2019-2020 6th Grade

The skills described in standard 6.1 are intended to define the "investigate" component of all of the other sixth-grade standards (6.2–6.9). The intent of standard 6.1 is that students will continue to develop a range of inquiry skills and achieve proficiency with those skills in the context of the concepts developed at the sixth grade. Standard 6.1 does not require a discrete unit on scientific investigation because the inquiry skills that make up the standard should be incorporated in all the other sixth-grade standards. It is also intended that by developing these skills, students will achieve greater understanding of scientific inquiry and the nature of science, as well as more fully grasp the content-related concepts in the standards. It is also intended that models, simulations and current applications are used throughout the course in order to learn and reinforce science concepts.

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

a. observations are made involving fine discrimination between similar objects and organisms;
b. precise and approximate measurements are recorded;
c. scale models are used to estimate distance, volume, and quantity;
d. hypotheses are stated in ways that identify the independent and dependent variables;
e. a method is devised to test the validity of predictions and inferences;
f. one variable is manipulated over time, using many repeated trials;
g. data are collected, recorded, analyzed, and reported using metric measurements and tools;
h. data are analyzed and communicated through graphical representation;
i. models and simulations are designed and used to illustrate and explain phenomena and systems; and
j. current applications are used to reinforce science concepts.

SOL Standards 6.8 Unit 1 Earth & Space Interactions Weeks 2-6 8/12/2019- 9/13/2019
6.8 The student will investigate and understand the organization of the solar system and the interactions among the various bodies that comprise it. Key concepts include **a) the sun, moon, Earth, other planets and their moons, dwarf planets, meteors, asteroids, and comets;** **b) relative size of and distance between planets;** **c) the role of gravity;** **d) revolution and rotation;** **e) the mechanics of day and night and the phases of the moon;** **f) the unique properties of Earth as a planet;** **g) the relationship of Earth's tilt and the seasons;** **h) the cause of tides; and** **i) the history and technology of space exploration.**

ESSENTIAL UNDERSTANDINGS **All students should:**	ESSENTIAL KNOWLEDGE AND SKILLS **To be successful with this standard, students are expected to:**
The concepts developed in this standard include the following: ● The solar system consists of the sun, moon, Earth, other planets and their moons, meteors, asteroids, and comets. Each body has its own characteristics and features. ● The distance between planets and sizes of the planets vary greatly. The outer, "gas" planets are very large, and the four inner planets are comparatively small and rocky. ● Gravity is a force that keeps the planets in motion around the sun. Gravity acts everywhere in the universe. ● Planets revolve around the sun, and moons revolve around planets. A planet rotates upon an axis. ● A dwarf planet revolves around the sun, and can maintain a nearly round shape as planets do, but it cannot move other objects away from its orbital neighborhood. ● As Earth rotates, different sides of Earth face toward or away	In order to meet this standard, it is expected that students will ● describe the planets and their relative positions from the sun. ● compare the characteristics of Pluto to the planets and explain its designation as a dwarf planet. ● design and interpret a scale model of the solar system. (A scale model may be a physical representation of an object or concept. It can also be a mathematical representation that uses factors such as ratios, proportions, and percentages.) ● explain the role of gravity in the solar system. ● compare and contrast revolution and rotation and apply these terms to the relative movements of planets and their moons. ● model and describe how day and night and the phases of the moon occur. ● model and describe how Earth's axial tilt and its annual orbit around the sun cause the seasons.

from the sun, thus causing day and night, respectively. ● The phases of the moon are caused by its position relative to Earth and the sun. ● Earth is a rocky planet, extensively covered with large oceans of liquid water and having frozen ice caps in its polar regions. Earth has a protective atmosphere consisting predominantly of nitrogen and oxygen and has a magnetic field. The atmosphere and the magnetic field help shield Earth's surface from harmful solar radiation. Scientific evidence indicates that Earth is about 4.5 billion years old. ● Seasons are caused by a combination of the tilt of Earth on its axis, the curvature of Earth's surface and, thus, the angle at which sunlight strikes the surface of Earth during its annual revolution around the sun. ● Tides are the result of the gravitational pull of the moon and sun on the surface waters of Earth. ● The ideas of Ptolemy, Aristotle, Copernicus, and Galileo contributed to the development of our understanding of the solar system. ● With the development of new technology over the last half-century, our knowledge of the solar system has increased substantially.	● describe the unique characteristics of planet Earth. ● discuss the relationship between the gravitational pull of the moon and the cycle of tides. ● compare and contrast the ideas of Ptolemy, Aristotle, Copernicus, and Galileo related to the solar system. ● create and interpret a timeline highlighting the advancements in solar system exploration over the past half century. This should include information on the first modern rockets, artificial satellites, orbital missions, missions to the moon, Mars robotic explorers, and exploration of the outer planets.

