Science Standards of Learning

Curriculum Framework 2010

Grade Three

Board of Education
Commonwealth of Virginia

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by the

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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.

Grade Three
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 3.1 represent more specifically what a student should be able to do as a result of science experiences in third grade. Across the grade levels, the skills in the "Scientific Investigation, Reasoning, and Logic" strand 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 standard 3.1 are a key part of this sequence (i.e., K.1, K.2, 1.1, 2.1, 3.1, 4.1, 5.1, and 6.1). The third-grade curriculum should ensure that skills from preceding grades are continuously reinforced and developed.

3.1	The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which a) observations are made and are repeated to ensure accuracy; b) predictions are formulated using a variety of sources of information; c) objects with similar characteristics or properties are classified into at least two sets and two subsets; d) natural events are sequenced chronologically; e) length, volume, mass, and temperature are estimated and measured in metric and standard English units using proper tools and techniques; f) time is measured to the nearest minute using proper tools and techniques; g) questions are developed to formulate hypotheses; h) data are gathered, charted, graphed, and analyzed; i) unexpected or unusual quantitative data are recognized; j) inferences are made and conclusions are drawn; k) data are communicated; l) models are designed and built; and m) current applications are used to reinforce science concepts.

Overview

The skills defined in standard 3.1 are intended to define the "investigate" component and the understanding of the nature of science for all of the other third-grade standards (3.2–3.11). The intent of standard 3.1 is that students will continue to develop a range of inquiry skills and achieve proficiency with those skills in the context of the concepts developed at the third grade, and continue to strengthen their understanding of the components of the nature of science. **Standard 3.1 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 third-grade standards.** For example, it is not expected that teachers should develop a separate unit on the metric system, but that they should integrate metric measurement into the teaching of the rest of the third-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.

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Understanding the Standard
(Background Information for Instructor Use Only)

- 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:
  a) the natural world is understandable;
  b) science is based on evidence, both observational and experimental;
  c) science is a blend of logic and innovation;
  d) scientific ideas are durable yet subject to change as new data are collected;
  e) science is a complex social endeavor; and
  f) scientists try to remain objective and engage in peer review to help avoid bias.

  In grade three, an emphasis should be placed on concepts a, b, c, and e.
- 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.
- Science demands evidence. Scientists develop their ideas based on

Essential Knowledge, Skills, and Processes

In order to meet this standard, it is expected that students will

- make and communicate careful observations.
- demonstrate that observations should be repeated to ensure accuracy.
- classify objects into at least two major sets and subsets based on similar characteristics, such as predator/prey and herbivore, carnivore, and omnivore.
- sequence natural events chronologically (Example: 3.8 — plant and animal life cycles, phases of the moon, the water cycle, and tidal change).
- measure length to the nearest centimeter, mass to the nearest gram, volume to the nearest milliliter, temperature to the nearest degree Celsius, and time to the nearest minute, using the appropriate instruments.
- develop hypotheses from simple questions. These questions should be related to the concepts in the third-grade standards. Hypotheses should be stated in terms such as: "If an object is cut into smaller pieces, then

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Understanding the Standard (Background Information for Instructor Use Only)	**Essential Knowledge, Skills, and Processes**
evidence and they change their ideas when new evidence becomes available or the old evidence is viewed in a different way. • Science uses both logic and innovation. Innovation has always been an important part of science. Scientists draw upon their creativity to visualize how nature works, using analogies, metaphors, and mathematics. • Science is a complex social activity. 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 third-grade students to engage in frequent discussions with peers about their understanding of their investigations. • Questions frequently arise from observations. Hypotheses can be developed from those questions. Data gathered from an investigation	the physical properties of the object and its smaller pieces will remain the same." • analyze data that have been gathered and organized. • communicate results of investigations by displaying data in the form of tables, charts, and graphs. Students will construct bar and picture graphs and line plots to display data (Example: 3.7 — comparison of types of soil and their effect on plant growth). • communicate any unexpected or unusual quantitative data that are noted. • make and communicate predictions about the outcomes of investigations. • design and build a model to show experimental results.

