Grade 7 Curriculum Map
Instructional Plan for Science Grade 7
Robert J. Buss
St. Paul's Lutheran School
Written: June 2020

Grade 7 Curriculum
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Submitted by Robert J. Buss
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	Content Type	Objectives	Standards	Assessment	Materials
A U G U S T & S E P T E M B E R	• 24 FOSS Module: Chemical Interactions Investigation 1: Mystery mixture Mixing Substances Investigation 2: Periodic Table Elements of the World Investigation 3: GasExpansion/Contraction Liquid Expansion/Contraction Solid Expansion/Contraction	• A substance is a form of matter with a unique composition and distinct physical and chemical properties that can be used to identify it. • Substances can be represented with common names, chemical names, and chemical formulas. • A chemical reaction occurs when substances interact to form new substances (products). • Different substances interact in predictable patterns. • Observe a mystery-mixture reaction and begin to consider the definition of substance and chemical reaction. • Identify the two substances in the mystery mixture by observing the characteristics of the reactions that occur when they mix pairs of known substances. • An element is a basic substance that cannot be broken into simpler substances during chemical interactions. • Elements combine to make all the substances on Earth. • The relative abundance of elements varies with location in the universe. • The periodic table of the elements displays all the naturally occurring and synthesized elements.Explore the periodic table of the elements. • Use an online resource to consider properties and categories of elements, and to research individual elements. • Matter is made of particles; every substance is defined by a unique particle. • Gas is matter—it has mass and occupies space; in a gas, particles are widely spaced and in constant motion. • Gas compresses when force is applied; gas expands when force is withdrawn.	• SCI.SEP3.A.m Students plan and carry out investigations that use multiple variables and provide evidence to support explanations or solutions. This includes the following: Individually and collaboratively plan an investigation, identifying: independent and dependent variables and controls, tools needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. Conduct an investigation. Evaluate and revise the experimental design to produce data that serve as the basis for evidence to meet the goals of the investigation. Evaluate the accuracy of various methods for collecting data. Collect data under a range of conditions that serve as the basis for evidence to answer scientific questions or test design solutions. Collect data about the performance of a proposed object, tool, process, or system under a range of conditions. • MS-ETS3-3. Mathematically evaluate products of chemical and physical changes to support ideas of atomic theory (PS1.A.m). • SCI.ETS1.B.m A solution needs to be tested and then modified on the basis of the test results in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. Models of all kinds are important for testing solutions. • SCI.ETS1.A.m The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. • MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures. • MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.	• Daily homework • Weekly quizzes • "muddiest point" formative interview assessment • Lab reports (3) • Chapter tests (2)	"Science Safety Rules" "White Substances Information" Online Activity "Two-Substance Reactions" "Science Safety Rules" "White Substances Information" Online Activity "Two-Substance Reactions" "Particles" "Three Phases of Matter" Online Activity "Gas in a Syringe" Slide Show Particles in Gases

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		• During compression and expansion, the number and character of particles in a sample of gas do not change; the space between the particles does change. • Read consumer-product labels to find elements in familiar substances create a mixture of carbon dioxide through chemical reaction, using a setup that allows capture and study of the resulting gas. • Determine the gas is carbon dioxide, which leads them to a study of air. • Use syringes to discover that air can be compressed and expanded. • Develop a particulate model for matter	• MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. • MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed. • MS-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction, and thus, mass is conserved. • MS-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. • SCI.SEP8.A.m Students evaluate the merit and validity of ideas and methods. This includes the following: Critically read scientific texts adapted for classroom use to determine the central ideas, to obtain scientific and technical information, and to describe patterns in and evidence about the natural and designed world(s). Clarify claims and findings by integrating text-based qualitative and quantitative scientific information with information contained in media and visual displays. Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication. Describe how they are supported or not supported by evidence and evaluate methods used. Evaluate data, hypotheses, and conclusions in scientific and technical texts in light of competing information or accounts. •		
O C T O B E R	• 20 FOSS MOdule: Chemical Interactions Investigations 4 and 5 Mixing Hot and Cold Particle Collisions Heat	• Observe expansion and contraction of solids, liquids, and gases, and explain the phenomena in terms of kinetic theory—the constant motion of particles. • Learn one way that energy moves and how to conceptualize energy transfer as changes of the kinetic energy of particles resulting from particle collisions. • Solids, liquids, and gases vary in how their particles are arranged, but the particles are always in motion. • Kinetic energy is energy of motion.	• MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures. • MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. • MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. • MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed. • MS-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction, and thus, mass is conserved.	• Daily homework • Weekly quizzes • "muddiest point" formative interview assessment • Lab reports (3) • Chapter tests (2)	"Particles in Motion" "Three Phases of Matter" (optional) "Expansion and Contraction" Online Activity "Particles in Solids, Liquids, and Gases" "Energy on the Move" Online Activities "Energy Transfer by Collision"

