



Science Curriculum Matrix

Sixth Grade

August 1, 2009

The Science Vertical Team has revised the Sixth Grade Science Curriculum Matrix for 2009-2010. In addition to the necessary correlation to the Virginia Science Standards of Learning, the Sixth Grade science content is organized by both concepts and topics. We encourage you to utilize this document while planning for instruction. A more dynamic version of this matrix is available on our wiki site at <http://acpsscience.pbworks.com/>. We anticipate making additional updates to this document as the school year progresses. Please contact Tony Borash with your comments and suggestions at tborash@k12albemarle.org.

In addition to this document, we recommend that you review the [Sixth Grade Science Curriculum Framework](#) for additional clarification regarding the Grade 6 Science SOL and the [Sixth Grade Science Enhanced Scope and Sequence](#) for unit and lesson planning resources.

Thanks,

The Science Vertical Team

Scientific Investigation, Reasoning, and Logic

GRADE: 6

CONCEPT: SCALE: Properties

ENDURING UNDERSTANDING: Properties characterize objects, organisms, and substances.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand that:</p> <ul style="list-style-type: none"> 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. Accurate observations and evidence are necessary to draw realistic and plausible conclusions. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> Use qualitative observations (color, style, texture, etc.) to describe the properties of two shoes. Use accurate quantitative observations (length, width, and mass measurements) to describe the same two shoes. <p>Application/Analysis Level</p> <ul style="list-style-type: none"> Explain how the two shoes the above example are similar and different, using both quantitative and qualitative observations. (Provide duplicate trays of random items for an “I Spy” mystery game.) Describe the item either qualitatively or quantitatively while another student identifies it from his or her own tray within 15 seconds. <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> Use the analysis of the two shoes above to conclude which shoe is more appropriate for skateboarding and which is more appropriate for basketball, using your background knowledge of those sports. Footprints: Use observations of multiple sets of footprints to draw conclusions. Use the website to get each of three images and present each separately. Imagine and describe what sort of creature made each set of prints. What happened? Which creature entered and left the area first? Cite the evidence you used. (image and link attached) OR: Use the shoes in above examples to create a footprints analysis of your own. 	<p>accuracy conclusion evidence observation property qualitative quantitative</p>

SOL 6.1 The student will plan and conduct investigations in which

- (a) observations are made involving fine discriminations between similar objects and organisms

Scientific Investigation, Reasoning, and Logic

GRADE: 6

CONCEPT: SYSTEMS: Organization

ENDURING UNDERSTANDING: Systems at various levels of organization can manifest different properties and functions.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand that:</p> <ul style="list-style-type: none"> Comparing and contrasting are important when collecting evidence. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> Classify a group of buttons into two categories based on similarities and differences. <p>Application/Analysis Level</p> <ul style="list-style-type: none"> Bring in a set of objects. Switch sets with another student, and classify the objects. The first student should determine the rule for classification. <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> Take the previous set of objects (or come up with your own). Develop a unique method for classifying the objects and defend your system to a partner. 	<p>classify compare contrast</p>

SOL 6.1 The student will plan and conduct investigations in which
 (b) a classification system is developed based on multiple attributes.

Scientific Investigation, Reasoning, and Logic

GRADE: 6

CONCEPT: SCALE: Measurement

ENDURING UNDERSTANDING: Measurement represents properties on a numerical scale

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand that:</p> <ul style="list-style-type: none"> Investigations require accurate and precise measurements. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> Have students measure a variety of classroom objects using standard metric tools (meter stick, triple beam balance, graduated cylinder) to within a range of +/- 0.1 unit. Discuss reasons for measurement error (misreading tool, incorrect calculations, etc.) Have students observe objects of known measurements (length and width of an index card, mass of an apple, volume of a juice box) and estimate the measurements. <p>Application/Analysis Level</p> <ul style="list-style-type: none"> Have students measure the same classroom objects using their own measurement tools and units. Give students benchmarks for length, mass, and volume and ask them to estimate the values for a variety of objects within a reasonable range. Ask students to brainstorm, and then chart areas in which some measurement error is acceptable and those for which accurate measures are critical. <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> “It says 20 oz, but it is really 19.6 oz”! Evaluate grocery store packages for accuracy and precision in measurement. Have students bring in multiple packages of the same product (same size package) and measure using appropriate tools to determine the accuracy and precision of the marked quantity. Tell students to write a one-page position paper either criticizing or defending the company for its variability between advertised and measured quantities. 	<p>error estimation measurement precision reproducible</p>

SOL 6.1 The student will plan and conduct investigations in which
(c) precise and approximate measures are recorded