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Understanding the Standard (Background Information for Instructor Use Only)	**Essential Knowledge, Skills, and Processes**
may support a hypothesis. A hypothesis is a statement written in a manner that describes the cause and effect relationship between the independent and dependent variables in an experiment. At the third-grade level, a method for helping students understand how to develop a hypothesis is to have them build "if/then" statements (e.g., If heat is added to ice, then the ice will melt.). • Complete observations are made using all of the senses. Simple instruments can help extend the senses (e.g., magnifying glass enhances the vision of an item). • Predictions are statements of what is expected to happen in the future based on past experiences and observations. • In order for data from an investigation to be most useful, it must be organized so that it can be examined more easily. • Charts and graphs are powerful tools for reporting and organizing data. • It is sometimes useful to organize objects according to similarities and differences. By organizing objects in sets and subsets, it may be easier to determine a specific type of characteristic.	

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Understanding the Standard (Background Information for Instructor Use Only)	**Essential Knowledge, Skills, and Processes**
• An inference is a tentative explanation based on background knowledge and available data. • A conclusion is a summary statement based on the results of an investigation. • Putting natural events in a sequence allows us to notice change over time. • Metric measures, including centimeters, grams, milliliters, and degrees Celsius, are a standard way to record measurements. The metric system is recognized everywhere around the world. • When using any standard measurement scale, measure to the marked increment and estimate one more decimal place. Scientists do not round their measurements as this would be inaccurate. • A bar graph can be horizontal or vertical, and it compares amounts. Both the X- and Y-axis need to be identified. • A line plot shows the spread of data. *(See Grade 3 Mathematics Curriculum Framework, Standard 3.17, page 31.)*	

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Understanding the Standard (Background Information for Instructor Use Only)	**Essential Knowledge, Skills, and Processes**
• A picture graph is similar to a bar graph except that it uses symbols to represent quantities. • Scientists use a variety of modes to communicate about their work. Examples of ways they communicate include oral presentations; graphs and charts created to visualize, analyze and present information about their data; and written reports. • In science, it is important that experiments and the observations recorded are replicable. There are two different types of data – qualitative and quantitative. Qualitative data deal with descriptions and data that can be observed, but not measured precisely. Quantitative data are data that can be counted or measured and the results can be recorded using numbers. Quantitative data can be represented visually in graphs and charts. Quantitative data define, whereas qualitative data describe. Quantitative data are more valuable in science because they allow direct comparisons between observations made by different people or at different times.	

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Understanding the Standard
(Background Information for Instructor Use Only)

Example of Qualitative Data vs. Quantitative Data

Third-Grade Class

Qualitative Data	Quantitative Data
• Friendly	• 25 students
• Like science	• 10 girls, 15 boys
• Positive about schoolwork	• 68 percent have perfect attendance

Essential Knowledge, Skills, and Processes

Grade Three
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.

3.2	The student will investigate and understand simple machines and their uses. Key concepts include a) purpose and function of simple machines; b) types of simple machines; c) compound machines; and d) examples of simple and compound machines found in the school, home, and work environments.

Overview

This standard introduces students to six types of simple machines, their uses, and examples of these six machines found in everyday environments. These simple machines function to make doing work easier. Activities should focus on identifying the six simple machines, explaining how they operate, and locating examples in everyday life that make a task easier at home, in school, and in the workplace. The students should have experiences using the simple and compound machines to determine how each makes a task easier. It is intended that students will actively develop and utilize scientific investigation, reasoning, and logic skills (3.1) in the context of the key concepts presented in this standard.

3.2 The student will investigate and understand simple machines and their uses. Key concepts include
a) purpose and function of simple machines;
b) types of simple machines;
c) compound machines; and
d) examples of simple and compound machines found in the school, home, and work environments.