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		• The particles in substances gain kinetic energy as they warm, and lose kinetic energy as they cool. • Matter expands when the kinetic energy of its particles increases; matter contracts when the kinetic energy of its particles decreases. • Mix equal volumes of hot and cold water and predict the final temperature. Use the result to determine an algorithm for calculating final temperature. • Measure and chart the calorie as a unit of energy transfer.	• MS-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. • SCI.PS2.A.m Motion and changes in motion can be qualitatively described using concepts of speed, velocity, and acceleration (including speeding up, slowing down, and/or changing direction). The role of the mass of an object must be qualitatively accounted for in any change of motion due to the application of a force (Newton's first and second law). For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law). • SCI.PS3.A.m Kinetic energy can be distinguished from the various forms of potential energy. • SCI.PS3.B.m Energy changes to and from each type can be tracked through physical or chemical interactions. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter •		"Mixing Hot and Cold Water" "Thermometer" "Energy Flow" "Engineering a Better Design" "Science Practices" "Engineering Practices" Online Activities "Energy Flow" "Particles in Solids, Liquids, and Gases"

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N O V E M B E R	• 19 FOSS Module: Chemical Interactions Investigation 6: • Insulation • Thermos Design Investigation 7: Dissolve & Melt Solubility Investigation 8: Melting Temperature Adding Thermal Energy Freezing Water, Changing Phase	• Insulating materials reduce energy transfer via conduction. • Materials with more widely spaced particles serve as better insulators. • Engineers try to solve problems that satisfy a set of criteria and that conform to constraints placed on a solution to the problem. • Energy transfers between particles when they collide. Energy transfer by contact is conduction. • Energy always transfers from particles with more kinetic energy to particles with less kinetic energy. • Energy is conserved. The amount of energy in a system does not change—no energy is ever created or destroyed. • Temperature is a measure of the average kinetic energy of the particles of a substance. • Employ understandings of energy transfer to engineer a container that keeps hot liquids hot and cold liquids cold. • Test materials for their insulating properties in preparation for the design challenge. • Determine criteria and constraints in the engineering design process and test their designs. • Dissolving occurs when one substance (solute) is reduced to particles and is distributed uniformly throughout the particles of a second substance (solvent). • Dissolving involves both kinetic interactions (collisions) and attractive forces (bonds). • Not all substances are soluble in water. • Solutions can be separated into their original components, which are not chemically changed during dissolution.	• SCI.ETS1.C.m Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. • SCI.PS3.B.m Energy changes to and from each type can be tracked through physical or chemical interactions. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter. • SCI.PS3.D.m Sunlight is captured by plants and used in a chemical reaction to produce sugar molecules for storing this energy. This stored energy can be released by respiration or combustion, which can be reversed by burning those molecules to release energy. • MS-PS3-3. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. • MS-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. • MS-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. • SCI.PS1.B.m Reacting substances rearrange to form different molecules, but the number of atoms is conserved. Some reactions release energy and others absorb energy. • SCI.PS1.A.m The fact that matter is composed of atoms and molecules can be used to explain the properties of substances, diversity of materials, states of matter, phase changes, and conservation of matter. • SCI.SEP2.A.m Students develop, use, and revise models to describe, test, and predict more abstract phenomena and design systems. This includes the following: Evaluate limitations of a model for a proposed object or tool. Develop or modify a model—based on evidence – to match what happens if a variable or component of a system is changed. Use and develop a model of simple systems with uncertain and less predictable factors.	• Daily homework • Weekly quizzes • "muddiest point" formative interview assessment • Lab reports (3) • Chapter tests (2)	Science Resources Book "How Things Dissolve" "Concentration" Online Activity "Explore Dissolving" "Rock Solid" "Heat of Fusion" "Science Practices" "Engineering Practices" Online Activity "Particles in Solids, Liquids, and Gases" Video: Hoar Frost "Better Living through Chemistry" "How Do Atoms Rearrange?" "Fireworks" "Antoine-Laurent Lavoisier" "Organic Compounds" Video: Burning Sugar Demonstration "Careers in Chemistry" "Element Hunters" Online Resource Science and Engineering Careers Database