PRIMARY Resources and Activities	SUPPLEMENTAL Resources and Activities	TEACHER NOTES
Early Astronomers Reading **Historical Theories Organizer- Request Permission** **Hubble Images** Solar System Informational Text		

IAU Pluto Designation as a Dwarf Planet Reading Pocket Solar System Brainpop- Build a Solar System Pluto Writing Assignment- request permission IAU Pluto Reading Lab Safety and Basic Instruments Practice Request permission Solar System Tic Tac Toe Menu		

SOL Standards 6.6 Unit 2 Earth's Atmosphere Weeks 7-10 9/16/2019-10/11/2019
6.6 The student will investigate and understand the properties of air and the structure and dynamics of Earth's atmosphere. Key concepts include **a. air as a mixture of gaseous elements and compounds;** **b. pressure, temperature, and humidity;** **c. atmospheric changes with altitude;** **natural and human-caused changes to the atmosphere and the importance of protecting and maintaining air quality;** **d. the relationship of atmospheric measures and weather conditions; and** **basic information from weather maps, including fronts, systems, and basic measurements.**

ESSENTIAL UNDERSTANDINGS All students should:	ESSENTIAL KNOWLEDGE AND SKILLS To be successful with this standard, students are expected to:
The concepts developed in this standard include the following: · Air is a mixture of gaseous elements and compounds. These include nitrogen, oxygen, water, argon and carbon dioxide. Nitrogen makes up the largest proportion of air. · Air exerts pressure. Air pressure decreases as altitude increases. · Moisture in the air is called humidity. · The atmosphere is made up of layers (troposphere, stratosphere, mesosphere, and thermosphere) that have distinct characteristics. · Temperature decreases as altitude increases in the lowest layer of the atmosphere. · Most of the air that makes up the atmosphere is found in the troposphere (the lowest layer). Virtually all weather takes place there. · Forest fires and volcanic eruptions are two natural processes that affect Earth's atmosphere. Many gaseous compounds and particles are released into the atmosphere by human activity. All of the effects of these materials are not yet fully understood. · Ozone, a form of oxygen, can form near the surface when exhaust pollutants react with sunlight. This pollutant can cause health problems. Naturally occurring ozone is also found in the upper atmosphere and helps to shield Earth from ultraviolet radiation.	In order to meet this standard, it is expected that students will · comprehend and apply basic terminology related to air and the atmosphere. · identify the composition and physical characteristics of the atmosphere. · analyze and interpret charts and graphs of the atmosphere in terms of temperature and pressure. · measure and record air temperature, air pressure, and humidity, using appropriate units of measurement and tools. · analyze and explain some of the effects that natural events and human activities may have on weather, atmosphere, and climate. · evaluate their own roles in protecting air quality. In order to meet this standard, it is expected that students will · describe the planets and their relative positions from the sun. · compare the characteristics of Pluto to the planets and explain its designation as a dwarf planet. · design and interpret a scale model of the solar system. (A scale model may be a physical representation of an object or concept. It can also be a mathematical representation that uses factors such as ratios, proportions, and percentages.) ·

PRIMARY Resources and Activities	SUPPLEMENTAL Resources and Activities	TEACHER NOTES
Atmosphere Design Lab Making Oxygen on Mars Atmosphere Basics- Diagram and Explanations Layers Data Tables Activity Layers Foldable Practice Labeling Layers Graph Atmospheric Temperature Teacher/Student Pages and Plan Atmospheric Pressure at Different Altitudes Data Its Our Air- Air Quality Activities and Videos Reading to accompany Gases Graph Making Gases in the Air Graph Making Template- Request Permission Weather/Climate/Atmosphere Simulations Volcanic Eruptions and Wildfires CDC Informational Readings		

SOL Standards 6.3 Unit 3 Solar Energy Weeks 11-14 10/15/2019- 11/08/2019
6.3 The student will investigate and understand the role of solar energy in driving most natural processes within the atmosphere, the hydrosphere, and on Earth's surface. Key concepts include **a) Earth's energy budget;** **b) the role of radiation and convection in the distribution of energy;** **c) the motion of the atmosphere and the oceans;** **d) cloud formation; and** **e) the role of thermal energy in weather-related phenomena including thunderstorms and hurricanes.**