Scientific Investigation, Reasoning, and Logic

GRADE: 6

CONCEPT: SCALE

ENDURING UNDERSTANDING: Scale compares objects, living things, and events relative to time and space.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand that:</p> <ul style="list-style-type: none"> Scale models must maintain relative values of size and/or quantity of the object or topic being modeled. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> Show a scaled drawing of the solar system and have students identify objects. Have students choose a planet to represent in a scale depiction of the solar system. Discuss what would be an appropriate scale for a model the solar system set up outside. Take the class outside and have them distance themselves from the student playing the “sun”, using the scale that was previously agreed upon. Ex. 1 yard=1,000,000 miles <p>Application/Analysis Level</p> <ul style="list-style-type: none"> After teaching students about the relative spacing between an atom’s nucleus and its electrons, have students draw or otherwise model a simple atom. Emphasize the need to show the difference in size of atomic particles as well as the distance between electrons and the nucleus. <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> After several lessons on modeling, have students choose their own project to model such as: mapping the route from their home to school, parts of a watershed, volumes of water in lakes versus oceans, etc. 	<p>model scale</p>

SOL 6.1 The student will plan and conduct investigations in which
 (d) Scale models are used to estimate distance, volume, and quantity.

Scientific Investigation, Reasoning, and Logic

GRADE: 6

CONCEPT: SCALE: Properties

ENDURING UNDERSTANDING: Properties characterize objects, organisms, and substances.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand that:</p> <ul style="list-style-type: none"> An <i>experiment</i> is a structured test of a hypothesis. A <i>hypothesis</i> is stated in terms of a testable relationship. A scientific <i>prediction</i> is a forecast about what may happen in some future situation. It is based on the application of scientific principle and factual information. An <i>inference</i> is a conclusion based on evidence about events that have already occurred. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> Designer Planes lab from Cochran et al. <p>Application/Analysis Level</p> <ul style="list-style-type: none"> Analyze an experimental scenario (ref: Cochran, et al) and determine the independent/dependent variables, derive the hypothesis for the scenario, and infer an outcome. Use data from the experiment to draw a conclusion. <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> Design an experiment of your own choosing, including a summary of your prediction, independent and dependent variables, and how your hypothesis relates the two variables. Perform your experiment, producing data tables and graphs as appropriate. Include an appropriate number of repeated trials. Draw conclusions based on your data. (Example: Consumer product testing) 	<p>control dependent variable experiment hypothesis independent variable inference prediction variable</p>

SOL 6.1 The student will plan and conduct investigations in which

- (e) hypotheses are stated in ways that identify the independent (manipulated) and dependent (responding) variables;
- (f) a method is devised to test the validity of predictions and inferences;
- (g) one variable is manipulated over time with many trials
- (h) data are collected, recorded, analyzed, and reported using appropriate metric measurement;
- (i) data are organized and communicated through graphical representation (graphs, charts, and diagrams)
- (j) models are designed to explain a sequence; and
- (k) an understanding of the nature of science is developed and reinforced

Physical Science: Force, Motion, and Energy: Energy

GRADE: 6

CONCEPT: CHANGE & CONSTANCY: Equilibrium

ENDURING UNDERSTANDING: Stability exists or otherwise occurs when changes are counterbalance

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand:</p> <ul style="list-style-type: none"> • All objects with mass have energy. • An object’s total energy is the sum of its potential and kinetic energies. • Potential energy is the state of stored energy or energy in position to be used. • Kinetic energy is the state of energy in motion or in use. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> • Student will identify a physical object’s energy as potential or kinetic. (Appendix A – examples) • Students will identify an object’s energy as potential or kinetic based on drawings and/or written descriptions. (Modify the physical assessment items to situations on paper.) (Appendix B – examples) <p>Application/Analysis Level</p> <ul style="list-style-type: none"> • Bounce a ball in front of the class. Draw the ball’s positions on the board. Ask students to identify where the ball’s energy is mostly potential and where it is mostly kinetic. • Give an energy scenario and ask students to explain what the total energy in the scenario is. <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> • Ask students to derive their own examples of each state of energy. They may act out their solution, draw it, build it, or write it out. • Have students design and build an egg drop vehicle that can survive a fall from a height of 3 meters. Evaluate the design based on the amount of energy the vehicle has at each stage of the drop. • Give students a windup toy and ask them to evaluate its energy, including total, potential, and kinetic through some number of repeated trials. Draw conclusions based on your data. 	<p>energy kinetic energy potential energy total energy</p>

SOL: 6.2 The student will investigate and understand basic sources of energy, their origins, transformations, and uses.

(a) potential and kinetic energy.

