Important Pacing Guide Information:

The SOLs within this Science pacing guide reflect the new 2010 Science Virginia Standards of Learning. These SOLs will be both taught and assessed during the 2011-2012 school year.

Pacing guides are always a work in progress. Please keep notes regarding your experiences with the pacing guides and associated assessments. This information will be used to improve the pacing guide over time.

A [ ] indicates the length of each unit for non-departmentalized schools.
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 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.
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 5.1 represent more specifically what a student should be able to do as a result of science experiences in fifth 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 5.1 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 fifth-grade curriculum should ensure that skills from preceding grades are continuously reinforced and developed.

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.

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

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 characteristics common to various groups of living organisms, and general and specific classification of organisms based on the characteristics 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.

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.

Earth Patterns, Cycles, and Change
This strand focuses on student understanding of patterns in nature, natural cycles, and changes that occur both quickly and slowly over time. An important idea represented in this strand is the relationship among Earth patterns, cycles, and change and their effects on living things. The topics developed include noting and measuring changes, weather and seasonal changes, the water cycle, cycles in the Earth-moon-sun system, our solar system, and change in Earth’s surface over time. This strand includes science standards K.9, K.10, 1.7, 2.7, 3.8, 3.9, 4.7, 4.8, and 5.7.
Investigations

On-Going ALL YEAR

[SOL 5.1 Short week beginning of the school year]

The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which:

a) items such as rocks, minerals, and organisms are identified using various classification keys;
b) estimates are made and accurate measurements of length, mass, volume, and temperature are made in metric units using proper tools;
c) estimates are made and accurate measurements of elapsed time are made using proper tools;
d) hypotheses are formed from testable questions;
e) independent and dependent variables are identified;
f) constants in an experimental situation are identified;
g) data are collected, recorded, analyzed, and communicated using proper graphical representations and metric measurements;
h) predictions are made using patterns from data collected, and simple graphical data are generated;
i) inferences are made and conclusions are drawn;
j) models are constructed to clarify explanations, demonstrate relationships, and solve needs; and
k) current applications are used to reinforce science concepts.

Overview

The skills in standard 5.1 are intended to define the “investigate” component and the understanding of the nature of science for all of the other fifth-grade standards (5.2–5.7). The intent of standard 5.1 is for students to continue to develop a range of inquiry skills, achieve proficiency with those skills, and develop and reinforce their understanding of the nature of science in the context of the concepts developed at the fifth-grade level. Standard 5.1 does not require a discrete unit be taught on scientific investigation because the skills that make up the standard should be incorporated in all the other fifth-grade standards. It is also intended that by developing these skills, students will achieve a greater understanding of scientific inquiry and the nature of science and will more fully grasp the content-related concepts.

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 five, an emphasis should be placed on concepts a, b, c, d, 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 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.

Essential Knowledge, Skills, and Processes

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

- use classification keys to identify rocks, minerals, and organisms.
- select and use the appropriate instruments, including centimeter rulers, meter sticks, graduated cylinders, balances, stopwatches, and thermometers for making basic measurements.
- make reasonable estimations of length, mass, volume, and elapsed time.
- measure length, mass, volume, and temperature using metric measures. This includes millimeters, centimeters, meters, kilometers, grams, kilograms, milliliters, liters, and degrees Celsius.
Scientists draw upon their creativity to visualize how nature works, using analogies, metaphors, and mathematics.

- Scientific ideas are durable yet subject to change as new data are collected. The main body of scientific knowledge is very stable and grows by being corrected slowly and having its boundaries extended gradually. Scientists themselves accept the notion that scientific knowledge is always open to improvement and can never be declared absolutely certain. New questions arise, new theories are proposed, new instruments are invented, and new techniques are developed.

- Science is a complex social endeavor. It is a complex social process for producing knowledge about the natural world. Scientific knowledge represents the current consensus among scientists 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 fifth-grade students to engage in frequent discussions with peers about their understanding of their investigations.

- Systematic investigations require standard measures and consistent and reliable tools. Metric measures are a standard way to make measurements and are recognized around the world.

- A classification key is an important tool used to help identify objects and organisms. It consists of a branching set of choices organized in levels, with most levels of the key having two choices. Each level provides more specific descriptors, eventually leading to identification.

- A hypothesis is an educated guess/prediction about what will happen based on what you already know and what you have already learned from your research. It must be worded so that it is “testable.” The hypothesis can be written as an “If…, then….” statement, such as “If all light is blocked from a plant for two weeks, then the plant will die.”

- An independent variable is the factor in an experiment that is altered by the experimenter. The independent variable is purposely changed or manipulated.

- A dependent variable is the factor in an experiment that changes as a result of the manipulation of the independent variable.

- The constants in an experiment are those things that are purposefully kept the same throughout the experiment.

- When conducting experiments, data are collected, recorded, analyzed, and communicated using proper graphical representations and metric measurements.

- Systematic investigations require organized reporting of data. The way the data are displayed can make it easier to see important patterns, trends, and relationships. Bar graphs and line graphs are useful tools for reporting discrete data and continuous data, respectively.

- A scientific prediction is a forecast about what may happen in some future situation. It is based on the application of factual information and principles and recognition of trends and patterns.
• Estimation is a useful tool for making approximate measures and giving general descriptions. In order to make reliable estimates, one must have experience using the particular unit.

• 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. Scientific conclusions are based on verifiable observations (science is empirical).

• Scientific modeling is the process of generating abstract, conceptual, graphical and/or mathematical models. It is an approximation or simulation of a real system that omits all but the most essential variables of the system. In order to create a model, a scientist must first make some assumptions about the essential structure and relationships of objects and/or events in the real world. These assumptions are about what is necessary or important to explain the phenomena.

• It is important for students to apply the science content that they have learned to current issues and applications.

| RESOURCES AND ACTIVITIES |   |
Investigations and Scientific Method

SOL 5.1

The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which:

- items such as rocks, minerals, and organisms are identified using various classification keys;
- estimates are made and accurate measurements of length, mass, volume, and temperature are made in metric units using proper tools;
- estimates are made and accurate measurements of elapsed time are made using proper tools;
- hypotheses are formed from testable questions;
- independent and dependent variables are identified;
- constants in an experimental situation are identified;
- data are collected, recorded, analyzed, and communicated using proper graphical representations and metric measurements;
- predictions are made using patterns from data collected, and simple graphical data are generated;
- inferences are made and conclusions are drawn;
- models are constructed to clarify explanations, demonstrate relationships, and solve needs; and
- current applications are used to reinforce science concepts.

Overview

The skills in standard 5.1 are intended to define the “investigate” component and the understanding of the nature of science for all of the other fifth-grade standards (5.2–5.7). The intent of standard 5.1 is for students to continue to develop a range of inquiry skills, achieve proficiency with those skills, and develop and reinforce their understanding of the nature of science in the context of the concepts developed at the fifth-grade level. Standard 5.1 does not require a discrete unit be taught on scientific investigation because the skills that make up the standard should be incorporated in all the other fifth-grade standards. It is also intended that by developing these skills, students will achieve a greater understanding of scientific inquiry and the nature of science and will more fully grasp the content-related concepts.

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

In grade five, an emphasis should be placed on concepts a, b, c, d, 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.

Essential Knowledge, Skills, and Processes

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

- use classification keys to identify rocks, minerals, and organisms.
- select and use the appropriate instruments, including centimeter rulers, meter sticks, graduated cylinders, balances, stopwatches, and thermometers for making basic measurements.
- make reasonable estimations of length, mass, volume, and elapsed time.
- measure length, mass, volume, and temperature using metric measures. This includes millimeters, centimeters, meters, kilometers, grams, kilograms, milliliters, liters, and degrees Celsius.
- use a testable question to form a hypothesis as cause and effect (e.g., “if…, then…”) statement.
- analyze the variables in a simple experiment and identify the independent and dependent variables, and the constants.
• Science demands evidence. Scientists develop their ideas based on evidence and they change their ideas when new evidence becomes available or the old evidence is viewed in a different way.

• 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.

• Scientific ideas are durable yet subject to change as new data are collected. The main body of scientific knowledge is very stable and grows by being corrected slowly and having its boundaries extended gradually. Scientists themselves accept the notion that scientific knowledge is always open to improvement and can never be declared absolutely certain. New questions arise, new theories are proposed, new instruments are invented, and new techniques are developed.

• Science is a complex social endeavor. It is a complex social process for producing knowledge about the natural world. Scientific knowledge represents the current consensus among scientists 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 fifth-grade students to engage in frequent discussions with peers about their understanding of their investigations.