ESSENTIAL UNDERSTANDINGS **All students should:**	ESSENTIAL KNOWLEDGE AND SKILLS **To be successful with this standard, students are expected to:**
The concepts developed in this standard include the following: ● Earth receives only a very small portion of the sun's energy, yet this energy is responsible for powering the motion of the atmosphere, the oceans, and many processes at Earth's surface. ● Solar radiation is made up of different types of radiation (including infrared, visible light, and ultraviolet). ● Incoming solar radiation is in close balance with the energy that leaves the atmosphere; otherwise Earth would heat up or cool down. Excess carbon dioxide and other gases may disrupt this balance, creating a greenhouse effect. ● About one-third of the sun's incoming energy is reflected back out to space. About one-half of the energy striking Earth is absorbed by Earth's surface. ● Earth's surface is heated unequally.	In order to meet this standard, it is expected that students will ● comprehend and apply basic terminology related to solar energy, including wavelength; ultraviolet, visible, and infrared radiation; and reflection and absorption. ● analyze and interpret a chart or diagram showing Earth's energy budget. ● analyze, model, and explain the greenhouse effect in terms of the energy entering and leaving the atmosphere. ● design an investigation to determine the effect of sunlight on the heating of a surface. ● analyze and explain how convection currents occur and how they distribute thermal energy in the atmosphere and oceans. ● analyze the role of heating and cooling in the formation of clouds. ● order the sequence of events that takes place in the formation of a cloud.

● When air or water is heated, the molecules move faster and farther apart, reducing their density and causing them to rise. Cooler air or water molecules move more slowly and are denser than warm air or water. Warm air or water rising coupled with cooler air or water descending forms a cyclic rising/falling pattern called convection. ● Radiation and convection from Earth's surface transfer thermal energy. This energy powers the global circulation of the atmosphere and the oceans on our planet. ● As bodies of water (oceans, lakes, rivers, etc.) absorb thermal energy, the water evaporates causing the air to be warm and moist. Warm, moist air is less dense than cold, dry air, so it rises relative to colder, drier air. As warm, moist air rises, it gives off some thermal energy as the moisture condenses, forming clouds. Clouds are not gaseous water vapor; rather they are minute, condensed water particles. ● Some thunderstorms are formed where the land is strongly heated. Hurricanes form over warm, tropical water and are fed by the energy of that water.	● describe the relationship between thermal energy and the formation of hurricanes and thunderstorms.

PRIMARY Resources and Activities	SUPPLEMENTAL Resources and Activities	TEACHER NOTES
Solar Radiation Balance		

SOL Standards 6.2, 6.9 Unit 4 Energy/Heat/Sun Weeks 15-20
11/11/2019-12/19/2019

6.2 The student will investigate and understand basic sources of energy, their origins, transformations, and uses. Key concepts include

a) potential and kinetic energy;
b) the role of the sun in the formation of most energy sources on Earth;
c) nonrenewable energy sources;
d) renewable energy sources; and
e) energy transformations.

6.9 The student will investigate and understand public policy decisions relating to the environment. Key concepts include

a) management of renewable resources;

a) management of renewable resources;

b) management of nonrenewable resources;

c) the mitigation of land-use and environmental hazards through preventive measures; and

d) cost/benefit tradeoffs in conservation policies.

Many sources of energy on Earth are the result of solar radiation. This can be energy Earth is currently receiving or energy that has been stored as fossil fuels. All energy exists in two basic forms — kinetic and potential. Understanding the forms of energy and their transformations will provide the foundation for students to investigate the transfer of energy within living and Earth systems as well as to understand chemical reactions, force, and motion. This standard builds upon concepts of energy sources introduced in science standard 3.11. It is intended that students will actively develop scientific investigation, reasoning, and logic skills, and an understanding of the nature of science (6.1) in the context of the key concepts presented in this standard.

Standard 6.9 is intended to develop student understanding of the importance of Earth's natural resources, the need to manage them, how they are managed, and the analysis of costs and benefits in making decisions about those resources. It applies and builds on the concepts described in several lower grades, especially science standard 4.9. Knowledge gained from this standard will be important to understanding numerous concepts in Life Science and Earth Science. It is intended that students will actively develop scientific investigation, reasoning, and logic skills, and an understanding of the nature of science (6.1) in the context of the key concepts presented in this standard.

