

SCOPE AND SEQUENCE

This is one model of a curriculum scope and sequence. Grade level expectations are clustered into suggested units and arranged to support development of conceptual understanding. School district personnel are encouraged to adapt this model as necessary in order to better meet the needs of their students. The Expectations described in Strand 7: Inquiry and Strand 8: Science/Technology/Human Activity should be made a priority and integrated throughout every teaching unit in each of the other strands. Grade-span assessments will be administered in science at grades 5, 8, and 11 no later than the 2007-2008 school year.

	Kindergarten	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	9, 10, 11
Strand 1 Matter & Energy	Properties of Matter Investigating Sound	Properties of Matter: Mass and Temperature	Properties of Rocks and Soil Forms of Energy: Sound	Investigating States of Matter Earth, Sun and Moon	Mixtures and Solutions Forms of Energy: Electrical Circuits		Properties of and Changes in Matter Forms of Energy: Light and Sound	Forms of Energy: Heat, Electricity, and Magnetism Energy Transformations	Physical and Chemical Properties and Changes of Matter	Atomic Theory and Changes in Matter Energy Forms and Transfer
Strand 2 Force & Motion	Change in Position	Investigating Motion	Forces and Motion		Laws of Motion	Work and Simple Machines		Force, Motion, and Work		Interactions between Energy, Force, and Motion
Strand 3 Living Organisms	Plants and Animals Parent-Offspring Relationships	Characteristics of Plants and Animals	Life Cycles of Animals	Plants		Classification of Plants and Animals	Characteristics of Living Organisms		Cells and Body Systems Disease Reproduction and Heredity	Diversity and Unity Among Organisms Cellular Processes Genetics and Heredity
Strand 4 Ecology	Weather and Seasons			Food Chains	Interactions among Organisms and their Environments		Ecosystems and Populations			Interdependence of Organisms and their Environment Matter and Energy in the Ecosystem Biological Evolution
Strand 5 Earth Systems	Weather and Seasons	Observing Water and Weather	Earth Materials: Rocks and Soil	Investigating States of Matter	Changes in the Earth's Surface	Water Cycle and Weather	Internal Processes and External Events Earth's Resources	Weather and Climate	Rock Cycle and Plate Tectonics	Components and Structure of Earth's Systems Interactions among Earth's Systems and Processes of Change Effect of Human Activity on Earth's Resources
Strand 6 Universe	Objects in the Sky			Earth, Sun, and Moon		Solar System		Objects and Their Motion in the Solar System		Objects in the Universe and Their Motion
Strand 7 Scientific Inquiry	Inquiry	Inquiry	Inquiry	Inquiry	Inquiry	Inquiry	Inquiry	Inquiry	Inquiry	Inquiry
Strand 8 Science, Technology, & Human Activity	Science, Technology, and Human Activity	Science, Technology, and Human Activity	Science, Technology, and Human Activity	Science, Technology, and Human Activity	Science, Technology, and Human Activity	Science, Technology, and Human Activity	Science, Technology, and Human Activity	Science, Technology, and Human Activity	Science, Technology, and Human Activity	Science, Technology, and Human Activity

Strand 1: Properties and Principles of Matter and Energy

1. Changes in properties and states of matter provide evidence of the atomic theory of matter			
Concept	Kindergarten	Grade 1	Grade 2
A. Objects, and the materials they are made of, have properties that can be used to describe and classify them	<i>Scope and Sequence – Properties of Matter</i> a. Describe physical properties of objects (i.e., size, shape, color, mass) by using the senses, simple tools (e.g., magnifiers, equal arm balances), and/or nonstandard measures (e.g., bigger/smaller; more/less) b. Identify materials (e.g., cloth, paper, wood, rock, metal) that make up an object and some of the physical properties of the materials (e.g., color, texture, shiny/dull, odor, sound, taste, flexibility) c. Sort objects based on observable physical properties (e.g., size, material, color, shape, mass)	<i>Scope and Sequence – Properties of Matter: Mass and Temperature</i> a. Given an equal-arm balance and various objects, illustrate arrangements in which the beam is balanced b. Measure and compare the mass of objects (more/less) c. Order objects according to mass	<i>Scope and Sequence – Properties of Rocks and Soil</i> a. Describe and compare the physical properties of objects by using simple tools (i.e., thermometer, magnifier, centimeter ruler, balance, magnet) b. Classify objects as “one kind of material” or a mixture
B. Properties of mixtures depend upon the concentrations, properties, and interactions of particles			<i>Scope and Sequence – Properties of Rocks and Soil</i> a. Observe and describe how mixtures are made by combining solids b. Describe ways to separate the components of a mixture by their physical properties (e.g., sorting, magnets, screening)
C. Properties of matter can be explained in terms of moving particles too small to be seen without tremendous magnification	Not assessed at this level		
D. Physical changes in the state of matter that result from thermal changes can be explained by the Kinetic Theory of Matter	Not assessed at this level		
E. The atomic model describes the electrically neutral atom	Not assessed at this level		

Strand 1: Properties and Principles of Matter and Energy

1. Changes in properties and states of matter provide evidence of the atomic theory of matter			
Concept	Kindergarten	Grade 1	Grade 2
F. The periodic table organizes the elements according to their atomic structure and chemical reactivity		Not assessed at this level	
G. Properties of objects and states of matter can change chemically and/or physically		Not assessed at this level	
H. Chemical bonding is the combining of different pure substances (elements, compounds) to form new substances with different properties		Not assessed at this level	
I. Mass is conserved during any physical or chemical change		Not assessed at this level	

Strand 1: Properties and Principles of Matter and Energy

2. Energy has a source, can be transferred, and can be transformed into various forms but is conserved between and within systems			
Concept	Kindergarten	Grade 1	Grade 2
A. Forms of energy have a source, a means of transfer (work and heat), and a receiver	<i>Scope and Sequence – Investigating Sound</i> a. Identify the sounds and their source of vibrations in everyday life (e.g., alarms, car horns, animals, machines, musical instruments) b. Compare different sounds (i.e., loudness, pitch, rhythm) c. Recognize that the ear serves as a receiver of sound	<i>Scope and Sequence – Properties of Matter: Mass and Temperature</i> a. Identify the source of energy that causes an increase in the temperature of an object (e.g., Sun, stove, flame, light bulb) b. Compare the temperature of hot and cold objects using a simple thermometer c. Describe the change in temperature of an object as warmer or cooler	<i>Scope and Sequence – Forms of Energy: Sound</i> a. Recognize that sound travels through different mediums (i.e., air, water, solids) b. Describe different ways to change the pitch of a sound (i.e., changes in size, such as length or thickness, and in tightness/tension of the source) c. Describe how the ear serves as a receiver of sound (i.e., sound vibrates eardrum)
B. Mechanical energy comes from the motion (kinetic energy) and/or relative position (potential energy) of an object	Not assessed at this level		
C. Electromagnetic energy from the Sun (solar radiation) is a major source of energy on Earth		<i>Scope and Sequence – Characteristics of Plants and Animals</i> a. Identify light from the Sun as a basic need of most plants	
D. Chemical reactions involve changes in the bonding of atoms with the release or absorption of energy	Not assessed at this level		

Strand 1: Properties and Principles of Matter and Energy

2. Energy has a source, can be transferred, and can be transformed into various forms but is conserved between and within systems			
Concept	Kindergarten	Grade 1	Grade 2
E. Nuclear energy is a major source of energy throughout the universe		Not assessed at this level	
F. Energy can change from one form to another within systems, but the total amount remains the same		Not assessed at this level	

Strand 1: Properties and Principles of Matter and Energy

1. Changes in properties and states of matter provide evidence of the atomic theory of matter			
Concept	Grade 3	Grade 4	Grade 5
A. Objects, and the materials they are made of, have properties that can be used to describe and classify them		<i>Scope and Sequence – Mixtures and Solutions</i> a. Describe and compare the masses of objects to the nearest gram using balances b. Describe and compare the volumes (the amount of space an object occupies) of objects using a graduated cylinder c. Recognize no two objects can occupy the same space at the same time (e.g., water level rises when an object or substance, such as a rock, is placed in a quantity of water) d. Classify types of materials (e.g., water, salt, sugar, iron filings, salt water) into substances (materials that have specific physical properties) or mixtures of substances by using their characteristic properties	
B. Properties of mixtures depend upon the concentrations, properties, and interactions of particles		<i>Scope and Sequence – Mixtures and Solutions/ Changes on the Earth's Surface</i> a. Identify water as a solvent that dissolves materials (Do NOT assess the term solvent) b. Observe and describe how mixtures are made by combining solids or liquids, or a combination of these c. Distinguish between the components in a mixture (e.g., trail mix, conglomerate rock, salad) d. Describe ways to separate the components of a mixture by their properties (i.e., sorting, filtration, magnets, screening)	
C. Properties of matter can be explained in terms of moving particles too small to be seen without tremendous magnification			<i>Scope and Sequence – Water Cycle and Weather</i> a. Recognize how changes in state (i.e., freezing/melting, condensation/evaporation) provide evidence that matter is made of particles too small to be seen

Strand 1: Properties and Principles of Matter and Energy

1. Changes in properties and states of matter provide evidence of the atomic theory of matter			
Concept	Grade 3	Grade 4	Grade 5
<p style="text-align: center;">D.</p> <p>Physical changes in the state of matter that result from thermal changes can be explained by the Kinetic Theory of Matter</p>	<p><i>Scope and Sequence – Investigating States of Matter</i></p> <ul style="list-style-type: none"> a. Compare the observable physical properties of solids, liquids, or gases (air) (i.e., visible vs. invisible, changes in shape, changes in the amount of space occupied) b. Identify everyday objects/substances as solid, liquid, or gas (e.g., air, water) c. Recognize water evaporates (liquid water changes into a gas as it moves into the air) d. Measure and compare the temperature of water when it exists as a solid to its temperature when it exists as a liquid e. Investigate and recognize water can change from a liquid to a solid (freeze), and back again to a liquid (melt), as the result of temperature changes f. Describe the changes in the physical properties of water (i.e., shape, volume) when frozen or melted g. Predict and investigate the effect of heat energy (i.e., change in temperature, melting, evaporation) on objects and materials 		<p><i>Scope and Sequence – Water cycle and Weather</i></p> <ul style="list-style-type: none"> a. Classify matter as a solid, a liquid, or a gas, as it exists at room temperature, using physical properties (i.e., volume, shape, ability to flow) b. Predict the effect of heat energy on the physical properties of water as it changes to and from a solid, liquid, or gas (i.e., freezing/melting, evaporation/condensation)
<p style="text-align: center;">E.</p> <p>The atomic model describes the electrically neutral atom</p>	Not assessed at this level		
<p style="text-align: center;">F.</p> <p>The periodic table organizes the elements according to their atomic structure and chemical reactivity</p>	Not assessed at this level		
<p style="text-align: center;">G.</p> <p>Properties of objects and states of matter can change chemically and/or physically</p>	Not assessed at this level		

Strand 1: Properties and Principles of Matter and Energy

1. Changes in properties and states of matter provide evidence of the atomic theory of matter			
Concept	Grade 3	Grade 4	Grade 5
<p style="text-align: center;">H.</p> <p>Chemical bonding is the combining of different pure substances (elements, compounds) to form new substances with different properties</p>	Not assessed at this level		
<p style="text-align: center;">I.</p> <p>Mass is conserved during any physical or chemical change</p>		<p><i>Scope and Sequence – Mixtures and Solutions</i></p> <p>a. Recognize that the total mass of a material remains constant whether it is together, in parts, or in a different state</p>	<p><i>Scope and Sequence – Water Cycle and Weather</i></p> <p>a. Recognize the mass of water remains constant as it changes state (as evidenced in a closed container)</p>

Strand 1: Properties and Principles of Matter and Energy

2. Energy has a source, can be transferred, and can be transformed into various forms but is conserved between and within systems			
Concept	Grade 3	Grade 4	Grade 5
<p>A. Forms of energy have a source, a means of transfer (work and heat), and a receiver</p>	<p><i>Scope and Sequence – Investigating States of Matter</i></p> <p>a. Identify sources of thermal energy (e.g., Sun, stove, fire, body) that can cause solids to change to liquids, and liquids to change to gas</p> <p><i>Scope and Sequence – Earth, Sun, and Moon</i></p> <p>b. Identify sources of light energy (e.g., Sun, bulbs, flames)</p> <p>c. Recognize light can be transferred from the source to the receiver (eye) through space</p> <p>d. Identify the three things (light source, object, and surface) necessary to produce a shadow</p>	<p><i>Scope and Sequence – Forms of Energy: Electrical Circuits</i></p> <p>a. Construct and diagram a complete electric circuit by using a source (e.g., battery), means of transfer (e.g., wires), and receiver (e.g., resistance bulbs, motors, fans)</p> <p>b. Observe and describe the evidence of energy transfer in a closed series circuit (e.g., lit bulb, moving motor, fan)</p> <p>c. Classify materials as conductors or insulators of electricity when placed within a circuit (e.g., wood, pencil lead, plastic, glass, aluminum foil, lemon juice, air, water)</p>	<p><i>Scope and Sequence – Solar System</i></p> <p>a. Recognize light can be transferred from the source to the receiver (eye) through space in straight lines</p> <p>b. Recognize how an object (e.g., moon, mirror, objects in a room) can only be seen when light is reflected from that object to the receiver (eye)</p>
<p>B. Mechanical energy comes from the motion (kinetic energy) and/or relative position (potential energy) of an object</p>	Not assessed at this level		
<p>C. Electromagnetic energy from the Sun (solar radiation) is a major source of energy on Earth</p>	<p><i>Scope and Sequence – Earth, Sun, and Moon/Food Chains</i></p> <p>a. Recognize the Sun is the primary source of light and food energy on Earth</p>		<p><i>Scope and Sequence – Water Cycle and Weather</i></p> <p>a. Recognize the Sun as the primary source of energy for temperature change on Earth</p>
<p>D. Chemical reactions involve changes in the bonding of atoms with the release or absorption of energy</p>	Not assessed at this level		

Strand 1: Properties and Principles of Matter and Energy

2. Energy has a source, can be transferred, and can be transformed into various forms but is conserved between and within systems			
Concept	Grade 3	Grade 4	Grade 5
<p style="text-align: center;">E.</p> <p>Nuclear energy is a major source of energy throughout the universe</p>	Not assessed at this level		
<p style="text-align: center;">F.</p> <p>Energy can change from one form to another within systems, but the total amount remains the same</p>		<p><i>Scope and Sequence – Forms of Energy: Electrical Circuits</i></p> <p>a. Identify the evidence of energy transformations (temperature change, light, sound, motion, and magnetic effects) that occur in electrical circuits</p>	