Understanding the Standard
(Background Information for Instructor Use Only)

- Simple machines are tools that make work easier. Examples of tasks made easier include lifting a heavy weight, moving a heavy object over a distance, pushing things apart, changing the direction of a force, or holding an object together.
- The six simple machines are the lever, inclined plane, wedge, wheel and axle, screw, and pulley.
- The lever is a stiff bar that moves about a fixed point (fulcrum). It is a simple machine that is used to push, pull, or lift things. Examples include a seesaw, crowbar, and shovel.
- The inclined plane is a flat surface that is raised so one end is higher than the other. The inclined plane helps move heavy objects up or down. An example is a ramp.
- The wedge is wide at one end and pointed at the other to help cut or split other objects. Examples include a knife or ax.
- The wheel and axle consists of a rod attached to a wheel. A wheel and axle makes it easier to move or turn things. Examples include bicycle wheels, roller skates, and a door knob.
- The screw is an inclined plane wrapped around a cylinder or cone. A common use of the screw is to hold objects together. Examples include a jar lid and wood screw.
- The pulley is a wheel that has a rope wrapped around it. Pulleys can be used to lift heavy objects by changing the direction or amount of the force. Examples include a flagpole.
- A compound machine is a combination of two or more simple machines. Examples include scissors, wheelbarrow, and bicycle.

Essential Knowledge, Skills, and Processes

In order to meet this standard, it is expected that students will

- identify and differentiate the six types of simple machines: lever, screw, pulley, wheel and axle, inclined plane, and wedge.
- differentiate and classify specific examples of simple machines found in school and household items. These include a screwdriver, nutcracker, screw, flagpole pulley, ramp, and seesaw.
- analyze the application of and explain the function of each of the six types of simple machines. An example would be that an inclined plane is a ramp to make it easier for a heavy object to be moved up or down.
- identify and classify the simple machines which compose a compound machine, such as scissors, wheelbarrow, and bicycle.
- design and construct an apparatus that contains a simple machine.

Grade Three
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 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.

3.3	The student will investigate and understand that objects are made of materials that can be described by their physical properties. Key concepts include a) objects are made of one or more materials; b) physical properties remain the same as the material is changed in visible size; and c) visible physical changes are identified.

Overview

Students should understand that all objects are made of materials that have observable physical properties. Every object that takes up space is made of matter. Materials can be different colors, shapes, textures, or sizes. They can be hard or soft. The properties of objects can be used to sort or classify them. If materials are broken down into smaller visible parts, each of these smaller parts still has the same physical properties as the original material. Clear examples include plastics, metal, paper, and ice. Substances that are coarse mixtures (e.g., many types of rock) are not good examples. It is intended that students will actively develop and utilize scientific investigation, reasoning, and logic skills (3.1) in the context of the key concepts presented in this standard.

3.3 The student will investigate and understand that objects are made of materials that can be described by their physical properties. Key concepts include

a) objects are made of one or more materials;
b) physical properties remain the same as the material is changed in visible size; and
c) visible physical changes are identified.

Understanding the Standard (Background Information for Instructor Use Only)	**Essential Knowledge, Skills, and Processes**
• Objects are made of one or more materials (e.g., toys, shoes, and furniture). • Physical properties (e.g., color, texture, phase, temperature, ability to dissolve in water) remain the same even if the visible material (e.g., plastic, paper, metal, ice) is reduced in size. • Nanotechnology is the study of materials at the molecular (atomic) scale. Items at this scale are so small they are no longer visible with the naked eye. Nanotechnology has shown that the behavior and properties of some substances at the nanoscale (a nanometer is one-billionth of a meter) contradict how they behave and what their properties are at the visible scale.	In order to meet this standard, it is expected that students will • explain that physical properties are observable characteristics that enable one to differentiate objects. • infer that objects are made of one or more materials based on observations of the physical properties that are common to each individual object. • compare the physical properties of smaller, visible pieces of a material to those physical properties of the entire material. • conclude that materials have their own set of physical properties that are observable. • design an investigation to determine if the physical properties of a material will remain the same if the material is reduced in size.

Grade Three
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.

3.4	The student will investigate and understand that adaptations allow animals to satisfy life needs and respond to the environment. Key concepts include a) behavioral adaptations; and b) physical adaptations.

Overview

Students will compare and contrast the physical and behavioral characteristics of different animals that allow the animals to adapt and respond to life needs. The students will need to describe specific examples of how animals gather food, find shelter, defend themselves, and rear young. The concepts of hibernation, migration, camouflage, mimicry, instinct, and learned behavior are specific ways in which animals respond to their environment. It is intended that students will actively develop and utilize scientific investigation, reasoning, and logic skills (3.1) in the context of the key concepts presented in this standard.