ESSENTIAL UNDERSTANDINGS **All students should:**	ESSENTIAL KNOWLEDGE AND SKILLS **To be successful with this standard, students are expected to:**
6.2 ● Potential energy is energy that is not "in use" and available to do work. Kinetic energy is energy that is "in use" — the energy a moving object has due to its motion. For example, moving water and wind have kinetic energy. The chemical energy in fossil fuels is potential energy until it is released. ● Solar energy from the ancient past is stored in fossil fuels, such as coal, petroleum, and natural gas. Fossil fuels are rich in the elements carbon and hydrogen. These sources of energy take very long periods of time to form and once depleted, are essentially nonrenewable. Nuclear power is also a source of nonrenewable energy. ● Many of Earth's energy resources are available on a perpetual basis. These include solar, wind, water (hydropower, tidal and waves), biofuels and geothermal energy. Some energy sources can be replenished over relatively short periods of time. These include wood and other biomass. All are considered renewable. ● Secondary sources of energy, such as electricity, are used to store, move, and deliver energy easily in usable form. Hydrogen is also a secondary source of energy, also called an energy carrier. ● Thermal and radiant energy can be converted into mechanical energy, chemical energy, and electrical energy and back again. 6.9 ● People, as well as other living organisms, are dependent upon the availability of clean water and air and a healthy environment. ● Local, state, and federal governments have significant roles in managing and protecting air, water, plant, and wildlife resources. ● Modern industrial society is dependent upon energy. Fossil fuels are the major sources of energy in developed and industrialized nations and should be managed to minimize adverse impacts. ● Many renewable and nonrenewable resources are managed by the private sector (private individuals and corporations).	6.2: ● compare and contrast potential and kinetic energy through common examples found in the natural environment. ● analyze and describe the transformations of energy involved with the formation and burning of coal and other fossil fuels. ● compare and contrast renewable (solar, wind, water [hydropower, tidal and waves], biofuels, geothermal, and biomass) and nonrenewable energy sources (coal, petroleum, natural gas, nuclear power). ● explain that hydrogen is not an energy source, but a means of storing and transporting energy. ● design an application of the use of solar and wind energy. ● chart and analyze the energy a person uses during a 24-hour period and determine the sources. ● compare and contrast energy sources in terms of their origins, how they are utilized, and their availability. ● analyze the advantages and disadvantages of using various energy sources and their impact on climate and the environment. ● analyze and describe how the United States' energy use has changed over time. ● analyze and describe sources of energy used in Virginia related to energy use nationally and globally. ● predict the impact of unanticipated energy shortages. ● comprehend and apply basic terminology related to energy sources and transformations. ● create and interpret a model or diagram of an energy transformation. ● design an investigation that demonstrates how light energy (radiant energy) can be transformed into other forms of energy (mechanical, chemical and electrical). 6.9:

● Renewable resources should be managed so that they produce continuously. Sustainable development makes decisions about long-term use of the land and natural resources for maximum community benefit for the longest time and with the least environmental damage. ● Regulations, incentives, and voluntary efforts help conserve resources and protect environmental quality. ● Conservation of resources and environmental protection begin with individual acts of stewardship. ● Use of renewable (water, air, soil, plant life, animal life) and nonrenewable resources (coal, oil, natural gas, nuclear power, and mineral resources) must be considered in terms of their cost/benefit tradeoffs. ● Preventive measures, such as pollution prevention or thoughtfully planned and enforced land-use restrictions, can reduce the impact of potential problems in the future. ● Pollution prevention and waste management are less costly than cleanup.	● differentiate between renewable and nonrenewable resources. ● describe the role of local and state conservation professionals in managing natural resources. These include wildlife protection; forestry and waste management; and air, water, and soil conservation. ● analyze resource-use options in everyday activities and determine how personal choices have costs and benefits related to the generation of waste. ● analyze how renewable and nonrenewable resources are used and managed within the home, school, and community. ● analyze reports, media articles, and other narrative materials related to waste management and resource use to determine various perspectives concerning the costs/benefits in real-life situations. ● evaluate the impact of resource use, waste management, and pollution prevention in the school and home environment.

PRIMARY Resources and Activities	SUPPLEMENTAL Resources and Activities	TEACHER NOTES

SOL Standards 6.4, 6.5 Unit 5 Water and Atoms Weeks 21-25 01/06/2020-02/07/2020
6.4 The student will investigate and understand that all matter is made up of atoms. Key concepts include **a. atoms consist of particles, including electrons, protons, and neutrons;** **b. atoms of a particular element are alike but are different from atoms of other elements;** **c. elements may be represented by chemical symbols;** **d. two or more atoms interact to form new substances, which are held together by electrical forces (bonds);** **e. compounds may be represented by chemical formulas;** **f. chemical equations can be used to model chemical changes; and** **g. a limited number of elements comprise the largest portion of the solid Earth, living matter, the oceans, and the atmosphere.** **6.5 The student will investigate and understand the unique properties and characteristics of water and its roles in the natural and human-made environment. Key concepts include** **a) water as the universal solvent;** **b) the properties of water in all three phases;**

ESSENTIAL UNDERSTANDINGS **All students should:**	ESSENTIAL KNOWLEDGE AND SKILLS **To be successful with this standard, students are expected to:**
6.5 Concepts ● The basic structural components of a typical atom are electrons, protons, and neutrons. Protons and neutrons comprise the nucleus of an atom. ● An element is a form of matter made up of one type of atom. The atoms of an element are basically alike, though the number of neutrons may vary.	6.5 In order to meet this standard, it is expected that students will ● create and interpret a simplified modern model of the structure of an atom. ● compare and contrast the atomic structure of two different elements. ● explain that elements are represented by symbols. ● identify the name and number of each element present in a simple molecule or compound, such as O2, H2O, CO2, or CaCO3.