• Systematic investigations require standard measures and consistent and reliable tools. Metric measures are a standard way to make measurements and are recognized around the world.

• A classification key is an important tool used to help identify objects and organisms. It consists of a branching set of choices organized in levels, with most levels of the key having two choices. Each level provides more specific descriptors, eventually leading to identification.

• A hypothesis is an educated guess/prediction about what will happen based on what you already know and what you have already learned from your research. It must be worded so that it is “testable.” The hypothesis can be written as an “If…, then….” statement, such as “If all light is blocked from a plant for two weeks, then the plant will die.”

• An independent variable is the factor in an experiment that is altered by the experimenter. The independent variable is purposely changed or manipulated.

• A dependent variable is the factor in an experiment that changes as a result of the change in the independent variable.

• collect, record, analyze, and report data, using charts and tables, and translate numerical data into bar or line graphs.

• make predictions based on trends in data. This requires the recognition of patterns and trends and determination of what those trends may represent.

• make inferences and draw conclusions.

• distinguish between inferences and conclusions.

• construct a physical model to clarify an explanation, demonstrate a relationship, or solve a need.
result of the manipulation of the independent variable.

- The constants in an experiment are those things that are purposefully kept the same throughout the experiment.
- When conducting experiments, data are collected, recorded, analyzed, and communicated using proper graphical representations and metric measurements.
- Systematic investigations require organized reporting of data. The way the data are displayed can make it easier to see important patterns, trends, and relationships. Bar graphs and line graphs are useful tools for reporting discrete data and continuous data, respectively.
- A scientific prediction is a forecast about what may happen in some future situation. It is based on the application of factual information and principles and recognition of trends and patterns.
- Estimation is a useful tool for making approximate measures and giving general descriptions. In order to make reliable estimates, one must have experience using the particular unit.
- 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. Scientific conclusions are based on verifiable observations (science is empirical).
- Scientific modeling is the process of generating abstract, conceptual, graphical and/or mathematical models. It is an approximation or simulation of a real system that omits all but the most essential variables of the system. In order to create a model, a scientist must first make some assumptions about the essential structure and relationships of objects and/or events in the real world. These assumptions are about what is necessary or important to explain the phenomena.
- It is important for students to apply the science content that they have learned to current issues and applications.

**RESOURCES AND ACTIVITIES**

- Interactive Notebooks
- Kidspration template for scientific investigations
- Scavenger hunt to explore lab tools
  - [www.augusta.k12.va.us](http://www.augusta.k12.va.us)
- Mind Notes for Elementary Science
  - “Scientific Investigations”
- SOL Review
  - Released Items Practice
    - [http://www.education.jlab.org/solquiz/](http://www.education.jlab.org/solquiz/)
  - Scroll down for Jeopardy Games
    - [http://www.richmond.k12.va.us/schools/thirteenacres/resources.htm](http://www.richmond.k12.va.us/schools/thirteenacres/resources.htm)
  - Science Files
    - [http://www.richmond.k12.va.us/schools/munford/scifiles.htm](http://www.richmond.k12.va.us/schools/munford/scifiles.htm)
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**5.1** The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

- a) items such as rocks, minerals, and organisms are identified using various classification keys;
- b) estimates are made and accurate measurements of length, mass, volume, and temperature are made in metric units using proper tools;
- c) estimates are made and accurate measurements of elapsed time are made using proper tools;
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- i) inferences are made and conclusions are drawn;
- j) models are constructed to clarify explanations, demonstrate relationships, and solve needs; and
- k) current applications are used to reinforce science concepts.

**5.7** The student will investigate and understand how Earth’s surface is constantly changing. Key concepts include

- a) identification of rock types;
- b) the rock cycle and how transformations between rocks occur;
- c) Earth history and fossil evidence;
- d) the basic structure of Earth’s interior;
- e) changes in Earth’s crust due to plate tectonics;
- f) weathering, erosion, and deposition; and
- g) human impact.

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**Overview**

This standard focuses on the constantly changing nature of Earth’s surface and builds on concepts learned in standards 4.6 and 4.8. Among the important ideas presented in this standard are the rock cycle, fossil evidence of change over time, energy from within Earth that drives tectonic plate movement, shifting tectonic plates that cause earthquakes and volcanoes, weathering and erosion, and human interaction with Earth’s surface. This standard can be related to several ideas found in science standard 5.6. It is intended that students will actively develop and utilize scientific investigation, reasoning, and logic skills (5.1) in the context of the key concepts presented in this standard.

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| Understanding the Standard (Background Information for Instructor Use Only) |
| In order to meet this standard, it is expected that students will |
|• Rocks have properties that can be observed, tested, and described. Composition, grain size and textural features, color, and the presence of fossils help with identification. Classification keys (5.1) can aid this process. |
|• Rocks move and change over time due to heat and pressure within Earth and due to weathering, erosion, and deposition at the surface. These and other processes constantly change rock from one type to another. |
| Essential Knowledge, Skills, and Processes |
|• Rocks have properties that can be observed, tested, and described. Composition, grain size and textural features, color, and the presence of fossils help with identification. Classification keys (5.1) can aid this process. |
|• Rocks move and change over time due to heat and pressure within Earth and due to weathering, erosion, and deposition at the surface. These and other processes constantly change rock from one type to another. |
|• In order to meet this standard, it is expected that students will |
|• apply basic terminology to explain how Earth’s surface is constantly changing. |
|• draw and label the rock cycle and describe the major processes and rock types involved. |
|• compare and contrast the origin of igneous, sedimentary, and metamorphic rocks. |
|• identify rock samples (granite, gneiss, slate, limestone, shale, sandstone, and coal), using a rock classification key. |
|• make plausible inferences about changes in Earth over time based on fossil evidence. This includes the presence of fossils of organisms in sedimentary rocks of Virginia found in the |
| • Depending on how rocks are formed, they are classified as sedimentary (layers of sediment cemented together), igneous (melted and cooled, e.g., lava and magma), and metamorphic (changed by heat and pressure). | • Appalachian Mountains, Piedmont, and Coastal Plain/Tidewater. |
| • Scientific evidence indicates Earth is ancient — approximately 4.6 billion years old. The age of many rocks can be determined very reliably. Fossils provide information about life and conditions of the past. | • describe the structure of Earth in terms of its major layers — crust, mantle, and outer core and inner core — and how Earth’s interior affects the surface. |
| • Scientific evidence indicates that Earth is composed of four concentric layers — crust, mantle, outer core, and inner core — each with its own distinct characteristics. The outer two layers are composed primarily of rocky material. The innermost layers are composed mostly of iron and nickel. Pressure and temperature increase with depth beneath the surface. | • differentiate among the three types of plate tectonic boundaries (divergent, convergent, and transform) and how these relate to the changing surface of Earth and the ocean floor (5.6). |
| • Earth’s thermal energy causes movement of material within Earth. Large continent-size blocks (plates) move slowly about Earth’s surface, driven by that thermal energy. | • compare and contrast the origin of earthquakes and volcanoes and how they affect Earth’s surface. |
| • Most earthquakes and volcanoes are located at the boundaries of the plates (faults). Plates can move together (convergent boundaries), apart (divergent boundaries), or slip past each other horizontally (transform boundaries, also called strike-slip or sliding boundaries). | • differentiate between weathering, erosion, and deposition. |
| • Geological features in the oceans (including trenches and mid-ocean ridges) and on the continents (mountain ranges, including the Appalachian Mountains) are caused by current and past plate movements. | • design an investigation to locate, chart, and report weathering, erosion, and deposition at home and on the school grounds. Create a plan to solve erosion and/or deposition problems that may be found. |
| • Rocks and other materials on Earth’s surface are constantly being broken down both chemically and physically. The products of weathering include clay, sand, rock fragments, and soluble substances. | • describe how people change Earth’s surface and how negative changes can be controlled. |
| • Materials can be moved by water and wind (eroded) and deposited in new locations as sediment (deposition). | • design an investigation to locate, chart, and report weathering, erosion, and deposition at home and on the school grounds. Create a plan to solve erosion and/or deposition problems that may be found. |
| • Humans have varying degrees of impact on Earth’s surface through their everyday activities. With careful planning, the impact on the land can be controlled. | • describe how people change Earth’s surface and how negative changes can be controlled. |
# RESOURCES AND ACTIVITIES

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- Hands-on Technology - [www.galaxy.net/~k12/general/map.shtml](http://www.galaxy.net/~k12/general/map.shtml)
- Benchmark Literacy: Relationships in Nature – Unit 4
- After the Earthquake – Unit 6
- Riches from the Earth – Unit 1
- Weather on the Earth – Unit 1
- Iron – Unit 6
- Mountain Maker, Earth Shaker – interactive website at PBS online
- The Action is at the Edges – interactive website at US Geological Survey, Dept. of Interior – deals with types of boundaries
- How to Dig a Hole to the other Side of the Earth, by: Faith McNulty (Harper & Row, NY;1979)
- 3D model of earth’s layers (use clay) labeled
- [www.augusta.k12.va.us](http://www.augusta.k12.va.us) Curriculum Elementary Science Mind Notes “Earth”
The student will investigate and understand the relationships among Earth, the moon, and the sun. Key concepts include:

- **a)** the motions of Earth, the moon, and the sun;
- **b)** the causes for Earth’s seasons;
- **c)** the causes for the phases of the moon;
- **d)** the relative size, position, age, and makeup of Earth, the moon, and the sun; and
- **e)** historical contributions in understanding the Earth-moon-sun system.