Strand 1: Properties and Principles of Matter and Energy

1. Changes in properties and states of matter provide evidence of the atomic theory of matter			
Concept	Grade 6	Grade 7	Grade 8
<p>A. Objects, and the materials they are made of, have properties that can be used to describe and classify them</p>	<p><i>Scope and Sequence – Properties of and Changes in Matter</i></p> <ol style="list-style-type: none"> a. Recognize matter is anything that has mass and volume b. 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 c. Describe and compare the masses (amounts of matter) of objects to the nearest gram using a balance d. Classify the types of matter in an object into pure substances or mixtures using their specific physical properties 		<p><i>Scope and Sequence – Physical and Chemical Properties and Changes of Matter</i></p> <ol style="list-style-type: none"> a. Recognize elements (unique atoms) and compounds (molecules or crystals) are pure substances that have characteristic properties b. Describe the physical and chemical properties (e.g., magnetic attraction, conductivity, melting point and boiling point, reactivity) of pure substances (elements or compounds) (e.g., copper wire, aluminum wire, iron, charcoal, sulfur, water, salt, sugar, sodium bicarbonate, galena, quartz, magnetite, pyrite) using appropriate senses and tools
<p>B. Properties of mixtures depend upon the concentrations, properties, and interactions of particles</p>	<p><i>Scope and Sequence – Properties of and Changes in Matter</i></p> <ol style="list-style-type: none"> a. 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) b. Describe appropriate ways to separate the components of different types of mixtures (sorting, evaporation, filtration, magnets, boiling, chromatography, screening) c. Predict how various solids (soluble/insoluble) behave (e.g., dissolve, settle, float) when mixed with water 		
<p>C. Properties of matter can be explained in terms of moving particles too small to be seen without tremendous magnification</p>	<p><i>Scope and Sequence – Properties of and Changes in Matter</i></p> <ol style="list-style-type: none"> a. 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 		<p><i>Scope and Sequence – Physical and Chemical Properties and Changes of Matter</i></p> <ol style="list-style-type: none"> a. Describe evidence (e.g., diffusion of colored material into clear material such as water; light reflecting off of dust particles in air; changes in physical properties and reactivity such as gold hammered into foil, oil spreading on the surface of water, decay of organic matter, condensation of water vapor by increased pressure) that supports the theory that matter is composed of moving particles too small to be seen (atoms, molecules)

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1. Changes in properties and states of matter provide evidence of the atomic theory of matter			
Concept	Grade 6	Grade 7	Grade 8
D. Physical changes in the state of matter that result from thermal changes can be explained by the Kinetic Theory of Matter	<i>Scope and Sequence – Earth's Resources</i> a. 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)	<i>Scope and Sequence – Weather and Climate</i> a. Describe the relationship between temperature and the movement of atmospheric gases (i.e., warm air rises due to expansion of the volume of gas, cool air sinks due to contraction of the volume of gas)	<i>Scope and Sequence – Physical and Chemical Properties and Changes of Matter</i> a. Using the Kinetic Theory model, illustrate and account for the physical properties (i.e., shape, volume, malleability, viscosity) of a solid, liquid, or gas in terms of the arrangement and motion of molecules in a substance b. Use the Kinetic Theory model to explain changes in the volume, shape, and viscosity of materials in response to temperature changes during a phase change c. Predict the effect of transfer on the physical properties of a substance as it changes to or from a solid, liquid, or gas (i.e., phase changes that occur during freezing, melting, evaporation, boiling, condensation)
E. The atomic model describes the electrically neutral atom	Not assessed at this level		
F. The periodic table organizes the elements according to their atomic structure and chemical reactivity			<i>Scope and Sequence – Physical and Chemical Properties and Changes of Matter</i> a. Recognize more than 100 known elements (unique atoms) exist that may be combined in nature or by man to produce compounds that make up the living and nonliving substances in the environment (Do NOT assess memorization of the Periodic Table)

Strand 1: Properties and Principles of Matter and Energy

1. Changes in properties and states of matter provide evidence of the atomic theory of matter			
Concept	Grade 6	Grade 7	Grade 8
G. Properties of objects and states of matter can change chemically and/or physically	<p><i>Scope and Sequence – Properties of and Changes in Matter</i></p> <p>a. Recognize and classify changes in matter as chemical and/or physical</p> <p>b. 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</p> <p>c. 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)</p>		
H. Chemical bonding is the combining of different pure substances (elements, compounds) to form new substances with different properties	Not assessed at this level		
I. Mass is conserved during any physical or chemical change	<p><i>Scope and Sequence – Properties of and Changes in Matter</i></p> <p>a. Demonstrate and provide evidence that mass is conserved during a physical change</p>	<p><i>Scope and Sequence – Weather and Climate</i></p> <p>a. Explain that the amount of matter remains constant while being recycled through the water cycle</p>	<p><i>Scope and Sequence – Physical and Chemical Properties and Changes of Matter</i></p> <p>a. Provide evidence that mass is conserved during a chemical change in a closed system (e.g., vinegar + baking soda, mold growing in a closed container, steel wool rusting)</p> <p><i>Scope and Sequence – Rock Cycle and Plate Tectonics</i></p> <p>b. Explain that the amount of matter remains constant while being recycled through the rock cycle</p> <p><i>Scope and Sequence – Cells and Body Systems</i></p> <p>c. Explain that the amount of matter remains constant while being recycled through food chains and food webs</p>

Strand 1: Properties and Principles of Matter and Energy

2. Energy has a source, can be transferred, and can be transformed into various forms but is conserved between and within systems			
Concept	Grade 6	Grade 7	Grade 8
A. Forms of energy have a source, a means of transfer (work and heat), and a receiver	<p><i>Scope and Sequence -- Forms of Energy: Light</i></p> <ol style="list-style-type: none"> a. Identify sources of visible light (e.g., the Sun and other stars, flint, bulb, flames, lightning) b. 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) c. Compare the reflection of visible light by various surfaces (i.e., mirror, smooth and rough surfaces, shiny and dull surfaces, moon) d. Compare the refraction of visible light passing through different transparent and translucent materials (e.g., prisms, water, a lens) e. 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 f. Identify receivers of visible light energy (e.g., eye, photocell) g. Recognize that an object is "seen" only when the object emits or reflects light to the eye h. 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 <p><i>Scope and Sequence – Forms of Energy: Sound</i></p> <ol style="list-style-type: none"> i. Describe how sound energy is transferred by wave-like disturbances that spread away from the source through a medium j. 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) 	<p><i>Scope and Sequence – Forms of Energy: Heat</i></p> <ol style="list-style-type: none"> a. Recognize thermal energy as the random motion (kinetic energy) of molecules or atoms within a substance b. Use the kinetic molecular model to explain changes in the temperature of a material c. Recognize thermal energy is transferred as heat from warmer objects to cooler objects until both reach the same temperature (equilibrium) d. Recognize the type of materials that transfer energy by conduction, convection, and/or radiation e. Describe how heat is transferred by conduction, convection, and radiation, and classify examples of each f. Classify common materials (e.g., wood, foam, plastic, glass, aluminum foil, soil, air, water) as conductors or insulators of thermal energy g. Predict the differences in temperature over time on different colored (black and white) objects placed under the same heat source <p><i>Scope and Sequence – Forms of Energy: Electricity and Magnetism</i></p> <ol style="list-style-type: none"> h. Describe the interactions (i.e., repel, attract) of like and unlike charges (i.e., magnetic, static electric, electrical) i. Diagram and identify a complete electric circuit by using a source (battery), means of transfer (wires), and receiver (resistance bulbs, motors, fans) j. Observe and describe the evidence of energy transfer in a closed series circuit k. Describe the effects of resistance (number of receivers), amount of voltage (number of energy sources), and kind of transfer materials on the current being transferred through a circuit (e.g., brightness of light, speed of motor) l. Classify materials as conductors or insulators of electricity when placed within a circuit (e.g., wood, pencil lead, plastic, glass, aluminum foil, lemon juice, air, water) m. Diagram and distinguish between complete series and parallel circuits n. Identify advantages and disadvantages of series and parallel circuits 	<p><i>Scope and Sequence – Physical and Chemical Properties and Changes of Matter</i></p> <ol style="list-style-type: none"> a. Recognize chemical energy is stored in chemical compounds (e.g., energy stored in and released from food molecules, batteries, nitrogen explosives, fireworks, organic fuels)

Strand 1: Properties and Principles of Matter and Energy

2. Energy has a source, can be transferred, and can be transformed into various forms but is conserved between and within systems			
Concept	Grade 6	Grade 7	Grade 8
B. Mechanical energy comes from the motion (kinetic energy) and/or relative position (potential energy) of an object	Not assessed at this level		
C. Electromagnetic energy from the Sun (solar radiation) is a major source of energy on Earth	<p><i>Scope and Sequence -- Forms of Energy: Light</i></p> <p>a. 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</p> <p><i>Scope and Sequence – Characteristics of Living Organisms</i></p> <p>b. Recognize the Sun is the source of almost all energy used to produce the food for living organisms</p>	<p><i>Scope and Sequence – Weather and Climate</i></p> <p>a. Identify solar radiation as the primary source of energy for weather phenomena</p>	
D. Chemical reactions involve changes in the bonding of atoms with the release or absorption of energy	Not assessed at this level		
E. Nuclear energy is a major source of energy throughout the universe	Not assessed at this level		
F. Energy can change from one form to another within systems, but the total amount remains the same		<p><i>Scope and Sequence – Energy Transformations</i></p> <p>a. Identify the different energy transformations that occur between different systems (e.g., chemical energy in battery converted to electricity in circuit converted to light and heat from a bulb)</p> <p>b. Recognize that, during an energy transformation, heat is often transferred from one object (system) to another because of a difference in temperature</p> <p>c. Recognize energy is not lost but conserved as it is transferred and transformed</p>	<p><i>Scope and Sequence – Physical and Chemical Properties and Changes of Matter</i></p> <p>a. Identify the evidence of different energy transformations (e.g., explosion of light, heat, and sound, temperature change, electrical charge) that may occur as chemical energy is released during a chemical reaction</p>

Strand 1: Properties and Principles of Matter and Energy

1. Changes in properties and states of matter provide evidence of the atomic theory of matter	
Concept	Grade 9, 10, 11
<p style="text-align: center;">A.</p> <p>Objects, and the materials they are made of, have properties that can be used to describe and classify them</p>	<p><i>Scope and Sequence – Atomic Theory and Changes in Matter</i></p> <ol style="list-style-type: none"> a. Compare the densities of regular and irregular objects using their respective measures of volume and mass b. Identify pure substances by their physical and chemical properties (i.e., color, luster/reflectivity, hardness, conductivity, density, pH, melting point, boiling point, specific heat, solubility, phase at room temperature, chemical reactivity) c. Classify a substance as being made up of one kind of atom (element) or a compound when given the molecular formula or structural formula (or electron dot diagram) for the substance d. Compare and contrast the common properties of metals, nonmetals, metalloids, and noble gases
<p style="text-align: center;">B.</p> <p>Properties of mixtures depend upon the concentrations, properties, and interactions of particles</p>	<p><i>Scope and Sequence – Atomic Theory and Changes in Matter</i></p> <ol style="list-style-type: none"> a. Classify solutions as dilute, concentrated, or saturated b. Compare and contrast the properties of acidic, basic, and neutral solutions c. Predict the effect of the properties of the solvent or solute (e.g., polarity, temperature, surface area/particle size, concentration, agitation) on the solubility of a substance
<p style="text-align: center;">C.</p> <p>Properties of matter can be explained in terms of moving particles too small to be seen without tremendous magnification</p>	<p>Not assessed at this level</p>
<p style="text-align: center;">D.</p> <p>Physical changes in states of matter due to thermal changes in materials can be explained by the Kinetic Theory of Matter</p>	<p><i>Scope and Sequence – Atomic Theory and Changes in Matter</i></p> <ol style="list-style-type: none"> a. Using the Kinetic Theory model, explain the changes that occur in the distance between atoms/molecules and temperature of a substance as energy is absorbed or released during a phase change b. Predict the effect of a temperature change on the properties (e.g., pressure, density) of a material (solids, liquids, gases) c. Predict the effect of pressure changes on the properties (e.g., temperature, density) of a material (solids, liquids, gases)
<p style="text-align: center;">E.</p> <p>The atomic model describes the electrically neutral atom</p>	<p><i>Scope and Sequence – Atomic Theory and Changes in Matter</i></p> <ol style="list-style-type: none"> a. Describe the atom as having a dense, positive nucleus surrounded by a cloud of negative electrons b. Calculate the number of protons, neutrons, and electrons of an element (or isotopes) given its atomic mass (or mass number) and atomic number c. Describe the information provided by the atomic number and the mass number (i.e., electrical charge, chemical stability)

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1. Changes in properties and states of matter provide evidence of the atomic theory of matter	
Concept	Grade 9, 10, 11
<p style="text-align: center;">F.</p> <p>The periodic table organizes the elements according to their atomic structure and chemical reactivity</p>	<p><i>Scope and Sequence – Atomic Theory and Changes in Matter</i></p> <ol style="list-style-type: none"> a. Explain the structure of the periodic table in terms of the elements with common properties (groups/families) and repeating properties (periods) b. Classify elements as metals, nonmetals, metalloids, and noble gases according to their location on the Periodic Table c. Predict the chemical reactivity of elements, and the type of bonds that may result between them, using the Periodic Table
<p style="text-align: center;">G.</p> <p>Properties of objects and states of matter can change chemically and/or physically</p>	<p><i>Scope and Sequence – Atomic Theory and Changes in Matter</i></p> <ol style="list-style-type: none"> a. Distinguish between physical and chemical changes in matter
<p style="text-align: center;">H.</p> <p>Chemical bonding is the combining of different pure substances (elements, compounds) to form new substances with different properties</p>	<p><i>Scope and Sequence – Atomic Theory and Changes in Matter</i></p> <ol style="list-style-type: none"> a. Describe how the valence electron configuration determines how atoms interact and may bond b. Predict the reaction rates of different substances based on their properties (i.e., concentrations of reactants, pressure, temperature, state of matter, surface area, type of reactant material) c. Compare and contrast the types of chemical bonds (i.e., ionic, covalent) d. Identify the consequences of different types of reactions (i.e., oxidation/reduction reactions such as combustion, acid/base reactions) to humans and human activity
<p style="text-align: center;">I.</p> <p>Mass is conserved during any physical or chemical change</p>	<p><i>Scope and Sequence – Atomic Theory and Changes in Matter</i></p> <ol style="list-style-type: none"> a. Compare the mass of the reactants to the mass of the products in a chemical reaction or physical change as support for the Law of Conservation of Mass b. Recognize whether the number of atoms of the reactants and products in a chemical equation are balanced

Strand 1: Properties and Principles of Matter and Energy

2. Energy has a source, can be transferred, and can be transformed into various forms but is conserved between and within systems	
Concept	Grade 9, 10, 11
A. Forms of energy have a source, a means of transfer (work and heat), and a receiver	<p><i>Scope and Sequence – Energy Forms and Transfer</i></p> <ul style="list-style-type: none"> a. Differentiate between thermal energy (the total internal energy of a substance which is dependent upon mass), heat (thermal energy that transfers from one object or system to another due to a difference in temperature), and temperature (the measure of average kinetic energy of molecules or atoms in a substance) b. Recognize chemical energy as the energy stored in the bonds between atoms in a compound c. Describe the relationship among wavelength, energy, and frequency as illustrated by the electromagnetic spectrum d. Differentiate between the properties and examples of conductors and insulators of different forms of energy (i.e., thermal, mechanical, electromagnetic) e. Describe sources and common uses of different forms of energy (i.e., chemical, nuclear, thermal, mechanical, electromagnetic) f. Identify and evaluate advantages/disadvantages of using various sources of energy (e.g., wind, solar, geothermal, hydroelectric, biomass, fossil fuel) for human activity g. Describe the effect of different frequencies of electromagnetic waves on the Earth and living organisms (e.g., radio, infrared, visible, ultraviolet, gamma, cosmic rays) h. Interpret examples (e.g., land and sea breezes, home heating, plate tectonics) of heat transfer as convection, conduction, or radiation
B. Mechanical energy comes from the motion (kinetic energy) and/or relative position (potential energy) of an object	<p><i>Scope and Sequence – Interactions between Energy, Force, and Motion</i></p> <ul style="list-style-type: none"> a. Relate kinetic energy to an object's mass and its velocity b. Relate an object's gravitational potential energy to its weight and height relative to the surface of the Earth c. Distinguish between examples of kinetic and potential energy (i.e., gravitational, elastic) within a system d. Describe the effect of work on an object's kinetic and potential energy
C. Electromagnetic energy from the Sun (solar radiation) is a major source of energy on Earth	<p><i>Scope and Sequence – Energy Forms and Transfer (Objects in the Universe and Their Motion)</i></p> <ul style="list-style-type: none"> a. Identify stars as producers of electromagnetic energy b. Describe how electromagnetic energy is transferred through space as electromagnetic waves (radiating charged particles) of varying wavelength and frequency
D. Chemical reactions involve changes in the bonding of atoms with the release or absorption of energy	<p><i>Scope and Sequence – Energy Forms and Transfer/Atomic Theory and Changes in Matter</i></p> <ul style="list-style-type: none"> a. Describe evidence of energy transfer and transformations that occur during exothermic and endothermic chemical reactions
E. Nuclear energy is a major source of energy throughout the universe	<p><i>Scope and Sequence – Energy Forms and Transfer</i></p> <ul style="list-style-type: none"> a. Describe how changes in the nucleus of an atom during a nuclear reaction (i.e., nuclear decay, fusion, fission) result in emission of radiation b. Identify the role of nuclear energy as it serves as a source of energy for the Earth, stars, and human activity (e.g., source of electromagnetic radiation, thermal energy within mantle, nuclear power plants, fuel for stars)