Physical Science: Force, Motion, and Energy: Energy

GRADE: 6

CONCEPT: CHANGE & CONSTANCY: EQUILIBRIUM

ENDURING UNDERSTANDING: Cycles organize change, which can lead to predictable outcomes

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand:</p> <ul style="list-style-type: none"> • Most of Earth’s energy comes from the sun as kinetic solar energy. • Solar energy can convert to other forms of kinetic energy, such as heat energy, light energy, and wind energy. • Plants convert solar energy to chemical potential energy through the process of photosynthesis. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> • Given a list of energy forms (solar, wind, heat, light), have students draw illustrations or symbols for each indicating motion or use. • Given a diagram of sunlight on a plant, have students label the forms of energy from the sun to a plant, including the term for the process used to convert light energy. <p>Application/Analysis Level</p> <ul style="list-style-type: none"> • Have students analyze and explain why the heat, light, and wind are all examples of kinetic energy. Their explanation should include words and pictures. <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> • Set up teams of students to research current uses of solar energy. Have them determine and illustrate various possibilities for converting solar energy to useful energy at school. 	<p>convert kinetic energy forms chemical potential heat light solar wind photosynthesis</p>

SOL: 6.2 The student will investigate and understand basic sources of energy, their origins, transformations, and uses.

(b) the role of the sun in the formation of most energy sources on Earth;

(e) energy transformations (heat/light to mechanical, chemical, and electrical energy).

Physical Science: Force, Motion, and Energy: Energy

GRADE: 6

CONCEPT: CHANGE & CONSTANCY: Equilibrium

ENDURING UNDERSTANDING: Stability exists or otherwise occurs when changes are counterbalanced.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand:</p> <ul style="list-style-type: none"> • Fossil fuels come from ancient plants and animals and store chemical energy until the energy is released. • Fossil fuel energy forms over millions of years and is thus nonrenewable. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> • Have students label a diagram of the layers of the earth, showing each form of fossil fuel and where it can be found. • Have students sequence a scrambled flow chart of the energy transformations from a fossil fuel to a television. <p>Application/Analysis Level</p> <ul style="list-style-type: none"> • Have students develop labeled drawings showing the conversion of energy from a fossil fuel to a household appliance. • Have students compare the energy of a plant to that of the animal that eats it and trace the animal’s energy back to the sun. • Ask students to explain why fossil fuels are considered to be nonrenewable, when plants continue to grow and die. <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> • Set up teams of students to debate the merits of depending on Virginia’s vast stores of coal for fueling electrical power plants. Bring in a third party to moderate the debate (such as the Gifted Resource Teacher). 	<p>fossil fuels: coal natural gas petroleum oil mechanical energy nonrenewable transformation</p>

SOL: 6.2 The student will investigate and understand basic sources of energy, their origins, transformations, and uses.

(c) nonrenewable energy sources (fossil fuels, including petroleum, natural gas, and coal);

(e) energy transformations (heat/light to mechanical, chemical, and electrical energy).

Physical Science: Force, Motion, and Energy: Energy

GRADE: 6

CONCEPT: CHANGE & CONSTANCY: Equilibrium

ENDURING UNDERSTANDING: Stability exists or otherwise occurs when changes are counterbalanced.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand:</p> <ul style="list-style-type: none"> Many of Earth’s resources are available on a perpetual basis. Some energy sources can be replaced over relatively short periods of time. Both are considered renewable. Modern industrial society depends on fossil fuel energy. There is a growing need for alternative energy forms in our society. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> Use a matching form for students to match the various renewable energy source terms with their definitions. Have students label action images of each renewable energy resource. <p>Application/Analysis Level</p> <ul style="list-style-type: none"> On a Venn diagram, sort the renewable resources into nature-derived and man-derived (i.e. wind versus wood, tides versus ethanol). Give students a graphic showing energy use over time in the United States. Give them a second graphic showing the availability of fossil fuels worldwide. Have students compare the availability of fossil fuels with energy requirements. <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> Organize teams of students for each of a variety of renewable and nonrenewable energy sources. Debate the merits (pros and cons) of each for various regions in Virginia. Bring in a third party to moderate the debate (such as the Gifted Resource Teacher). Organize teams of students to debate our best alternative energy choice for the future. 	<p>biomass ethanol geothermal hydropower wind turbine renewable</p>

SOL: 6.2 The student will investigate and understand basic sources of energy, their origins, transformations, and uses.
 (d) renewable energy sources (wood, wind, hydro, geothermal, tidal, and solar).

Physical Science: Force, Motion, and Energy: Energy

GRADE: 6

CONCEPT: CHANGE & CONSTANCY: Equilibrium

ENDURING UNDERSTANDING: Stability exists or otherwise occurs when changes are counterbalanced

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand:</p> <ul style="list-style-type: none"> Incoming solar energy must be in close balance with outgoing energy to keep Earth’s temperature relatively constant. Excess carbon dioxide and other pollutants may disrupt the balance and increase the Greenhouse Effect on Earth. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> Have students tell where radiation, absorption, conduction, convection (rising air), and reflection are occurring on Earth. Ask students to compare incoming total energy percentages with outgoing total percentages. <p>Application/Analysis Level</p> <ul style="list-style-type: none"> Have students draw a picture of the relationship between the earth and the atmosphere. Explain why the greenhouse effect is so important. How does this differ from other planets in our solar system? <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> Modern industrial countries burn fossil fuels at a constantly increasing rate, adding carbon dioxide and other greenhouse gases to the atmosphere. What effect might this have on Earth’s total Energy Budget? Design a public service ad to show that global warming (an enhanced greenhouse effect) can result from the rising use of fossil fuels across the globe. Make suggestions as to what we can do to combat this. 	<p>absorb atmosphere conduction energy budget global warming Greenhouse Effect radiation reflection solar radiation: infrared ultraviolet visible wavelength</p>

SOL: 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 the Earth’s surface.