### Overview

This standard focuses on the Earth-moon-sun system and includes knowledge related to the motions of this system and the results of our unique position in it. This includes the presence of an atmosphere, liquid water, and life. The standard is built on concepts developed in science standards K.8, 1.6, and 3.8 and that will be further expanded in 6.8. A more in-depth study of Earth’s makeup is in standard 5.7. It is intended that students will actively develop and utilize scientific investigation, reasoning, and logic skills (4.1) in the context of the key concepts presented in this standard.

### Understanding the Standard

**Background Information for Instructor Use Only**

| • Earth completes one revolution around the sun every 365 ¼ days. The moon revolves around Earth about once every month. | In order to meet this standard, it is expected that students will |
| Due to its axial tilt, Earth experiences seasons during its revolution around the sun. | • differentiate between rotation and revolution. |
| The phases of the moon are caused by its position relative to Earth and the sun. The phases of the moon include the new, waxing crescent, first quarter, waxing gibbous, full, waning gibbous, last (third) quarter, and waning crescent. | • describe how Earth’s axial tilt causes the seasons. |
| The sun is an average-sized yellow star, about 110 times the diameter of Earth. The sun is approximately 4.6 billion years old. | • model the formation of the eight moon phases, sequence the phases in order, and describe how the phases occur. |
| Our moon is a small rocky satellite, having about one-quarter the diameter of Earth and one-eighth its mass. It has extremes of temperature, virtually no atmosphere or life, and very little water. | • describe the major characteristics of the sun, including its approximate size, color, age, and overall composition. |
| Earth is one of eight planets that revolve around the sun and comprise the solar system. Earth, the third planet from the sun, is one of the four terrestrial inner planets. It is about 150 million kilometers from the sun. | • create and describe a model of the Earth-moon-sun system with approximate scale distances and sizes. |
| Earth is a geologically active planet with a surface that is constantly changing. Unlike the other three inner planets (Mercury, Venus, and Mars), it has large amounts of life-supporting water and an oxygen-rich atmosphere. Earth’s protective atmosphere blocks out most of the sun’s damaging rays. | • compare and contrast the surface conditions of Earth, the moon, and the sun. |
| Our understanding of the solar system has changed from an Earth-centered model of Aristotle and Ptolemy to the sun-centered model of Copernicus and Galileo. | • compare and contrast an Earth-centered to the sun-centered model of the solar system. |
| The NASA Apollo missions added greatly to our understanding of the moon. | • analyze the differences in what Aristotle, Ptolemy, Copernicus, and Galileo observed and what influenced their conclusions. |
| Our understanding of the sun, moon, and the solar system continues to change with new scientific discoveries. | • describe a contribution of the NASA Apollo missions to our understanding of the moon. |
## RESOURCES AND ACTIVITIES

| Benchmark Literacy:  
| Life of a Star – Unit 2  
| Space Exploration – Unit 6  
| Astronomers – Unit 8  
| Catastrophic Storms – Unit  
| Earth: The Water Plant – Unit 8  
| Basic Heredity – Unit 8  |
5.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
   a) items such as rocks, minerals, and organisms are identified using various classification keys;
   b) estimates are made and accurate measurements of length, mass, volume, and temperature are made in metric units using proper tools;
   c) estimates are made and accurate measurements of elapsed time are made using proper tools;
   d) hypotheses are formed from testable questions;
   e) independent and dependent variables are identified;
   f) constants in an experimental situation are identified;
   g) data are collected, recorded, analyzed, and communicated using proper graphical representations and metric measurements;
   h) predictions are made using patterns from data collected, and simple graphical data are generated;
   i) inferences are made and conclusions are drawn;
   j) models are constructed to clarify explanations, demonstrate relationships, and solve needs; and
   k) current applications are used to reinforce science concepts.

5.6 The student will investigate and understand characteristics of the ocean environment. Key concepts include
   a) geological characteristics;
   b) physical characteristics; and
   c) ecological characteristics.

Overview
This standard extends the study of ecosystems to the ocean environment. It focuses on the major descriptive characteristics of oceans. Among the concepts are the geological characteristics of the ocean floor, the physical characteristics of ocean water, and the ecological characteristics of communities of marine organisms. Connections can be made to standards 5.2, 5.3, 5.4, 5.5, and 5.7. It is intended that students will actively develop and utilize scientific investigation, reasoning, and logic skills (5.1) in the context of the key concepts presented in this standard.

### Understanding the Standard
(Background Information for Instructor Use Only)

- Oceans cover about 70 percent of the surface of Earth.
- Important features of the ocean floor near the continents are the continental shelf, the continental slope, and the continental rise. These areas are covered with thick layers of sediments (sand, mud, rocks).
- The depth of the ocean varies. Ocean trenches are very deep, and the continental shelf is relatively shallow.
- Ocean water is a complex mixture of gases (air) and dissolved solids (salts, especially sodium chloride). Marine organisms are dependent on dissolved gases for survival. The salinity of ocean water varies in some places depending on rates of evaporation and amount of runoff from nearby land.
- The basic motions of ocean water are the waves, currents, and tides.
- Ocean currents, including the Gulf Stream, are caused by wind patterns and the differences in water densities (due to salinity and temperature differences).

### Essential Knowledge, Skills, and Processes

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

- create and interpret a model of the ocean floor and label and describe each of the major features.
- research and describe the variation in depths associated with ocean features, including the continental shelf, slope, rise, the abyssal plain, and ocean trenches.
- design an investigation (including models and simulations) related to physical characteristics of the ocean environment (depth, salinity, formation of waves, causes of tides, and currents, such as the Gulf Stream).
- interpret graphical data related to physical characteristics of the ocean.
- explain the formation of ocean currents and describe and locate the Gulf Stream.
Ocean currents affect the mixing of ocean waters. This can affect plant and animal populations. Currents also affect navigation routes.

- As the depth of ocean water increases, the temperature decreases, the pressure increases, and the amount of light decreases. These factors influence the type of life forms that are present at a given depth.
- Plankton are tiny free-floating organisms that live in water. Plankton may be animal-like or plant-like. Animal-like plankton are called zooplankton. Plant-like plankton (phytoplankton) carry out most of the photosynthesis on Earth. Therefore, they provide much of Earth’s oxygen. Phytoplankton form the base of the ocean food web. Plankton flourish in areas where nutrient-rich water upwells from the deep.

**RESOURCES AND ACTIVITIES**

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<td>C83 How Do Oceans And Freshwater Compare?</td>
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<td>C85 Quick Lab – Fresh Water Salt Water</td>
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<tr>
<td>Laser Disc – Earth Science Vol. 3</td>
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<tr>
<td>Magic School Bus Ocean Floor (book/video)</td>
</tr>
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<td>Demo Ocean food chain using picture cards and string</td>
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<tr>
<td>Make clay models of ocean floor</td>
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<tr>
<td>Hot and cold water lab</td>
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<tr>
<td>Ocean project research – research a sea creature – make visual and write</td>
</tr>
<tr>
<td><a href="http://www.augusta.k12.va.us">www.augusta.k12.va.us</a></td>
</tr>
<tr>
<td>Mind Notes – Elementary Science</td>
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<tr>
<td>Oceans</td>
</tr>
<tr>
<td>Scientific Method Activity</td>
</tr>
<tr>
<td>Ocean Water</td>
</tr>
<tr>
<td>Draw and label ocean floor on dry erase boards</td>
</tr>
</tbody>
</table>

| Interactive Notebooks                   |
| Food Web –                              |
| [http://oceanlink.island.net/oinfo/foodweb/foodweb.html](http://oceanlink.island.net/oinfo/foodweb/foodweb.html) |
| Human Impact                            |
| [http://oceanlink.island.net/oceanmatters/OceanMatters.html](http://oceanlink.island.net/oceanmatters/OceanMatters.html) |
| General Info                            |
| [http://www.cybrary.org/ocean.htm](http://www.cybrary.org/ocean.htm) |
| Build a Fish                            |
| Benchmark Literacy:                     |
| Astronomers – Unit 8                    |
| Catastrophic Storms – Unit              |
| Earth: The Water Plant – Unit 8         |
| Basic Heredity – Unit 8                 |
| Enhanced Scope & Sequence – Grade 5 p.46-63 |
| Ocean Environment                       |
| Laser Disc – Earth Science Vol. 3      |

**4.6** The student will investigate and understand how weather conditions and phenomena occur and can be predicted. Key concepts include

a) weather phenomena;
b) weather measurements and meteorological tools; and
c) use of weather measurements and weather phenomena to make weather predictions.