Strand 1: Properties and Principles of Matter and Energy

2. Energy has a source, can be transferred, and can be transformed into various forms but is conserved between and within systems

Concept	Grade 9, 10, 11
F. Energy can change from one form to another within and between systems, but the total amount remains the same	<i>Scope and Sequence – Energy Forms and Transfer</i> a. Describe the transformations that occur as energy changes from kinetic to potential within a system (e.g., car moving on rollercoaster track, child swinging, diver jumping off a board) (Do NOT assess calculations) b. Compare the efficiency of simple machines (recognizing that, as work is done, the amount of usable energy decreases with each transformation as it is transferred as heat due to friction) c. Classify the different forms of energy (i.e., chemical, nuclear, thermal, mechanical, electromagnetic) that can be observed as energy is transferred and transformed within a system when given a scenario (e.g., dynamite explosion, solar radiation interacting with the Earth, electromagnetic motor doing work, energy generated by nuclear reactor) d. Explain how energy can be transferred (absorbed or released) or transformed between and within systems as the total amount of energy remains constant (i.e., Law of Conservation of Energy)

Strand 2: Properties and Principles of Force and Motion

1. The motion of an object is described by its change in position relative to another object or point			
Concept	Kindergarten	Grade 1	Grade 2
A. The motion of an object is described as a change in position, direction, and speed relative to another object (frame of reference)	<i>Scope and Sequence – Changes in Position</i> a. Describe an object's position relative to another object (e.g., above, below, in front of, behind)	<i>Scope and Sequence – Investigating Motion</i> a. Compare the position of an object relative to another object (e.g., left of or right of) b. Describe an object's motion as straight, circular, vibrational (back and forth), zigzag, stopping, starting, or falling c. Compare the speeds (faster vs. slower) of two moving objects	
B. An object that is accelerating is speeding up, slowing down, or changing direction	Not assessed at this level		
C. Momentum depends on the mass of the object and the velocity with which it is traveling	Not assessed at this level		

Strand 2: Properties and Principles of Force and Motion

2. Forces affect motion			
Concept	Kindergarten	Grade 1	Grade 2
<p>A. Forces are classified as either contact (pushes, pulls, friction, buoyancy) or non-contact forces (gravity, magnetism), that can be described in terms of direction and magnitude</p>	<p><i>Scope and Sequence – Changes in Position</i> a. Identify ways (push, pull) to cause some objects to move by touching them b. Recognize magnets cause some objects to move without touching them</p>	<p><i>Scope and Sequence – Investigating Motion</i> a. Identify the force (i.e., push or pull) required to do work (move an object)</p>	<p><i>Scope and Sequence – Forces and Motion</i> a. Recognize magnets attract and repel each other and certain materials b. Describe magnetism as a force that can push or pull other objects without touching them c. Measure (using non-standard units) and compare the force (i.e., push or pull) required to overcome friction and move an object over different surfaces (i.e., rough, smooth)</p>
<p>B. Every object exerts a gravitational force on every other object</p>			<p><i>Scope and Sequence – Forces and Motion</i> a. Describe Earth's gravity as a force that pulls objects on or near the Earth toward the Earth without touching the object</p>
<p>C Magnetic forces are related to electrical forces as different aspects of a single electromagnetic force</p>	<p>Not assessed at this level</p>		
<p>D. Newton's Laws of Motion explain the interaction of mass and forces, and are used to predict changes in motion</p>		<p><i>Scope and Sequence – Investigating Motion</i> a. Describe ways to change the motion of an object (i.e., how to cause an object to go slower, go faster, go farther, change direction, stop)</p>	<p><i>Scope and Sequence – Forces and Motion</i> a. Describe the direction and amount of force (i.e., direction of push or pull, strong/weak push or pull) needed to change an object's motion (i.e., faster/slower, change in direction) b. Describe and compare the distances traveled by heavier/lighter objects after applying the same amount of force (i.e., push or pull) in the same direction c. Describe and compare the distances traveled by objects with the same mass after applying different amounts of force (i.e., push or pull) in the same direction</p>

Strand 2: Properties and Principles of Force and Motion

2. Forces affect motion			
Concept	Kindergarten	Grade 1	Grade 2
E. Perpendicular forces act independently of each other	Not assessed at this level		
F. Simple machines (levers, inclined planes, wheel and axle, pulleys) affect the force applied to an object and/or direction of movement as work is done			<i>Scope and Sequence – Forces and Motion</i> a. Compare and describe the amount of force (i.e., more, less, or same push or pull) needed to raise an object to a given height, with or without using inclined planes (ramps) of different slopes b. Compare and describe the amount of force (i.e., more, less, or same push or pull) needed to raise an object to a given height, with or without using levers c. Apply the use of an inclined plane (ramp) and/or lever to different real life situations in which objects are raised

Strand 2: Properties and Principles of Force and Motion

1. The motion of an object is described by its change in position relative to another object or point			
Concept	Grade 3	Grade 4	Grade 5
A. The motion of an object is described as a change in position, direction, and speed relative to another object (frame of reference)		<i>Scope and Sequence – Laws of Motion</i> a. Classify different types of motion (straight line, curved, back and forth) b. Describe an object's motion in terms of distance and time	
B. An object that is accelerating is speeding up, slowing down, or changing direction	Not assessed at this level		
C. Momentum depends on the mass of the object and the velocity with which it is traveling	Not assessed at this level		

Strand 2: Properties and Principles of Force and Motion

2. Forces affect motion			
Concept	Grade 3	Grade 4	Grade 5
<p style="text-align: center;">A.</p> <p>Forces are classified as either contact forces (pushes, pulls, friction, buoyancy) or non-contact forces (gravity, magnetism), that can be described in terms of direction and magnitude</p>		<p><i>Scope and Sequence – Laws of Motion</i></p> <ul style="list-style-type: none"> a. Identify the forces acting on the motion of objects traveling in a straight line b. Recognize friction as a force that slows down or stops a moving object that is touching another object or surface c. Compare the forces (measured by a spring scale in Newtons) required to overcome friction when an object moves over different surfaces (i.e., rough/smooth) 	<p><i>Scope and Sequence – Work and Simple Machines</i></p> <ul style="list-style-type: none"> a. Identify the forces acting on a load and use a spring scale to measure the weight (resistance force) of the load
<p style="text-align: center;">B.</p> <p>Every object exerts a gravitational force on every other object</p>		<p><i>Scope and Sequence – Laws of Motion</i></p> <ul style="list-style-type: none"> a. Determine the gravitational pull of the Earth on an object (weight) using a spring scale 	
<p style="text-align: center;">C.</p> <p>Magnetic forces are related to electrical forces as different aspects of a single electromagnetic force</p>	Not assessed at this level		

Strand 2: Properties and Principles of Force and Motion

2. Forces affect motion			
Concept	Grade 3	Grade 4	Grade 5
<p style="text-align: center;">D.</p> <p>Newton’s Laws of Motion explain the interaction of mass and forces, and are used to predict changes in motion</p>		<p><i>Scope and Sequence – Laws of Motion</i></p> <ul style="list-style-type: none"> a. Recognize that balanced forces do not affect an object’s motion b. Describe how unbalanced forces acting on an object changes its speed (faster/slower), direction of motion, or both c. Explain how increasing or decreasing the amount of force on an object affects the motion of that object d. Explain how the mass of an object (e.g., cars, marbles, rocks, boulders) affects the force required to move it e. Predict how the change in speed of an object (i.e., faster/slower/remains the same) is affected by the amount of force applied to an object and the mass of the object <p><i>Scope and Sequence – Forms of Energy: Electrical Circuits</i></p> <ul style="list-style-type: none"> f. Predict the effects of an electrostatic force (static electricity) on the motion of objects (attract or repel) 	<p><i>Scope and Sequence – Work and Simple Machines</i></p> <ul style="list-style-type: none"> a. Describe how friction affects the amount of force needed to do work over different surfaces or through different media
<p style="text-align: center;">E.</p> <p>Perpendicular forces act independently of each other</p>	<p>Not assessed at this level</p>		
<p style="text-align: center;">F.</p> <p>Simple machines (levers, inclined planes, wheel and axle, pulleys) affect the force applied to an object and/or direction of movement as work is done</p>			<p><i>Scope and Sequence – Work and Simple Machines</i></p> <ul style="list-style-type: none"> a. Explain how work can be done on an object (force applied and distance moved) (No formula calculations at this level) b. Recognize simple machines change the amount of effort force and/or direction of force c. Compare the measures of effort force (measured using a spring scale to the nearest Newton) needed to lift a load with and without the use of simple machines d. Identify the simple machines in common tools and household items

Strand 2: Properties and Principles of Force and Motion

1. The motion of an object is described by its change in position relative to another object or point			
Concept	Grade 6	Grade 7	Grade 8
A. The motion of an object is described as a change in position, direction, and speed relative to another object (frame of reference)		<i>Scope and Sequence – Force, Motion, and Work</i> a. Describe the circular motion of a moving object as the result of a force acting toward the center b. Classify different types of motion (e.g., straight line, projectile, circular, vibrational) c. Given an object in motion, calculate its speed (distance/time) d. Interpret a line graph representing an object's motion in terms of distance over time (speed) using metric units	
B. An object that is accelerating is speeding up, slowing down, or changing direction	Not assessed at this level		
C. Momentum depends on the mass of the object and the velocity with which it is traveling	Not assessed at this level		

Strand 2: Properties and Principles of Force and Motion

2. Forces affect motion			
Concept	Grade 6	Grade 7	Grade 8
<p style="text-align: center;">A.</p> <p>Forces are classified as either contact forces (pushes, pulls, friction, buoyancy) or non-contact forces (gravity, magnetism), that can be described in terms of direction and magnitude</p>		<p><i>Scope and Sequence – Force, Motion, and Work</i></p> <p>a. Identify and describe the types of forces acting on an object in motion, at rest, floating/sinking (i.e., type of force, direction, amount of force in Newtons)</p> <p>b. Compare the forces acting on an object by using a spring scale to measure them to the nearest Newton</p>	
<p style="text-align: center;">B.</p> <p>Every object exerts a gravitational force on every other object</p>		<p><i>Scope and Sequence – Force, Motion, and Work</i></p> <p>a. Recognize every object exerts a gravitational force of attraction on every other object</p> <p>b. Recognize an object's weight is a measure of the gravitational force of a planet/moon acting on that object</p> <p>c. Compare the amount of gravitational force acting between objects (which is dependent upon their masses and the distance between them)</p>	
<p style="text-align: center;">C.</p> <p>Magnetic forces are related to electrical forces as different aspects of a single electromagnetic force</p>	Not assessed at this level		

Strand 2: Properties and Principles of Force and Motion

2. Forces affect motion			
Concept	Grade 6	Grade 7	Grade 8
<p style="text-align: center;">D.</p> <p>Newton's Laws of Motion explain the interaction of mass and forces, and are used to predict changes in motion</p>		<p><i>Scope and Sequence – Force, Motion, and Work</i></p> <p>a. Compare the effects of balanced and unbalanced forces (including magnetic, gravity, friction, push or pull) on an object's motion</p> <p>b. Explain that when forces (including magnetic, gravity, friction, push or pull) are balanced, objects are at rest or their motion remains constant</p> <p>c. Explain that a change in motion is the result of an unbalanced force acting upon an object</p> <p>d. Explain how the acceleration of a moving object is affected by the amount of net force applied and the mass of the object</p>	
<p style="text-align: center;">E.</p> <p>Perpendicular forces act independently of each other</p>	Not assessed at this level		
<p style="text-align: center;">F.</p> <p>Simple machines (levers, inclined planes, wheels and axles, pulleys) affect the forces applied to an object and/or direction of movement as work is done</p>		<p><i>Scope and Sequence – Force, Motion, and Work</i></p> <p>a. Recognize examples of work being done on an object (force applied and distance moved in the direction of the applied force) with and without the use of simple machines</p> <p>b. Calculate the amount of work done when a force is applied to an object over a distance ($W = F \times d$)</p> <p>c. Explain how simple machines affect the amount of effort force, distance through which a force is applied, and/or direction of force while doing work</p> <p>d. Recognize the amount of work output is never greater than the amount of work input, with or without the use of a simple machine</p> <p>e. Evaluate simple machine designs to determine which design requires the least amount of effort force and explain why</p>	

Strand 2: Properties and Principles of Force and Motion

1. The motion of an object is described by its change in position relative to another object or point	
Concept	Grade 9, 10, 11
<p style="text-align: center;">A.</p> <p>The motion of an object is described as a change in position, direction, and speed relative to another object (frame of reference)</p>	<p><i>Scope and Sequence – Interactions between Energy, Force, and Motion</i></p> <ul style="list-style-type: none"> a. Represent and analyze the motion of an object graphically b. Analyze the speed of two objects in terms of distance and time c. Calculate the speed of objects (speed = distance/time)
<p style="text-align: center;">B.</p> <p>An object that is accelerating is speeding up, slowing down, or changing direction</p>	<p><i>Scope and Sequence – Interactions between Energy, Force, and Motion</i></p> <ul style="list-style-type: none"> a. Measure and analyze an object's motion in terms of speed, velocity, and acceleration b. Calculate the acceleration of an object (final velocity-starting velocity/time)
<p style="text-align: center;">C.</p> <p>Momentum depends on the mass of the object and the velocity with which it is traveling</p>	<p><i>Scope and Sequence – Interactions between Energy, Force, and Motion</i></p> <ul style="list-style-type: none"> a. Compare the momentum of two objects in terms of mass and velocity (Do NOT assess calculations) b. Explain that the total momentum remains constant within a system