(a) the Earth’s energy budget.

Physical Science: Force, Motion, and Energy: Energy

GRADE: 6

CONCEPT: SYSTEMS: Interactions

ENDURING UNDERSTANDING: A system is an organized collection of parts, which display observable and predictable patterns.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand:</p> <ul style="list-style-type: none"> Solar energy drives many important processes on Earth through radiation and convection. Different surfaces on the Earth heat and cool at different rates. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> Label a diagram with the heat transfer terms: radiation, convection, and conduction. Show the relative temperatures (warm vs. cool) on a diagram of an ocean current. Show the relative temperatures (warm vs. cool) on a diagram of wind currents. <p>Application/Analysis Level</p> <ul style="list-style-type: none"> A cup of milk is sitting on the burner. Use the heat transfer terms to describe how the milk heats up and how a person might sense the heat. Explain why ocean breezes blow in one direction during the day and in the reverse direction at night. <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> Relate the heating of hot chocolate to the heating of the atmosphere. Use the concepts of radiation, convection currents, and circulation to explain heat movement in each fluid. Write an essay describing what might happen if Earth warmed up enough so that land and sea masses were all the same temperature. 	<p>circulation convection ocean currents winds</p>

SOL: 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 the Earth’s surface.

- (b) the role of radiation and convection in the distribution of energy;
- (c) the motion of the atmosphere and the oceans.

Physical Science: Force, Motion, and Energy: Energy

GRADE: 6

CONCEPT: SYSTEMS: Interactions

ENDURING UNDERSTANDING: Parts of a system interact to form a functional whole.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand:</p> <ul style="list-style-type: none"> As bodies of water (oceans, lakes, rivers, etc.) absorb heat energy, the water evaporates forming clouds. Warm, moist air rises above cool, dry air. As moisture condenses, heat transfers to the atmosphere, resulting in condensation. Clouds are composed of minute, condensed water molecules. Thunderstorms form where land is strongly heated. Hurricanes form over warm, tropical water as the energy transfers from the water to the air. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> Present several cloud types and have students name them. Name and draw a picture of the clouds that you observe each day this week. <p>Application/Analysis Level</p> <ul style="list-style-type: none"> Use process words to describe the sequence of cloud formation. Infer the type of weather and storms likely to occur during different scenarios. Play “Hurricane Tracker” through JASON project’s Monster Storms online curriculum. <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> Pretend you are a weather forecaster. Describe a hurricane that could actually occur in the future, hitting shore somewhere along the East Coast. Use lots of details -describe the environment of the area, the season of the year, etc. From the point of view of a newspaper or TV reporter, report all parts of the storm formation, duration, and end. Include any cleanup that might need to happen. Create a three to five day weather forecast based on the data that you have collected over the last week. 	<p>cloud condensation evaporation hurricane thunderstorm</p>

SOL: 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 the Earth’s surface.

(d) cloud formation;

(e) the role of heat energy in weather-related phenomena including thunderstorms and hurricanes.

Physical Science: Matter: Structure: Atomic Structure

GRADE: 6

CONCEPT: SYSTEMS: Organization

ENDURING UNDERSTANDING: Parts of a system interact to form a functional whole.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand:</p> <ul style="list-style-type: none">• Atoms are made of protons, neutrons, and electrons. Protons and neutrons occur in the nucleus of an atom. Electrons orbit the nucleus.• Elements are made of one type of atom, and all atoms of an element may only differ by their number of neutrons.	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none">• Locate and label the parts of an atom correctly.• Match the charge of the atomic part to its name. <p>Application/Analysis Level</p> <ul style="list-style-type: none">• Compare and contrast the helium and lithium atoms. How can you tell they are two different elements? <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none">• Hydrogen atoms can form with 1, 2, or 3 particles in their nuclei. How can this be, when all hydrogen atoms must have only 1 proton?	<p>atom electron element neutron nucleus proton</p>

SOL: 6.4 The student will investigate and understand that all matter is made up of atoms.

(a) atoms are made up of electrons, protons, and neutrons:

(b) atoms of any element are alike but are different from atoms of other elements.