**Overview**

This standard focuses on weather conditions and a more technical understanding of the tools and methods used to forecast future atmospheric conditions. Weather is introduced in science standard 2.6. It is intended that students will actively develop and utilize scientific investigation, reasoning, and logic skills (4.1) in the context of the key concepts presented in this standard.
### Understanding the Standard

**Background Information for Instructor Use Only**

- Temperature is the measure of the amount of thermal energy in the atmosphere.
- Air pressure is due to the weight of the air and is determined by several factors including the temperature of the air.
- A front is the boundary between air masses of different temperature and humidity.
- Cirrus, stratus, cumulus, and cumulo-nimbus clouds are associated with certain weather conditions.
- Cumulus clouds are fluffy and white with flat bottoms. They usually indicate fair weather. However, when they get larger and darker on the bottom, they become cumulo-nimbus clouds. Cumulo-nimbus clouds may produce thunderstorms.
- Stratus clouds are smooth, gray clouds that cover the whole sky (block out direct sunlight). Light rain and drizzle are usually associated with stratus clouds.
- Cirrus clouds are feathery clouds. They are associated with fair weather. Cirrus clouds often indicate that rain or snow will fall within several hours.
- Extreme atmospheric conditions create various kinds of storms such as thunderstorms, hurricanes, and tornadoes.
- Different atmospheric conditions create different types of precipitation.
- Meteorologists gather data by using a variety of instruments.
- Meteorologists use data to predict weather patterns.
- A barometer measures air pressure.
- An anemometer measures wind speed.
- A rain gauge measures the amount of precipitation.
- A thermometer measures the temperature of the air.

### Essential Knowledge, Skills, and Processes

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

- design an investigation in which a thermometer is used to compare air temperatures over a period of time.
- analyze the changes in air pressure occurring over time, using a barometer, and predict what the changes mean in terms of changing weather patterns.
- illustrate and label high and low pressures on a map.
- differentiate between the types of weather associated with high and low pressure air masses. Illustrate and label high and low pressure air masses and warm and cold fronts.
- differentiate between cloud types (i.e., cirrus, stratus, cumulus, and cumulo-nimbus clouds) and the associated weather.
- compare and contrast the formation of different types of precipitation (e.g., rain, snow, sleet, and hail).
- recognize a variety of storm types, describe the weather conditions associated with each, and explain when they occur (e.g., thunderstorms, hurricanes, and tornadoes).
- analyze and report information about temperature and precipitation on weather maps.
- measure wind speed, using an anemometer.
- measure precipitation with a rain gauge.
- design an investigation in which weather data are gathered using meteorological tools and charted to make weather predictions.

### RESOURCES AND ACTIVITIES

**Benchmark Literacy:**
- Weather on Earth – Unit 1
- Tsunamis – Unit 4
- Astronomers – Unit 8
- Catastrophic Storms – Unit 8
- Earth: The Water Planet – Unit 8
- Basic Heredity – Unit 8
### Matter SOL 5.1, 5.4

#### 5.1
The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- a) items such as rocks, minerals, and organisms are identified using various classification keys;
- b) estimates are made and accurate measurements of length, mass, volume, and temperature are made in metric units using proper tools;
- c) estimates are made and accurate measurements of elapsed time are made using proper tools;
- d) hypotheses are formed from testable questions;
- e) independent and dependent variables are identified;
- f) constants in an experimental situation are identified;
- g) data are collected, recorded, analyzed, and communicated using proper graphical representations and metric measurements;
- h) predictions are made using patterns from data collected, and simple graphical data are generated;
- i) inferences are made and conclusions are drawn;
- j) models are constructed to clarify explanations, demonstrate relationships, and solve needs; and
- k) current applications are used to reinforce science concepts.

#### 5.4
The student will investigate and understand that matter is anything that has mass and takes up space; and occurs as a solid, liquid, or gas. Key concepts include
- a) distinguishing properties of each phase of matter;
- b) the effect of temperature on the phases of matter;
- c) atoms and elements;
- d) molecules and compounds; and
- e) mixtures including solutions.

### Overview
This standard incorporates various characteristics of matter such as mass, volume, and the effect of temperature changes on the three basic phases of matter. Instruction should center on the basic structure of matter and how it behaves. This standard builds on standard 3.3, which provides a basis for understanding the structure of matter. It is intended that students will actively develop and utilize scientific investigation, reasoning, and logic skills (5.1) in the context of the key concepts presented in this standard.

### Understanding the Standard
*(Background Information for Instructor Use Only)*

- Matter is anything that has mass and volume.
- Mass is the amount of matter in an object. The mass of an object does not change. (Weight of an object changes based on the gravitational pull on it. A person will have the same mass on Earth, Mars, and our moon. However, his or her weight on our moon will be 1/6 of what it is on Earth and will be 1/3 as much on Mars.)
- Matter can exist in several distinct forms which are called phases. The three basic phases of matter generally found on Earth are gas, liquid, and solid. (Though other phases of matter have been identified, these are the phases of matter that fifth-grade students are expected to know.)

### Essential Knowledge, Skills, and Processes

In order to meet this standard, it is expected that students will
- construct and interpret a sequence of models (diagrams) showing the activity of molecules in all three basic phases of matter.
- construct and interpret models of atoms and molecules.
- identify substances as being an element or a compound.
- design an investigation to determine how a change in temperature affects the phases of matter (e.g., water). Include in the design ways information will be recorded, what measures will be made, what instruments will be used, and ways the data will be graphed.
- compare and contrast mixtures and solutions.
### Characteristics of Gases, Liquids, and Solids

<table>
<thead>
<tr>
<th></th>
<th>gas</th>
<th>liquid</th>
<th>solid</th>
</tr>
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<tbody>
<tr>
<td>Assumptions of shape of its container</td>
<td>Assumes the shape of its container</td>
<td>Retains a fixed shape</td>
<td></td>
</tr>
<tr>
<td>Assumes the volume of its container – no definite volume</td>
<td>Has a definite volume</td>
<td>Has a definite volume</td>
<td></td>
</tr>
<tr>
<td>Compressible (lots of free space between particles)</td>
<td>Not easily compressible (little free space between particles)</td>
<td>Not easily compressible (little free space between particles)</td>
<td></td>
</tr>
<tr>
<td>Flows easily (particles can move past one another)</td>
<td>Flows easily (particles can move/slide past one another)</td>
<td>Does not flow easily (rigid-particles cannot move/slide past one another)</td>
<td></td>
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</tbody>
</table>

- As its temperature increases, many kinds of matter change from a solid to a liquid to a gas. As its temperature decreases, that matter changes from a gas to a liquid to a solid.
- All matter, regardless of its size, shape, or color, is made of particles (atoms and molecules) that are too small to be seen by the unaided eye.
- There are more than 100 known elements that make up all matter. A few of the more familiar elements include: hydrogen (H), oxygen (O), helium (He), carbon (C), sodium (Na), and potassium (K). The smallest part of an element is an atom.
- A mixture is a combination of two or more substances that do not lose their identifying characteristics when combined. A solution is a mixture in which one substance dissolves in another.
- When two or more elements combine to form a new substance, it is called a compound. There are many different types of compounds because atoms of elements combine in many different ways (and in different whole number ratios) to form different compounds. Examples include water (H₂O) and table salt (NaCl). The smallest part of a compound is a molecule.
- 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. Many products on the market today are already benefiting from nanotechnology such as sunscreens, scratch-resistant coatings, and medical procedures.
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<td>Enhanced Scope &amp; Sequence – Grade 5 p.1-18</td>
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<tr>
<td>Structure and States of Matter</td>
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<tr>
<td>Venn Diagrams compare/contrast</td>
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<tr>
<td>Create mixtures and solutions</td>
</tr>
<tr>
<td>Make flip book with vocabulary</td>
</tr>
<tr>
<td>Students act out solid, liquid, gas as a group</td>
</tr>
</tbody>
</table>

| **Matter** –          |
| Dissolving Mixtures BBC |
| [http://www.bbc.co.uk/schools/revisewise/science/materials/10_act.shtml](http://www.bbc.co.uk/schools/revisewise/science/materials/10_act.shtml) |
| Temperature & Matter BBC |
| Measuring |
| www.augusta.k12.va.us |
| Mind Notes Elementary Science |
| Matter |
| Benchmark Literacy: |
| Using Math in Science – Unit 2 |
### Understanding the Standard