● The atoms of one element differ from those of another element in the number of protons. ● Elements can be represented by chemical symbols. ● Two or more atoms of different elements may combine to form a compound. Compounds can be represented by chemical formulas. Each different element in the compound is represented by its unique symbol. The number of each type of element in the compound (other than 1) is represented by a small number (the subscript) to the right of the element symbol. ● Chemical equations can be used to model chemical changes, illustrating how elements become rearranged in a chemical reaction. ● A limited number of elements, including silicon, aluminum, iron, sodium, calcium, potassium, magnesium, hydrogen, oxygen, nitrogen, and carbon, form the largest portion of Earth's crust, living matter, the oceans, and the atmosphere. 6.4 Concepts ● Among water's unique properties is that one side of each water molecule is slightly negative and the other is slightly positive. Individual water molecules, therefore, attract other water molecules like little magnets as the slightly positive portion of a water molecule is attracted to the slightly negative portion of an adjacent water molecule. In this way, water molecules "stick together." ● Due to water's polar nature, a large number of substances will "dissolve" in water. For this reason, water is often called the universal solvent. ● Water is the only compound that commonly exists in all three states (solid, liquid, gas) on Earth. The unique properties of water are a major factor in the ability of our planet to sustain life. ● Additional properties of water are its high surface tension and the large range of temperature (0–100 degrees Celsius) in which it	● model a simple chemical change with an equation and account for all atoms. ● Distinguish the types of elements and number of each element in the chemical equation. (Balancing equations will be further developed in Physical Science.) ● name some of the predominant elements found in the atmosphere, the oceans, living matter, and Earth's crust ● comprehend and apply key terminology related to water and its properties and uses. ● model and explain the shape and composition of a water molecule. ● design an investigation to demonstrate the ability of water to dissolve materials. ● comprehend the adhesive and cohesive properties of water. ● compare the effects of adding thermal energy to the states of water. ● explain why ice is less dense than liquid water. ● relate the three states of water to the water cycle. ● design an investigation to model the action of freezing water on rock material. ● design an investigation to determine the presence of water in plant material (e.g., a fruit). ● infer how the unique properties of water are key to the life processes of organisms. ● design an investigation to model the action of acidified water on building materials such as concrete, limestone, or marble. ● chart, record, and describe evidence of chemical weathering in the local environment. ● analyze and explain the difference in average winter temperatures among areas in central and western Virginia and cities and counties along the Chesapeake Bay and Atlantic coast. ● explain the role of water in power generation. ● describe the importance of careful management of water resources.

can be found in the liquid state, as well as the fact that, unlike other substances, solid water is less dense than liquid water. ● Water is able to absorb thermal energy without showing relatively large changes in temperature. Large bodies of water act to moderate the climate of surrounding areas by absorbing thermal energy in summer and slowly releasing that energy in the winter. For this reason, the climate near large bodies of water is slightly milder than areas without large bodies of water. ● Water (rain, ice, snow) has shaped our environment by physically and chemically weathering rock and soil and transporting sediments. Freezing water can break rock without any change in the minerals that form the rock (physical weathering). This usually produces small particles and sand. Water with dissolved gases and other chemicals causes the minerals in rocks to be changed, leading to the deterioration of the rock (chemical weathering). ● Most of Earth's water is salt water in the oceans (97 percent). Non-frozen, freshwater makes up less than 1 percent of the water on Earth. ● Water is essential for agriculture. Crops watered by reliable irrigation systems are more productive and harvests more dependable. ● Water is an important resource used in power generation. Hydroelectric power plants make use of the kinetic energy of water as it flows through turbines. Water is also heated in power plants and turned to steam. The steam is used to turn turbines, which generate electricity. ● In the past, streams and rivers were often used to dispose of human waste, and open sewers were common. During the mid-1800s, public health officials recognized the connection between disease outbreaks and contamination of public wells and	