Physical Science: Matter: Atomic Structure

GRADE: 6

CONCEPT: SYSTEMS: Organization

EDURING UNDERSTANDING: Parts of a system interact to form a functional whole.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand:</p> <ul style="list-style-type: none">• Each element has its own chemical symbol.• Only a small number of elements make up most of the Earth’s oceans, land, living creatures, and atmosphere.	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none">• Match symbol to name for the elements. <p>Application/Analysis Level</p> <ul style="list-style-type: none">• Why do hydrogen and helium have different symbols?• Sort the list of earth’s most common elements into the categories: water, rock (land), atmosphere, and life. <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none">• What would happen if all carbon disappeared from the Earth and hydrogen and nitrogen were the most common elements?	<p>symbol</p>

SOL: 6.4 The student will investigate and understand that all matter is made up of atoms.

(c) elements may be represented by chemical symbols;

(g) a limited number of elements comprise the largest portion of the solid Earth, living matter, the oceans, and the atmosphere.

Physical Science: Matter: Changes in Matter

GRADE: 6

CONCEPT: SYSTEMS: Organization

ENDURING UNDERSTANDING: Systems at various levels of organization can manifest different properties and functions.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand:</p> <ul style="list-style-type: none">• Compounds are the result of chemical bonds between two or more different atoms.• A chemical formula uses the symbol for each element in the compound and a number representing how many atoms of that element are in the compound.• Elements get rearranged in a chemical reaction. A chemical equation models that chemical change.	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none">• Given a list of common compounds, write the formulae. OR: Given the formulae for common compounds, write the names. OR: Match the formula to the name for these common compounds.• What holds each of these compounds together? <p>Application/Analysis Level</p> <ul style="list-style-type: none">• Compare the two materials: sodium metal and salt. Why is one an element the other a compound? (Provide students with the appropriate symbols and formula.) <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none">• Write a chemical equation that models the formation of table salt.	<p>chemical bond chemical equation chemical reaction compound formula molecule</p>

SOL: 6.4 The student will investigate and understand that all matter is made up of atoms.

- (d) two or more atoms may be chemically combined;
- (e) compounds may be represented by chemical formulas;
- (f) chemical equations can be used to model chemical changes.

Physical Science: Matter: Changes in Matter

GRADE: 6

CONCEPT: SCALE: Properties

ENDURING UNDERSTANDING: Properties characterize objects, organisms, and substances.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand:</p> <ul style="list-style-type: none"> The compound water occurs in its solid, liquid, and gas states on Earth. The oceans contain most of our water (97%). Water on Earth may have come from the cooling of the planet 4.5 billion years ago, forming the oceans. When water is frozen it is less dense than the liquid form. Water freezes at 0° C and boils at 100° C. Water molecules are slightly charged and stick tightly together. Water has a high surface tension. Water absorbs heat energy without great changes in temperature, allowing oceans to moderate coastal climates. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> Write the formula for the compound water as a solid, a liquid, and a gas. Identify the state of water, given its temperature. Complete a chart or graphic showing the percentage of water in its various forms on Earth. <p>Application/Analysis Level</p> <ul style="list-style-type: none"> Explain why summers and winters are milder along the coastline of Virginia compared to the western border of the state. Why can you fill a glass of water past the top of the glass? Explain why we use water to wash clothes and other objects. Compare the properties of ice cubes in a drink with those of icebergs in the ocean. Why do ships need to avoid icebergs? <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> Some scientists dispute the idea that all of Earth’s water came from the cooling of the planet. Use the Internet and other resources to research other accepted scientific ideas about the origin of Earth’s water. Prepare an oral report of your conclusions as to the origin of water on Earth, backing up your opinions with scientific evidence. 	<p>moderate</p> <p>states of matter: solid liquid gas</p> <p>surface tension universal solvent</p>

SOL: 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.

- (a) water as the universal solvent;
- (b) the properties of water in all three states;
- (d) the ability of large bodies of water to store heat and moderate climate;
- (e) the origin and occurrence of water on Earth.

Physical Science: Matter: Changes in Matter

GRADE: 6

CONCEPT: SCALE: Properties

ENDURING UNDERSTANDING: Scale compares objects, living things, and events relative to time and space.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand:</p> <ul style="list-style-type: none"> Freezing water can break rock as it expands and can move sediments as it melts as part of physical weathering. Dissolved substances in water can chemically change minerals in rock as part of chemical weathering. Early cultures settled near rivers to facilitate irrigation for agriculture. Power generation stations use water. Rivers were used to dispose of human sewage, which led to outbreaks of disease. Modern technology is used in water treatment plants to clean wastewater. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> List the characteristics of physical weathering. List the characteristics of chemical weathering. <p>Application/Analysis Level</p> <ul style="list-style-type: none"> Explain why the early Monacan Indians settled on the banks of the Rivanna River. What property of water does the North Anna nuclear power plant use? How does this use of water compare with a coal-burning power plant? Compare these uses of water with a hydroelectric power plant on the Colorado River. How could you tell if a rocky cliff was experiencing chemical weathering? <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> A farming community reported a high incidence of e-coli infections during the summer swimming and canoeing season. There had been a lot of rain recently, and there are several chicken and pig farms located along the river. What can the community do to protect itself in the future? 	<p>chemical weathering</p> <p>physical weathering</p> <p>hydroelectric power</p>

SOL: 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.