3.4 The student will investigate and understand that adaptations allow animals to satisfy life needs and respond to the environment. Key concepts include
a) behavioral adaptations; and
b) physical adaptations.

Understanding the Standard (Background Information for Instructor Use Only)	**Essential Knowledge, Skills, and Processes**
• In order to survive, animals act in different ways to gather and store food, find shelter, defend themselves, and rear their young. • Physical adaptations help animals survive in their environment (e.g., camouflage, mimicry). • Various animals possess adaptations which help them blend into their environments to protect themselves from enemies (camouflage). Camouflage is the means by which animals escape the notice of predators, usually because of a resemblance to their surroundings using coloration or outer coverage patterns. • Mimicry occurs when a species has features similar to another species. Either one or both are protected when a third species cannot tell them apart. (Mimicry happens in both animal and plant species.) Some animals look like other animals to avoid being eaten (mimicry). This adaptation helps protect them from their predators. (For example, the viceroy butterfly tastes good to birds, but the monarch butterfly tastes bad. Because the viceroy looks like the monarch butterfly, it is safer from predators.) Mimicry can also occur as mimicked behaviors, mimicked sounds, or mimicked scents. • Behavioral adaptations allow animals to respond to life needs. Examples include hibernation, migration, dormancy, instinct, and learned behavior. • Some animals (e.g., groundhogs, black bears) go into a deep sleep in which their body activities slow down due to seasonal changes and they can live off stored food (hibernation). Hibernation is a condition of biological rest or inactivity where growth, development, and metabolic processes slow down. • Some animals (e.g., geese, monarch butterflies, tundra swans) go on a	In order to meet this standard, it is expected that students will • give examples of methods that animals use to gather and store food, find shelter, defend themselves, and rear young. • describe and explain the terms camouflage, mimicry, hibernation, migration, dormancy, instinct, and learned behavior. • explain how an animal's behavioral adaptations help it live in its specific habitat. • distinguish between physical and behavioral adaptations of animals. • compare the physical characteristics of animals, and explain how the animals are adapted to a certain environment. • compare and contrast instinct and learned behavior. • create (model) a camouflage pattern for an animal living in a specific dry-land or water-related environment. (Relates to 3.6.) • design and construct a model of a habitat for an animal with a specific adaptation.

3.4	The student will investigate and understand that adaptations allow animals to satisfy life needs and respond to the environment. Key concepts include a) behavioral adaptations; and b) physical adaptations.

Understanding the Standard (Background Information for Instructor Use Only)	**Essential Knowledge, Skills, and Processes**
long-distance journey from one place to another (migration) in search of a new temporary habitat because of climate, availability of food, season of the year, or reproduction. • Dormancy is a state of reduced metabolic activity adopted by many organisms (both plants and animals) under conditions of environmental stress or, when such stressful conditions are likely to appear, as in winter. • Some animals are born with natural behaviors that they need in order to survive in their environments (instincts). These behaviors are not learned but are instinctive, such as a beaver building a dam or a spider spinning a web. • Some behaviors need to be taught in order for the animal to survive, such as a bear cub learning to hunt (learned behavior).	

Grade Three
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 organisms and a general classifying of them 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.

3.5	The student will investigate and understand relationships among organisms in aquatic and terrestrial food chains. Key concepts include a) producer, consumer, decomposer; b) herbivore, carnivore, omnivore; and c) predator and prey.

Overview

This standard focuses on student understanding of the food chain in water and land environments. It focuses on the types of relationships among living organisms and their dependence on each other for survival. The strand focuses on the life processes of plants and animals and the specific needs of each. The major topics developed in the strand include the 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.7, 1.4, 1.5, 2.4, 3.4, 4.4, and 6.7. It is intended that students will actively develop and utilize scientific investigation, reasoning, and logic skills (3.1) in the context of the key concepts presented in this standard.

3.5 The student will investigate and understand relationships among organisms in aquatic and terrestrial food chains. Key concepts include
a) producer, consumer, decomposer;
b) herbivore, carnivore, omnivore; and
c) predator and prey.

