Science	
Properties and Principles of Matter and Energy	
	The students will understand that: **Changes in properties and states of matter provide evidence of the atomic theory of matter** ▪ Recognize matter is anything that has mass and volume ▪ Describe and compare the volumes (the amount of space an object occupies) of objects or substances directly, using a graduated cylinder, and/or indirectly, using displacement methods ▪ Describe and compare the masses (amounts of matter) of objects to the nearest gram using a balance ▪ Classify the types of matter in an object into pure substances or mixtures using their specific physical properties ▪ Describe the properties of each component in a mixture/solution and their distinguishing properties (e.g., salt water, oil and vinegar, pond water, Kool-Aid) ▪ Describe appropriate ways to separate the components of different types of mixtures (sorting, evaporation, filtration, magnets, boiling, chromatography, screening) ▪ Predict how various solids (soluble/insoluble) behave (e.g., dissolve, settle, float) when mixed with water ▪ Recognize evidence (e.g., diffusion of food coloring in water, light reflecting off of dust particles in the air, condensation of water vapor by increased pressure or decreased temperature) that supports the theory that matter is composed of small particles (atoms, molecules) that are in constant, random motion ▪ Describe the relationship between the change in the volume of water and changes in temperature as it relates to the properties of water (i.e., water expands and becomes less dense when frozen) ▪ Recognize and classify changes in matter as

	chemical and/or physical ▪ Identify chemical changes (i.e., rusting, oxidation, burning, decomposition by acids, decaying, baking) in common objects (i.e., rocks such as limestone, minerals, wood, steel wool, plants) as a result of interactions with sources of energy or other matter that form new substances with different characteristic properties ▪ Identify physical changes in common objects (e.g., rocks, minerals, wood, water, steel wool, plants) and describe the processes which caused the change (e.g., weathering, erosion, cutting, dissolving) ▪ Demonstrate and provide evidence that mass is conserved during a physical change **Energy has a source, can be transferred, and can be transformed into various forms but is conserved between and within systems** Forms of Energy: Light ▪ Identify sources of visible light (e.g., the Sun and other stars, flint, bulb, flames, lightning) ▪ Describe evidence (i.e., cannot bend around walls) that visible light travels in a straight line, using the appropriate tools (i.e., pinhole viewer, ray box, laser pointer) ▪ Compare the reflection of visible light by various surfaces (i.e., mirror, smooth and rough surfaces, shiny and dull surfaces, moon) ▪ Compare the refraction of visible light passing through different transparent and translucent materials (e.g., prisms, water, a lens) ▪ Predict how different surfaces (transparent, translucent, opaque) and lenses (convex, concave) affect the behavior of visible light rays and the resulting image of an object ▪ Identify receivers of visible light energy (e.g., eye, photocell) ▪ Recognize that an object is “seen” only when the object emits or reflects light to the eye ▪ Recognize differences in wavelength and energy levels within that range of visible light that can be seen by the human eye are perceived as differences in color

	▪ Recognize energy from the Sun is transferred to Earth in a range of wavelengths and energy levels, including visible light, infrared radiation, and ultraviolet radiation Forms of Energy: Sound ▪ Describe how sound energy is transferred by wave-like disturbances that spread away from the source through a medium ▪ Predict how the properties of the medium (e.g., air, water, empty space, rock) affect the speed of different types of mechanical waves (i.e., earthquake, sound) Characteristics of Living Organisms ▪ Recognize the Sun is the source of almost all energy used to produce the food for living organisms
Characteristics and Interactions of Living Organisms	
	The students will understand that: **There is a fundamental unity underlying the diversity of all organisms** ▪ Describe the common life processes necessary to the survival of organisms (i.e., growth, reproduction, life span, response to stimuli, energy use, exchange of gases, use of water, elimination of waste) ▪ Recognize all organisms are composed of cells, the fundamental units of life, which carry on all life processes ▪ Recognize most of the organisms on Earth are unicellular (e.g., bacteria, protists) and other organisms, including humans, are multicellular ▪ Identify examples of unicellular (e.g., bacteria, some protists, fungi) and multicellular organisms (e.g., some fungi, plants, animals) **Living organisms carry out life processes in order to survive** ▪ Compare and contrast the following plant and animal cell structures: cell membrane, nucleus, cell wall, chloroplast, and cytoplasm