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		• Investigate the phenomenon of dissolving, and distinguish it from melting. • Compare the solubility of two substances, calcium carbonate and sodium chloride • Matter exists on Earth in three common states—solid, liquid, and gas. • Change of phase is the result of change of energy and motion of the particles in a sample of matter. • During phase change, particles do not change; relationships between particles do change. • The temperatures at which phase changes occur are different for different substances. • The processes of phase change are evaporation, condensation, melting, freezing, sublimation, and deposition. • Determine how to separate mixtures to recover the original parts • Explore the phenomenon of phases of matter. • Examine water as a solid, liquid, and gas, and investigate the conditions that induce substances to change from one phase to another. •	Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena. Develop and use a model to predict and describe phenomena. Develop a model to describe unobservable mechanisms. Develop and use a model to generate data to test ideas about phenomena in natural or designed • SCI.SEP1.B.m Students define a design problem that can be solved through the development of an object, tool, process, or system, and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. • SCI.CC6.m Students model complex and microscopic structures and systems and visualize how their function depends on the shapes, composition, and relationships among their parts. They analyze many complex natural and designed structures and systems to determine how they function. They design structures to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. • SCI.CC5.m Students understand matter is conserved because atoms are conserved in physical and chemical processes. They also understand that within a natural or designed system the transfer of energy drives the motion and cycling of matter. Energy may take different forms (e.g. energy in fields, thermal energy, and energy of motion). The transfer of energy can be tracked as energy flows through a designed or natural system. •		
D E C E M B E R	• 15 FOSS Module: Earth History Investigation1: Earth is Rock Investigation 2: Weathering and Erosion Investigation 3: Deposition	• Explore the Grand Canyon to study the landforms and rocks that make up Earth's crust. • Observe aerial images of Earth's surface, sedimentary rock samples, and images from the Grand Canyon, to begin develop awareness about the complexity of Earth's crust • Earth's surface has a variety of different landforms and water features. • Every place on Earth's surface has a unique geologic story. • Rocks hold the clues to the story of a place. • Limestone, sandstone, and shale are rocks found in the Grand Canyon that	• MS-ETS3-1. Construct an argument supported by evidence about the values held by different societies based on the resources expended for exploration and understanding of the universe (ESS1.B.m). • MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives plate tectonics. • MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. • MS-ESS2-3. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. • MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.	• Daily homework • Weekly quizzes • "muddiest point" formative interview assessment • Lab reports (3) • Chapter tests (2)	"Seeing Earth" "Powell's Grand Canyon Expedition, 1869" Online Activities "Landforms Tour" "Scale Model" "Grand Canyon Correlation " Video and Slide Show Grand Canyon Flyover Powell's River Trip slide show

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		can be identified by their characteristics. • Explore the phenomena of earth material movement over the surface of Earth. • Observe a stream table to discover how water can erode sediments from one location and deposit the sorted sediments in a basin downstream. • Model how rocks weather and what happens to sediments. • Consider how soil forms. • Conclude that most landforms are shaped by slow, persistent processes that proceed over time: weathering, erosion, and deposition. • Deduce that rock can be weathered into sediments by a number of processes, including frost wedging, abrasion, chemical dissolution, and root wedging. • Categorize and sort particles of earth material by size. • Observe that most sediments move downhill until they are deposited in a basin. • Observe that sediments that do not form rock can become widely distributed over Earth's surface as soil. • Investigate the phenomenon of the variety of sedimentary rocks on Earth. • Observe processes by which bedrock that is weathered and eroded ends up deposited in basins. There, favorable conditions can turn the sediments into sedimentary rock. • Consider how evidence in sedimentary rocks can lead to inferences about the ancient environments in which they formed. • Sediments deposited by water usually form flat, horizontal layers. • Sediments turn into solid rock through the process of lithification, which	• MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. • MS-ESS2-6. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates • SCI.ESS2.B.m Plate tectonics is the unifying theory that explains movements of rocks at Earth's surface and geological history. Maps are used to display evidence of plate movement. • SCI.ESS2.A.m Energy flows and matter cycles within and among Earth's systems, including the sun and Earth's interior as primary energy sources. Plate tectonics is one result of these processes. • MS-ESS1-4. Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's "4.6-billion-year-old history." • SCI.ESS1.C.m Rock strata and the fossil record can be used as evidence to organize the relative occurrence of major historical events in Earth's history. •		Grand Canyon Flood!" "Weathering and Erosion" "Soil Stories" (optional) Videos Stream Table: High Flow vs. Low Flow Stream Table: High Slope vs. Low Slope Stream Table: Heterogeneous vs. Homogeneous Material "Where in the World Is Calcium Carbonate?" "Water on Mars?" Online Activities "Sandstone Formation" "Shale Formation" "Zion National Park Expedition" "Limestone Formation" "Rock Column Movie Maker" "Rock Database" "Sedimentary Rocks Tour" Glen Canyon Dam High Flow Experiment, USGS Debris Flow Frost Wedging Rock Fall Freezing Glass Bottle

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		involves compaction, cementation, and dissolution. • Theorize that relative ages of sedimentary rock can be determined by the sequence of layers. Lower layers are older than higher layers. • The processes we observe today probably acted in the same way long ago, producing sedimentary rocks.			