drinking water. Advances in water treatment and sanitary sewers have helped eliminate diseases associated with human waste. ● Due to water's importance in power generation, agriculture, and human health, it is important to conserve water resources.	
6.5 The concepts developed in this standard include the following: ● Among water's unique properties is that one side of each water molecule is slightly negative and the other is slightly positive. Individual water molecules, therefore, attract other water molecules like little magnets as the slightly positive portion of a water molecule is attracted to the slightly negative portion of an adjacent water molecule. In this way, water molecules "stick together." ● Due to water's polar nature, a large number of substances will "dissolve" in water. For this reason, water is often called the universal solvent. ● Water is the only compound that commonly exists in all three states (solid, liquid, gas) on Earth. The unique properties of water are a major factor in the ability of our planet to sustain life. ● Additional properties of water are its high surface tension and the large range of temperature (0–100 degrees Celsius) in which it can be found in the liquid state, as well as the fact that, unlike other substances, solid water is less dense than liquid water. ● Water is able to absorb thermal energy without showing relatively large changes in temperature. Large bodies of water act to moderate the climate of surrounding areas by absorbing thermal energy in summer and slowly releasing that energy in the winter. For this reason, the climate near large bodies of water is slightly milder than areas without large bodies of water.	6.5 In order to meet this standard, it is expected that students will ● comprehend and apply key terminology related to water and its properties and uses. ● model and explain the shape and composition of a water molecule. ● design an investigation to demonstrate the ability of water to dissolve materials. ● comprehend the adhesive and cohesive properties of water. ● compare the effects of adding thermal energy to the states of water. ● explain why ice is less dense than liquid water. ● relate the three states of water to the water cycle. ● design an investigation to model the action of freezing water on rock material. ● design an investigation to determine the presence of water in plant material (e.g., a fruit).

PRIMARY Resources and Activities	SUPPLEMENTAL Resources and Activities	TEACHER NOTES

SOL Standards 6.5 Unit 6 Water's Role in the Natural and Human-made Environment Weeks 26-29 02/10/2020-03/06/2020

6.5

c) the action of water in physical and chemical weathering;
d) the ability of large bodies of water to store thermal energy and moderate climate;
e) the importance of water for agriculture, power generation, and public health; and
f) the importance of protecting and maintaining water resources.

ESSENTIAL UNDERSTANDINGS **All students should:**	ESSENTIAL KNOWLEDGE AND SKILLS **To be successful with this standard, students are expected to:**
● Water (rain, ice, snow) has shaped our environment by physically and chemically weathering rock and soil and transporting sediments. Freezing water can break rock without any change in the minerals that form the rock (physical weathering). This usually produces small particles and sand. Water with dissolved gases and other chemicals causes the minerals in rocks to be changed, leading to the deterioration of the rock (chemical weathering). ● Most of Earth's water is salt water in the oceans (97 percent). Non-frozen, freshwater makes up less than 1 percent of the water on Earth. ● Water is essential for agriculture. Crops watered by reliable irrigation systems are more productive and harvests more dependable. ● Water is an important resource used in power generation. Hydroelectric power plants make use of the kinetic energy of water as it flows through turbines. Water is also heated in power plants and turned to steam. The steam is used to turn turbines, which generate electricity. ● In the past, streams and rivers were often used to dispose of human waste, and open sewers were common.	● infer how the unique properties of water are key to the life processes of organisms. ● design an investigation to model the action of acidified water on building materials such as concrete, limestone, or marble. ● chart, record, and describe evidence of chemical weathering in the local environment. ● analyze and explain the difference in average winter temperatures among areas in central and western Virginia and cities and counties along the Chesapeake Bay and Atlantic coast. ● explain the role of water in power generation. ● describe the importance of careful management of water resources.

PRIMARY Resources and Activities	SUPPLEMENTAL Resources and Activities	TEACHER NOTES

SOL Standards 6.7, 6.9	Unit 7	Watersheds and Earth's Resources	Weeks 30-34	03/09/2020- 04/17/2020

6.7 The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include

a. **the health of ecosystems and the abiotic factors of a watershed;**
b. **the location and structure of Virginia's regional watershed systems;**
c. **divides, tributaries, river systems, and river and stream processes;**
d. **wetlands;**
e. **estuaries;**
f. **major conservation, health, and safety issues associated with watersheds; and**
g. **water monitoring and analysis using field equipment including hand-held technology.**

6.9 The student will investigate and understand public policy decisions relating to the environment. Key concepts include

a) management of renewable resources;

b) management of nonrenewable resources;

c) the mitigation of land-use and environmental hazards through preventive measures; and

d) cost/benefit tradeoffs in conservation policies.