	▪ Recognize the chloroplast as the cell structure where food is produced in plants and some unicellular organisms (e.g., algae, some protists) ▪ Recognize plants use energy from the Sun to produce food and oxygen through the process of photosynthesis
Changes in Ecosystems and Interactions of Organisms with their Environments	
	The students will understand that: **Organisms are interdependent with one another and with their environment** ▪ Identify the biotic factors (populations of organisms) and abiotic factors (e.g., quantity of light and water, range of temperatures, soil composition) that make up an ecosystem ▪ Identify populations within a community that are in competition with one another for resources ▪ Recognize the factors that affect the number and types of organisms an ecosystem can support (e.g., food availability, abiotic factors such as quantity of light and water, temperature and temperature range, soil composition, disease, competitions from other organisms, predation) ▪ Predict the possible effects of changes in the number and types of organisms in an ecosystem on the populations of other organisms within that ecosystem ▪ Describe beneficial and harmful activities of organisms, including humans (e.g., deforestation, overpopulation, water and air pollution, global warming, restoration of natural environments, river bank/coastal stabilization, recycling, channelization, reintroduction of species, depletion of resources), and explain how these activities affect organisms within an ecosystem ▪ Predict the impact (beneficial or harmful) of a natural environmental change (e.g., forest fire, flood, volcanic eruption, avalanche) on the

	organisms in an ecosystem ▪ Describe possible solutions to potentially harmful environmental changes within an ecosystem **Matter and energy flow through an ecosystem** ▪ Diagram and describe the transfer of energy in an aquatic food web and a land food web with reference to producers, consumers, decomposers, scavengers, and predator/prey relationships ▪ Classify populations of unicellular and multicellular organisms as producers, consumers, and decomposers by the role they serve in the ecosystem **Genetic variation sorted by the natural selection process explains evidence of biological evolution** ▪ Identify fossils as evidence some types of organisms (e.g., dinosaurs, trilobites, mammoths, giant tree ferns) that once lived in the past, and have since become extinct, have similarities with and differences from organisms living today ▪ Relate examples of adaptations (specialized structures or behaviors) within a species to its ability to survive in a specific environment (e.g., hollow bones/flight, hollow hair/insulation, dense root structure/compact soil, seeds/food, protection for plant embryo vs. spores, fins/movement in water) ▪ Predict how certain adaptations, such as behavior, body structure, or coloration, may offer a survival advantage to an organism in a particular environment
Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere, and Hydrosphere	

	The students will understand that: **Earth's Systems (geosphere, atmosphere, and hydrosphere) have common components and unique structures** ▪ Describe the components of soil and other factors that influence soil texture, fertility, and resistance to erosion (e.g., plant roots and debris, bacteria, fungi, worms, rodents) ▪ Recognize the properties of water that make it an essential component of the Earth system (e.g., its ability to act as a solvent, its ability to remain as a liquid at most Earth temperatures **Earth's Systems (geosphere, atmosphere, and hydrosphere) interact with one another as they undergo change by common processes** ▪ Make inferences about the formation of sedimentary rocks from their physical properties (e.g., layering and the presence of fossils indicate sedimentation) ▪ Explain how the formation of sedimentary rocks depends on weathering and erosion ▪ Describe how weathering agents and erosional processes (i.e., force of water as it freezes or flows, expansion/contraction due to temperature, force of wind, force of plant roots, action of gravity, chemical decomposition) slowly cause surface changes that create and/or change landforms ▪ Describe how the Earth's surface and surface materials can change abruptly through the activity of floods, rock/mudslides, or volcanoes ▪ Identify events (earthquakes, volcanic eruptions) and the landforms created by them on the Earth's surface that occur at different plate boundaries ▪ Explain the types of fossils and the processes by which they are formed (i.e., replacement, mold and cast, preservation, trace) ▪ Use fossil evidence to make inferences about changes on Earth and in its environment (i.e., superposition of rock layers, similarities between fossils in different geographical locations, fossils of seashells indicate the area