**SOL 5.1, 5.2, 5.3**

**4th Grade Review: Force, Motion, Energy, and Electricity - SOL 4.2, 4.3**

#### 5.1

The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

- a) items such as rocks, minerals, and organisms are identified using various classification keys;
- b) estimates are made and accurate measurements of length, mass, volume, and temperature are made in metric units using proper tools;
- c) estimates are made and accurate measurements of elapsed time are made using proper tools;
- d) hypotheses are formed from testable questions;
- e) independent and dependent variables are identified;
- f) constants in an experimental situation are identified;
- g) data are collected, recorded, analyzed, and communicated using proper graphical representations and metric measurements;
- h) predictions are made using patterns from data collected, and simple graphical data are generated;
- i) inferences are made and conclusions are drawn;
- j) models are constructed to clarify explanations, demonstrate relationships, and solve needs; and
- k) current applications are used to reinforce science concepts.

#### 5.2

The student will investigate and understand how sound is created and transmitted, and how it is used. Key concepts include

- a) compression waves;
- b) vibration, compression, wavelength, frequency, amplitude;
- c) the ability of different media (solids, liquids, and gases) to transmit sound; and
- d) uses and applications of sound waves.

### Essential Knowledge, Skills, and Processes

- Sound is a form of energy produced and transmitted by vibrating matter.
- Sound waves are compression (longitudinal) waves.
- When compression (longitudinal) waves move through matter (solid, liquid, or a gas), the molecules of the matter move backward and forward in the direction in which the wave is traveling. As sound waves travel, molecules are pressed together in some parts (compression) and in some parts are spread out (rarefaction). A child’s toy in the form of a coil is a good tool to demonstrate a compression (longitudinal) wave.

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

- use the basic terminology of sound to describe what sound is, how it is formed, how it affects matter, and how it travels.
- create and interpret a model or diagram of a compression wave.
- explain why sound waves travel only where there is matter to transmit them.
- explain the relationship between frequency and pitch.
- design an investigation to determine what factors affect
The frequency of sound is the number of wavelengths in a given unit of time.

The wavelength of sound is the distance between two compressions or between two rarefactions. The wavelength can be measured from any point on a wave as long as it is measured to the same point on the next wave.

When we talk, sound waves travel in air. Sound also travels in liquids and solids. Sound waves must have a medium through which to travel. In a vacuum sound cannot travel because there is no matter for it to move through.

Pitch is determined by the frequency of a vibrating object. Objects vibrating faster have a higher pitch than objects vibrating slower. A change in frequency of sound waves causes an audible sensation—a difference in pitch.

Amplitude is the amount of energy in a compression (longitudinal) wave and is related to intensity and volume. For example, when a loud sound is heard, it is because many molecules have been vibrated with much force. A soft sound is made with fewer molecules being vibrated with less force.

Sound travels more quickly through solids than through liquids and gases because the molecules of a solid are closer together. Sound travels the slowest through gases because the molecules of a gas are farthest apart.

Some animals make and hear ranges of sound vibrations different from those that humans can make and hear.

Musical instruments vibrate to produce sound. There are many different types of musical instruments and each instrument causes the vibrations in different ways. The most widely accepted way to classify musical instruments is to classify them by the way in which the sound is produced by the instrument. The four basic classifications are percussion instruments (e.g., drums, cymbals), stringed instruments (e.g., violin, piano, guitar), wind instruments (e.g., flute, clarinet, trumpet, trombone), and electronic instruments (e.g., electronic organ, electric guitar).
The student will investigate and understand basic characteristics of visible light and how it behaves. Key concepts include:

- Transverse waves (a)
- The visible spectrum (b)
- Opaque, transparent, and translucent (c)
- Reflection of light from reflective surfaces (d)
- Refraction of light through water and prisms (e)

### Overview

Concepts related to light are introduced at the fifth-grade level. Standard 5.3 focuses on the characteristics of visible light and the tools that aid in the production and use of light. Instruction should center on the basic science concerning light energy and how we use light in our daily lives. A related science standard is 4.2, which focuses on forms of energy and provides a foundation for understanding that light is energy. It is intended that students will actively develop and utilize scientific investigation, reasoning, and logic skills (5.1) in the context of the key concepts presented in this standard.

### Understanding the Standard

(Background Information for Instructor Use Only)

#### Essential Knowledge, Skills, and Processes

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

- Diagram and label a representation of a light wave, including wavelength, crest, and trough.
- Explain the relationships between wavelength and the color of light. Name the colors of the visible spectrum.
- Explain the terms transparent, translucent, and opaque, and give an example of each.
- Compare and contrast reflection and refraction, using water, prisms, and mirrors.
- Analyze the effects of a prism on white light and describe why this occurs.
- Explain the relationship between the refraction of light and the formation of a rainbow.

- Light has properties of both a wave and a particle. Recent theory identifies light as a small particle, called a photon. A photon moves in a straight line. In both the light wave and photon descriptions, light is energy.

- Because light has both electric and magnetic fields, it is referred to as electromagnetic radiation. Light waves move as transverse waves and travel through a vacuum at a speed of approximately 186,000 miles per second (2.99 x 10^8 meters per second). Compared to sound, light travels extremely fast. It takes light from the sun less than 8 1/2 minutes to travel 93 million miles (150 million kilometers) to reach Earth.

- Unlike sound, light waves travel in straight paths called rays and do not need a medium through which to move. A ray is the straight line that represents the path of light. A beam is a group of parallel rays.

- Light waves are characterized by their wavelengths and the frequency of their wavelengths.

- The size of a wave is measured as its wavelength, which is the distance between any two corresponding points on successive waves, usually crest-to-crest or trough-to-trough. The wavelength can be measured from any point on a wave as long as it is measured to the same point on the next wave.

- Frequency is the number of waves passing a given point every second. The greater the frequency, the greater the amount of energy.

- Light waves are waves of energy. The amount of energy in a light wave is proportionally related to its frequency: high frequency light has high energy; low frequency light has low energy. The more wavelengths in a light wave in a given period of time, the higher the energy level. Thus gamma rays have the most energy, and radio waves have the least. Of visible light, violet has the most energy and red the least.

- The entire range of electromagnetic radiation (light) is called the electromagnetic spectrum.
Transverse Wave

Wavelength
Crest
Crest
Trough

Light Wave Energy

Time = 1 second

Low frequency wave
(3 wavelengths in 1 second)
Low energy wave

High frequency wave
(21 wavelengths in 1 second)
High energy wave

* The entire range of electromagnetic radiation (light) is called the electromagnetic spectrum.
• The only difference between the various types of electromagnetic radiation is the amount of energy. Sunlight consists of the entire electromagnetic spectrum.

• The wavelengths detectible by the human eye represent only a very small part of the total electromagnetic spectrum.

• We see visible light as the colors of the rainbow. Each color has a different wavelength. Red has the longest wavelength and violet has the shortest wavelength. The colors of the visible spectrum from the longest wavelength to the shortest wavelength are: red, orange, yellow, green, blue, and violet (ROYGBV). Most scientists no longer include the color indigo, which used to be included between blue and violet.

• Black and white are not spectral colors. Black is when a material absorbs all the visible light and no light is reflected back. Black is a total absence of reflected light. White is a reflection of all visible light together.

• Light travels in straight paths until it hits an object, where it bounces off (is reflected), is bent (is
refracted), passes through the object (is transmitted), or is absorbed as heat.

- The term reflected light refers to light waves that are neither transmitted nor absorbed, but are thrown back from the surface of the medium they encounter. If the surface of the medium contacted by the wave is smooth and polished (e.g., a mirror), each reflected wave will be reflected back at the same angle as the incident wave. The wave that strikes the surface of the medium (e.g., a mirror) is called the incident wave, and the one that bounces back is called the reflected wave.