ESSENTIAL UNDERSTANDINGS **All students should:**	ESSENTIAL KNOWLEDGE AND SKILLS **To be successful with this standard, students are expected to:**
The concepts developed in this standard include the following: ● An ecosystem is made up of the biotic (living) community and the abiotic (nonliving) factors that affect it. The health of an ecosystem is directly related to water quality. ● Abiotic factors determine ecosystem type and its distribution of plants and animals as well as the usage of land by people. Abiotic factors include water supply, topography, landforms, geology, soils, sunlight, and air quality/O_2 availability. ● Human activities can alter abiotic components and thus accelerate or decelerate natural processes. For example, people can affect the rate of natural erosion. Plowing cropland can cause greater erosion, while planting trees can prevent it. Flood protection/wetland loss is another example. ● A watershed is the land that water flows across or through on its way to a stream, lake, wetland, or other body of water. Areas of higher elevations, such as ridgelines and divides, separate watersheds. ● The three major regional watershed systems in Virginia lead to the Chesapeake Bay, the North Carolina sounds, or the Gulf of Mexico. ● River systems are made up of tributaries of smaller streams that join along their courses. Rivers and streams generally have wide, flat, border areas, called flood plains, onto which water spills out at times of high flow. ● Rivers and streams carry and deposit sediment. As water flow decreases in speed, the size of the sediment it carries decreases. ● Wetlands form the transition zone between dry land and bodies of water such as rivers, lakes, or bays. Both tidal and nontidal wetlands perform important water quality functions, including	In order to meet this standard, it is expected that students will ● comprehend and apply basic terminology related to watersheds. ● use topographic maps to determine the location and size of Virginia's regional watershed systems. ● locate their own local watershed and the rivers and streams associated with it. ● design an investigation to model the effects of stream flow on various slopes. ● analyze and explain the functioning of wetlands and appraise the value of wetlands to humans. ● explain what an estuary is and why it is important to people. ● propose ways to maintain water quality within a watershed. ● explain the factors that affect water quality in a watershed and how those factors can affect an ecosystem. ● forecast potential water-related issues that may become important in the future. ● locate and critique a media article or editorial (print or electronic) concerning water use or water quality. Analyze and evaluate the science concepts involved. ● argue for and against commercially developing a parcel of land containing a large wetland area. Design and defend a land-use model that minimizes negative impact. ● measure, record, and analyze a variety of water quality indicators and describe what they mean to the health of an ecosystem.

regulating runoff by storing flood waters; reducing erosion by slowing down run-off; maintaining water quality by filtering sediments, trapping nutrients, and breaking down pollutants; and recharging groundwater. They also provide food and shelter for wildlife and fish and nesting and resting areas for migratory birds. ● Estuaries perform important functions, such as providing habitat for many organisms and serving as nurseries for their young. ● The Chesapeake Bay is an estuary where fresh and saltwater meet and are mixed by tides. It is the largest estuary in the contiguous United States and one of the most productive. ● Water quality monitoring is the collection of water samples to analyze chemical and/or biological parameters. Simple parameters include pH, temperature, salinity, dissolved oxygen, turbidity, and the presence of macroinvertebrate organisms. ●	
6.9 The concepts developed in this standard include the following: ● People, as well as other living organisms, are dependent upon the availability of clean water and air and a healthy environment. ● Local, state, and federal governments have significant roles in managing and protecting air, water, plant, and wildlife resources. ● Modern industrial society is dependent upon energy. Fossil fuels are the major sources of energy in developed and industrialized nations and should be managed to minimize adverse impacts. ● Many renewable and nonrenewable resources are managed by the private sector (private individuals and corporations). ● Renewable resources should be managed so that they produce continuously. Sustainable development makes decisions about long-term use of the land and natural resources for maximum community benefit for the longest time and with the least environmental damage.	In order to meet this standard, it is expected that students will ● differentiate between renewable and nonrenewable resources. ● describe the role of local and state conservation professionals in managing natural resources. These include wildlife protection; forestry and waste management; and air, water, and soil conservation. ● analyze resource-use options in everyday activities and determine how personal choices have costs and benefits related to the generation of waste. ● analyze how renewable and nonrenewable resources are used and managed within the home, school, and community. ● analyze reports, media articles, and other narrative materials related to waste management and resource use to determine various perspectives concerning the costs/benefits in real-life situations.

● Regulations, incentives, and voluntary efforts help conserve resources and protect environmental quality. ● Conservation of resources and environmental protection begin with individual acts of stewardship. ● Use of renewable (water, air, soil, plant life, animal life) and nonrenewable resources (coal, oil, natural gas, nuclear power, and mineral resources) must be considered in terms of their cost/benefit tradeoffs. ● Preventive measures, such as pollution prevention or thoughtfully planned and enforced land-use restrictions, can reduce the impact of potential problems in the future. ● Pollution prevention and waste management are less costly than cleanup.	● evaluate the impact of resource use, waste management, and pollution prevention in the school and home environment.