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J A N U A R Y	● 21 ● FOSS Module: Earth History Investigation 4: Fossils and Past Environments Investigation 5: Igneous Rocks	● Experience the phenomenon of fossils. ● Become familiar with the geologic time scale to understand how old fossils are and begin to comprehend the enormous spans of time that are described by geologic time. ● Use fossils to put the history of the Grand Canyon into the geologic time scale. ● Key Understandings: ● A fossil is any remains, trace, or imprint of a plant or animal that was preserved in Earth's crust during ancient times. ● The fossil record represents what we know about ancient life and is constantly refined as new fossil evidence is discovered. ● Geologic time extends from Earth's origin to the present. ● Earth's history is often measured in millions and billions of years. ● Index fossils allow rock layers to be correlated by age over vast distances. ● Interpreting the Fossil Record ● Conflicting views of the beginning: ● Special creation, evolution: ● Big bang, theistic evolution ● Limitations of geology: principle of uniformity ● Geology and the Genesis Flood ● Uniformitarianism: Charles Lyell, problems with, Charles Darwin ● Catastrophism: Georges Cuvier ● Paleontology: ● Fossil formation ● Geologic column: ● Eons, eras, periods, epochs, index fossils ● Imaginary arrangement, circular reasoning, anomalies ● Radiometric dating: carbon-14 dating ● Biblical explanation of the fossil record ● Evidence of a flood:	● SCI.ESS2.E.m The fossil record documents the existence, diversity, extinction, and change of many life forms throughout history (linked to content in LS4.A). ● MS-LS4-1. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past. ● MS-LS4-2. Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. ● SCI.LS4.A.m The fossil record documents the existence, diversity, extinction, and change of many life forms and their environments through Earth's history. The fossil record and comparisons of anatomical similarities between organisms enables the inference of lines of evolutionary descent. ● SCI.SEP8.A.m Students evaluate the merit and validity of ideas and methods. This includes the following: Critically read scientific texts adapted for classroom use to determine the central ideas, to obtain scientific and technical information, and to describe patterns in and evidence about the natural and designed world(s). Clarify claims and findings by integrating text-based qualitative and quantitative scientific information with information contained in media and visual displays. Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication. Describe how they are supported or not supported by evidence and evaluate methods used. Evaluate data, hypotheses, and conclusions in scientific and technical texts in light of competing information or accounts. ● SCI.SEP7.A.m Students construct a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. This includes the following. Compare and critique two arguments on the same topic. Analyze whether they emphasize similar or different evidence and interpretations of facts. Respectfully provide and receive critiques about one's explanations, procedures, models, and questions by citing	● Daily homework ● Weekly quizzes ● "muddiest point" formative interview assessment ● Lab reports (3) ● Chapter tests (2)	"A Fossil Primer" "Rocks, Fossils, and Time" "Floating on a Prehistoric Sea" Online Activities "Rock Column Movie Maker" "Sandstone Formation" "Shale Formation" "Limestone Formation" "Timeliner" "Index-Fossil Correlation" "Dating Rock Layers" "Minerals, Crystals, and Rocks" Online Activities "Pacific Northwest Tour" "Extrusive Rock Formation" "Intrusive Rock Formation" "Yosemite National Park Tour" "Hawaii Tour" (optional) "Rock Database" Video Salol Crystal Formation Slide Show Earth's Interior

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		• Quick deposition: massive "graveyards," polystrate fossils, • unconformity • Living fossils: coelacanth, stasis • Evidence against evolution: • "Missing links": • Seymouria, Archaeopteryx, Tiktaalik • Cambrian explosion • Impossibility of intermediates • Natural selection and intermediates • Punctuated equilibrium • Evolution of man—a mistaken belief: • Man vs. ape: body structure, upright posture, cranial capacity • Questionable intermediates: • Ramapithecus, Neanderthal man • Australopithecines, Lucy, Homo habilis, Skull 1470 • Homo erectus, Java man, Peking man, Cro-Magnon man • True origin of man: created in God's image • Present rock samples from a new location. • Investigate the relationship between crystal size and the formation of igneous rocks. • Study and recount the formation of igneous rocks. • Key Understandings: • Earth is composed of layers of earth materials, from its hard crust of rock all the way down to its hot core. • Heat inside Earth melts rocks; melted rock can cool and form igneous rocks. • Molten rock cools quickly on the surface of Earth and can be identified by small mineral crystals. Molten rock that cools more slowly inside Earth forms larger mineral crystals. • Compile a series of facts and geologic/fossil records to support or refute the theory of evolution and billions of years to develop the geologic record vs. a global flood and	relevant evidence and posing and responding to questions that elicit pertinent elaboration and detail. Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. Make an oral or written argument that supports or refutes the advertised performance of a device, process, or system. Base the argument on empirical evidence. • SCI.SEP6.A.m Students construct explanations supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. This includes the following: Construct an explanation that includes qualitative or quantitative relationships between variables that predict and describe phenomena. Construct an explanation using models or representations. Construct a scientific explanation based on valid and reliable evidence obtained from sources, including the students' own experiments. Solutions should build on the following assumption: theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. Apply scientific ideas, principles, and evidence to construct, revise, or use an explanation for real world phenomena, examples, or events. Apply scientific reasoning to show why the data or evidence is adequate for the explanation. • SCI.CC7.m Students explain stability and change in natural or designed systems by examining changes over time, and considering forces at different scales, including the atomic scale. They understand changes in one part of a system might cause large changes in another part, systems in dynamic equilibrium are stable due to a balance of feedback mechanisms, and stability might be disturbed by either sudden events or gradual changes that accumulate over time. •		

