6th Grade Science: First Trimester
Experimental Design

VA Standards of Learning (SOL) Essential Understandings	Content Knowledge and Skills	State and MCPS Adopted Materials	Supporting Materials
6.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which **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;** The concepts developed in this standard include the following: • 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. • To communicate an observation accurately, one must provide critical details of exactly what is being observed. Using that information, students will be able to differentiate definitively between or among similar objects and/or organisms. Systematic investigations require accurate measurements; however, in the absence of precision tools, observers must record careful estimations. • Scale models must maintain relative values of size and/or quantity in order to maintain the integrity of the object or topic being modeled.	Standard 6.1 does not require a discrete unit on scientific investigation because the inquiry skills that make up the standard should be incorporated across the other 6th grade science standards. Skills d, e, and f are placed at the beginning of year as an introductory unit in conducting scientific investigations. **All other 6.1 process skills have been connected to specific content within this curriculum guide, but teachers may also provide instruction in any of the skills throughout the school year.** In order to meet this standard, it is expected that students will: • make connections between the components of the nature of science and their investigations and the greater body of scientific knowledge and research. • make observations that can be used to discriminate similar objects and organisms, paying attention to fine detail. • make precise and consistent measurements and estimations. • create approximate scale models to demonstrate an understanding of distance, volume, and quantity. • differentiate between independent and dependent variables in a hypothesis.		**AIMS SI Binder** Keyed to Leaves Looking at Lepidoptera Families of Flakes Mystery Reactions Denser Sensor Selective Service Pleased as Punch Models How Far to the Sun? Area of Virginia The Food Tube Scientific Inquiry: Hypothesizing Rally Round the Room Marbleous Rolls How Does Your Heart Rate? Now That's Using Your Head Bubble Busters Souper Solutions Heroes Take a Spin It Floats! It Sinks! Floating Wood What's in a BB? Rally Round the Room The Art of Hurling Droopy Drawers Rubber Band Shoot Bubble Busters Topping Off Mount St. Helens Sun Watchers Lining Up the Planets Sedimentary Stories

• An experiment is a structured test of a hypothesis. A hypothesis is stated in terms of a testable relationship. • A scientific prediction is a forecast about what may happen in some future situation. It is based on the application of scientific principle and factual information. • An inference is an explanation based on observations and background knowledge. A conclusion is formulated from collected data. For example, one might observe darkly colored pond water and make the inference that it is polluted. However, only after data are collected can a conclusion be formulated. • Patterns discerned from direct observations can be the basis for predictions or hypotheses that attempt to explain the mechanism responsible for the pattern. • Accurate observations and evidence are necessary to draw realistic and plausible conclusions. • In order to conduct an experiment, one must recognize all of the potential variables that can affect an outcome. • In a scientific investigation, data should be collected, recorded, analyzed, and reported using appropriate metric measurement and tools. • In a scientific investigation, data should be organized and communicated through appropriate graphical representation (graph, chart, table, and diagram). • Models provide a way of visually representing abstract concepts. The use of models permits students to order events or processes. • Science concepts are applied through observations and connections with everyday life and technology.	• propose hypotheses or predictions from observed patterns. • compare and contrast predictions and inferences. Analyze and judge the evidence, observations, scientific principles, and data used in making predictions and inferences. • design an experiment in which one variable is manipulated over many trials. • collect, record, analyze, and report data, using metric terminology and tools. • analyze and communicate data, using graphs (bar, line, and circle), charts, and diagrams. • design a model that explains a sequence, for example, the sequence of events involved in the formation of a cloud.		**STEM Activity: The Great Egg Drop**

6th Grade Science: First Trimester
Energy

VA Standards of Learning (SOL) Essential Understandings	Content Knowledge and Skills	State and MCPS Adopted Materials	Supporting Materials
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 energy transformations.** The concepts developed in this standard include the following: • 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 and, 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	In order to meet this standard, it is expected that students will: • 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).	Atoms and Energy 2: The Kinetic and Potential Energy of a Pendulum Explore changing kinetic energy when it interconverts with potential energy.	**AIMS PS Binder** Get Energized: Potential and Kinetic Water Rockets Magnetic Potential Coaster Construction Frog Legs Research on Resources Renewable, Nonrenewable, and Inexhaustible Natural Resources Fueled Up Wood Waste Measuring Trees Wind Rollers Windmills How to Hydro Geothermal Energy Tide Turning Turbines Getting in Hot Water Energy Connections **Enhanced Scope and Sequence Plus** Energy Energy Sources Electricity Generation Energy Transformations

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.	**Skills** **j) Current applications are used to reinforce science concepts.**		