Strand 2: Properties and Principles of Force and Motion

2. Forces affect motion	
Concept	Grade 9, 10, 11
<p style="text-align: center;">A.</p> <p>Forces are classified as either contact forces (pushes, pulls, friction, buoyancy) or non-contact forces (gravity, magnetism), that can be described in terms of direction and magnitude</p>	<p><i>Scope and Sequence – Interactions between Energy, Force, and Motion</i></p> <p>a. Identify and describe the forces acting on an object (i.e., type of force, direction, magnitude in Newtons)</p>
<p style="text-align: center;">B.</p> <p>Every object exerts a gravitational force on every other object</p>	<p><i>Scope and Sequence – Interactions between Energy, Force, and Motion</i></p> <p>a. Describe gravity as an attractive force among all objects</p> <p>b. Compare and describe the gravitational forces between two objects in terms of their masses and the distances between them</p> <p>c. Describe weight in terms of the force of a planet's or moon's gravity acting on a given mass</p> <p>d. Recognize all free-falling bodies accelerate at the same rate due to gravity regardless of their mass</p>
<p style="text-align: center;">C.</p> <p>Magnetic forces are related to electrical forces as different aspects of a single electromagnetic force</p>	<p><i>Scope and Sequence – Interactions between Energy, Force, and Motion</i></p> <p>a. Recognize changing magnetic fields can produce electrical current and electric currents can produce magnetic forces</p> <p>b. Predict the effects of an electromagnetic force on the motion of objects (attract or repel)</p>
<p style="text-align: center;">D.</p> <p>Newton's Laws of Motion explain the interaction of mass and forces, and are used to predict changes in motion</p>	<p><i>Scope and Sequence – Interactions between Energy, Force, and Motion</i></p> <p>a. Recognize that inertia is a property of matter that can be described as an object's tendency to resist a change in motion, and is dependent upon the object's mass (Newton's First Law of Motion)</p> <p>b. Describe the effect of a change in mass of an object on the inertia of that object (Newton's First Law of Motion)</p> <p>c. Using information about the mass and acceleration of two objects, compare the forces required to move them (force = mass x acceleration) (Newton's Second Law of Motion)</p> <p>d. Identify forces acting on a falling object and the factors that affect the rate of fall (i.e., mass, volume, shape, or type of material from which the object is made)</p> <p>e. Determine the overall effect (i.e., direction and magnitude) of forces acting on an object at the same time (i.e., net force)</p> <p>f. Predict and explain the effect of a change in force and/or mass on the motion of an object (Newton's Second Law of Motion)</p> <p>g. Analyze action/reaction forces acting between two objects (e.g., handball hits concrete wall, shotgun firing) and describe their magnitude and direction (Newton's Third Law of Motion)</p> <p>h. Predict the change in motion of one object when it is acted upon by the equal and opposite force of another object (i.e., action/reaction forces) (Newton's Third Law of Motion)</p>

Strand 2: Properties and Principles of Force and Motion

2. Forces affect motion	
Concept	Grade 9, 10, 11
<p style="text-align: center;">E.</p> <p>Perpendicular forces act independently of each other</p>	<p><i>Scope and Sequence – Interactions between Energy, Force, and Motion</i></p> <ul style="list-style-type: none"> a. Describe the force(s) that keep an object traveling in a circular path b. Describe the force(s) acting on a projectile on the Earth c. Predict the path of an object when the forces directing it change
<p style="text-align: center;">F.</p> <p>Simple machines (levers, inclined planes, wheel and axle, pulleys) affect the forces applied to an object and/or direction of movement as work is done</p>	<p><i>Scope and Sequence – Interactions between Energy, Force, and Motion</i></p> <ul style="list-style-type: none"> a. Describe the relationships between work, applied net force, and the distance an object moves b. Explain how the efficiency of machines can be expressed as a ratio of work output to work input c. Describe power in terms of work and time d. Analyze and describe the relationship among work, power, and efficiency

Strand 3: Characteristics and Interactions of Living Organisms

1. There is a fundamental unity underlying the diversity of all living organisms			
Concept	Kindergarten	Grade 1	Grade 2
A. Organisms have basic needs for survival		<i>Scope and Sequence – Characteristics of Plants and Animals</i> a. Identify the basic needs of most animals (i.e., air, water, food, shelter) b. Identify the basic needs of most plants (i.e., air, water, light) c. Predict and investigate the growth of plants when growing conditions are altered (e.g., dark vs. light, water vs. no water)	
B. Organisms progress through life cycles unique to different types of organisms			<i>Scope and Sequence – Life Cycles of Animals</i> a. Recognize that animals progress through life cycles of birth, growth and development, reproduction, and death b. Record observations on the life cycle of different animals (e.g., butterfly, frog, chicken) c. Sequence the stages in the life cycle of animals (i.e., butterfly, frog, chicken)
C. Cells are the fundamental units of structure and function of all living things	Not assessed at this level		
D. Plants and animals have different structures that serve similar functions necessary for the survival of the organism	<i>Scope and Sequence – Plants and Animals</i> a. Observe and compare the structures and behaviors of different kinds of plants and animals	<i>Scope and Sequence – Characteristics of Plants and Animals</i> a. Identify and compare the physical structures of a variety of plants (e.g., stem, leaves, flowers, seeds, roots) b. Identify and compare the physical structures of a variety of animals (e.g., sensory organs, beaks, appendages, body covering) (Do NOT assess terms: sensory organs, appendages) c. Identify the relationships between the physical structures of plants and the function of those structures (e.g., absorption of water, absorption of light energy, support, reproduction) d. Identify the relationships between the physical structures of animals and the function of those structures (e.g., taking in water, support, movement, obtaining food, reproduction)	

Strand 3: Characteristics and Interactions of Living Organisms

1. There is a fundamental unity underlying the diversity of all living organisms			
Concept	Kindergarten	Grade 1	Grade 2
E. Biological classifications are based on how organisms are related		<i>Scope and Sequence – Characteristics of Plants and Animals</i> a. Distinguish between plants and animals based on observable structures and behaviors	

Strand 3: Characteristics and Interactions of Living Organisms

2. Living organisms carry out life processes in order to survive			
Concept	Kindergarten	Grade 1	Grade 2
<p style="text-align: center;">A.</p> <p>The cell contains a set of structures called organelles that interact to carry out life processes through physical and chemical means</p>		Not assessed at this level	
<p style="text-align: center;">B.</p> <p>Photosynthesis and cellular respiration are complementary processes necessary to the survival of most organisms on Earth</p>		Not assessed at this level	
<p style="text-align: center;">C.</p> <p>Complex multicellular organisms have systems that interact to carry out life processes through physical and chemical means</p>		Not assessed at this level	
<p style="text-align: center;">D.</p> <p>Cells carry out chemical transformations that use energy for the synthesis or breakdown of organic compounds</p>		Not assessed at this level	
<p style="text-align: center;">E.</p> <p>Protein structure and function are coded by the DNA (Deoxyribonucleic acid) molecule</p>		Not assessed at this level	

Strand 3: Characteristic and Interactions of Living Organisms

2. Living organisms carry out life processes in order to survive			
Concept	Kindergarten	Grade 1	Grade 2
<p style="text-align: center;">F.</p> <p>Cellular activities and responses can maintain stability internally while external conditions are changing (homeostasis)</p>	Not assessed at this level		
<p style="text-align: center;">G.</p> <p>Life processes can be disrupted by disease (intrinsic failures of the organ systems or by infection due to other organisms)</p>	Not assessed at this level		

Strand 3: Characteristics and Interactions of Living Organisms

3. There is a genetic basis for the transfer of biological characteristics from one generation to the next through reproductive processes			
Concept	Kindergarten	Grade 1	Grade 2
A. Reproduction can occur asexually or sexually	Not assessed at this level		
B. All living organisms have genetic material (DNA) that carries hereditary information	Not assessed at this level		
C. Chromosomes are components of cells that occur in pairs and carry hereditary information from one cell to daughter cells and from parent to offspring during reproduction	Not assessed at this level		
D. There is heritable variation within every species of organism	<i>Scope and Sequence – Parent – Offspring Relationships</i> a. Recognize that living things have offspring b. Recognize a parent – offspring relationship based on the organisms’ physical similarities and differences		<i>Scope and Sequence – Life Cycles of Animals</i> a. Identify and relate the similarities and differences between animal parents and their offspring b. Recognize similarities and differences among multiple offspring of an animal parent
E. The pattern of inheritance for many traits can be predicted by using the principles of Mendelian genetics	Not assessed at this level		

Strand 3: Characteristics and Interactions of Living Organisms

1. There is a fundamental unity underlying the diversity of all living organisms			
Concept	Grade 3	Grade 4	Grade 5
A. Organisms have basic needs for survival	<i>Scope and Sequence – Plants</i> a. Describe the basic needs of most plants (i.e., air, water, light, nutrients, temperature)		
B. Organisms progress through life cycles unique to different types of organisms	<i>Scope and Sequence – Plants</i> a. Recognize plants progress through life cycles of seed germination, growth and development, reproduction, and death b. Sequence and describe the stages in the life cycle of a flowering plant		
C. Cells are the fundamental units of structure and function of all living things	Not assessed at this level		
D. Plants and animals have different structures that serve similar functions necessary for the survival of the organism	<i>Scope and Sequence – Plants</i> a. Identify the major organs (roots, stems, flowers, leaves) and their functions in vascular plants (e.g., absorption, transport, reproduction) (Do NOT assess the term vascular)		<i>Scope and Sequence – Classification of Plants and Animals</i> a. Compare structures (e.g., wings vs. fins vs. legs; gills vs. lungs; feathers vs. hair vs. scales) that serve similar functions for animals belonging to different vertebrate classes
E. Biological classifications are based on how organisms are related			<i>Scope and Sequence – Classification of Plants and Animals</i> a. Explain how similarities are the basis for classification b. Distinguish between plants (which use sunlight to make their own food) and animals (which must consume energy-rich food) c. Classify animals as vertebrates or invertebrates d. Classify vertebrate animals into classes (amphibians, birds, reptiles, mammals, fish) based on their characteristics e. Identify plants or animals using simple dichotomous keys

Strand 3: Characteristics and Interactions of Living Organisms

2. Living organisms carry out life processes in order to survive			
Concept	Grade 3	Grade 4	Grade 5
<p>A. The cell contains a set of structures called organelles that interact to carry out life processes through physical and chemical means</p>	Not assessed at this level		
<p>B. Photosynthesis and cellular respiration are complementary processes necessary to the survival of most organisms on Earth</p>	Not assessed at this level		
<p>C. Complex multicellular organisms have systems that interact to carry out life processes through physical and chemical means</p>	<p><i>Scope and Sequence – Plants</i> a. Illustrate and trace the path of water and nutrients as they move through the transport system of a plant</p>		<p><i>Scope and Sequence – Classification of Plants and Animals</i> a. Recognize the major life processes carried out by the major systems of plants and animals (e.g., support, reproductive, digestive, transport/circulatory, excretory, response) (Do NOT assess naming of organs within each system or explanation of the processes carried out by those systems)</p>
<p>D. Cells carry out chemical transformations that use energy for the synthesis or breakdown of organic compounds</p>	Not assessed at this level		

Strand 3: Characteristic and Interactions of Living Organisms

2. Living organisms carry out life processes in order to survive			
Concept	Grade 3	Grade 4	Grade 5
E. Protein structure and function are coded by the DNA (Deoxyribonucleic acid) molecule		Not assessed at this level	
F. Cellular activities and responses can maintain stability internally while external conditions are changing (homeostasis)		Not assessed at this level	
G. Life processes can be disrupted by disease (intrinsic failures of the organ systems or by infection due to other organisms)		Not assessed at this level	

Strand 3: Characteristic and Interactions of Living Organisms

3. There is a genetic basis for the transfer of biological characteristics from one generation to the next through reproductive processes			
Concept	Grade 3	Grade 4	Grade 5
A. Reproduction can occur asexually or sexually	Not assessed at this level		
B. All living organisms have genetic material (DNA) that carries hereditary information	Not assessed at this level		
C. Chromosomes are components of cells that occur in pairs and carry hereditary information from one cell to daughter cells and from parent to offspring during reproduction	Not assessed at this level		
D. There is heritable variation within every species of organism	<i>Scope and Sequence – Plants</i> a. Identify and relate the similarities and differences between plants and their offspring (i.e., seedlings)		
E. The pattern of inheritance for many traits can be predicted by using the principles of Mendelian genetics	Not assessed at this level		

Strand 3: Characteristic and Interactions of Living Organisms

1. There is a fundamental unity underlying the diversity of all living organisms			
Concept	Grade 6	Grade 7	Grade 8
A. Organisms have basic needs for survival	<i>Scope and Sequence – Characteristics of Living Organisms</i> a. 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)		<i>Scope and Sequence – Cells and Body Systems</i> a. Recognize that most plants and animals require food and oxygen (needed to release the energy from that food)
B. Organisms progress through life cycles unique to different types of organisms	Not assessed at this level		
C. Cells are the fundamental units of structure and function of all living things	<i>Scope and Sequence – Characteristics of Living Organisms</i> a. Recognize all organisms are composed of cells, the fundamental units of life, which carry on all life processes		
D. Plants and animals have different structures that serve similar functions necessary for the survival of the organism			<i>Scope and Sequence – Cells and Body Systems</i> a. Identify and contrast the structures of plants and animals that serve similar functions (e.g., taking in water and oxygen, support, response to stimuli, obtaining energy, circulation, digestion, excretion, reproduction)
E. Biological classifications are based on how organisms are related	<i>Scope and Sequence – Characteristics of Living Organisms</i> a. Recognize most of the organisms on Earth are unicellular (e.g., bacteria, protists) and other organisms, including humans, are multicellular b. Identify examples of unicellular (e.g., bacteria, some protists, fungi) and multicellular organisms (e.g., some fungi, plants, animals)		

Strand 3: Characteristic and Interactions of Living Organisms

2. Living organisms carry out life processes in order to survive			
Concept	Grade 6	Grade 7	Grade 8
<p style="text-align: center;">A.</p> <p>The cell contains a set of structures called organelles that interact to carry out life processes through physical and chemical means</p>	<p><i>Scope and Sequence – Characteristics of Living Organisms</i></p> <p>a. Compare and contrast the following plant and animal cell structures: cell membrane, nucleus, cell wall, chloroplast, and cytoplasm</p> <p>b. Recognize the chloroplast as the cell structure where food is produced in plants and some unicellular organisms (e.g., algae, some protists)</p>		<p><i>Scope and Sequence – Cells and Body Systems</i></p> <p>a. Recognize the cell membrane helps regulate the transfer of materials in and out of the cell</p> <p>b. Recognize the function of the chloroplast is photosynthesis</p>
<p style="text-align: center;">B.</p> <p>Photosynthesis and cellular respiration are complementary processes necessary to the survival of most organisms on Earth</p>	<p><i>Scope and Sequence – Characteristics of Living Organisms</i></p> <p>a. Recognize plants use energy from the Sun to produce food and oxygen through the process of photosynthesis</p>		<p><i>Scope and Sequence – Cells and Body Systems</i></p> <p>a. Recognize photosynthesis is a chemical change with reactants (water and carbon dioxide) and products (energy-rich sugar molecules and oxygen) that takes place in the presence of light and chlorophyll</p> <p>b. Recognize oxygen is needed by all cells of most organisms for the release of energy from nutrient (sugar) molecules (Do NOT assess the term cellular respiration)</p> <p>c. Describe the importance of the transport and exchange of oxygen and carbon dioxide to the survival of the organism</p>

Strand 3: Characteristic and Interactions of Living Organisms

2. Living organisms carry out life processes in order to survive			
Concept	Grade 6	Grade 7	Grade 8
<p style="text-align: center;">C.</p> <p>Complex multicellular organisms have systems that interact to carry out life processes through physical and chemical means</p>			<p><i>Scope and Sequence – Cells and Body Systems</i></p> <ul style="list-style-type: none"> a. Identify and give examples of each level of organization (cell, tissue, organ, organ system) in multicellular organisms (plants, animals) b. Illustrate and explain the path water and nutrients take as they move through the transport system of a plant c. Explain the interactions between the circulatory and digestive systems as nutrients are processed by the digestive system, passed into the blood stream, and transported in and out of the cell d. Compare and contrast the processes of mechanical and chemical digestion, and their role in providing materials necessary for survival of the cell and organism e. Identify the importance of the transport and exchange of nutrient and waste molecules to the survival of the cell and organism f. Explain the interactions between the circulatory and respiratory systems in exchanging oxygen and carbon dioxide between cells and the atmosphere (when oxygen enters the body, passes into the blood stream, and is transported into the cell; carbon dioxide is transported out of the cell, passes into the blood stream, and exits the body) g. Explain the interactions between the nervous and muscular systems when an organism responds to a stimulus
<p style="text-align: center;">D.</p> <p>Cells carry out chemical transformations that use energy for the synthesis or breakdown of organic compounds</p>	Not assessed at this level		
<p style="text-align: center;">E.</p> <p>Protein structure and function are coded by the DNA (Deoxyribonucleic acid) molecule</p>	Not assessed at this level		