Understanding the Standard (Background Information for Instructor Use Only)	**Essential Knowledge, Skills, and Processes**
• A food chain shows a food relationship among plants and animals in a specific area or environment. • Terrestrial organisms are found on land habitats such as deserts, grasslands, and forests. Aquatic organisms are found in water habitats such as ponds, marshes, swamps, rivers, and oceans. • A green plant makes its own food using sunlight, air, and water. Green plants are producers. • A consumer is an animal that eats living organisms (plant or animal). • Certain organisms break down decayed plants and animals into smaller pieces that can be used again by other living organisms. These organisms are decomposers. • A food chain, which shows part of a food web, can have an animal that eats only plants (herbivore). It can have an animal that eats only other animals (carnivore). It can also have an animal that eats both plants and animals (omnivore). • An animal can hunt other animals to get its food (predator). • An animal can be hunted by another animal for food (prey).	In order to meet this standard, it is expected that students will • differentiate between predators and prey. • distinguish among producers, consumers, herbivores, omnivores, carnivores, and decomposers. • infer that most food chains begin with a green plant. • identify sequences of feeding relationships in a food chain. • explain how a change in one part of a food chain might affect the rest of the food chain. • create and interpret a model of a food chain showing producers and consumers.

3.6	The student will investigate and understand that ecosystems support a diversity of plants and animals that share limited resources. Key concepts include a) aquatic ecosystems; b) terrestrial ecosystems; c) populations and communities; and d) the human role in conserving limited resources.

Overview

Students should become familiar with several specific examples of aquatic and terrestrial ecosystems and the plants and animals unique to them. The water-related ecosystems to be discussed are the pond, marshland, swamp, stream, river, and ocean, and the dry-land ecosystems to be discussed are the desert, grassland, rain forest, and forest. Water-related and dry-land ecosystems contain many types of plants and animals that often compete for the same natural resources. These resources are often shared. Students will also explore the human role in protecting and conserving limited resources in the various ecosystems. It is intended that students will actively develop and utilize scientific investigation, reasoning, and logic skills (3.1) in the context of the key concepts presented in this standard.

3.6 The student will investigate and understand that ecosystems support a diversity of plants and animals that share limited resources. Key concepts include

a) aquatic ecosystems;
b) terrestrial ecosystems;
c) populations and communities; and
d) the human role in conserving limited resources.

Understanding the Standard (Background Information for Instructor Use Only)	**Essential Knowledge, Skills, and Processes**
• Water-related ecosystems include those with fresh water or salt water. Examples include ponds, marshes, swamps, streams, rivers, and oceans. • Dry-land ecosystems include deserts, grasslands, rain forests, and forests. • There are distinct differences among pond, marshland, swamp, stream, river, ocean, desert, grassland, rainforest, and forest ecosystems. • A population is a group of organisms of the same kind that lives in the same place. Examples of a population are a flock of swans in a pond, a school of fish in a river, and a herd of cattle in the grassland. • A community is all of the populations that live together in the same place. An example of a dry-land community would be a forest made up of trees, squirrels, worms, rabbits, and hawks. An example of a water-related community would be an ocean made up of fish, crabs, and seaweed. • Organisms compete for the limited resources in their specific ecosystem. • Humans need to help conserve limited resources.	In order to meet this standard, it is expected that students will • describe major water-related ecosystems and examples of animals and plants that live in each. • describe major dry-land ecosystems and examples of animals and plants that live in each. • compare and contrast water-related and dry-land ecosystems. • explain how animals and plants use resources in their ecosystem. • distinguish between a population and a community. • predict what would occur if a population in a specific ecosystem was to die. • analyze models or diagrams of different water-related ecosystems in order to describe the community of organisms each contains and interpret how the organisms use the resources in that ecosystem. • analyze models or diagrams of different dry-land ecosystems in order to describe the community of organisms each contains and interpret how the organisms use the resources in that ecosystem. • list ways that humans can help conserve limited resources.

Grade Three
Science Strand

Interrelationships in Earth/Space Systems

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

3.7	The student will investigate and understand the major components of soil, its origin, and its importance to plants and animals including humans. Key concepts include a) soil provides the support and nutrients necessary for plant growth; b) topsoil is a natural product of subsoil and bedrock; c) rock, clay, silt, sand, and humus are components of soils; and d) soil is a natural resource and should be conserved.