PRIMARY Resources and Activities	SUPPLEMENTAL Resources and Activities	TEACHER NOTES

SOL Standards All Review, Post Testing, Projects Weeks 35-39
04/20/2020- 05/15/2020

Scientific Investigation, Reasoning, and Logic

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

a. observations are made involving fine discrimination between similar objects and organisms;
b. precise and approximate measurements are recorded;
c. scale models are used to estimate distance, volume, and quantity;
d. hypotheses are stated in ways that identify the independent and dependent variables;
e. a method is devised to test the validity of predictions and inferences;
f. one variable is manipulated over time, using many repeated trials;
g. data are collected, recorded, analyzed, and reported using metric measurements and tools;
h. data are analyzed and communicated through graphical representation;
i. models and simulations are designed and used to illustrate and explain phenomena and systems; and
j. current applications are used to reinforce science concepts.

Force, Motion, and Energy

6.2 The student will investigate and understand basic sources of energy, their origins, transformations, and uses. Key concepts include

a. potential and kinetic energy;
b. the role of the sun in the formation of most energy sources on Earth;
c. nonrenewable energy sources;
d. renewable energy sources; and
e. energy transformations.

6.3 The student will investigate and understand the role of solar energy in driving most natural processes within the atmosphere, the hydrosphere, and on Earth's surface. Key concepts include

a. Earth's energy budget;
b. the role of radiation and convection in the distribution of energy;
c. the motion of the atmosphere and the oceans;
d. cloud formation; and
e. the role of thermal energy in weather-related phenomena including thunderstorms and hurricanes.

Matter

6.4 The student will investigate and understand that all matter is made up of atoms. Key concepts include

a. atoms consist of particles, including electrons, protons, and neutrons;
b. atoms of a particular element are alike but are different from atoms of other elements;
c. elements may be represented by chemical symbols;
d. two or more atoms interact to form new substances, which are held together by electrical forces (bonds);
e. compounds may be represented by chemical formulas;

f. chemical equations can be used to model chemical changes; and
g. a limited number of elements comprise the largest portion of the solid Earth, living matter, the oceans, and the atmosphere.

6.5 The student will investigate and understand the unique properties and characteristics of water and its roles in the natural and human-made environment. Key concepts include
a. water as the universal solvent;
b. the properties of water in all three phases;
c. the action of water in physical and chemical weathering;
d. the ability of large bodies of water to store thermal energy and moderate climate;
e. the importance of water for agriculture, power generation, and public health; and
f. the importance of protecting and maintaining water resources.

6.6 The student will investigate and understand the properties of air and the structure and dynamics of Earth's atmosphere. Key concepts include
a. air as a mixture of gaseous elements and compounds;
b. pressure, temperature, and humidity;
c. atmospheric changes with altitude;
d. natural and human-caused changes to the atmosphere and the importance of protecting and maintaining air quality;
e. the relationship of atmospheric measures and weather conditions; and
f. basic information from weather maps, including fronts, systems, and basic measurements.

Living Systems

6.7 The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include
a. the health of ecosystems and the abiotic factors of a watershed;
b. the location and structure of Virginia's regional watershed systems;
c. divides, tributaries, river systems, and river and stream processes;
d. wetlands;
e. estuaries;
f. major conservation, health, and safety issues associated with watersheds; and
g. water monitoring and analysis using field equipment including hand-held technology.

Interrelationships in Earth/Space Systems

6.8 The student will investigate and understand the organization of the solar system and the interactions among the various bodies that comprise it. Key concepts include
a. the sun, moon, Earth, other planets and their moons, dwarf planets, meteors, asteroids, and comets;
b. relative size of and distance between planets;
c. the role of gravity;
d. revolution and rotation;
e. the mechanics of day and night and the phases of the moon;
f. the unique properties of Earth as a planet;
g. the relationship of Earth's tilt and the seasons;
h. the cause of tides; and
i. the history and technology of space exploration.

Earth Resources

6.9 The student will investigate and understand public policy decisions relating to the environment. Key concepts include

a. management of renewable resources;
b. management of nonrenewable resources;
c. the mitigation of land-use and environmental hazards through preventive measures; and
d. cost/benefit tradeoffs in conservation policies.

ESSENTIAL UNDERSTANDINGS **All students should:**	ESSENTIAL KNOWLEDGE AND SKILLS **To be successful with this standard, students are expected to:**

PRIMARY **Resources and Activities**	**SUPPLEMENTAL** **Resources and Activities**	**TEACHER NOTES**