Strand 3: Characteristic and Interactions of Living Organisms

2. Living organisms carry out life processes in order to survive			
Concept	Grade 6	Grade 7	Grade 8
<p style="text-align: center;">F.</p> <p>Cellular activities and responses can maintain stability internally while external conditions are changing (homeostasis)</p>			<p><i>Scope and Sequence – Cells and Body Systems</i></p> <p>a. Predict the response the body may take to maintain internal balance during an environmental change (e.g., shivering when cold, slowing metabolism when food supply decreases or when dehydrated, adrenaline rush when frightened)</p>
<p style="text-align: center;">G.</p> <p>Life processes can be disrupted by disease (intrinsic failures of the organ systems or by infection due to other organisms)</p>			<p><i>Scope and Sequence – Disease</i></p> <p>a. Explain the cause and effect of diseases (e.g., AIDS, cancer, diabetes, hypertension) on the human body</p> <p>b. Relate some common diseases (i.e., cold, influenza, strep throat, dysentery, fungal infections) to the organisms that cause them (bacteria, viruses, protists, fungi)</p> <p>c. Differentiate between infectious and noninfectious diseases</p> <p>d. Explain the role of antibiotics and vaccines in the treatment and prevention of diseases</p>

Strand 3: Characteristic and Interactions of Living Organisms

3. There is a genetic basis for the transfer of biological characteristics from one generation to the next through reproductive processes			
Concept	Grade 6	Grade 7	Grade 8
<p style="text-align: center;">A.</p> <p>Reproduction can occur asexually or sexually</p>			<p><i>Scope and Sequence – Reproduction and Heredity</i></p> <ul style="list-style-type: none"> a. Compare and contrast the processes of asexual and sexual reproduction, including the type and number of cells involved (one body cell in asexual, two sex cells in sexual), and the number of gene sets (body cell has two sets, sex cells have one set each) passed from parent(s) to offspring b. Identify examples of asexual reproduction (i.e., plants budding, binary fission of single cell organisms) c. Compare and contrast the reproductive mechanisms of classes of vertebrates (i.e., internal vs. external fertilization) d. Explain how flowering plants reproduce sexually
<p style="text-align: center;">B.</p> <p>All living organisms have genetic material (DNA) that carries hereditary information</p>	Not assessed at this level		
<p style="text-align: center;">C.</p> <p>Chromosomes are components of cells that occur in pairs and carry hereditary information from one cell to daughter cells and from parent to offspring during reproduction</p>			<p><i>Scope and Sequence – Reproduction and Heredity</i></p> <ul style="list-style-type: none"> a. Identify chromosomes as cellular structures that occur in pairs that carry hereditary information in units called genes b. Recognize that when asexual reproduction occurs, the same genetic information found in the parent cell is copied and passed on to each new daughter cell (Assess only the concept – not the term or process of mitosis) c. Recognize that when sexual reproduction occurs, genetic material from both parents is passed on and combined to form the genetic code for the new organism (Assess only the concept – not the term or process of meiosis)

Strand 3: Characteristic and Interactions of Living Organisms

3. There is a genetic basis for the transfer of biological characteristics from one generation to the next through reproductive processes			
Concept	Grade 6	Grade 7	Grade 8
<p style="text-align: center;">D.</p> <p>There is heritable variation within every species of organism</p>			<p><i>Scope and Sequence – Reproduction and Heredity</i></p> <p>a. Recognize that when asexual reproduction occurs, the daughter cell is identical to the parent cell (assuming no change in the parent genes)</p> <p>b. Recognize that when sexual reproduction occurs, the offspring is not identical to either parent due to the combining of the different genetic codes contained in each sex cell</p>
<p style="text-align: center;">E.</p> <p>The pattern of inheritance for many traits can be predicted by using the principles of Mendelian genetics</p>	Not assessed at this level		

Strand 3: Characteristic and Interactions of Living Organisms

1. There is a fundamental unity underlying the diversity of all living organisms	
Concept	Grades 9, 10, 11
A. Organisms have basic needs for survival	Not assessed at this level
B. Organisms progress through life cycles unique to different types of organisms	<p><i>Scope and Sequence – Diversity and Unity Among Organisms</i></p> <p>a. Recognize cells both increase in number and differentiate, becoming specialized in structure and function, during and after embryonic development</p> <p>b. Identify factors (e.g., biochemical, temperature) that may affect the differentiation of cells and the development of an organism</p>
C. Cells are the fundamental units of structure and function of all living things	<p><i>Scope and Sequence – Diversity and Unity Among Organisms</i></p> <p>a. Recognize all organisms are composed of cells, the fundamental units of structure and function</p> <p>b. Describe the structure of cell parts (e.g., cell wall, cell membrane, cytoplasm, nucleus, chloroplast, mitochondrion, ribosomes, vacuole) found in different types of cells (e.g., bacterial, plant, skin, nerve, blood, muscle) and the functions they perform (e.g., structural support, transport of materials, storage of genetic information, photosynthesis and respiration, synthesis of new molecules, waste disposal) that are necessary to the survival of the cell and organism</p>
D. Plants and animals have different structures that serve similar functions necessary for the survival of the organism	Not assessed at this level
E. Biological classifications are based on how organisms are related	<p><i>Scope and Sequence – Diversity and Unity Among Organisms</i></p> <p>a. Explain how similarities used to group taxa might reflect evolutionary relationships (e.g., similarities in DNA and protein structures, internal anatomical features, patterns of development)</p> <p>b. Explain how and why the classification of any taxon might change as more is learned about the organisms assigned to that taxon</p>

Strand 3: Characteristic and Interactions of Living Organisms

2. Living organisms carry out life processes in order to survive	
Concept	Grades 9, 10, 11
<p style="text-align: center;">A.</p> <p>The cell contains a set of structures called organelles that interact to carry out life processes through physical and chemical means</p>	<p><i>Scope and Sequence – Cellular Processes</i></p> <ul style="list-style-type: none"> a. Compare and contrast the structure and function of mitochondria and chloroplasts b. Compare and contrast the structure and function of cell wall and cell membranes c. Explain physical and chemical interactions that occur between organelles as they carry out life processes
<p style="text-align: center;">B.</p> <p>Photosynthesis and cellular respiration are complementary processes necessary to the survival of most organisms on Earth</p>	<p><i>Scope and Sequence – Cellular Processes</i></p> <ul style="list-style-type: none"> a. Compare and contrast photosynthesis and cellular respiration reactions (Do NOT assess intermediate reactions) b. Explain the interrelationship between the processes of photosynthesis and cellular respiration c. Determine what factors affect the processes of photosynthesis and cellular respiration (i.e., light intensity, availability of reactants, temperature)
<p style="text-align: center;">C.</p> <p>Complex multicellular organisms have systems that interact to carry out life processes through physical and chemical means</p>	<p>Not assessed at this level</p>
<p style="text-align: center;">D.</p> <p>Cells carry out chemical transformations that use energy for the synthesis or breakdown of organic compounds</p>	<p><i>Scope and Sequence – Cellular Processes</i></p> <ul style="list-style-type: none"> a. Summarize how energy transfer occurs during photosynthesis and cellular respiration (i.e., the storage and release of energy in the bonds of chemical compounds) b. Distinguish among organic compounds (e.g., proteins, nucleic acids, lipids, carbohydrates) in relation to their role in living systems c. Recognize energy is absorbed or released in the breakdown and/or synthesis of organic compounds d. Explain how protein enzymes affect chemical reactions (e.g., the breakdown of food molecules) e. Interpret a data table showing the effects of an enzyme on a biochemical reaction
<p style="text-align: center;">E.</p> <p>Protein structure and function are coded by the DNA (Deoxyribonucleic acid) molecule</p>	<p><i>Scope and Sequence – Cellular Processes</i></p> <ul style="list-style-type: none"> a. Explain how the DNA code determines the sequence of amino acids necessary for protein synthesis b. Recognize the function of protein in cell structure and function (i.e., enzyme action, growth and repair of body parts, regulation of cell division and differentiation)

Strand 3: Characteristic and Interactions of Living Organisms

2. Living organisms carry out life processes in order to survive.	
Concept	Grades 9, 10, 11
<p style="text-align: center;">F.</p> <p>Cellular activities and responses can maintain stability internally while external conditions are changing (homeostasis)</p>	<p><i>Scope and Sequence – Cellular Processes</i></p> <ul style="list-style-type: none"> a. Explain the significance of semi-permeability to the transport of molecules across cellular membranes b. Predict the movement of molecules needed for a cell to maintain homeostasis, given concentration gradients of different sizes of molecules c. Relate the role of diffusion, osmosis, and active transport to the movement of molecules across semi-permeable membranes d. Explain how water is important to cells (e.g., is a buffer for body temperature, provides soluble environment for chemical reactions, serves as a reactant in chemical reactions, provides hydration that maintains cell turgidity, maintains protein shape)
<p style="text-align: center;">G.</p> <p>Life processes can be disrupted by disease (intrinsic failures of the organ systems or by infection due to other organisms)</p>	<p>Not assessed at this level</p>

Strand 3: Characteristic and Interactions of Living Organisms

3. There is a genetic basis for the transfer of biological characteristics from one generation to the next through reproductive processes	
Concept	Grades 9, 10, 11
A. Reproduction can occur asexually or sexually	<p><i>Scope and Sequence – Genetics and Heredity</i></p> <p>a. Distinguish between asexual (i.e., binary fission, budding, cloning) and sexual reproduction</p>
B. All living organisms have genetic material (DNA) that carries hereditary information	<p><i>Scope and Sequence – Genetics and Heredity</i></p> <p>a. Describe the chemical and structural properties of DNA (e.g., DNA is a large polymer formed from linked subunits of four kinds of nitrogen bases; genetic information is encoded in genes based on the sequence of subunits; each DNA molecule in a cell forms a single chromosome) (Assess the concepts – NOT memorization of nitrogen base pairs)</p> <p>b. Recognize that DNA codes for proteins, which are expressed as the heritable characteristics of an organism</p> <p>c. Recognize that degree of relatedness can be determined by comparing DNA sequences</p> <p>d. Explain how an error in the DNA molecule (mutation) can be transferred during replication</p> <p>e. Identify possible external causes (e.g., heat, radiation, certain chemicals) and effects of DNA mutations (e.g., protein defects which affect chemical reactions, structural deformities)</p>
C. Chromosomes are components of cells that occur in pairs and carry hereditary information from one cell to daughter cells and from parent to offspring during reproduction	<p><i>Scope and Sequence – Genetics and Heredity</i></p> <p>a. Recognize the chromosomes of daughter cells, formed through the processes of asexual reproduction and mitosis, the formation of somatic (body) cells in multicellular organisms, are identical to the chromosomes of the parent cell</p> <p>b. Recognize that during meiosis, the formation of sex cells, chromosomes are reduced to half the number present in the parent cell</p> <p>c. Explain how fertilization restores the diploid number of chromosomes</p> <p>d. Identify the implications of human sex chromosomes for sex determination</p>
D. There is heritable variation within every species of organism	<p><i>Scope and Sequence – Diversity and Unity Among Organisms</i></p> <p>a. Describe the advantages and disadvantages of asexual and sexual reproduction with regard to variation within a population</p> <p>b. Describe how genes can be altered and combined to create genetic variation within a species (e.g., mutation, recombination of genes)</p> <p>c. Recognize that new heritable characteristics can only result from new combinations of existing genes or from mutations of genes in an organism's sex cells</p>
E. The pattern of inheritance for many traits can be predicted by using the principles of Mendelian genetics	<p><i>Scope and Sequence – Genetics and Heredity</i></p> <p>a. Explain how genotypes (heterozygous and homozygous) contribute to phenotypic variation within a species</p> <p>b. Predict the probability of the occurrence of specific traits, including sex-linked traits, in an offspring by using a monohybrid cross</p> <p>c. Explain how sex-linked traits may or may not result in the expression of a genetic disorder (e.g., hemophilia, muscular dystrophy, color blindness) depending on gender</p>

Strand 4: Changes in Ecosystems and Interactions of Organisms with their Environments

1. Organisms are interdependent with one another and with their environment			
Concept	Kindergarten	Grade 1	Grade 2
<p>A. All populations living together within a community interact with one another and with their environment in order to survive and maintain a balanced ecosystem</p>	<p><i>Scope and Sequence –Weather and Seasons</i> a. Describe how the seasons affect the behavior of plants and animals. b. Describe how the seasons affect the everyday life of humans (e.g., clothing, activities)</p>	<p><i>Scope and Sequence – Characteristics of Plants and Animals</i> a. Identify ways man depends on plants and animals for food, clothing, and shelter</p>	
<p>B. Living organisms have the capacity to produce populations of infinite size, but environments and resources are finite</p>	Not assessed at this level		
<p>C. All organisms, including humans, and their activities cause changes in their environment that affect the ecosystem</p>	Not assessed at this level		
<p>D. The diversity of species within an ecosystem is affected by changes in the environment, which can be caused by other organisms or outside processes</p>	Not assessed at this level		

Strand 4: Changes in Ecosystems and Interactions of Organisms with their Environments

2. Matter and energy flow through an ecosystem			
Concept	Kindergarten	Grade 1	Grade 2
<p>A. As energy flows through the ecosystem, all organisms capture a portion of that energy and transform it to a form they can use</p>		Not assessed at this level	
<p>B. Matter is recycled through an ecosystem</p>		Not assessed at this level	

3. Genetic variation sorted by the natural selection process explains evidence of biological evolution			
Concept	Kindergarten	Grade 1	Grade 2
<p>A. Evidence for the nature and rates of evolution can be found in anatomical and molecular characteristics of organisms and in the fossil record</p>		Not assessed at this level	
<p>B. Reproduction is essential to the continuation of every species</p>		Not assessed at this level	
<p>C. Natural selection is the process of sorting individuals based on their ability to survive and reproduce within their ecosystem</p>		Not assessed at this level	

Strand 4: Changes in Ecosystems and Interactions of Organisms with their Environments

1. Organisms are interdependent with one another and with their environment			
Concept	Grade 3	Grade 4	Grade 5
A. All populations living together within a community interact with one another and with their environment in order to survive and maintain a balanced ecosystem		<i>Scope and Sequence – Interactions among Organisms and their Environment</i> a. Identify the ways a specific organism may interact with other organisms or with the environment (e.g., pollination, shelter, seed dispersal, camouflage, migration, hibernation, defensive mechanism) b. Recognize different environments (i.e., pond, forest, prairie) support the life of different types of plants and animals	
B. Living organisms have the capacity to produce populations of infinite size, but environments and resources are finite	Not assessed at this level		
C. All organisms, including humans, and their activities cause changes in their environment that affect the ecosystem	Not assessed at this level		
D. The diversity of species within an ecosystem is affected by changes in the environment, which can be caused by other organisms or outside processes		<i>Scope and Sequence – Interactions among Organisms and their Environment</i> a. Identify examples in Missouri where human activity has had a beneficial or harmful effect on other organisms (e.g., feeding birds, littering vs. picking up trash, hunting/conservation of species, paving/restoring greenspace)	