Overview

Students should know that most plants grow in soil and that people and many other animals are dependent on plants for food. The nutrients in soil are materials that plants and animals need to live and grow. Soil takes a long time to form; therefore, it should be conserved. Soil is made up of humus, silt, rock, and sand. Humus is decayed (once living) matter in soil. It is intended that students will actively develop and utilize scientific investigation, reasoning, and logic skills (3.1) in the context of the key concepts presented in this standard.

3.7 The student will investigate and understand the major components of soil, its origin, and its importance to plants and animals including humans. Key concepts include

a) soil provides the support and nutrients necessary for plant growth;
b) topsoil is a natural product of subsoil and bedrock;
c) rock, clay, silt, sand, and humus are components of soils; and
d) soil is a natural resource and should be conserved.

Understanding the Standard (Background Information for Instructor Use Only)	**Essential Knowledge, Skills, and Processes**
• Soil is important because many plants grow in soil, and it provides support and nutrients for the plants. • Over many years, weather, water, and living organisms help break down rocks and create soil (weathering). • Nutrients are materials that plants and animals need to live and grow. • Rock, clay, silt, sand, and humus are components of soil. • Topsoil is the upper soil surface and a natural product of subsoil and bedrock. Topsoil is best for plant growth. • Subsoil and bedrock are layers of soil under the topsoil that are formed over a long period of time by the action of water. • Subsoil and bedrock are not as good for growing plants as is topsoil. • Humus is decayed matter in soil. It adds nutrients to the soil. It is located in the topsoil. • Clay contains tiny particles of soil that hold water well and provides nutrients. • Sand is made up of small grains of worn-down rock, has few nutrients, and does not hold water well. • Silt is made up of very small broken pieces of rock. Its particles are larger than clay and smaller than sand. • Since soil takes a long time to form, it should be conserved, not wasted.	In order to meet this standard, it is expected that students will • observe and recognize that soil, as a natural resource, provides the support and nutrients necessary for plant growth. • understand the key terminology related to soil, including humus, nutrients, topsoil, and bedrock. • interpret and illustrate a basic diagram showing major soil layers, including bedrock, subsoil, and topsoil. • analyze and describe the different components of soil, including rock fragments, clay, silt, sand, and humus. • explain how soil forms over time. • design an investigation to compare how different types of soil affect plant growth. This includes organizing data in tables and constructing simple graphs. • collect, chart, and analyze data on soil conservation on the school grounds. • evaluate the importance of soil to people. • describe how soil can be conserved.

Grade Three
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 organisms. 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 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.

3.8	The student will investigate and understand basic patterns and cycles occurring in nature. Key concepts include a) patterns of natural events such as day and night, seasonal changes, simple phases of the moon, and tides; b) animal life cycles; and c) plant life cycles.

Overview

This standard focuses on students understanding that many events on Earth happen in cycles or patterns. Examples of these patterns are day turning into night and night into day. Seasons cycle from fall to winter to spring to summer and back to fall. Light reflecting from the sun causes the moon to appear illuminated. The phases of the moon appear in sequence as the moon makes one revolution around Earth. Seasons are caused by the tilt of Earth as it revolves around the sun. The main cause of the tides is the gravitational attraction between Earth and the moon. Plants and animals also undergo life cycles from birth to death. It is intended that students will actively develop and utilize scientific investigation, reasoning, and logic skills (3.1) in the context of the key concepts presented in this standard.

3.8 The student will investigate and understand basic patterns and cycles occurring in nature. Key concepts include
a) patterns of natural events such as day and night, seasonal changes, simple phases of the moon, and tides;
b) animal life cycles; and
c) plant life cycles.