6th Grade Science: First Trimester
Environmental Resources

VA Standards of Learning (SOL) Essential Understandings	Content Knowledge and Skills	State and MCPS Adopted Materials	Supporting Materials
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;** 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. • Regulations, incentives, and voluntary efforts help conserve resources and protect environmental quality. • Conservation of resources and environmental protection begin with the 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.	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. • evaluate the impact of resource use, waste management, and pollution prevention in the school and home environment. **Skills** **h) data are analyzed and communicated through graphical representation**		**Climate change for Middle School** Inquiry-based labs to investigate essential climate literacy principles. Assessment Access - Login: eliteacher Password: 87dja92 **Enhanced Scope and Sequence Plus** Conservation and Environmental Agencies Conservation of Water **Tox Town Unit** Lessons and activities of the curriculum combine research on the Tox Town Web site with hands-on experiments and communication and social action activities. The objective is to introduce middle school students to environmental health issues in their everyday lives, emphasizing the relevance of science to informed citizenship.

6th Grade Science: First Trimester
Solar Energy

VA Standards of Learning (SOL) Essential Understandings	Content Knowledge and Skills	State and MCPS Adopted Materials	Supporting Materials
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.** 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 the 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 the Earth is absorbed by the Earth's surface. • The 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 the 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 heat 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. • describe the relationship between thermal energy and the formation of hurricanes and thunderstorms.	**Activities** Greenhouse Gases [65] Explore how Earth's atmosphere affects the energy balance between incoming and outgoing radiation. (Model) Energy Balance and Temperature [66] Explore the energy balance between incoming and outgoing radiation on Earth. (Model) Water Cycle: Create a Cloud [1528] Using water, ice and smoke, create a cloud, take various temperature readings and record data. (Sensor: Temperature) **Models/Simulations:** Climate Change, With Temperature Graph Investigate basic factors in climate change, including greenhouse gases, clouds, incoming sunlight and outgoing infrared. (T) Climate Change Starter, Without Graph Investigate basic factors in climate change, including greenhouse gases, clouds, incoming sunlight and outgoing infrared. (T)	**AIMS ES Binder** Solar Bucks Heat Moves The Greenhouse Effect Carbon Dioxide: A Greenhouse Gas What Goes Around Comes Around Keeping Current on Balloons Heating of Land and Water Tub Temps The Great Moderator Moving Water A Cloud is Born Pasta Parallels Hurricanes and Thunderstorms **Enhanced Scope and Sequence Plus** Reflection and Refraction of Light Waves Convection Currents and Thermal Energy Cloud Formation

• 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 the 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 forming clouds 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.		Energy Skate Park Investigate potential energy, kinetic energy, friction, and heat using a skate park simulation.	

6th Grade Science: First Trimester
Atmosphere

VA Standards of Learning (SOL) Essential Understandings	Content Knowledge and Skills	State and MCPS Adopted Materials	Supporting Materials
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.** 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.	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. • design an investigation to relate temperature, barometric pressure, and humidity to changing weather conditions. • compare and contrast cloud types and relate cloud types to weather conditions. • compare and contrast types of precipitation. • compare and contrast weather-related phenomena, including thunderstorms, tornadoes, hurricanes, and drought. • interpret basic weather maps and make forecasts based on the information presented. • map the movement of cold and warm fronts and interpret their effects on observable weather conditions. **Skills** a) **observations are made involving fine discrimination between similar objects and organisms**	**Activities**: Dew Point [115] Investigate how to condense water from your classroom air. Tracking a Storm [113] Measure changing weather conditions prior to, during, and after a storm. **Models/Simulations:** Climate Change, With Temperature Graph This model includes basic factors in climate change, including greenhouse gases, clouds, incoming sunlight and outgoing infrared. The Pressure-Temperature Relationship (Gay-Lussac) The Gay-Lussac Law is that the pressure of a gas of fixed mass and fixed volume is directly proportional to the gas's absolute temperature. In the model a virtual gauge is placed in the container of gas to measure pressure. The output is shown with a bar graph.	**AIMS ES Binder** Air Bags **Enhanced Scope and Sequence Plus** Atmospheric Pressure Layers of the Atmosphere Air Quality Weather Forecasting Weather

• The amounts of thermal energy and water vapor in the air and the pressure of the air largely determine what the weather conditions are. • Clouds are important indicators of atmospheric conditions. Clouds are found at various levels within the troposphere. Three major types of clouds are cumulus, stratus, and cirrus. • 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. • Maintaining good air quality is a crucial goal for modern society, and it is everyone's responsibility to work toward it. • Weather maps show much useful information about descriptive air measurements, observations, and boundaries between air masses (fronts). The curved lines showing areas of equal air pressure and temperature are key features of weather maps. Weather maps are important for understanding and predicting the weather.			