	was once underwater) **Human activity is dependent upon and affects Earth's resources and systems** Earth's Resources ▪ Relate the comparative amounts of fresh water and salt water on the Earth to the availability of water as a resource for living organisms and human activity ▪ Describe the affect of human activities (e.g., landfills, use of fertilizers and herbicides, farming, septic systems) on the quality of water Internal Processes and External Events ▪ Analyze the ways humans affect the erosion and deposition of soil and rock materials (e.g., clearing of land, planting vegetation, paving land, construction of new buildings, building or removal of dams)
Scientific Inquiry	
	The students will understand that: **Science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning, and critical thinking** ▪ Formulate testable questions and hypotheses ▪ Recognize the importance of the independent variable, dependent variables, control of constants, and multiple trials to the design of a valid experiment ▪ Design and conduct a valid experiment ▪ Evaluate the design of an experiment and make suggestions for reasonable improvements or extensions of an experiment ▪ Recognize different kinds of questions suggest different kinds of scientific investigations (e.g., some involve observing and describing objects, organisms, or events; some involve collecting specimens; some involve experiments; some involve making observations in nature; some involve discovery of new objects and phenomena; some involve making models ▪ Make qualitative observations using the five

	senses ▪ Determine the appropriate tools and techniques to collect data ▪ Use a variety of tools and equipment to gather data (e.g., microscopes, thermometers, computers, spring scales, balances, magnets, metric rulers, graduated cylinders, stopwatches) ▪ Measure length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, temperature to the nearest degree Celsius, force (weight) to the nearest Newton, time to the nearest second ▪ Compare amounts/measurements ▪ Judge whether measurements and computation of quantities are reasonable ▪ Use quantitative and qualitative data as support for reasonable explanations (conclusions) ▪ Use data as support for observed patterns and relationships, and to make predictions to be tested ▪ Recognize the possible effects of errors in observations, measurements, and calculations on the formulation of explanations (conclusions) ▪ Evaluate the reasonableness of an explanation (conclusion) ▪ Analyze whether evidence (data) and scientific principles support proposed explanations (hypotheses, laws, theories) ▪ Communicate the procedures and results of investigations and explanations through: o oral presentations o drawings and maps o data tables (allowing for the recording and analysis of data relevant to the experiment, such as independent and dependent variables, multiple trials, beginning and ending times or temperatures, derived quantities) o graphs (bar, single line, pictograph) writings
Impact of Science, Technology and Human Activity	

	The students will understand that: ▪ The nature of technology can advance, and is advanced by, science as it seeks to apply scientific knowledge in ways that meet human needs. ▪ Explain how technological improvements, such as those developed for use in space exploration, the military, or medicine, have led to the invention of new products that may improve lives here on Earth (e.g., new materials, freeze-dried foods, infrared goggles, Velcro, satellite imagery, robotics, lasers) ▪ Explain how technological developments and the scientific discoveries made possible through their development (e.g., Hubble telescope and stellar evolution, composition and structure of the universe; the electron microscope and cell organelles; sonar and the composition of the Earth; manned and unmanned space missions and space exploration; Doppler radar and weather conditions; MRI and CAT-scans and brain activity) ▪ Describe how technological solutions to problems (e.g., storm water runoff, fiber optics, windmills, efficient car design, electronic trains without conductors, sonar, robotics, Hubble telescope) can have both benefits and drawbacks (e.g., design constraints, unintended consequences, risks) ▪ Historical and cultural perspectives of scientific explanations help to improve understanding of the nature of science and how science knowledge and technology evolve over time ▪ Describe how the contributions of scientists and inventors, representing different cultures, races, and gender, have contributed to science, technology and human activity (e.g., George Washington Carver, Thomas Edison, Thomas Jefferson, Isaac Newton, Marie Curie, Galileo, Albert Einstein, Mae Jemison, Edwin Hubble, Charles Darwin, Jonas Salk, Louis Pasteur, Jane Goodall, Tom Akers, John Wesley Powell, Rachel Carson) ▪ Recognize the difficulty science innovators experience as they attempt to break through accepted ideas (hypotheses, laws, theories) of

	their time to reach conclusions that may lead to changes in those ideas and serve to advance scientific understanding (e.g., Darwin, Copernicus, Newton) ▪ Recognize explanations have changed over time as a result of new evidence ▪ Science and technology affect, and are affected by, society ▪ Describe ways in which science and society influence one another (e.g., scientific knowledge and the procedures used by scientists influence the way many individuals in society think about themselves, others, and the environment; societal challenges often inspire questions for scientific research; social priorities often influence research priorities through the availability of funding for research) ▪ Identify and evaluate the physical, social, economic, and/or environmental problems that may be overcome using science and technology (e.g., the need for alternative fuels, human travel in space, AIDS)