Understanding the Standard
(Background Information for Instructor Use Only)

- A cycle is a repeated pattern. A sequence is a series of events that occur in a natural order.
- The pattern of day and night is caused by the rotation of Earth. One complete rotation occurs every 24 hours. The part of Earth toward the sun has daylight while the part of Earth away from the sun has night.
- The pattern of seasonal changes takes place because Earth's axis is tilted toward or away from the sun during its revolution around the sun. Because the tilt of Earth on its axis is 23.5°, the sun's energy is not equally intense at different latitudes. Rays striking Earth near the equator do so at close to a 90° angle. Rays striking Earth near the poles do so at a much smaller angle and thus the same amount of sunlight is spread over a larger area. For this reason, the same amount of energy from the sun will be less intense nearer the poles and these areas will have a colder climate. Earth takes 365¼ days, or one year, to make one revolution.
- The cycle of moon phases occurs as the moon makes one revolution around Earth. The visible portion of the moon that we see each night follows a pattern.
- The tides follow a pattern of two high and two low tides every 24 hours. This pattern is caused for the most part by the gravitational attraction between Earth and the moon.
- Plants and animals undergo life cycles (e.g., Frogs begin as eggs in water. The eggs grow into tadpoles, the tadpoles eventually become frogs, and the adult frogs lay eggs to start a new life cycle over again. In the plant life cycle, a seed grows into a new plant that forms seeds. Then the new seeds repeat the life cycle.).

Essential Knowledge, Skills, and Processes

In order to meet this standard, it is expected that students will

- explain how some events in nature occur in a pattern or cycle, such as the seasons, day and night, phases of the moon (first quarter, full, last [third] quarter, new), tides, and life cycles.
- recognize that the relationships that exist between and among Earth, the sun, and the moon result in day and night, seasonal changes, phases of the moon, and the tides.
- model and describe how Earth's rotation causes day and night.
- model and describe how the sun's rays strike Earth to cause seasons.
- observe, chart, and illustrate phases of the moon (first quarter, full, last [third] quarter, new), and describe the changing pattern of the moon as it revolves around Earth.
- collect and analyze data from simple tide tables to determine a pattern of high and low tides.
- explain the pattern of growth and change that organisms, such as the frog and butterfly undergo during their life cycle.

3.9	The student will investigate and understand the water cycle and its relationship to life on Earth. Key concepts include a) there are many sources of water on Earth; b) the energy from the sun drives the water cycle; c) the water cycle involves several processes; d) water is essential for living things; and e) water on Earth is limited and needs to be conserved.

Overview

This standard introduces students to the movement of water on Earth by evaporation, condensation, and precipitation, which is called the water cycle. All the water on Earth is part of the water cycle. Water is stored in ponds, lakes, streams, rivers, ground water, and oceans. Water is essential to maintain life on Earth and should be conserved as a natural resource. It is intended that students will actively develop and utilize scientific investigation, reasoning, and logic skills (3.1) in the context of the key concepts presented in this standard.

3.9 The student will investigate and understand the water cycle and its relationship to life on Earth. Key concepts include

a) there are many sources of water on Earth;
b) the energy from the sun drives the water cycle;
c) the water cycle involves several processes;
d) water is essential for living things; and
e) water on Earth is limited and needs to be conserved.

Understanding the Standard (Background Information for Instructor Use Only)	**Essential Knowledge, Skills, and Processes**
• The water cycle is the movement of water from the ground to the air and back to the ground by evaporation, condensation, and precipitation. The energy that drives this cycle comes from the sun. • During the water cycle, liquid water is heated and changed to a gas (water vapor). This process is called evaporation. The gas (water vapor) is cooled and changed back to a liquid. This process is called condensation. Water as a liquid or a solid falls to the ground as precipitation. • Our water supply on Earth is limited. Pollution reduces the amount of usable water; therefore, the supply should be conserved carefully. • Water is a simple compound essential for life on Earth. Living cells are mostly water. In each cell, the chemicals necessary for life are dissolved in water.	In order to meet this standard, it is expected that students will • identify the sun as the origin of energy that drives the water cycle. • describe the processes of evaporation, condensation, and precipitation as they relate to the water cycle. • construct and interpret a model of the water cycle. • identify the different ways that organisms get water from the environment. • identify major water sources for a community, including rivers, reservoirs, and wells. Describe the major water sources for the local community. • explain methods of water conservation in the home and school. • identify and communicate the importance of water to people and to other living organisms. • analyze possible sources of water pollution in their neighborhoods, at school, and in the local community. This includes runoff from over-fertilized lawns and fields, oil from parking lots, eroding soil, and animal waste.