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		creationism's BIblical perspective to explain both in roughly 6,000 years of Earth's history. ● Compose an essay presenting facts to support either theory. ● Debate the argument in class.			
F E B R U A R Y	● 18 FOSS Module: Earth History Investigation 6: Volcanoes and Earthquakes Investigation7: Mountains and Metamorphic Rocks	● Investigate a pattern of geologic activity. ● Become familiar with subduction, convection, and the theory of crustal plate tectonics ● Explain continental drift, plate boundary interactions, and the patterns of volcanoes and earthquakes. ● Key Understandings ● Volcanoes and earthquakes occur along plate boundaries. ● Earth's crust and solid upper mantle make up Earth's plates. Plates can be the size of continents or larger or smaller. ● Earth's plates "float" on top of the layer of viscous, semisolid earth material below the asthenosphere. ● The asthenosphere is a heated, semisolid, semifluid material that flows due to convection currents. ● Plate movements result in plate-boundary interactions that produce volcanoes, earthquakes, and continental drift. ● ● Key Understandings: ● Interactions between tectonic plates at their boundaries deform the plates, producing landforms on Earth's surface. ● Mountains form as a result of plate interactions. ● When plates interact, high heat and immense pressure can change rock into new forms of rock (metamorphic rock). ● The rock cycle describes how rock is constantly being recycled and how	● .SCI.ETS2.A.m Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. Science and technology drive each other forward ● MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. ● MS-ESS3-2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. ● SCI.ESS3.A.m Humans depend on Earth's land, oceans, fresh water, atmosphere, and biosphere for different resources, many of which are limited or not renewable. Resources are distributed unevenly around the planet as a result of past geologic processes. ● SCI.ESS2.D.m Complex interactions determine local weather patterns and influence climate, including the role of the ocean. ● SCI.ESS2.C.m Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features ● SCI.CC3.m Students observe time, space, and energy phenomena at various scales using models to study systems that are too large or too small. They understand phenomena observed at one scale may not be observable at another scale, and the function of natural and designed systems may change with scale. They use proportional relationships (e.g., speed as the ratio of distance traveled to time taken) to gather information about the magnitude of properties and processes. They represent scientific relationships through the use of algebraic expressions and equations. ● SCI.CC2.m Students classify relationships as causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause,	● Daily homework ● Weekly quizzes ● "muddiest point" formative interview assessment ● Lab reports (3) ● Chapter tests (2)	"The History of the Theory of Plate Tectonics" "Historical Debates about a Dynamic Earth" Online Activities "Latitude and Longitude" "Volcano-Plotting Activity" "Volcanoes around the World" "Volcanoes" "Earthquake-Plotting Activity" "Earthquakes around the World" "Plate-Boundaries Map" Videos: Mount St. Helens: The Eruption Impact ShakeAlert Wegener Convection Plate Tectonics "Earth's Dynamic Systems" "Rock Transformations" "How One Rock Becomes Another Rock" Online Activities "Convergent Boundary" "Divergent Boundary" "Transform Boundary" "Folding"

