, hibernation, camouflage, adaptation, dormancy); and
- b) weathering and erosion of the land surface.

Understanding the Standard

Students are introduced to the concepts of patterns, cycles, and change in standards K.8 and K.9. These concepts include, in K.8, weather observations, shapes and forms of common natural objects (seeds, cones, and leaves), animal and plant growth, and home and school routine. K.9 introduces concepts that include natural and human-made things that change over time, either fast or slow, and that change can be measured. In 1.7 students investigate and understand the relationship between seasonal change and weather. Important concepts include how plants, animals, and people respond to changes in light, temperature, and precipitation. In 2.7 the students investigate and understand that weather and seasons affect plants, animals, and their surroundings. The effects of weather and seasonal changes on weathering and erosion of the land surface are included in 2.7. It is intended that students will actively develop scientific investigation, reasoning, and logic skills (2.1) in the context of the key concepts presented in this standard.

Standard 2.7

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none">• Living things respond to weather and seasonal changes. This can be reflected in changes in growth and behavior.• Adverse conditions of weather may slow the growth and development of plants and animals (<i>dormancy</i>), whereas optimal weather conditions may accelerate the growth and development of plants and animals.• Many trees produce new leaves in the spring and lose them in the fall due to seasonal changes in temperature and light.• The outward coloration and coloration patterns of many animals are similar in appearance to the plants in the places in which they live. This similarity to background is referred to as <i>camouflage</i>, and it enables animals to hide and avoid those that may eat or harm them.• Some animals travel from one place to another and back again (<i>migration</i>) or go into a deep sleep (<i>hibernation</i>) due to seasonal changes.• Some animals (geese, monarch butterflies) migrate. Some animals (bears, groundhogs) hibernate. Some animals undergo physical changes (thickening of dog fur in the winter and shedding in the summer) from season to season.	<p>In order to meet this standard, it is expected that students should be able to</p> <ul style="list-style-type: none">• identify growth and behavioral responses of plants and animals to weather and seasonal changes. Examples of responses that are adaptive include migration, hibernation, and dormancy.• identify animals that migrate, hibernate, or show other changes throughout the seasons or in the presence of adverse environmental conditions.• evaluate the usefulness of camouflage in an animal's habitat (for example, coloration patterns in frogs).• compare and contrast the responses of plants and animals to weather and seasonal changes.• model the effects of weathering and erosion on the land surface.

Standard 2.7 (continued)

Overview	Essential Knowledge, Skills, and Processes
<ul style="list-style-type: none">• Land surfaces are subject to the agents of weathering and erosion. Land surfaces that are not covered with or protected by plants are more likely to be subject to the loss of soil by wind and water.• <i>Weathering</i> is the breaking down of rocks.• <i>Erosion</i> is the process by which the products of weathering are moved from one place to another.	

Grade Two Science Strand

Resources

This strand focuses on student understanding of the role of resources in the natural world and how people can utilize those resources in a sustainable way. An important idea represented in this strand is the concept of management of resource use. This begins with basic ideas of conservation and proceeds to more abstract consideration of costs and benefits. The topics developed include conservation of materials, 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 2.8

The student will investigate and understand that plants produce oxygen and food, are a source of useful products, and provide benefits in nature. Key concepts include

- a) important plant products (fiber, cotton, oil, spices, lumber, rubber, medicines, and paper);
- b) the availability of plant products affects the development of a geographic area; and
- c) plants provide homes and food for many animals and prevent soil from washing away.

Understanding the Standard

In K.10 students investigate and understand that materials can be used, recycled, and conserved, while in 1.8 students investigate and understand that natural resources, which are identified as plants, animals, water, air, land, minerals, forests, and soil, are limited. In 2.8 students investigate and understand that plants produce oxygen and food, are a source of useful products, and provide benefits in nature. It is intended that students will actively develop scientific investigation, reasoning, and logic skills (2.1) in the context of the key concepts presented in this standard.

Standard 2.8

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none">• Plants provide many useful products and materials, which benefit human beings as well as other living things.• Plant products include such essentials as oxygen and food, as well as materials useful for clothing and shelter.• Plants may grow well only in certain geographic areas, thus enabling the production of plant products that allow humans to live in as well as to develop those areas.• Plants provide homes and food for many animals.• Plants are also important agents in the prevention of soil erosion.	<p>In order to meet this standard, it is expected that students should be able to</p> <ul style="list-style-type: none">• comprehend that plants produce oxygen and food.• classify and identify the sources and uses of plant products, such as fiber, cotton, oil, spices, lumber, rubber, medicines, and paper.• describe plant products grown in Virginia that are useful to people, including wood, fruits, and vegetables. List and classify plant products.• compare and contrast different ways animals use plants as homes and shelters.• construct and interpret a chart illustrating the plant foods consumed by different animals.• construct and interpret a model that demonstrates how plants prevent soil erosion.