6th Grade Science: Second Trimester
Solar System

VA Standards of Learning (SOL) Essential Understandings	Content Knowledge and Skills	State and MCPS Adopted Materials	Supporting Materials
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.** 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 variesy 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.	In order to meet this standard, it is expected that students will: • describe the nine 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 moons their moons. • model and describe how day and night and the phases of the moon occur. • model and describe how the Earth's axial tilt and its annual orbit around the sun cause the seasons. • 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. **Skills** **c) scale models are used to estimate distance, volume, and quantity**	**Activities:** Our Solar System [118] Study the revolutions of the planets in our solar system and chart the periods of each planet to compare. (Model) Moon Phases [4] Use a model to explore the phases of the moon. (Model) Seasons: Changing Length of Daylight [3] Explore how the changing length of daylight causes seasons on Earth. (Sensor: Temperature, Model) Seasons: Changing Position of the Sun [2] Explore how the changing position of the sun causes seasons on the earth. (Sensors: Light, Temperature, Model) **Models/Simulations:** Phases of the Moon The moon revolves around Earth and the corresponding phase of the moon, as displayed from Earth, is displayed. (T)	Space Station Timeline Uncle Percy's Adventures in Space **Enhanced Scope and Sequence Plus** Space Exploration Phases of the Moon The Tilt of the Earth and the Seasons Tides Exploring the Moon Educator Guide (NASA)

• 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 the Earth rotates, different sides of the Earth face toward or away from the sun, thus causing day and night, respectively. • The phases of the moon are caused by its position relative to the Earth and 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 the 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.		Solar System Explore the relative rates of the planets as they revolve around the sun.(T)	

6th Grade Science: Second Trimester
Matter

VA Standards of Learning (SOL) Essential Understandings	Content Knowledge and Skills	State and MCPS Adopted Materials	Supporting Materials
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.** The concepts developed in this standard include the following: • 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. • 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.	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. • 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 the Earth's crust.	**Activities** Building Atomic Models-Eimers [334] Build Bohr and electron cloud models. (Model) Building Atomic Models-LKSD [2869] Explore models that show the arrangement of subatomic particles. (Model) **Models/Simulations** Atomic Structure 3: The Elements Use the atom builder to experiment with combining different amounts of protons, neutrons and electrons to make various kinds of atoms. Build an Atom Build an atom and then play a game to challenge your skills. Build a Molecule Build molecules and view them in 3D.	**AIMS PS Binder** Black Boxes All About Atoms Cook-Keys to Elements Fabulous Periodic Eggs Puzzling Over the Periodic Table Set the Table Compound Hangups The Elements and Their Table ELEMENTary Cards Elemental Twelve I Have, Who Has? Elements Chem Cubes Tiny Bubbles Compound Composition **Enhanced Scope and Sequence Plus** Modeling the Atom

• 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 the Earth's crust, living matter, the oceans, and the atmosphere.		Balancing Chemical Equations Balance chemical equations and see a model of the equation as it is balanced.	

6th Grade Science: Third Trimester
Water

VA Standards of Learning (SOL) Essential Understandings	Content Knowledge and Skills	State and MCPS Adopted Materials	Supporting Materials
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.** • 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. • 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." • A large number of substances will "dissolve" in water. For this reason, water is often called the universal solvent. • Water is able to absorb heat energy without showing relatively large changes in temperature. Large bodies of water act to moderate the climate	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 determine the relative density of liquid and solid water at various temperatures. • compare the relative densities of liquid and solid water. • comprehend the adhesive and cohesive properties of water. • design an investigation to determine the effects of heat on the states of water. • model and explain why ice is less dense than liquid water. • relate the three states of water to the water cycle. • design an investigation to demonstrate the ability of water to dissolve materials. • 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 freezing water on rock material. • design an investigation to model the action of acidified water on building materials such as concrete, limestone, or marble.	**Activities** Water Moving Around the Earth [144] Investigate Earth's water cycle. (Model) Water from Air [151] Explore how to make water droplets form from water in the air. (Sensor: Temperature, Model) Water into the Air [150] Explore evaporation of water into the air. (Sensors: Relative Humidity, Temperature) Water in Classroom Air [121] Calculate the actual amount of water in the air in your classroom. (Sensors: Temperature, Relative Humidity) Melting Ice [109] Monitor the temperature of a melting ice cube. (Sensors: Temperature, Model) Heating Objects-Specific Heat [375] Examine variable heating of differing objects. (Sensors: Temperature, Model) **Models/Simulations** Water Cycle A dynamic display of the water cycle.	**AIMS ES Binder** Involving Dissolving Moving Water Ice Cube in Water Water Activities The Water Molecule Stream Lined Water Olympics Chalk It up to Weathering Boulder to Bits Tub Temps The Great Moderator Accounting for Water Earth's Water Moving Water Uses for Water Mini Water Treatment Plant Water Island **American Chemical Society** *Water is a Polar Molecule* *Surface Tension* *Why Does Water Dissolve Salt?* *Why Does Water Dissolve Sugar?* *Using Dissolving to Identify an Unknown* *Does Temperature Affect Dissolving?* *Can Liquids Dissolve in Water?* *Can Gases Dissolve in Water?* *Temperature Changes in Dissolving*