Grade Three
Science Strand

Earth 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.11, 1.8, 2.8, 3.10, 3.11, 4.9, and 6.9.

3.10	The student will investigate and understand that natural events and human influences can affect the survival of species. Key concepts include a) the interdependency of plants and animals; b) the effects of human activity on the quality of air, water, and habitat; c) the effects of fire, flood, disease, and erosion on organisms; and d) conservation and resource renewal.

Overview

This standard reinforces the concept that plants and animals are dependent upon each other for survival. Living organisms depend on other living organisms to survive. Human and natural events can change habitats. Natural disasters such as fire, flood, disease, and erosion can kill organisms and destroy their habitats. Methods of ensuring the survival of plant and animal species include specific conservation measures. These are resource renewal, habitat management procedures, and species monitoring practices. It is intended that students will actively develop and utilize scientific investigation, reasoning, and logic skills (3.1) in the context of the key concepts presented in this standard.

3.10 The student will investigate and understand that natural events and human influences can affect the survival of species. Key concepts include
a) the interdependency of plants and animals;
b) the effects of human activity on the quality of air, water, and habitat;
c) the effects of fire, flood, disease, and erosion on organisms; and
d) conservation and resource renewal.

Understanding the Standard (Background Information for Instructor Use Only)	**Essential Knowledge, Skills, and Processes**
• Every organism depends on other organisms to survive. This is called interdependency. • Human actions, such as polluting, can affect the survival of plants and animals. • Natural events, such as fires, floods, diseases, and erosion, can also affect the survival of plant and animal species. • Conservation is the careful use and preservation of our natural resources. • Resource renewal is a conservation practice in which species are protected. An example would be protecting endangered plants by saving their seeds, growing the seeds indoors, and later putting the new plants back in their natural habitats.	In order to meet this standard, it is expected that students will • explain how organisms in an area are dependent on each other. • compare and contrast human influences on the quality of air, water, and habitats. • analyze the effects of fire, flood, disease, and erosion on organisms and habitats. • describe how conservation practices can affect the survival of a species. • describe a conservation practice in the local community.

3.11	The student will investigate and understand different sources of energy. Key concepts include a) energy from the sun; b) sources of renewable energy; and c) sources of nonrenewable energy.

Overview

This standard focuses on Earth's major types of energy sources. The sun produces light and thermal energy. Natural forms of energy include sunlight, water, and wind. Important fossil fuels are coal, oil, and natural gas, which were formed over millions of years by decaying plants and animals buried in layers of rock. Sources of energy are classified either as renewable or nonrenewable. It is intended that students will actively develop and utilize scientific investigation, reasoning, and logic skills (3.1) in the context of the key concepts presented in this standard.

3.11 The student will investigate and understand different sources of energy. Key concepts include
a) energy from the sun;
b) sources of renewable energy; and
c) sources of nonrenewable energy.

Understanding the Standard (Background Information for Instructor Use Only)	**Essential Knowledge, Skills, and Processes**
• The sun is the source of almost all energy on Earth. The sun is the direct source of light and thermal energy. • Sunlight, water, and wind are sources of energy. The force of flowing water and moving air (wind) can also be used to generate electricity. • Wood comes from trees. It has many important uses, including its use as a fuel. • Some energy sources are renewable. That means that they can be replaced. Some energy sources are nonrenewable. That means that once they are used up, they are gone and cannot be replaced. Coal, oil, and natural gas are nonrenewable resources. • Fossil fuels, such as coal, oil, and natural gas, are formed from decayed plants and animals. The formation of fossil fuels takes millions of years.	In order to meet this standard, it is expected that students will • explain that the sun is the major source of energy for Earth. • identify sources of energy and their uses. • describe how solar energy, wind, and moving water can be used to produce electricity. • describe how fossil fuels are used as an energy source. • compare and contrast renewable and nonrenewable energy sources. • analyze the advantages and disadvantages of using different naturally occurring energy sources. • design a basic investigation to determine the effects of sunlight on warming various objects and materials, including water.