- Refraction means the bending of a wave resulting from a change in its velocity (speed) as it moves from one medium to another (e.g., light moving from the air into water). The frequency of the wave does not change.

- The amount of bending of the light wave (refraction) depends on:
  1. The density of the material it is entering;
  2. The wavelength of the light wave; and
  3. The angle at which the original light wave enters the new medium.

- Some examples of refraction are when:
  1. Refraction causes a setting sun to look flat.
  2. A spoon appears to bend when it is immersed in a cup of water. The bending seems to take place at the surface of the water, or exactly at the point where there is a change of density.
  3. Shadows on the bottom of a pool are caused because air and water have different densities.
  4. A glass prism disperses white light into its individual colors. As visible light exits the prism, it is refracted and separated into a display of colors.

- A rainbow is an example of both refraction and reflection. Sunlight is first refracted when it enters the surface of a spherical raindrop, it is then reflected off the back of the raindrop, and once again refracted as it leaves the raindrop.

- A prism can be used to refract and disperse visible light. When the different wavelengths of light in visible light pass through a prism, they are bent at different angles (refracted). Dispersion occurs when we see the light separated into a display of colors: ROYGBV.

- **Dispersion** is the separation of light. Dispersion occurs with transparent surfaces that are not parallel to each other, such as a prism or gemstone facets.

- Light passes through some materials easily (transparent materials), through some materials partially (translucent materials), and through some not at all (opaque materials). The relative terms transparent, translucent, and opaque indicate the amount of light that passes through an object.
  1. Examples of transparent materials include clear glass, clear plastic food wrap, clean water, and air.
  2. Examples of translucent materials include wax paper, frosted glass, thin fabrics, some plastics, and thin paper.
  3. Examples of opaque materials include metal, wood, bricks, aluminum foil, and thick paper.
### RESOURCES AND ACTIVITIES

<table>
<thead>
<tr>
<th>Light</th>
<th>Sound</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Text</strong> – Chapter 14 – Light</td>
<td><strong>Ocean Odyssey – Sound Exploration</strong>&lt;br&gt;<a href="http://www.engineeringinteract.org/resources/oceanodyssey/oceanodysseylink.htm">http://www.engineeringinteract.org/resources/oceanodyssey/oceanodysseylink.htm</a></td>
</tr>
<tr>
<td>Laser Disc – Physical Science, Vol.1, Lesson 3</td>
<td><strong><a href="http://www.augusta.k12.va.us">www.augusta.k12.va.us</a></strong>&lt;br&gt;Mind Notes Elementary Science – Sound</td>
</tr>
<tr>
<td>Enhanced Scope &amp; Sequence – Grade 5 p.113-138 Light</td>
<td><strong>Scientific Method Activities – Pitch</strong></td>
</tr>
<tr>
<td><strong>Text</strong> – F46-76 – Sound</td>
<td><strong>• Sound Cannon Experiment</strong></td>
</tr>
<tr>
<td><strong>Spoon and String Experiment</strong> – Tie spoon to string. Twirl yarn around fingers and put fingers in ears. Hit spoon on table for sound travels best through solids</td>
<td><strong>• Dancing Salt Experiment (search on line)</strong></td>
</tr>
<tr>
<td>Enhanced Scope &amp; Sequence – p.95-112 - Sound</td>
<td><strong>• Station Rotation with Pitch and Vibration (recorder, guitar, ruler)</strong></td>
</tr>
<tr>
<td><strong>Light</strong> – <strong>Alien Attack – Light Activity</strong>&lt;br&gt;<a href="http://engineeringinteract.org/resources/alienattack/alienattack/link.htm">http://engineeringinteract.org/resources/alienattack/alienattack/link.htm</a></td>
<td><strong>• Bottles of Water and Pitch Experiment</strong></td>
</tr>
<tr>
<td><strong>BBC Light &amp; Shadows</strong>&lt;br&gt;<a href="http://www.bbc.co.uk/schools/scienceclips/ages/7_8/light_shadows.shtml">http://www.bbc.co.uk/schools/scienceclips/ages/7_8/light_shadows.shtml</a></td>
<td><strong>Light –</strong></td>
</tr>
<tr>
<td><strong><a href="http://www.augusta.k12.va.us">www.augusta.k12.va.us</a></strong>&lt;br&gt;Mind Notes Elementary Science – Light</td>
<td><strong>• Reflection lab using mirrors and flashlights</strong></td>
</tr>
<tr>
<td><strong>• Refraction lab using glass beakers and water</strong></td>
<td><strong>• Roy G. Biv color mixture experiment with color paddles and flashlight – show white light</strong></td>
</tr>
<tr>
<td><strong>• Prism – How to make a rainbow</strong></td>
<td><strong>• Opaque/transparent/translucent - sort</strong></td>
</tr>
</tbody>
</table>

**Released Test Items**

Compare sound and light for similarities and differences.
The student will investigate and understand characteristics and interactions of moving objects. Key concepts include:

- a) motion is described by an object’s direction and speed;
- b) changes in motion are related to force and mass;
- c) friction is a force that opposes motion; and
- d) moving objects have kinetic energy.

**Overview**
This standard is introduced in first grade and prepares students for a more in-depth study of energy in eighth grade. This standard focuses on the characteristics of moving objects. Key concepts include the effect of forces, such as friction, on moving objects. It is intended that students will actively develop and utilize scientific investigation, reasoning, and logic skills (4.1) in the context of the key concepts presented in this standard.

**Understanding the Standard**
*(Background Information for Instructor Use Only)*

- The position of an object can be described by locating it relative to another object or to the background.
- Tracing and measuring an object’s position over time can describe its motion.
- Speed describes how fast an object is moving.
- Energy may exist in two states: kinetic or potential.
- Kinetic energy is the energy of motion.
- A force is any push or pull that causes an object to move, stop, or change speed or direction.
- The greater the force, the greater the change in motion will be. The more massive an object, the less effect a given force will have on the object.
- Friction is the resistance to motion created by two objects moving against each other. Friction creates heat.
- Unless acted on by a force, objects in motion tend to stay in motion and objects at rest remain at rest.

**Essential Knowledge, Skills, and Processes**

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

- describe the position of an object.
- collect and display in a table and line graph time and position data for a moving object.
- explain that speed is a measure of motion.
- interpret data to determine if the speed of an object is increasing, decreasing, or remaining the same.
- identify the forces that cause an object’s motion.
- describe the direction of an object’s motion: up, down, forward, backward.
- infer that objects have kinetic energy.
- design an investigation to test the following hypothesis: “If the mass of an object increases, then the force needed to move it will increase.”
- design an investigation to determine the effect of friction on moving objects. Write a testable hypothesis and identify the dependent variable, the independent variable, and the constants. Conduct a fair test, collect and record the data, analyze the data, and report the results of the data.
The student will investigate and understand the characteristics of electricity. Key concepts include
   a) conductors and insulators;
   b) basic circuits;
   c) static electricity;
   d) the ability of electrical energy to be transformed into light and motion, and to produce heat;
   e) simple electromagnets and magnetism; and
   f) historical contributions in understanding electricity.

**Overview**
This standard focuses on the characteristics of electricity as related to circuits and circuit components, magnetism, static charges, and historical contributions important to the understanding of electricity. As electrical energy is an integral part of modern civilization (e.g., powering our computers; lighting, heating and cooling our homes and businesses; and making the information age possible), it is critical that students begin to understand basic electricity concepts. This standard will be the basis for a more in-depth study in the eighth grade. It is intended that students will actively develop and utilize scientific investigation, reasoning, and logic skills (4.1) in the context of the key concepts presented in this standard.

### Understanding the Standard

**Background Information for Instructor Use Only**

- A continuous flow of negative charges (electrons) creates an electric current. The pathway taken by an electric current is a circuit. Closed circuits allow the movement of electrical energy. Open circuits prevent the movement of electrical energy.
- Electrical energy moves through materials that are conductors (metals). Insulators (rubber, plastic, wood) do not conduct electricity well.
- Among conducting materials, the rate at which energy flows depends on the material’s resistance.
- In a series circuit, there is only one pathway for the current, but in a parallel circuit there are two or more pathways for it.
- Rubbing certain materials together creates static electricity.
- Lightning is the discharge of static electricity in the atmosphere.
- Electrical energy can be transformed into light or motion, and can produce thermal energy.
- Certain iron-bearing metals attract other such metals (also nickel and cobalt).
- Lines of force extend from the poles of a magnet in an arched pattern defining the area over which magnetic force is exerted.
- An electric current creates a magnetic field, and a moving magnetic field creates an electric current.