of surrounding areas by absorbing heat in summer and slowly releasing that heat in the winter. For this reason, the climate near large bodies of water is slightly milder than areas without large bodies of water. • 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, it expands when it freezes. Ice is less dense than liquid 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). • Scientific evidence indicates that the Earth formed about four-and-a-half billion years ago from the dust and debris orbiting the sun. Due to gravity, this debris became compacted and grew quite hot, creating hot gases, including water vapor and carbon dioxide. Over millions of years, the Earth and its gases cooled, and seas are believed to have formed when the Earth cooled enough for water vapor in the atmosphere to condense. • Most of Earth's water is salt water in the oceans (97 percent). Available non-frozen, fresh water makes up less than 1 percent of the water on Earth.	• chart, record, and describe evidence of chemical weathering in the local environment. • explain the role of water in power generation. • 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. • describe the importance of careful management of water resources.	Solubility 2a: How Does Salt Dissolve in Water A view of dissolving at the salt-water interface. Salt is represented by the green and purple atoms. In water, the red atoms represent oxygen and the white ones hydrogen. Molecular Geometry 3: Unshared Electrons and the "Bent" Shape A simulation of a 3-D water molecule. Atomic Structure 3: The Elements Use the atom builder to experiment with combining different amounts of protons, neutrons, and electrons to make various kinds of atoms. Solubility 6: Temperature Affects Dissolving Increase the amount of heat to determine effect on dissolving. Dissolving: The Impact of Heating A model of dissolving a salt crystal; the impact of adding heat. Water Freezing: Showing Changes Control the temperature to see the effect on water molecules. Liquid and Gas Compares the movement of atoms in a gas and a liquid. Add or remove heat to see affects. States of Mater: Basics Add and remove thermal energy to watch phase changes.	**STEM Activity: Ice Cube Challenge** **Enhanced Scope and Sequence Plus** Universal Solvent Heat and Water Molecular Attraction Density The Ocean's Effect on Climate, 1 The Ocean's Effect on Climate, 2 Hydroelectric Power

6th Grade Science: Third Trimester
Watersheds

VA Standards of Learning (SOL) Essential Understandings	Content Knowledge and Skills	State and MCPS Adopted Materials	Supporting Materials
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.** 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 watersheds systems in Virginia lead to the Chesapeake Bay, the North Carolina sounds, or the Gulf of Mexico.	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.		Virginia Watersheds **Aims LS Binder** Watershed Scramble Water Colors Help Save the Birds! Environmental Analysis Water Rights and Responsibilities Watersheds Modeling Watersheds Modeling Rivers Chesapeake Bay Watershed Puzzle Virginia Watersheds Take Shape Watershed Logic Virginia's Watershed Systems Soil Tables Soaking Up the Wetlands Help Save the Birds! The Value & Importance of the Wetlands Wetland Protection Up for Debate Brackish Waters Water Waste is a Weighty Issue Drip Drop, Flip Flop Teddy Bears Fight Pollution Pollution Paradigm Water Colors

• 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 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 salt water 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.	**Skills** **i) models and simulations are designed and used to illustrate and explain phenomena and systems**		**STEM Project: Composting** **Enhanced Scope and Sequence Plus** Virginia's Watersheds Estuaries Macroinvertebrates Water Quality Water Testing

6th Grade Science: Third Trimester
Environmental Policy

VA Standards of Learning (SOL) Essential Understandings	Content Knowledge and Skills	State and MCPS Adopted Materials	Supporting Materials
6.9 The student will investigate and understand public policy decisions relating to the environment. Key concepts include **c) The mitigation of land-use and environmental hazards through preventive measures** **d) Cost/benefit tradeoffs in conservation policies.** 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. • Regulations, incentives, and voluntary efforts help conserve resources and protect environmental quality. • Conservation of resources and environmental protection begin with the individual acts of stewardship. • Use of renewable (water, air, soil, plant life,	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. • evaluate the impact of resource use, waste management, and pollution prevention in the school and home environment. **Skills** **b) precise and approximate measurements are recorded**	**Activities**: Renewable Energy Generator Construction [1560] Investigate and construct working models of wind turbines and hydroelectric generators. Students will experiment with their own designs and visualize how the energy transfers into electricity production. (Sensor: Voltage)	PBS Resources: Green Renewable Energy Lessons **Enhanced Scope and Sequence Plus** Conservation and Environmental Agencies Conservation of Water

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.			