Strand 4: Changes in Ecosystems and Interactions of Organisms with their Environments

2. Matter and energy flow through an ecosystem			
Concept	Grade 3	Grade 4	Grade 5
<p>A. As energy flows through the ecosystem, all organisms capture a portion of that energy and transform it to a form they can use</p>	<p><i>Scope and Sequence – Food Chains</i></p> <ul style="list-style-type: none"> a. Identify sunlight as the primary source of energy plants use to produce their own food b. Classify populations of organisms as producers or consumers by the role they serve in the ecosystem c. Sequence the flow of energy through a food chain beginning with the Sun d. Predict the possible effects of removing an organism from a food chain 	<p><i>Scope and Sequence – Interactions among Organisms and their Environment</i></p> <ul style="list-style-type: none"> a. Classify populations of organisms as producers, consumers, or decomposers by the role they serve in the ecosystem b. Differentiate between the three types of consumers (herbivore, carnivore, omnivore) c. Categorize organisms as predator or prey in a given ecosystem 	
<p>B. Matter is recycled through an ecosystem</p>	<p>Not assessed at this level</p>		

Strand 4: Changes in Ecosystems and Interactions of Organisms with their Environments

3. Genetic variation sorted by the natural selection process explains evidence of biological evolution			
Concept	Grade 3	Grade 4	Grade 5
A. Evidence for the nature and rates of evolution can be found in anatomical and molecular characteristics of organisms and in the fossil record		<i>Scope and Sequence – Changes in the Earth's Surface</i> a. Compare and contrast common fossils found in Missouri (i.e., trilobites, ferns, crinoids, gastropods, bivalves, fish, mastodons) to organisms present on Earth today	
B. Reproduction is essential to the continuation of every species	Not assessed at this level		
C. Natural selection is the process of sorting individuals based on their ability to survive and reproduce within their ecosystem		<i>Scope and Sequence – Interactions among Organisms and their Environment</i> a. Identify specialized structures and describe how they help plants survive in their environment (e.g., root, cactus needles, thorns, winged seed, waxy leaves) b. Identify specialized structures and senses and describe how they help animals survive in their environment (e.g., antennae, body covering, teeth, beaks, whiskers, appendages) c. Recognize internal cues (e.g., hunger) and external cues (e.g., changes in the environment) that cause organisms to behave in certain ways (e.g., hunting, migration, hibernation) d. Predict which plant or animal will be able to survive in a specific environment based on its special structures or behaviors	

Strand 4: Changes in Ecosystems and Interactions of Organisms with their Environments

1. Organisms are interdependent with one another and with their environment			
Concept	Grade 6	Grade 7	Grade 8
<p>A. All populations living together within a community interact with one another and with their environment in order to survive and maintain a balanced ecosystem</p>	<p><i>Scope and Sequence – Ecosystems and Populations</i> a. 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</p>		
<p>B. Living organisms have the capacity to produce populations of infinite size, but environments and resources are finite</p>	<p><i>Scope and Sequence – Ecosystems and Populations</i> a. Identify populations within a community that are in competition with one another for resources b. 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) c. 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</p>		
<p>C. All organisms, including humans, and their activities cause changes in their environment that affect the ecosystem</p>	Not assessed at this level		

Strand 4: Changes in Ecosystems and Interactions of Organisms with their Environments

1. Organisms are interdependent with one another and with their environment			
Concept	Grade 6	Grade 7	Grade 8
<p>D. The diversity of species within an ecosystem is affected by changes in the environment, which can be caused by other organisms or outside processes</p>	<p><i>Scope and Sequence – Ecosystems and Populations</i></p> <p>a. 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</p> <p>b. 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</p> <p>c. Describe possible solutions to potentially harmful environmental changes within an ecosystem</p>		<p><i>Scope and Sequence – Disease</i></p> <p>a. Explain the beneficial or detrimental impact that some organisms (i.e., viruses, bacteria, protists, fungi) may have on other organisms (e.g., diseases, antibiotics, breakdown of waste, fermentation)</p>

Strand 4: Changes in Ecosystems and Interactions of Organisms with their Environments

2. Matter and energy flow through an ecosystem			
Concept	Grade 6	Grade 7	Grade 8
A. As energy flows through the ecosystem, all organisms capture a portion of that energy and transform it to a form they can use	<i>Scope and Sequence – Ecosystems and Populations</i> a. 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 b. Classify populations of unicellular and multicellular organisms as producers, consumers, and decomposers by the role they serve in the ecosystem		
B. Matter is recycled through an ecosystem			<i>Scope and Sequence – Cells and Body Systems</i> a. Illustrate the oxygen/carbon dioxide cycles b. Describe the processes involved in the recycling of matter in the oxygen/carbon dioxide cycles

Strand 4: Changes in Ecosystems and Interactions of Organisms with their Environments

3. Genetic variation sorted by the natural selection process explains evidence of biological evolution			
Concept	Grade 6	Grade 7	Grade 8
A. Evidence for the nature and rates of evolution can be found in anatomical and molecular characteristics of organisms and in the fossil record	<i>Scope and Sequence – Ecosystems and Populations</i> a. 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		
B. Reproduction is essential to the continuation of every species	Not assessed at this level		
C. Natural selection is the process of sorting individuals based on their ability to survive and reproduce within their ecosystem	<i>Scope and Sequence – Ecosystems and Populations</i> a. 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) b. Predict how certain adaptations, such as behavior, body structure, or coloration, may offer a survival advantage to an organism in a particular environment		

Strand 4: Changes in Ecosystems and Interactions of Organisms with their Environments

1. Organisms are interdependent with one another and their environment	
Concept	Grades 9, 10, 11
A. All populations living together within a community interact with one another and with their environment in order to survive and maintain a balanced ecosystem	<p><i>Scope and Sequence – Interdependence of Organisms and their Environment</i></p> <ul style="list-style-type: none"> a. Explain the nature of interactions between organisms in different symbiotic relationships (i.e., mutualism, commensalism, parasitism) b. Explain how cooperative (e.g., symbiosis) and competitive (e.g., predator/prey) relationships help maintain balance within an ecosystem c. Explain why no two species can occupy the same niche in a community
B. Living organisms have the capacity to produce populations of infinite size, but environments and resources are finite	<p><i>Scope and Sequence – Interdependence of Organisms and their Environment</i></p> <ul style="list-style-type: none"> a. Identify and explain the limiting factors that may affect the carrying capacity of a population within an ecosystem b. Predict how populations within an ecosystem change in number and/or structure in response to hypothesized changes in biotic and/or abiotic factors
C. All organisms, including humans, and their activities cause changes in their environment that affect the ecosystem	<p><i>Scope and Sequence – Interdependence of Organisms and their Environment</i></p> <ul style="list-style-type: none"> a. Devise a multi-step plan to restore the stability and/or biodiversity of an ecosystem when given a scenario describing the possible adverse effects of human interactions with that ecosystem (e.g., destruction caused by direct harvesting, pollution, atmospheric changes) b. Predict and explain how natural or human caused changes (biological, chemical and/or physical) in one ecosystem may affect other ecosystems due to natural mechanisms (e.g., global wind patterns, water cycle, ocean currents)
D. The diversity of species within an ecosystem is affected by changes in the environment, which can be caused by other organisms or outside processes	<p><i>Scope and Sequence – Interdependence of Organisms and their Environment</i></p> <ul style="list-style-type: none"> a. Predict the impact (beneficial or harmful) a natural environmental event (e.g., forest fire, flood, volcanic eruption, avalanche) may have on the diversity of different species in an ecosystem b. Describe possible causes of extinction of a population

Strand 4: Changes in Ecosystems and Interactions of Organisms with their Environments

2. Matter and energy flow through the ecosystem	
Concept	Grades 9, 10, 11
<p style="text-align: center;">A.</p> <p>As energy flows through the ecosystem, all organisms capture a portion of that energy and transform it to a form they can use</p>	<p><i>Scope and Sequence – Matter and Energy in the Ecosystem</i></p> <ul style="list-style-type: none"> a. Illustrate and describe the flow of energy within a food web b. Explain why there are generally more producers than consumers in an energy pyramid c. Predict how energy distribution and energy use will be altered due to changes in a food web
<p style="text-align: center;">B.</p> <p>Matter is recycled through an ecosystem</p>	<p><i>Scope and Sequence – Matter and Energy in the Ecosystem</i></p> <ul style="list-style-type: none"> a. Explain the processes involved in the recycling of nitrogen, oxygen, and carbon through an ecosystem b. Explain the importance of the recycling of nitrogen, oxygen, and carbon within an ecosystem

Strand 4: Changes in Ecosystems and Interactions of Organisms with their Environments

3. Genetic variation sorted by the natural selection process explains evidence of biological evolution	
Concept	Grade 9, 10, 11
<p style="text-align: center;">A.</p> <p>Evidence for the nature and rates of evolution can be found in anatomical and molecular characteristics of organisms and in the fossil record</p>	<p><i>Scope and Sequence – Biological Evolution</i></p> <ul style="list-style-type: none"> a. Interpret fossil evidence to explain the relatedness of organisms using the principles of superposition and fossil correlation b. Evaluate the evidence that supports the theory of biological evolution (e.g., fossil records, similarities between DNA and protein structures, similarities between developmental stages of organisms, homologous and vestigial structures)
<p style="text-align: center;">B.</p> <p>Reproduction is essential to the continuation of every species</p>	<p><i>Scope and Sequence – Biological Evolution</i></p> <ul style="list-style-type: none"> a. Define a species in terms of the ability to breed and produce fertile offspring b. Explain the importance of reproduction to the survival of a species (i.e., the failure of a species to reproduce will lead to extinction of that species)
<p style="text-align: center;">C.</p> <p>Natural selection is the process of sorting individuals based on their ability to survive and reproduce within their ecosystem</p>	<p><i>Scope and Sequence – Biological Evolution</i></p> <ul style="list-style-type: none"> a. Describe how variation in characteristics provides populations an advantage for survival b. Identify examples of adaptations that may have resulted from variations favored by natural selection (e.g., long-necked giraffes, long-eared jack rabbits) c. Explain how genetic homogeneity may cause a population to be more susceptible to extinction (e.g., succumbing to a disease for which there is no natural resistance) d. Explain how environmental factors (e.g., habitat loss, climate change, pollution, introduction of non-native species) can be agents of natural selection e. Given a scenario describing an environmental change, hypothesize why a given species was unable to survive

Strand 5: Processes and Interactions of the Earth’s Systems (Geosphere, Atmosphere, and Hydrosphere)

1. Earth’s systems (geosphere, atmosphere, and hydrosphere) have common components and unique structures			
Concept	Kindergarten	Grade 1	Grade 2
<p>A. The Earth’s crust is composed of various materials, including soil, minerals, and rocks, with characteristic properties</p>			<p><i>Scope and Sequence – Earth Materials: Rocks and Soils</i></p> <p>a. Observe and describe the physical properties (e.g., odor, color, appearance, relative grain size, texture, absorption of water) and different components (i.e., sand, clay, humus) of soils</p> <p>b. Observe and describe the physical properties of rocks (e.g., size, shape, color, presence of fossils)</p>
<p>B. The hydrosphere is composed of water (a material with unique properties) and other materials</p>	Not assessed at this level		
<p>C. The atmosphere (air) is composed of a mixture of gases, including water vapor, and minute particles</p>	<p><i>Scope and Sequence – Weather and Seasons</i></p> <p>a. Recognize moving air is felt as wind</p>		
<p>D. Climate is a description of average weather conditions in a given area over time</p>	Not assessed at this level		

Strand 5: Processes and Interactions of the Earth’s Systems (Geosphere, Atmosphere, and Hydrosphere)

2. Earth’s systems (geosphere, atmosphere, and hydrosphere) interact with one another as they undergo change by common processes			
Concept	Kindergarten	Grade 1	Grade 2
A. The Earth’s materials and surface features are changed through a variety of external processes			<i>Scope and Sequence – Earth Materials: Rocks and Soils</i> a. Observe and recognize examples of slow changes in the Earth’s surface and surface materials (e.g., rock, soil layers) due to processes such as decay (rotting), freezing, thawing, breaking, or wearing away by running water or wind
B. There are internal processes and sources of energy within the geosphere that cause changes in Earth’s crustal plates		Not assessed at this level	
C. Continual changes in the Earth’s materials and surface that result from internal and external processes is described by the rock cycle		Not assessed at this level	
D. Changes in the Earth over time can be inferred through rock and fossil evidence		Not assessed at this level	

Strand 5: Processes and Interactions of the Earth’s Systems (Geosphere, Atmosphere, and Hydrosphere)

2. Earth’s systems (geosphere, atmosphere, and hydrosphere) interact with one another as they undergo change by common processes			
Concept	Kindergarten	Grade 1	Grade 2
E. Changes in the form of water as it moves through Earth’s systems are described as the water cycle	Not assessed at this level		
F. Constantly changing properties of the atmosphere occur in patterns which are described as weather	<i>Scope and Sequence – Weather and Seasons</i> a. Observe and describe daily weather: precipitation (e.g., snow, rain, sleet, fog), wind (i.e., light breezes to strong wind), cloud cover, temperature b. Observe and describe the general weather conditions that occur during each season	<i>Scope and Sequence – Observing Water and Weather</i> a. Observe, measure, record weather data throughout the year (i.e., cloud cover, temperature, precipitation, wind speed) by using thermometers, rain gauges, wind socks b. Compare temperatures in different locations (e.g., inside, outside, in the sun, in the shade) c. Compare weather data observed at different times throughout the year (e.g., hot vs. cold, cloudy vs. clear, types of precipitation, windy vs. calm) d. Recognize patterns indicating relationships between observed weather data and weather phenomena (e.g., temperature and types of precipitation, clouds and amounts of precipitation)	
G. The geosphere, hydrosphere, and atmosphere are continually interacting through processes that transfer energy and Earth’s materials	Not assessed at this level		

Strand 5: Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere, and Hydrosphere)

3. Human activity is dependent upon and affects Earth's resources and systems			
Concept	Kindergarten	Grade 1	Grade 2
A. Earth's materials are limited natural resources affected by human activity		<i>Scope and Sequence – Observing Water and Weather</i> a. Observe and describe ways water, both as a solid and liquid, is used in every day activities at different times of the year (e.g., bathe, drink, make ice cubes, build snowmen, cook, swim)	<i>Scope and Sequence – Earth Materials: Rocks and Soil</i> a. Observe and describe ways humans use Earth's materials (e.g., soil, rocks) in daily life

Strand 5: Processes and Interactions of the Earth’s Systems (Geosphere, Atmosphere, and Hydrosphere)

1. Earth’s systems (geosphere, atmosphere, and hydrosphere) have common components and unique structures			
Concept	Grade 3	Grade 4	Grade 5
A. The Earth’s crust is composed of various materials, including soil, minerals, and rocks, with characteristic properties		<i>Scope and Sequence – Changes in the Earth’s Surface</i> a. Identify and describe the components of soil (e.g., plant roots and debris, bacteria, fungi, worms, types of rock) and its properties (e.g., odor, color, resistance to erosion, texture, fertility, relative grain size, absorption rate) b. Compare the physical properties (i.e., size, shape, color, texture, layering, presence of fossils) of rocks (mixtures of different Earth materials, each with observable physical properties)	
B. The hydrosphere is composed of water (a material with unique properties) and other materials			<i>Scope and Sequence – Water Cycle and Weather</i> a. Classify major bodies of surface water (e.g., rivers, lakes, oceans, glaciers) as fresh or salt water, flowing or stationary, large or small, solid or liquid, surface or groundwater b. Relate the type of water body to the process by which it was formed
C. The atmosphere (air) is composed of a mixture of gases, including water vapor, and minute particles	<i>Scope and Sequence – Investigating States of Matter</i> a. Recognize liquid water can change into a gas (vapor) in the air b. Recognize clouds and fog are made of tiny droplets of water c. Recognize air is a substance that surrounds us, takes up space, and moves around us as wind		<i>Scope and Sequence – Water Cycle and Weather</i> a. Recognize the atmosphere is composed of a mixture of gases, water, and minute particles
D. Climate is a description of average weather conditions in a given area over time	Not assessed at this level		