### Essential Knowledge, Skills, and Processes

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

- apply the terms insulators, conductors, open and closed in describing electrical circuits.
- differentiate between an open and closed electric circuit.
- use the dry cell symbols (−) and (+).
- create and diagram a functioning series circuit using dry cells, wires, switches, bulbs, and bulb holders.
- create and diagram a functioning parallel circuit using dry cells, wires, switches, bulbs, and bulb holders.
- differentiate between a parallel and series circuit.
- describe the types of energies (i.e., thermal, radiant, and mechanical) that are transformed by various household appliances (e.g., lamp, toaster, fan).
- create a diagram of a magnetic field using a magnet.
- compare and contrast a permanent magnet and an electromagnet.
- explain how electricity is generated by a moving magnetic field.
- design an investigation using static electricity to attract or repel a variety of materials.
- explain how static electricity is created and occurs in nature.
- A current flowing through a wire creates a magnetic field. Wrapping a wire around certain iron-bearing metals (iron nail) and creating a closed circuit is an example of a simple electromagnet.
- Benjamin Franklin, Michael Faraday, and Thomas Edison made important discoveries about electricity.

<table>
<thead>
<tr>
<th>RESOURCES AND ACTIVITIES</th>
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Benchmark Literacy:
- Electrifying Personalities - Unit 2
- Electricity Adds Up – Unit 4
- Forces and Motion on Earth – Unit 7
## Living Systems

### SOL 5.1, 5.5

#### (4th Grade Review: Plants and Ecosystems- SOL 4.4, 4.5)

### Weeks 26-28

#### [Weeks 25-26]

#### (Week 25) [Week 24]

### Understanding the Standard

<table>
<thead>
<tr>
<th>Essential Knowledge, Skills, and Processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>In order to meet this standard, it is expected that students will</td>
</tr>
<tr>
<td>• draw, label, and describe the essential structures and functions of plant and animal cells. For plants, include the nucleus, cell wall, cell membrane, vacuole, chloroplasts, and cytoplasm. For animals, include the nucleus, cell membrane, vacuole, and cytoplasm.</td>
</tr>
<tr>
<td>• design an investigation to make observations of cells.</td>
</tr>
<tr>
<td>• compare and contrast plant and animal cells and identify their major parts and functions.</td>
</tr>
<tr>
<td>• group organisms into categories, using their characteristics: plants (vascular and nonvascular) and animals (vertebrates or invertebrates). Name and describe two common examples of each group.</td>
</tr>
</tbody>
</table>

| Overview |
| This standard emphasizes the major categories of living organisms and builds on science standards 2.4 and 4.4. The use of a microscope may be applied to the study of plants, animals, and cells. It is intended that students will actively develop and utilize scientific investigation, reasoning, and logic skills (5.1) in the context of the key concepts presented in this standard. |

| 5.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which |
| a) items such as rocks, minerals, and organisms are identified using various classification keys; |
| b) estimates are made and accurate measurements of length, mass, volume, and temperature are made in metric units using proper tools; |
| c) estimates are made and accurate measurements of elapsed time are made using proper tools; |
| d) hypotheses are formed from testable questions; |
| e) independent and dependent variables are identified; |
| f) constants in an experimental situation are identified; |
| g) data are collected, recorded, analyzed, and communicated using proper graphical representations and metric measurements; |
| h) predictions are made using patterns from data collected, and simple graphical data are generated; |
| i) inferences are made and conclusions are drawn; |
| j) models are constructed to clarify explanations, demonstrate relationships, and solve needs; and |
| k) current applications are used to reinforce science concepts. |

| 5.5 The student will investigate and understand that organisms are made of one or more cells and have distinguishing characteristics that play a vital role in the organism’s ability to survive and thrive in its environment. Key concepts include |
| a) basic cell structures and functions; |
| b) classification of organisms using physical characteristics, body structures, and behavior of the organism; and |
| c) traits of organisms that allow them to survive in their environment. |

<table>
<thead>
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<th>Understanding the Standard</th>
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<tbody>
<tr>
<td>(Background Information for Instructor Use Only)</td>
</tr>
<tr>
<td>• Living things are made of cells. Cells carry out all life processes. New cells come from existing cells. Cells are too small to be seen with the eye alone. By using a microscope, many parts of a cell can be seen.</td>
</tr>
<tr>
<td>• Though plant and animal cells are similar, they are also different in shape and in some of their parts. Plant cells tend to be rectangular, while animal cells tend to be spherical or at times irregular.</td>
</tr>
<tr>
<td>• Organisms that share similar characteristics can be organized into groups in order to help understand similarities and differences.</td>
</tr>
<tr>
<td>• Plants can be categorized as vascular (having special tissues to transport food and water — for example, trees and flowering plants) and nonvascular (not having tissues to transport food and water — for example, moss, liverworts, and</td>
</tr>
</tbody>
</table>
hornworts). Most plants are vascular.

- Animals can be categorized as vertebrates (having backbones) or invertebrates (not having backbones).

- compare and contrast the distinguishing characteristics of groups of organisms.
- identify and explain traits of organisms that allow them to survive in their environment.

## RESOURCES AND ACTIVITIES

<table>
<thead>
<tr>
<th>Textbook Unit A, pp. G2-G5 (Cells)</th>
<th>Sort cards for 6 kingdoms and cell parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relates to Reading Theme 6- Animal Encounters</td>
<td>Microscope investigation of micro organisms and cells</td>
</tr>
<tr>
<td>United Streaming</td>
<td>Make a Jello/ edible cell</td>
</tr>
<tr>
<td>Interactive Notebooks</td>
<td>Venn Diagram to compare/contrast</td>
</tr>
<tr>
<td>Text – A4-17 Classifying Living Things</td>
<td><a href="http://www.augusta.k12.va.us">www.augusta.k12.va.us</a></td>
</tr>
<tr>
<td>A48-49 Vascular and Nonvascular</td>
<td>Mind Notes Elementary Science</td>
</tr>
<tr>
<td>A94-100 Vertebrates and invertebrates</td>
<td>Living Systems</td>
</tr>
<tr>
<td>Laser Disc – Life Science Vol. 1</td>
<td>Benchmark Literacy:</td>
</tr>
<tr>
<td>Enhanced Scope &amp; Sequence – Grade 5 p.30-44</td>
<td>Body Systems: Human Cells – 5.5 – Unit 3</td>
</tr>
<tr>
<td>Characteristics of Organisms</td>
<td>Cells – Unit 4</td>
</tr>
<tr>
<td></td>
<td>Basic Heredity – Unit 8</td>
</tr>
</tbody>
</table>

### Understanding the Standard (Background Information for Instructor Use Only)

- For many typical green plants, there are anatomical structures that perform certain basic functions. For example, roots anchor the plants and take water

### Essential Knowledge, Skills, and Processes

In order to meet this standard, it is expected that students will
and nutrients from the soil. Plant stems provide support and allow movement of water and nutrients.

- Plants can be divided into two general groups: those that produce seeds and those that produce spores.
- Many seed-producing plants have roots, stems, leaves, and flowers.
- Seeds vary considerably in size. Orchids, for example, produce seeds as small as dust particles. The coconut is one of the largest seeds in the plant kingdom. In many seeds, the protective outer seed coat is resistant to physical damage and may also contain waxes and oils that help prevent water loss.
- The embryo within the seed begins as a single cell, the zygote. The basic organs of the plant body can be found in the embryo. In some seeds the embryonic leaves are quite large, filling most of the volume of the seed. The embryonic leaves are a major source of stored food for the embryo. Beans are an example of plants with large embryonic leaves. In many other plants the embryonic leaves are relatively small, and the embryo is nourished by a tissue called endosperm.
- Pollination is part of the reproductive process of flowering plants. Pollination is the process by which pollen is transferred from the stamens to the stigma.
- The stamen and pistil are reproductive parts of the flower. The sepals are the small leaves that form the housing of the developing flower.
- Some plants reproduce with spores. These include ferns and mosses.
- Green plants produce their own food through the process of photosynthesis. Green plants use chlorophyll to produce food (sugar), using carbon dioxide, water, enzymes and other chemicals, and sunlight. Leaves are the primary food-producing part of these plants.
- Oxygen is released during photosynthesis.
- Plants adapt to changes in their environment in order to survive. Dormancy is a plant adaptation. Dormancy is a period of suspended life processes brought on by changes in the environment.