- (c) the action of water in physical and chemical weathering;
- (f) the importance of water for agriculture, power generation, and public health;
- (g) the importance of protecting and maintaining water resources.

Earth Science: Earth Patterns, Cycles, and Change: Meteorology

GRADE: 6

CONCEPT: SCALE: Properties

ENDURING UNDERSTANDING: Properties characterize objects, organisms, and substances.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand:</p> <ul style="list-style-type: none"> Air is a gaseous mixture of mostly nitrogen with a lesser amount of oxygen and a small amount of water vapor, argon, and carbon dioxide. Air exerts pressure. Air pressure decreases with altitude. Moisture in the air is called humidity. Temperature decreases with altitude in the lower layer of the atmosphere. Most of the atmosphere is concentrated in the troposphere. The composition and density of atmospheric layers changes with altitude. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> Color and label a pie chart with the molecules and compounds that make up most of the atmosphere. Identify the layers of the atmosphere on a graphic. <p>Application/Analysis Level</p> <ul style="list-style-type: none"> Compare relative temperature measurements from three levels of the atmosphere: the troposphere, the stratosphere, and the thermosphere. Explain why they do not follow the same trend. Using the pie chart that you made earlier to assist you, compare the composition of earth’s atmosphere with the atmosphere in another planet in our solar system. Are there any similarities? What are the main differences? Use local weather data or make your own measurements to track temperature, air pressure, and humidity for 7 days. Graph the data and write a conclusion analyzing the trend of your measurements. <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> What do you predict would happen to the temperature and pressure in the stratosphere if its density were similar to that of the troposphere? 	<p>air pressure altitude atmosphere mesosphere stratosphere thermosphere troposphere density humidity ozone</p>

SOL: 6.6 The student will investigate and understand the properties of air and the structure and dynamics of the Earth’s atmosphere.

- (a) air as a mixture of gaseous elements and compounds;
- (b) air pressure, temperature, and humidity;
- (c) how the atmosphere changes with altitude.

Physical Science: Earth Patterns, Cycles, and Change: Meteorology

GRADE: 6

CONCEPT: CONSTANCY: Cause & Effect

ENDURING UNDERSTANDING: Observable changes occur in nature, and inferences can be made to explain their causes.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand:</p> <ul style="list-style-type: none"> Natural events, such as forest fires and volcanic eruptions add pollutants to the troposphere. Human activities, such as burning fossil fuels, add pollutants that can react with sunlight to form ozone and with water to form acid rain. People can practice preventative measures to control air pollution and acid rain. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> List the pollutants that natural events might add to the atmosphere. List the pollutants that human activities might add to the atmosphere. In which layer of the atmosphere do most pollutants stay? <p>Application/Analysis Level</p> <ul style="list-style-type: none"> Compare the composition of Earth’s atmosphere with the atmosphere of Venus. Venus has many volcanoes still erupting all over the planet. Are there any similarities? What are the main differences? <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> Which of these poses a greater long-term threat to human health; naturally occurring polluting events, such as volcanic eruptions, or human-caused events, such as burning fossil fuels in automobiles and in power plants? Base your opinions on news articles and government statistics and write a one-page paper explaining your position. 	<p>acid rain air pollutant</p>

SOL: 6.6 The student will investigate and understand the properties of air and the structure and dynamics of the Earth’s atmosphere.

- (d) natural and human-caused changes to the atmosphere;
- (g) the importance of protecting and maintaining air quality.

Physical Science: Earth Patterns, Cycles, and Change

GRADE: 6

CONCEPT: SYSTEMS: Interactions

ENDURING UNDERSTANDING: Parts of a system interact to form a functional whole.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand:</p> <ul style="list-style-type: none"> Weather takes place in the troposphere, and depends on heat energy, water vapor, and air pressure. Cloud types indicate atmospheric conditions, and form at different levels of the troposphere. Weather maps represent air measurements and show boundaries between air masses. Lines of equal air pressure and temperature on a map help to understand and predict the weather. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> Identify the three major cloud types, and indicate their relative position in the troposphere. Identify the map symbols on a weather map. <p>Application/Analysis Level</p> <ul style="list-style-type: none"> Analyze a national weather map for today and infer the day’s weather for different parts of the country. <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> Collect weather data over a period of time for your local area, prepare a weather map to reflect the data, and create a forecast for the next few days. Explain major fronts that may be shown in your area. 	<p>air mass cirrus cumulus drought forecast isobar isotherm precipitation stratus</p>

SOL: 6.6 The student will investigate and understand the properties of air and the structure and dynamics of the Earth’s atmosphere.

(e) the relationship of atmospheric measures and weather conditions;

(f) basic information from weather maps including fronts, systems, and basic measurements.