Strand 5: Processes and Interactions of the Earth’s Systems (Geosphere, Atmosphere, and Hydrosphere)

2. Earth’s systems (geosphere, atmosphere, and hydrosphere) interact with one another as they undergo change by common processes			
Concept	Grade 3	Grade 4	Grade 5
A The Earth’s materials and surface features are changed through a variety of external processes		<i>Scope and Sequence – Changes in the Earth’s Surface</i> a. Observe and describe the breakdown of plant and animal material into soil through decomposition processes (i.e., decay, rotting, composting, digestion) b. Identify the major landforms on Earth (i.e., mountains, plains, oceans, river valleys, coastlines, canyons) c. Describe how weathering agents (e.g., water, chemicals, temperature, wind, plants) cause surface changes that create and/or change Earth’s surface materials and/or landforms d. Describe how erosional processes (i.e., action of gravity, waves, wind, rivers, glaciers) cause surface changes that create and/or change Earth’s surface materials and/or landforms	
B. There are internal processes and sources of energy within the geosphere that cause changes in Earth’s crustal plates		Not assessed at this level	
C. Continual changes in the Earth’s materials and surface that result from internal and external processes is described by the rock cycle		Not assessed at this level	
D. Changes in the Earth over time can be inferred through rock and fossil evidence		Not assessed at this level	

Strand 5: Processes and Interactions of the Earth’s Systems (Geosphere, Atmosphere, and Hydrosphere)

2. Earth’s Systems (geosphere, atmosphere, and hydrosphere) interact with one another as they undergo change by common processes			
Concept	Grade 3	Grade 4	Grade 5
<p>E. Changes in the form of water as it moves through Earth’s systems are described as the water cycle</p>	<p><i>Scope and Sequence – Investigating States of Matter</i> a. Describe clouds and precipitation as forms of water</p>		<p><i>Scope and Sequence – Water Cycle and Weather</i> a. Describe and trace the path of water as it cycles through the hydrosphere, geosphere, and atmosphere (i.e., the water cycle: evaporation, condensation, precipitation, surface run-off/ groundwater flow) b. Identify the different forms water can take (e.g., snow, rain, sleet, fog, clouds, dew) as it moves through the water cycle</p>
<p>F. Constantly changing properties of the atmosphere occur in patterns which are described as weather</p>			<p><i>Scope and Sequence – Water Cycle and Weather</i> a. Identify and use appropriate tools (i.e., thermometer, anemometer, wind vane, hygrometer, barometer, rain gauge, satellite images, weather maps) to collect weather data (i.e., temperature, wind speed and direction, relative humidity, air pressure, precipitation, cloud type and cover) b. Recognize and summarize relationships between weather data (e.g., temperature and time of day, cloud cover and temperature, wind direction and temperature) collected over a period of time</p>
<p>G. The geosphere, hydrosphere, and atmosphere are continually interacting through processes that transfer energy and Earth’s materials</p>	<p>Not assessed at this level</p>		

Strand 5: Processes and Interactions of the Earth’s Systems (Geosphere, Atmosphere, and Hydrosphere)

3. Human activity is dependent upon and affects Earth’s resources and systems			
Concept	Grade 3	Grade 4	Grade 5
<p>A. Earth’s materials are limited natural resources affected by human activity</p>		<p><i>Scope and Sequence – Changes in the Earth’s Surface</i></p> <p>a. Identify the ways humans affect the erosion and deposition of Earth’s materials (e.g., clearing of land, planting vegetation, paving land, construction of new buildings)</p> <p>b. Propose ways to solve simple environmental problems (e.g., recycling, composting, ways to decrease soil erosion) that result from human activity</p>	<p><i>Scope and Sequence – Water Cycle and Weather</i></p> <p>a. Explain how major bodies of water are important natural resources for human activity (e.g., food, recreation, habitat, irrigation, solvent, transportation)</p> <p>b. Describe how human needs and activities (e.g., irrigation, damming of rivers, waste treatment, sources of drinking water) have affected the quantity and quality of major bodies of fresh water</p> <p>c. Propose solutions to problems related to water quality and availability that result from human activity</p>

Strand 5: Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere, and Hydrosphere)

1. Earth's Systems (geosphere, atmosphere, and hydrosphere) have common components and unique structures			
Concept	Grade 6	Grade 7	Grade 8
A. The Earth's crust is composed of various materials, including soil, minerals, and rocks, with characteristic properties	<i>Scope and Sequence – Earth's Resources</i> a. 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)		<i>Scope and Sequence – Rock Cycle and Plate Tectonics</i> a. Differentiate between minerals and rocks (which are composed of different kinds of minerals) b. Describe the distinguishing properties that can be used to classify minerals (i.e., texture, smell, luster, hardness, crystal shape, streak, reaction to magnets and acids) c. Describe the methods used to identify the distinguishing properties of minerals d. Classify rocks as sedimentary, igneous, or metamorphic
B. The hydrosphere is composed of water (a material with unique properties), gases, and other materials	<i>Scope and Sequence – Earth's Resources</i> a. 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)		
C. The atmosphere (air) is composed of a mixture of gases, including water vapor, and minute particles		<i>Scope and Sequence – Weather and Climate</i> a. Describe the composition of the Earth's atmosphere (i.e., mixture of gases, water and minute particles) and how it circulates as air masses b. Describe the role atmosphere (e.g., clouds, ozone) plays in precipitation, reflecting and filtering light from the Sun, and trapping heat energy emitted from the Earth's surface	
D. Climate is a description of average weather conditions in a given area over time		<i>Scope and Sequence – Weather and Climate</i> a. Differentiate between weather and climate b. Identify factors that affect climate (e.g., latitude, altitude, prevailing wind currents, amount of solar radiation)	

Strand 5: Processes and Interactions of the Earth’s Systems (Geosphere, Atmosphere, and Hydrosphere)

2. Earth’s Systems (geosphere, atmosphere, and hydrosphere) interact with one another as they undergo change by common processes			
Concept	Grade 6	Grade 7	Grade 8
A. The Earth’s materials and surface features are changed through a variety of external processes	<p><i>Scope and Sequence – Internal Processes and External Events</i></p> <ul style="list-style-type: none"> a. Make inferences about the formation of sedimentary rocks from their physical properties (e.g., layering and the presence of fossils indicate sedimentation) b. Explain how the formation of sedimentary rocks depends on weathering and erosion c. 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 d. Describe how the Earth’s surface and surface materials can change abruptly through the activity of floods, rock/mudslides, or volcanoes 		
B. There are internal processes and sources of energy within the geosphere that cause changes in Earth’s crustal plates	<p><i>Scope and Sequence – Internal Processes and External Events</i></p> <ul style="list-style-type: none"> a. Identify events (earthquakes, volcanic eruptions) and the landforms created by them on the Earth’s surface that occur at different plate boundaries 		<p><i>Scope and Sequence – Rock Cycle and Plate Tectonics</i></p> <ul style="list-style-type: none"> a. Explain convection currents are the result of uneven heating inside the mantle resulting in the melting of rock materials, convection of magma, eruption/flow of magma, and movement of crustal plates b. Explain how rock layers are affected by the folding, breaking, and uplifting of rock layers due to plate motion c. Describe how the movement of crustal plates can cause earthquakes and volcanic eruptions that can result in mountain building and trench formation

Strand 5: Processes and Interactions of the Earth’s Systems (Geosphere, Atmosphere, and Hydrosphere)

2. Earth’s Systems (geosphere, atmosphere, and hydrosphere) interact with one another as they undergo change by common processes			
Concept	Grade 6	Grade 7	Grade 8
C. Continual changes in the Earth’s materials and surface that result from internal and external processes is described by the rock cycle			<i>Scope and Sequence – Rock Cycle and Plate Tectonics</i> a. Explain how heating and cooling in the mantle layer leads to the formation of metamorphic rocks and some igneous rocks b. Make inferences about the formation of igneous and metamorphic rocks from their physical properties (e.g., crystal size indicates rate of cooling, air pockets or glassy texture indicate volcanic activity) c. Explain and diagram the external and internal processes of the rock cycle (e.g., weathering and erosion, sedimentation, compaction, heating, recrystallization, resurfacing due to forces that drive plate motion)
D. Changes in the Earth over time can be inferred through rock and fossil evidence	<i>Scope and Sequence – Internal Processes and External Events</i> a. Explain the types of fossils and the processes by which they are formed (i.e., replacement, mold and cast, preservation, trace) b. 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)		<i>Scope and Sequence – Rock Cycle and Plate Tectonics</i> a. Describe the methods used to estimate geologic time and the age of the Earth (e.g., techniques used to date rocks and rock layers, presence of fossils) b. Use rock and fossil evidence to make inferences about the age, history, and changing life forms and environment of the Earth (i.e., changes in successive layers of sedimentary rock and the fossils contained within them, similarities between fossils in different geographic locations, similarities between fossils and organisms present today, fossils of organisms indicating changes in climate, fossils of extinct organisms)
E. Changes in the form of water as it moves through Earth’s systems are described as the water cycle		<i>Scope and Sequence – Weather and Climate</i> a. Explain and trace the possible paths of water through the hydrosphere, geosphere, and atmosphere (i.e., the water cycle: evaporation, condensation, precipitation, surface run-off/ groundwater flow) b. Relate the different forms water can take (i.e., snow, rain, sleet, fog, clouds, dew, humidity) as it moves through the water cycle to atmospheric conditions (i.e., temperature, pressure, wind direction and speed, humidity) at a given geographic location c. Explain how thermal energy is transferred throughout the water cycle by the processes of convection, conduction, and radiation	

Strand 5: Processes and Interactions of the Earth’s Systems (Geosphere, Atmosphere, and Hydrosphere)

2. Earth’s Systems (geosphere, atmosphere, and hydrosphere) interact with one another as they undergo change by common processes			
Concept	Grade 6	Grade 7	Grade 8
<p style="text-align: center;">F.</p> <p>Constantly changing properties of the atmosphere occur in patterns which are described as weather</p>		<p><i>Scope and Sequence – Weather and Climate</i></p> <ul style="list-style-type: none"> a. Explain how the differences in surface temperature, due to the different heating and cooling rates of water and soil, affect the temperature and movement of the air above b. Recognize the characteristics of air masses (i.e., high/low barometric pressure, temperature) and predict their effect on the weather in a given location c. Identify weather conditions associated with cold fronts and warm fronts d. Identify factors that affect weather patterns in a particular region (e.g., proximity to large bodies of water, latitude, altitude, prevailing wind currents, amount of solar radiation, location with respect to mountain ranges) e. Collect and interpret weather data (e.g., cloud cover, precipitation, wind speed and direction) from weather instruments and maps to explain present day weather and to predict the next day’s weather f. Recognize significant changes in temperature and barometric pressure may cause dramatic weather phenomena (i.e., severe thunderstorms, tornadoes, hurricanes) 	
<p style="text-align: center;">G.</p> <p>The geosphere, hydrosphere, and atmosphere are continually interacting through processes that transfer energy and Earth’s materials</p>	<p>Not assessed at this level</p>		

Strand 5: Processes and Interactions of the Earth’s Systems (Geosphere, Atmosphere, and Hydrosphere)

3. Human activity is dependent upon and affects Earth’s resources and systems			
Concept	Grade 6	Grade 7	Grade 8
<p>A. Earth’s materials are limited natural resources affected by human activity</p>	<p><i>Scope and Sequence – Earth’s Resources</i></p> <ul style="list-style-type: none"> a. 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 b. Describe the affect of human activities (e.g., landfills, use of fertilizers and herbicides, farming, septic systems) on the quality of water <p><i>Scope and Sequence – Internal Processes and External Events</i></p> <ul style="list-style-type: none"> c. 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) 	<p><i>Scope and Sequence – Energy Transformations</i></p> <ul style="list-style-type: none"> a. Distinguish between renewable (e.g., geothermal, hydroelectric) and nonrenewable (e.g., fossil fuel) energy sources <p><i>Scope and Sequence – Weather and Climate</i></p> <ul style="list-style-type: none"> b. Provide examples of how the availability of fresh water for humans and other living organisms is dependent upon the water cycle 	

Strand 5: Processes and Interactions of the Earth’s Systems (Geosphere, Atmosphere, and Hydrosphere)

1. Earth’s Systems (geosphere, atmosphere, and hydrosphere) have common components and unique structures	
Concept	Grade 9, 10, 11
<p style="text-align: center;">A.</p> <p>The Earth’s crust is composed of various materials, including soil, minerals, and rocks, with characteristic properties</p>	<p>Not assessed at this level</p>
<p style="text-align: center;">B.</p> <p>The hydrosphere is composed of water (a material with unique properties) and other materials</p>	<p><i>Scope and Sequence – Components and Structure of Earth’s Systems</i></p> <p>a. Recognize the importance of water as a solvent in the environment as it relates to karst topography (cave formation), acid rain, and water pollution</p>
<p style="text-align: center;">C.</p> <p>The atmosphere (air) is composed of a mixture of gases, including water vapor, and minute particles</p>	<p><i>Scope and Sequence – Components and Structure of Earth’s Systems</i></p> <p>a. Relate the composition of gases and temperature of the layers of the atmosphere (i.e., troposphere, stratosphere, ionosphere) to cloud formation and transmission of radiation (e.g., ultraviolet, infrared)</p> <p>b. Describe the causes and consequences of observed and predicted changes in the ozone layer</p>
<p style="text-align: center;">D.</p> <p>Climate is a description of average weather conditions in a given area over time</p>	<p><i>Scope and Sequence – Components and Structure of Earth’s Systems</i></p> <p>a. Provide evidence (e.g., melting glaciers, fossils, desertification) that supports theories of climate change due to natural phenomena and/or human interactions</p> <p>b. Explain how climate and weather patterns in a particular region are affected by factors, such as proximity to large bodies of water or ice/ocean currents, latitude, altitude, prevailing wind currents, and amount of solar radiation</p>

Strand 5: Processes and Interactions of the Earth’s Systems (Geosphere, Atmosphere, and Hydrosphere)