- analyze a common plant: identify the roots, stems, leaves, and flowers, and explain the function of each.
- create a model/diagram illustrating the parts of a flower and its reproductive processes. Explain the model/diagram using the following terminology: pollination, stamen, stigma, pistil, sepal, embryo, spore, seed.
- compare and contrast different ways plants are pollinated.
- explain that ferns and mosses reproduce with spores rather than seeds.
- explain the process of photosynthesis, using the following terminology: sunlight, chlorophyll, water, carbon dioxide, oxygen, and sugar.
- explain the role of adaptations of common plants to include dormancy, response to light, and response to moisture.
4.5 The student will investigate and understand how plants and animals, including humans, in an ecosystem interact with one another and with the nonliving components in the ecosystem. Key concepts include
a) plant and animal adaptations;
b) organization of populations, communities, and ecosystems and how they interrelate;
c) flow of energy through food webs;
d) habitats and niches;
e) changes in an organism’s niche at various stages in its life cycle; and
f) influences of human activity on ecosystems.

Overview
This standard focuses on the relationships among plants, animals, and the nonliving environment and brings together several elements of both Life Processes and Living Systems. This standard assumes students have a basic understanding that all living organisms are interrelated and dependent in some way on other living organisms and their environment. Plants and animals in ecological systems live in a web of interdependence in which each species contributes to the functioning of the overall system. Organisms live in a habitat to which they are structurally and behaviorally adapted. Certain conditions within environments determine which organisms and communities succeed there. This standard builds upon previous standards 1.5, 2.4, 2.5, 3.4, 3.5 and 3.6. It is intended that students will actively develop and utilize scientific investigation, reasoning, and logic skills (4.1) in the context of the key concepts presented in this standard.

Understanding the Standard
(Background Information for Instructor Use Only)

- Organisms have structural adaptations or physical attributes that help them meet a life need.
- Organisms also have behavioral adaptations, or certain types of activities they perform, which help them meet a life need.
- All the organisms of the same species that live in the same place at the same time are a population.
- Populations of species that live in the same place at the same time together make up a community.
- The organization of communities is based on the utilization of the energy from the sun within a given ecosystem. The greatest amount of energy in a community is in the producers.
- Within a community, organisms are dependent on the survival of other organisms. Energy is passed from one organism to another.
- All the populations and the nonliving components in an environment that interact with each other form an ecosystem.
- The sun’s energy cycles through ecosystems from producers through consumers and back into the nutrient pool through decomposers.
- A habitat is the place or kind of place in which an animal or plant naturally lives. An organism’s habitat provides food, water, shelter, and space. The size of the habitat depends on the organism’s needs.

Essential Knowledge, Skills, and Processes

In order to meet this standard, it is expected that students will
- distinguish between structural (physical) and behavioral adaptations.
- investigate and infer the function of basic adaptations.
- understand that adaptations allow an organism to succeed in a given environment.
- explain how different organisms use their unique adaptations to meet their needs.
- describe why certain communities exist in given habitats.
- illustrate the food webs in a local area.
- compare and contrast the niches of several different organisms within the community.
- compare and contrast the differing ways an organism interacts with its surroundings at various stages of its life cycle. Specific examples include a frog and a butterfly.
- differentiate among positive and negative influences of human activity on ecosystems.
• A niche is the function that an organism performs in the food web of that community. A niche also includes everything else the organism does and needs in its environment. No two types of organisms occupy exactly the same niche in a community.

• The organization of a community is defined by the interrelated niches within it.

• During its life cycle, an organism’s role in the community — its niche — may change. For example, what an animal eats, what eats it, and other relationships will change.

• Humans can have a major impact on ecosystems.

RESOURCES AND ACTIVITIES

Benchmark Literacy:
Riches from the Earth – Unit 1
Plant Genetics – 4.4 - Unit 10
**Measurement SOL 5.1, MATH SOL 5.8d&e**

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<thead>
<tr>
<th>Weeks 29-30</th>
<th>[Week 29-30]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5.1</strong> The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which</td>
<td><strong>ESSENTIAL UNDERSTANDINGS</strong></td>
</tr>
<tr>
<td>a) items such as rocks, minerals, and organisms are identified using various classification keys;</td>
<td>All students should</td>
</tr>
<tr>
<td>b) estimates are made and accurate measurements of length, mass, volume, and temperature are made in metric units using proper tools;</td>
<td>• Understand how to select a measuring device and unit of measure to solve problems involving measurement.</td>
</tr>
<tr>
<td>c) estimates are made and accurate measurements of elapsed time are made using proper tools;</td>
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<td></td>
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<td>k) current applications are used to reinforce science concepts.</td>
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</tr>
</tbody>
</table>

**MATH SOL:**

5.8 The student will

d) estimate and then measure to solve problems, using U.S. Customary and metric units; and

e) choose an appropriate unit of measure for a given situation involving measurement using U.S. Customary and metric units.

**UNDERSTANDING THE STANDARD (Background Information for Instructor Use Only)**

- **Length is the distance along a line or figure from one point to another.**
- **U.S. Customary units for measurement of length include inches, feet, yards, and miles. Appropriate measuring devices include rulers, yardsticks, and tape measures. Metric units for measurement of length include millimeters, centimeters, meters, and kilometers. Appropriate measuring devices include centimeter ruler, meter stick, and tape measure.**
- **When measuring with U.S. Customary units, students should be able to measure to the nearest part of an inch \( \frac{1}{2}, \frac{1}{4}, \frac{1}{8} \), foot, or yard.**
- **Weight and mass are different. Mass is the amount of matter in an object. Weight is determined by the pull of gravity on the mass of**

**ESSENTIAL KNOWLEDGE AND SKILLS**

The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to

- **Identify equivalent measurements within the metric system for the following:**
  - length: millimeters, centimeters, meters, and kilometers;
  - mass: grams and kilograms;
  - liquid volume: milliliters, and liters.

- **Solve problems involving measurement by selecting an appropriate measuring device and a U.S. Customary or metric unit of measure for the following:**
  - length: part of an inch \( \frac{1}{2}, \frac{1}{4}, \frac{1}{8} \), inches, feet, yards, millimeters, centimeters, meters, and kilometers;
an object. The mass of an object remains the same regardless of its location. The weight that an object changes is dependent on the gravitational pull at its location. In everyday life, most people are actually interested in determining an object’s mass, although they use the term weight (e.g., “How much does it weigh?” versus “What is its mass?”).

- Appropriate measuring devices to measure mass in U.S. Customary units (ounces, pounds) and metric units (grams, kilograms) are balances.
- U.S. Customary units to measure liquid volume (capacity) include cups, pints, quarts, and gallons. Metric units to measure liquid volume (capacity) include milliliters and liters.
- Temperature is measured using a thermometer. The U.S. Customary unit of measure is degrees Fahrenheit; the metric unit of measure is degrees Celsius.
- Practical experience measuring familiar objects helps students establish benchmarks and facilitates students’ ability to use the units of measure to make estimates.

- weight: ounces, pounds, and tons;
- mass: grams and kilograms;
- liquid volume: cups, pints, quarts, gallons, milliliters, and liters;
- area: square units; and
- temperature: Celsius and Fahrenheit units.
  - Water freezes at 0°C and 32°F.
  - Water boils at 100°C and 212°F.
  - Normal body temperature is about 37°C and 98.6°F.

### RESOURCES AND ACTIVITIES

<table>
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<th>MATH -ESS lesson: Measurement Mania</th>
</tr>
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<td>Science:</td>
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<td>R2-R11 Measurement</td>
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<td>E5 Mass – Balloon Experiment</td>
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<thead>
<tr>
<th>SOL Review</th>
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<td>Released Items Practice</td>
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<tr>
<td><a href="http://www.education.jlab.org/solquiz/">http://www.education.jlab.org/solquiz/</a></td>
</tr>
<tr>
<td>Scroll down for Jeopardy Games</td>
</tr>
<tr>
<td><a href="http://www.richmond.k12.va.us/schools/thirteenacres/resources.htm">http://www.richmond.k12.va.us/schools/thirteenacres/resources.htm</a></td>
</tr>
<tr>
<td>Science Files</td>
</tr>
<tr>
<td><a href="http://www.richmond.k12.va.us/schools/munford/scifiles.htm">http://www.richmond.k12.va.us/schools/munford/scifiles.htm</a></td>
</tr>
<tr>
<td>Mountain View Elementary Review</td>
</tr>
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</table>
### SOL Review and Assess

**Weeks 33-40**

[Week 35-40]

- Review ALL 4th and 5th SOLs
- SOL Testing
- End of Year Assessments
- Review and Extend

### RESOURCES AND ACTIVITIES

<table>
<thead>
<tr>
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