Life Science: Living Processes: Environment

GRADE: 6

CONCEPT: CHANGE & CONSTANCY: Cause & Effect

ENDURING UNDERSTANDING: Observable changes occur in nature, and inferences can be made to explain their causes.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand:</p> <ul style="list-style-type: none"> • Abiotic factors, such as water supply, landforms, and air quality determine the ecosystem type and health. • Human activity can alter abiotic components, for example, by affecting erosion rates and reducing wetlands. • Watersheds drain the water that flows through or across the land, and are separated by divides. • Virginia’s major watershed systems drain to the Chesapeake Bay, the North Carolina Sounds, and the Gulf of Mexico. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> • Label the parts of a watershed on a drawing or aerial photograph of a watershed. • Label a map of Virginia with its major rivers, and indicate which of the three major watershed systems they drain. <p>Application/Analysis Level</p> <ul style="list-style-type: none"> • Draw the watershed your house is in, and find where the rainwater drains. Determine in which of Virginia’s drainage systems you live. • Imagine that your family is creating a garden. What can you tell them about potential erosion and runoff effects that could result from your work? • Compare and contrast the location and functions of wetlands and estuaries. <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> • Create a public service announcement teaching landowners how to fertilize their lawns, and why they should use care in this process. • Design a home or shopping center using landscaping and plants that will mitigate the effects of runoff. • Describe what might happen to water quality if the area around the Chesapeake Bay were to be filled in for development. 	<p>abiotic divides ecosystem estuaries river systems stream processes tributaries watershed wetlands</p>

SOL: 6.7 The student will investigate and understand the natural processes and human interactions that affect watershed systems.

- (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.

Life Science: Living Systems: Environment

GRADE: 6

CONCEPT: SCALE: Measurement

ENDURING UNDERSTANDING: Measurement represents properties on a numerical scale.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand:</p> <ul style="list-style-type: none"> Water quality monitoring involves collecting and analyzing water samples for chemical and biological parameters, including pH, temperature, salinity, dissolved oxygen, turbidity, and type and presence of macroinvertebrate organisms. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> Use the water quality terms to complete a crossword puzzle. Use a temperature probe to measure and record the temperature of a body of water at different times of day. Use a Secchi disk to determine the turbidity of a column of water. <p>Application/Analysis Level</p> <ul style="list-style-type: none"> Collect a sample of water from your neighborhood and bring it in for testing. Prepare a report describing the quality of your water sample. You have a sample of well water with a high level of salinity. The water came from a well near an estuary. There is a paper mill nearby. Hypothesize what could have caused the high levels of salt in the water. Collect a macroinvertebrate sample from a nearby stream. Determine whether or not the stream is healthy based on the variety and number of species found. <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> You are an environmental safety officer and you received a report about possible water contamination. Design an investigation of the water source that includes all components of water quality testing we have learned. In your investigation, include a checklist to determine if the water is of high or low quality, based on your findings. 	<p>monitor salinity turbidity</p>

SOL: 6.7 The student will investigate and understand the natural processes and human interactions that affect watershed systems.
 (e) major conservation, health, and safety issues associated with watersheds; and
 (f) water monitoring and analysis using field equipment including hand-held technology.

Earth Science: Interrelationships in Earth/Space Systems: Astronomy

GRADE: 6

CONCEPT: SYSTEMS: Organization

ENDURING UNDERSTANDING: Parts of a system interact to form a functional whole.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand:</p> <ul style="list-style-type: none"> • Our Solar System consists of planets, moons, asteroids, comets, and meteors, all in orbit about the Sun. • We characterize the planets based on their distance from the sun, their size, and their compositions. • Gravity holds the solar system together and the moon’s gravity causes tides on the Earth. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> • Label a diagram with parts of the solar system. • Describe the inner planets. • Describe the outer planets. <p>Application/Analysis Level</p> <ul style="list-style-type: none"> • Create a Venn diagram that compares and contrasts the inner and outer planets, based on their characteristics. • Create a comic demonstrating the difference in mass and weight if you took a trip to the moon. • What makes Earth unique in our solar system? <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> • Do you agree with NASA’s position in changing the status of Pluto? Use your knowledge of what a planet is to support your opinion. • If the moon disappeared, would we still have tides? Support your opinion. 	<p>gravity orbit phase revolution rotation</p>

SOL: 6.8 The student will investigate and understand the organization of the solar system and the relationships among the various bodies that comprise it.

- (a) the, sun, moon, Earth, other planets and their moons, meteors, asteroids, and comets;
- (b) relative size of and distance between planets;
- (c) the role of gravity;
- (h) the cause of tides.