		each type of rock can be transformed into other rock types. ● Apply prior knowledge to develop a geologic story of a place or process. ● Key Understandings: ● Geologic processes help tell the story of a physical place. ● Evidence and observations of a site's geology provide clues to tell the geologic story. ● Knowledge of uplift, plate tectonics, volcanism, weathering, erosion, and fossil evidence plus the principles of uniformitarianism, superposition, and original horizontality can help tell the story of a place. ● Compare four sites across the United States—four phenomena. Each team of students researches the story of one of those places, the processes that shaped it, and the implications of the story for human society. ● Key understandings: ● Evidence that provides clues about Earth's geologic history comes from observing rocks, landforms, and other earth materials. ● Scientists specialize in many different disciplines to collect and analyze evidence to help put together Earth's geologic history. ● Scientists use a number of different tools and techniques to analyze and synthesize evidence obtained from Earth to tell its story. ● Synthesize what they have learned about Earth's geologic history and to use their knowledge to recount the story of the Grand Canyon.	and some cause and effect relationships in systems can only be explained using probability. ● SCI.CC1.m Students recognize macroscopic patterns are related to the nature of microscopic and atomic-level structure. They identify patterns in rates of change and other numerical relationships that provide information about natural and human-designed systems. They use patterns to identify cause and effect relationships and use graphs and charts to identify patterns in data. ●		"Volcanoes around the World" "Appalachian Mountain Tour" "Rock Database" "How Metamorphic Rocks Form" "Slate" Slide Show: Mountain Types "Geoscenario Introduction: Glaciers" "Geoscenario Introduction: Coal" "Geoscenario Introduction: Yellowstone Hotspot" "Geoscenario Introduction: Oil" Online Activities "Geoscenarios" "Timeliner" "Rock Column Movie Maker" "Research Careers in the Lab and Field" Online Activities "Grand Canyon Revisited" "Rock Column Movie Maker" "Timeliner" Video: Colorado Plateau over Time

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M A R C H	• 17 FOSS Module: Populations and Ecosystems Investigation 1: Milkweed Bugs Investigatin 2: Sorting Out Life Investigation 3: Mono Lake	• Raise milkweed bugs in a supportive habitat to study the insect's reproductive biology. • Observe and record the entire milkweed-bug life-cycle. • Key understandings: • An organism is any living thing, and a • population is a group of organisms of the same kind living in an area at a specified time. • A habitat is where an organism lives and supplies all the resources an organism needs to survive and grow. • Organisms depend on environmental interactions with both other living things and nonliving factors. • Use ecosystem sorting cards to reflect on organizing concepts in ecology and develop the vocabulary associated with those concepts. • Watch a Jane Goodall video to become familiar with a specific population study of chimpanzees. • Explore one of ten ecoscenarios representing major biomes of Earth that will be studied throughout the course. • Key understandings: • A community is all the interacting populations in a specified area. • An ecosystem is a system of interacting organisms and nonliving factors in a specified area. • Biotic factors are living factors in an ecosystem; abiotic factors are nonliving factors. • Ecosystems are defined by their biotic and abiotic factors. • Biomes are large systems on Earth with similar abiotic factors. • Humans depend on ecosystems services.	• MS-LS4-3. Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy. • MS-LS4-4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. • MS-LS4-5. Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms. • MS-LS4-6. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. • SCI.LS4.D.m Changes in biodiversity can influence humans' resources and ecosystem services they rely on. • SCI.LS4.C.m Species can change over time in response to changes in environmental conditions through adaptation by natural selection acting over generations. Traits that support successful survival and reproduction in the new environment become more common. • SCI.LS4.B.m Both natural and artificial selection result from certain traits giving some individuals an advantage in surviving and reproducing, leading to predominance of certain traits in a population. • MS-LS3-1. Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. • MS-LS3-2. Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information, and sexual reproduction results in offspring with genetic variation. • SCI.LS3.B.m In sexual reproduction, each parent contributes half of the genes acquired by the offspring resulting in variation between parent and offspring. Genetic information can be altered because of mutations, which may result in beneficial, negative, or no change to proteins in or traits of an organism. • SCI.LS3.A.m Genes chiefly regulate a specific protein, which affect an individual's traits.	• Daily homework • Weekly quizzes • "muddiest point" formative interview assessment • Lab reports (3) • Chapter tests (2)	"Observations and Inferences" "Milkweed Bugs" "Life in a Community" "Ecoscenario Introductions" "Defining a Biome" Online Activities "Ecoscenarios" "Biomes" Video Among the Wild Chimpanzees "An Introduction to Mono Lake" Online Activities "Mono Lake Food Web" "Ecoscenarios" Online Resource "Organism Database" Video The Mono Lake Story

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		• Use Mono Lake, an important alkaline lake, as a simple ecosystem case study. • Study the functional roles of populations to construct a food web. • Construct a food web for their ecoscenario. • Key understandings: • The Mono Lake alkaline-lake ecosystem is defined by the interactions among the organisms and abiotic factors. • The path that food takes as one organism eats another is a food chain. • The feeding relationships in an ecosystem can be represented as a food web. • All ecosystems are defined by the interactions among the organisms and abiotic factors that exist in the region.	• SCI.LS1.B.m Animals engage in behaviors that increase the odds of reproduction. An organism's growth is affected by both genetic and environmental factors. • SCI.LS1.A.m All living things are made up of cells. In organisms, cells work together to form tissues and organs that are specialized for particular body functions. • SCI.SEP4.A.m Students extend quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. This includes the following: Construct, analyze, or interpret graphical displays of data and large data sets to identify linear and nonlinear relationships. Use graphical displays (e.g., maps, charts, graphs, and tables) of large data sets to identify temporal and spatial relationships. Distinguish between causal and correlational relationships in data. Analyze and interpret data to provide evidence for explanations of phenomena. Apply concepts of statistics and probability (including mean, median, mode, and variability) to analyze and characterize data, using digital tools when feasible. Consider limitations of data analysis (e.g., measurement error), and seek to improve precision and accuracy • SCI.SEP1.A.m Students ask questions to specify relationships between variables and clarify arguments and models. This includes the following: Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify or seek additional information. Ask questions to identify and clarify evidence and the premise(s) of an argument. Ask questions to determine relationships between independent and dependent variables and relationships in models. Ask questions to clarify or refine a model, an explanation, or an engineering problem. Ask questions that require sufficient and appropriate empirical evidence to answer. Ask questions that can be investigated within the scope of the classroom, outdoor environment,and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. Ask questions that challenge the premise(s) of an argument or the interpretation of a data set.		

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A P R I L	• 20 FOSS Module: Populations and Ecosystems Investigation 4: Mini Habitats Investigation 5: Producers Investigation 6: Follow the Energy	• Construct aquatic and terrestrial ecosystems in the classroom. • Observe them over time to understand ecosystem interactions. • Use a scientific log to observe, describe, and monitor changes in biotic and abiotic factors. • Key Understandings: • An aquatic ecosystem functions in water. • A terrestrial ecosystem functions on land. • Organisms depend on the abiotic elements in their ecosystem • Explore the effect of light on photosynthesis by studying wheat plants. • Observe that through photosynthesis, producers increase the biomass of an ecosystem. • Investigate the producers in specific ecosystems and identify their roles. • Model and measure the energy transferred from food. • Key Understandings • Photosynthesis is the process by which energy-rich molecules are made from water, carbon dioxide, and light. • Photosynthesis produces potential energy, and aerobic cellular respiration transfers usable energy to organisms. • Producers increase the biomass of an ecosystem through photosynthesis; ecosystems are defined by their producers. • Food is energy-rich organic matter that organisms need to conduct their life processes. • Learn how energy provided by producers is used by all organisms. • Explore how food energy moves from one trophic level to another through feeding relationships.	• SCI.PS3.D.m Sunlight is captured by plants and used in a chemical reaction to produce sugar molecules for storing this energy. This stored energy can be released by respiration or combustion, which can be reversed by burning those molecules to release energy. • MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. • MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. • MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. • MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. • MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services. • SCI.LS2.D.m Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on -- for example, water purification and recycling. • SCI.LS2.C.m Ecosystem characteristics vary over time. Disruptions to any part of an ecosystem can lead to shifts in all of its populations. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. • SCI.LS2.B.m The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. Food webs model how matter and energy are transferred among producers, consumers, and decomposers as the three groups interact within an ecosystem. • SCI.LS2.A.m Organisms and populations are dependent on their environmental interactions both with other living things and with nonliving factors, any of which can limit their growth. Competitive, predatory, and mutually beneficial interactions vary across ecosystems but the patterns are shared. • MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. • MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.	• Daily homework • Weekly quizzes • "muddiest point" formative interview assessment • Lab reports (3) • Chapter tests (2)	"Biosphere 2: An Experiment in Isolation" Online Resources "Plant and Animal Care" "Organism Database" "Where Does Food Come From?" "Energy and Life" "What Does Water Do?" "Wangari Maathai: Being a Hummingbird" Online Activities "Ecosenarios" "Biomes" "Rachel Carson and the Silent Spring" "Trophic Levels" "Decomposers"

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		• Simulate feeding relationships and determine what is needed to sustain a food chain. • Investigate the role of decomposers in ecosystems. • Key Understandings: • Every activity undertaken by living organisms involves expenditure of energy. • Feeding relationships identify trophic roles. • Biomass moves through an ecosystem from one trophic level to the next. • Only a small fraction of the biomass consumed at a level is used to produce growth (biomass) at that level; most of it is used for energy and much is lost to the environment. • Decomposers recycle food molecules to basic particles for use by organisms in the ecosystem.	• MS-LS1-7. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. • MS-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. • SCI.LS1.C.m Plants use the energy from light to make sugars through photosynthesis. Within individual organisms, food is broken down through a series of chemical reactions that rearrange molecules and release energy. • SCI.CC5.m Students understand matter is conserved because atoms are conserved in physical and chemical processes. They also understand that within a natural or designed system the transfer of energy drives the motion and cycling of matter. Energy may take different forms (e.g. energy in fields, thermal energy, and energy of motion). The transfer of energy can be tracked as energy flows through a designed or natural system. • SCI.CC4.m Students understand systems may interact with other systems: they may have sub-systems and be a part of larger complex systems. They use models to represent systems and their interactions—such as inputs, processes, and outputs—and energy, matter, and information flows within systems. They also learn that models are limited in that they only represent certain aspects of the system under study. •		