Earth Science: Interrelationships in Earth/Space Systems: Astronomy

GRADE: 6

CONCEPT: CHANGE & CONSTANCY: Cause & Effect

ENDURING UNDERSTANDING: Cycles organize change, which can lead to predictable outcomes.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand:</p> <ul style="list-style-type: none"> • Planets rotate on an axis. • As Earth rotates, different sides of the Earth face toward or away from the sun, causing day and night, respectively. • Lunar phases appear because of the moon’s position relative to the Sun and the Earth. • Earth is unique because of its liquid waters, protective atmosphere, and magnetic field. • Tilted axis of the Earth cause the seasons. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> • Label the phases of the moon. <p>Application/Analysis Level</p> <ul style="list-style-type: none"> • Given a sequence of lunar phases, predict the next in the sequence. Is the moon waxing or waning? • Explain how rotation is different from revolution. Draw an illustration to go with your explanation. • Use Oreo cookies to make a model of the moon phases. <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> • Predict what would happen if the Earth stopped rotating. • What would happen to the seasons if the Earth stopped revolving around the sun and simply rotated in one position? • Write a short story based on an imaginary natural event that resulted in the Earth’s magnetic field disappearing. How would life change? 	<p>lunar phases revolution rotation</p>

SOL: 6.8 The student will investigate and understand the organization of the solar system and the relationships among the various bodies that comprise it.

- (d) revolution and rotation;
- (e) the mechanics of day and night and phases of the moon;
- (f) the unique properties of Earth as a planet;
- (g) the relationship of the Earth’s tilt and seasons.

Earth Science: Interrelationships in Earth/Space Systems: Astronomy

GRADE: 6

CONCEPT: COMMUNICATION: Theory

ENDURING UNDERSTANDING: Theories explain why natural phenomena occur and evolve to incorporate new knowledge.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand:</p> <ul style="list-style-type: none"> The ideas of Ptolemy, Aristotle, Copernicus, and Galileo contributed to the development of our understanding of the solar system. The development of new technology over the last half-century has increased our knowledge of the solar system substantially. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> Match the term to its definition: rocket, space probe, artificial satellite, natural satellite, international space station, and robotic explorers. Put major astronomy discoveries in an appropriate time sequence. <p>Application/Analysis Level</p> <ul style="list-style-type: none"> Compare and contrast Ptolemy, Aristotle, Copernicus, and Galileo’s ideas about the solar system. Apply what you learned about unmanned and manned space exploration to a possible trip to Mars. What would be important to consider if people traveled to Mars? <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> Create a timeline to show the history of space exploration, beginning with the ancient astronomers and ending with a current day mission. You are selected to be part of a Planning Committee for a manned trip to Mars. Research how long the trip might take, what provisions are needed, and what studies you will do when you get there. Create an ad to raise public support for the trip that includes potential benefits to the people on Earth. 	<p>Galileo satellite</p>

SOL: 6.8 The student will investigate and understand the organization of the solar system and the relationships among the various bodies that comprise it.

(i) the history and technology of space exploration.

Earth Science: Resources: Environmental Policy

GRADE: 6

CONCEPT: CHANGE & CONSTANCY: Equilibrium

ENDURING UNDERSTANDING: Stability exists or otherwise occurs when changes are counterbalanced.

Essential Understandings	Assessment Samples – Bloom’s Levels	Vocabulary
<p>Students should understand:</p> <ul style="list-style-type: none"> • People, as well as other living organisms, are dependent upon the availability of clean water and air and a healthy environment. • Government plays a significant role in managing and protecting natural resources. • Most renewable and nonrenewable resources are managed and/or controlled by public and/or private entities. • Nonrenewable resources will eventually be depleted if not conserved. • Pollution prevention and waste management is more economical than cleanup. 	<p>Knowledge/Comprehension Level</p> <ul style="list-style-type: none"> • Differentiate between renewable and nonrenewable resources. • Identify some common renewable and nonrenewable resources. <p>Application/Analysis Level</p> <ul style="list-style-type: none"> • How much water does a community of 20,000 people require? Diagram a suitable municipal water system for a community of approximately 20,000 people. Include water sources, water storage (i.e. reservoirs and water storage tanks), water treatment, and wastewater treatment. <p>Synthesis/Evaluation Level</p> <ul style="list-style-type: none"> • Have small groups of students develop a plan to reduce their “carbon footprint” on the world. Include ways to reduce energy use at home and school as well as the possible conversion to more environmental friendly forms of energy. Also include ways reduce energy use in daily transportation. 	<p>nonrenewable resources: coal oil natural gas nuclear power mineral resources</p> <p>renewable resources water air soil plant life animal life</p> <p>land-use waste management conservation</p>

SOL: 6.9 The student will investigate and understand public policy decisions relating to the environment.

- (a) management of renewable resources (water, air, soil, plant life, animal life);
- (b) management of nonrenewable resources (coal, oil, natural gas, nuclear power, mineral resources);
- (c) the mitigation of land-use and environmental hazards through preventive measures; and
- (d) cost/benefit tradeoffs in conservation policies.