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M A Y	● 24 FOSS Module: Populations and Ecosystems Investigation 7: Population Sizes Investigation 8: Human Impact Investigation 9: Ecoscenarios	● Explore some of the variables in an ecosystem that limit population size. ● Recall their milkweed-bug study to predict what the population would be in 12 months. ● Use simulations to explore population interactions and outcomes. ● Key Understandings: ● Reproductive potential is the theoretical unlimited growth of a population over time. ● A limiting factor is any biotic or abiotic component of the ecosystem that controls the size of a population. ● Explore the importance of biodiversity on the health of the ecosystem. ● Investigate how humans have interacted with the ecosystem and have stressed biodiversity. ● Postulate and gather information on how humans can reverse these stresses and help restore ecosystems. ● Key Understandings: ● Biodiversity is the variety of organisms in an ecosystem. ● A biodiversity index is one measure of the health of an ecosystem and its ability to recover from stress. In a sustainable ecosystem, the system is resilient to change. ● Introduced species compete with native species in an ecosystem. ● If an introduced species has no predators in the new ecosystem, it can thrive and become invasive. ● Humans affect ecosystems in both positive and negative ways. ● Return to the ecoscenarios and synthesize the knowledge developed in previous investigations to analyze the	● MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services. ● MS-LS4-5. Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms. ● MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. ● SCI.ETS2.B.m All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. The uses of technologies are driven by people's needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Technology use varies over time and from region to region. ● MS-ETS3-2. Evaluate information and evidence about issues related to genetically modifying organisms and identify questions that can, and cannot, be answered by science (LS3.B.m) ● SCI.ETS3.C.m A theory is an explanation of some aspect of the natural world. Scientists develop theories by using multiple approaches. Validity of these theories and explanations is increased through a peer review process that tests and evaluates the evidence supporting scientific claims. Theories are explanations for observable phenomena based on a body of evidence developed over time. A hypothesis is a statement that can be tested to evaluate a theory. Scientific laws describe cause and effect relationships among observable phenomena. Engineers develop solutions using multiple approaches and evaluate their solutions against criteria such as cost, safety, time and performance. This evaluation often involves trade-offs between constraints to find the optimal solution. ● SCI.ETS3.B.m Science asks questions to understand the natural world and assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. Science carefully considers and evaluates anomalies in data and evidence. Engineering seeks solutions to human problems, including issues that arise due to human interaction with the	● Daily homework ● Weekly quizzes ● "muddiest point" formative interview assessment ● Lab reports (3) ● Chapter tests (2)	"Milkweed Bugs" "Limiting Factors" "Mono Lake throughout the Year" Online Activities "Milkweed Bugs, Unlimited" "Milkweed Bugs, Limited" "Biodiversity" "Invasive Species" "Mono Lake in the Spotlight" Videos Hawaii: Strangers in Paradise The Mono Lake Story "Ecoscenario Introductions" Online Activity "Ecoscenario Research Center"

		effects of human interactions in their ecosystem. ● Develop several engineering solutions and evaluate which they feel is the best solution to preserve or restore the ecosystem. ● Key Understandings: ● Humans rely on ecosystems for ecosystem services (provisioning, regulating, cultural, and supporting services). ● Ecosystems are dynamic systems of complex interactions. ● Disruptions to abiotic factors in ecosystems can cause shifts in populations and changes to ecosystem sustainability. ● Changes in ecosystems can affect services essential to humans. ● Solutions can be engineered to mitigate human impact.	environment. It uses some of the same practices as science and often applies scientific principles to solutions. Science and engineering have direct impacts on the quality of life for all people. Therefore, scientists and engineers need to pursue their work in an ethical manner that requires honesty, fairness and dedication to public health, safety and welfare. ● SCI.ETS3.A.m Individuals and teams from many nations, cultures and backgrounds have contributed to advances in science and engineering. Scientists and engineers are persistent, use creativity, reasoning, and skepticism, and remain open to new ideas. Science and engineering are influenced by what is valued in society. ● MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. ● MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. ● MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. ● SCI.ESS3.D.m Evidence suggests human activities affect global warming. Decisions to reduce the impact of global warming depend on understanding climate science, engineering capabilities, and social dynamics. ● SCI.ESS3.C.m Human activities have altered the hydrosphere, atmosphere, and lithosphere which in turn has altered the biosphere. Changes to the biosphere can have different impacts for different living things. Activities and technologies can be engineered to reduce people's impacts on Earth. ● SCI.ESS3.B.m Patterns can be seen through mapping the history of natural hazards in a region and understanding related geological forces. ●		