2. Earth’s Systems (geosphere, atmosphere, and hydrosphere) interact with one another as they undergo change by common processes	
Concept	Grade 9, 10, 11
<p>A. The Earth’s materials and surface features are changed through a variety of external processes</p>	<p><i>Scope and Sequence – Interactions among Earth’s Systems and Processes of Change</i></p> <ul style="list-style-type: none"> a. Explain the external processes (i.e., weathering, erosion, deposition of sediment) that result in the formation and modification of landforms b. Describe the factors that affect rates of weathering and erosion of landforms (e.g., soil/rock type, amount and force of run-off, slope)
<p>B. There are internal processes and sources of energy within the geosphere that cause changes in Earth’s crustal plates</p>	<p><i>Scope and Sequence – Interactions among Earth’s Systems and Processes of Change</i></p> <ul style="list-style-type: none"> a. Describe the internal source of energy on Earth that results in uneven heating of the mantle (i.e., decay of radioactive isotopes) b. Illustrate and explain the convection currents that result from the uneven heating inside the mantle and cause movement of crustal plates c. Describe how the energy of an earthquake travels as seismic waves and provides evidence for the layers of the geosphere d. Relate the densities of the materials found in continental and oceanic plates to the processes that result in each type of plate boundary (i.e., diverging, converging, transform) e. Describe the effects of the movement of crustal plates (i.e., earthquakes, sea floor spreading, mountain building, volcanic eruptions) at a given location on the planet f. Articulate the processes involved in the Theory of Plate Tectonics (i.e., uneven heating of the mantle due to the decay of radioactive isotopes, movement of materials via convection currents, movement of continental and oceanic plates along diverging, converging, or transform plate boundaries) and describe evidence that supports that theory (e.g., correlation of rock sequences, landforms, and fossils; presence of intrusions and faults; evidence of sea-floor spreading)
<p>C. Continual changes in the Earth’s materials and surface that result from internal and external processes is described by the rock cycle</p>	<p>Not assessed at this level</p>
<p>D. Changes in the Earth over time can be inferred through rock and fossil evidence</p>	<p><i>Scope and Sequence – Interactions among Earth’s Systems and Processes of Change</i></p> <ul style="list-style-type: none"> a. Use evidence from relative and real dating techniques (e.g., correlation of trace fossils, landforms, and rock sequences; evidence of climate changes; presence of intrusions and faults; magnetic orientation; relative age of drill samples)) to infer geologic history
<p>E. Changes in the form of water as it moves through Earth’s systems are described as the water cycle</p>	<p>Not assessed at this level</p>

Strand 5: Processes and Interactions of the Earth’s Systems (Geosphere, Atmosphere, and Hydrosphere)

2. Earth’s Systems (geosphere, atmosphere, and hydrosphere) interact with one another as they undergo change by common processes	
Concept	Grade 9, 10, 11
<p>F. Constantly changing properties of the atmosphere occur in patterns which are described as weather</p>	<p><i>Scope and Sequence – Interactions among Earth’s Systems and Processes of Change</i></p> <ul style="list-style-type: none"> a. Predict the weather at a designated location using weather maps (including map legends) and/or weather data (e.g., temperature, barometric pressure, cloud cover and type, wind speed and direction, precipitation) b. Discover and evaluate patterns and relationships in the causes of weather phenomena and regional climates (e.g., circulation of air and water around the Earth, movement of global winds and water cycles due to solar radiation)
<p>G. The geosphere, hydrosphere, and atmosphere are continually interacting through processes that transfer energy and Earth’s materials</p>	<p><i>Scope and Sequence – Interactions among Earth’s Systems and Processes of Change</i></p> <ul style="list-style-type: none"> a. Explain how global wind and ocean currents are produced on the Earth’s surface (e.g., effects of unequal heating of the Earth’s land masses, oceans, and air by the Sun due to latitude and surface material type; effects of gravitational forces acting on layers of air of different densities due to temperature differences; effects of the rotation of the Earth; effects of surface topography) b. Describe the effects of natural phenomena (e.g., burning organic material, volcanic eruptions, lightning, changes in global wind and ocean currents) on the properties of the atmosphere

3. Human activity is dependent upon and affects Earth’s resources and systems	
Concept	Grade 9, 10, 11
<p>A. Earth’s materials are limited natural resources affected by human activity</p>	<p><i>Scope and Sequence – Effect of Human Activity on Earth’s Resources</i></p> <ul style="list-style-type: none"> a. Distinguish between renewable and nonrenewable energy resources b. Recognize the finite availability of fresh water for use by living organisms c. Identify human activities that adversely affect the composition of the atmosphere, hydrosphere, or geosphere d. Predict the effect of change on the other sphere when given a scenario describing how the composition of the atmosphere, hydrosphere, or geosphere is altered e. Recognize how the geomorphology of Missouri (i.e., different types of Missouri soil and rock materials such as limestone, granite, clay, loam; land formations such as karst (cave) formations, glaciated plains, river channels) affects the development of land use (e.g., agriculture, recreation, planning and zoning, waste management) f. Recognize the limited availability of major mineral deposits in the United States (e.g., lead, petroleum, coal, copper, zinc, iron, gravel, aluminum) and the factors that affect their availability g. Recognize the economic, political, social, and ethical constraints associated with obtaining and using natural resources (e.g., mining and use of different types of Missouri mineral resources such as lead mining, gravel dredging, strip mining, coal burning, production of fertilizers and explosives; use of fossil fuels versus renewable resources) (Assess Locally)

Strand 6: Composition and Structure of the Universe and the Motion of the Objects Within It

1. The universe has observable properties and structure			
Concept	Kindergarten	Grade 1	Grade 2
A. The Earth, Sun, and moon are part of a larger system that includes other planets and smaller celestial bodies	<i>Scope and Sequence – Objects in the Sky</i> a. Observe and describe the presence of the Sun, moon, and stars in the sky b. Recognize there are more stars in the sky than anyone can easily count, but they are not scattered evenly and vary in brightness		
B. The Earth has a composition and location suitable to sustain life	Not assessed at this level		
C. Most of the information we know about the universe comes from the electromagnetic spectrum	Not assessed at this level		

Strand 6: Composition and Structure of the Universe and the Motion of the Objects Within It

2. Regular and predictable motions of objects in the universe can be described and explained as the result of gravitational forces			
Concept	Kindergarten	Grade 1	Grade 2
A. The apparent position of the Sun and other stars, as seen from Earth, changes in observable patterns	<i>Scope and Sequence – Objects in the Sky</i> a. Describe the Sun as only being seen in the daytime b. Recognize the Sun appears to move across the sky from morning to night		
B. The apparent position of the moon, as seen from Earth, and its actual position relative to Earth change in observable patterns	<i>Scope and Sequence – Objects in the Sky</i> a. Observe the moon can be seen sometimes at night and sometimes during the daytime b. Recognize the moon appears to change shape over the course of a month		
C. The regular and predictable motions of the Earth and moon relative to the Sun explain natural phenomena on Earth, such as day, month, year, shadows, moon phases, eclipses, tides, and seasons	<i>Scope and Sequence – Weather and Seasons</i> a. Observe and describe the characteristics of the four seasons as they cycle through the year (summer, fall, winter, spring)		
D. Gravity is a force of attraction between objects in the solar system that governs their motion	Not assessed at this level		

Strand 6: Composition and Structure of the Universe and the Motion of the Objects Within It

1. The universe has observable properties and structure			
Concept	Grade 3	Grade 4	Grade 5
A. The Earth, Sun, and moon are part of a larger system that includes other planets and smaller celestial bodies	<i>Scope and Sequence – Earth, Sun, and Moon</i> a. Describe our Sun as a star because it provides light energy to the solar system b. Recognize the moon is a reflector of light		<i>Scope and Sequence – Solar System</i> a. Recognize the Earth is one of several planets within a solar system that orbits the Sun b. Recognize the moon orbits the Earth c. Recognize planets look like stars and appear to move across the sky among the stars
B. The Earth has a composition and location suitable to sustain life			<i>Scope and Sequence – Solar System</i> a. Describe physical features of the planet Earth that allows life to exist (e.g., air, water, temperature) and compare these to the physical features of the Sun, the moon, and other planets
C. Most of the information we know about the universe comes from the electromagnetic spectrum	Not assessed at this level		

Strand 6: Composition and Structure of the Universe and the Motion of the Objects Within It

2. Regular and predictable motions of objects in the universe can be described and explained as the result of gravitational forces			
Concept	Grade 3	Grade 4	Grade 5
<p>A. The apparent position of the Sun and other stars, as seen from Earth, change in observable patterns</p>	<p><i>Scope and Sequence – Earth, Sun, and Moon</i> a. Illustrate and describe how the Sun appears to move slowly across the sky from east to west during the day</p>		
<p>B. The apparent position of the moon, as seen from Earth, and its actual position relative to Earth change in observable patterns</p>	<p><i>Scope and Sequence – Earth, Sun, and Moon</i> a. Illustrate and describe how the moon appears to move slowly across the sky from east to west during the day and/or night b. Observe the change in the moon's appearance relative to time of day and month over several months and note the pattern in this change</p>		<p><i>Scope and Sequence – Solar System</i> a. Sequence images of the lit portion of the moon seen from Earth as it cycles day-to-day in about a month in order of occurrence (Do NOT assess cause of moon phases)</p>
<p>C. The regular and predictable motions of the Earth and moon relative to the Sun explain natural phenomena on Earth, such as day, month, year, shadows, moon phases, eclipses, tides, and seasons</p>	<p><i>Scope and Sequence – Earth, Sun, and Moon</i> a. Recognize there is a day/night cycle every 24 hours b. Describe the changes in length and position (direction) of shadows from morning to midday to afternoon c. Describe how the Sun's position in the sky changes the length and position of shadows</p>		<p><i>Scope and Sequence – Solar System</i> a. Recognize the Earth rotates once every 24 hours b. Relate changes in the length and position of a shadow to the time of day and apparent position of the Sun in the sky, as determined by Earth's rotation c. Relate the apparent motion of the Sun, moon, and stars in the sky to the rotation of the Earth (Do not assess apparent motion of polar constellations)</p>
<p>D. Gravity is a force of attraction between objects in the solar system that governs their motion</p>	<p>Not assessed at this level</p>		

Strand 6: Composition and Structure of the Universe and the Motion of the Objects Within It

1. The universe has observable properties and structure			
Concept	Grade 6	Grade 7	Grade 8
A. The Earth, Sun, and moon are part of a larger system that includes other planets and smaller celestial bodies		<p><i>Scope and Sequence – Objects and Their Motion in the Solar System</i></p> <ul style="list-style-type: none"> a. Classify celestial bodies in the solar system into categories: Sun, moon, planets, and other small bodies (i.e., asteroids, comets, meteors), based on physical properties b. Compare and contrast the size, composition, atmosphere, and surface of the planets (inner vs. outer) in our solar system and Earth's moon c. Identify the relative proximity of common celestial bodies (i.e., Sun, moon, planets, smaller celestial bodies such as comets and meteors, other stars) in the sky to the Earth 	
B. The Earth has a composition and location suitable to sustain life		<p><i>Scope and Sequence – Objects and Their Motion in the Solar System</i></p> <ul style="list-style-type: none"> a. Describe how the Earth's placement in the solar system is favorable to sustain life (i.e., distance from the Sun, temperature, atmosphere) b. Compare and contrast the characteristics of Earth that support life with the characteristics of other planets that are considered favorable or unfavorable to life (e.g., atmospheric gases, extremely high/low temperatures) 	
C. Most of the information we know about the universe comes from the electromagnetic spectrum		<p><i>Scope and Sequence – Objects and Their Motion in the Solar System</i></p> <ul style="list-style-type: none"> a. Recognize stars are separated from one another by vast and different distances, which causes stars to appear smaller than the Sun b. Compare the distance light travels from the Sun to Earth to the distance light travels from other stars to Earth using light years 	

Strand 6: Composition and Structure of the Universe and the Motion of the Objects Within It

2. Regular and predictable motions of objects in the universe can be described and explained as the result of gravitational forces			
Concept	Grade 6	Grade 7	Grade 8
<p>A. The apparent position of the Sun and other stars, as seen from Earth, change in observable patterns</p>		<p><i>Scope and Sequence – Objects and Their Motion in the Solar System</i></p> <ol style="list-style-type: none"> a. Relate the apparent east-to-west changes in the positions of the Sun, other stars, and planets in the sky over the course of a day to Earth's counterclockwise rotation about its axis b. Describe the pattern that can be observed in the changes in number of hours of visible sunlight, and the time and location of sunrise and sunset, throughout the year c. Recognize, in the Northern Hemisphere, the Sun appears lower in the sky during the winter and higher in the sky during the summer d. Recognize, in winter, the Sun appears to rise in the Southeast and set in the Southwest, accounting for a relatively short day length, and, in summer, the Sun appears to rise in the Northeast and set in the Northwest, accounting for a relatively long day length e. Recognize the Sun is never directly overhead when observed from North America 	
<p>B. The apparent position of the moon, as seen from Earth, and its actual position relative to Earth change in observable patterns</p>		<p><i>Scope and Sequence – Objects and Their Motion in the Solar System</i></p> <ol style="list-style-type: none"> a. Observe the change in time and location of moon rise, moon set, and the moon's appearance relative to time of day and month over several months, and note the pattern in this change b. Recognize the moon rises later each day due to its revolution around the Earth in a counterclockwise direction c. Recognize the Moon is in the sky for roughly 12 hours in a 24-hour period (i.e., if the Moon rises at about 6 P.M., it will set at about 6 A.M.) d. Recognize that one half of the Moon is always facing the Sun and, therefore, one half of the Moon is always lit e. Relate the apparent change in the moon's position in the sky as it appears to move east-to-west over the course of a day to Earth's counterclockwise rotation about its axis f. Describe how the appearance of the moon that can be seen from Earth changes approximately every 28 days in an observable pattern (moon phases) 	

Strand 6: Composition and Structure of the Universe and the Motion of the Objects Within It

2. Regular and predictable motions of objects in the universe can be described and explained as the result of gravitational forces			
Concept	Grade 6	Grade 7	Grade 8
<p style="text-align: center;">C.</p> <p>The regular and predictable motions of a planet and moon relative to the Sun explain natural phenomena on a planet, such as day, month, year, shadows, moon phases, eclipses, tides, and seasons</p>		<p><i>Scope and Sequence – Objects and Their Motion in the Solar System</i></p> <ul style="list-style-type: none"> a. Illustrate and explain a day as the time it takes a planet to make a full rotation about its axis b. Diagram the path (orbital ellipse) the Earth travels as it revolves around the Sun c. Illustrate and explain a year as the time it takes a planet to revolve around the Sun d. Explain the relationships between a planet's length of year (period of revolution) and its position in the solar system e. Describe how the moon's relative position changes as it revolves around the Earth f. Recognize the phases of the moon are due to the relative positions of the Moon with respect to the Earth and Sun g. Relate the axial tilt and orbital position of the Earth as it revolves around the Sun to the intensity of sunlight falling on different parts of the Earth during different seasons 	
<p style="text-align: center;">D.</p> <p>Gravity is a force of attraction between objects in the solar system that governs their motion</p>		<p><i>Scope and Sequence -- Objects and Their Motion in the Solar System</i></p> <ul style="list-style-type: none"> a. Describe how the Earth's gravity pulls any object on or near the Earth toward it (including natural and artificial satellites) b. Describe how the planets' gravitational pull keeps satellites and moons in orbit around them c. Describe how the Sun's gravitational pull holds the Earth and other planets in their orbits 	

Strand 6: Composition and Structure of the Universe and the Motion of the Objects Within It

1. The universe has observable properties and structure	
Concept	Grade 9, 10, 11
<p>A. The Earth, Sun, and moon are part of a larger system that includes other planets and smaller celestial bodies</p>	<p><i>Scope and Sequence – Objects in the Universe and Their Motion</i></p> <p>a. Describe and relate the positions and motions of the Sun-Earth solar system, the Milky-Way galaxy, and other galaxies within the universe (i.e., it is just one of several solar systems orbiting the center of a rotating spiral galaxy; that spiral galaxy is just one of many galaxies which orbit a common center of gravity; the expanding universe causes the distance between galaxies to increase)</p>
<p>B. The Earth has a composition and location suitable to sustain life</p>	<p><i>Scope and Sequence – Objects in the Universe and Their Motion</i></p> <p>a. Explain how Earth's environmental characteristics and location in the universe (e.g., atmosphere, temperature, orbital path, magnetic field, mass-gravity, location in solar system) provide a life-supporting environment</p> <p>b. Compare the environmental characteristics and location in the universe of Earth and other celestial bodies (e.g., planets, moons) to determine ability to support life</p>
<p>C. Most of the information we know about the universe comes from the electromagnetic spectrum</p>	<p><i>Scope and Sequence – Objects in the Universe and Their Motion</i></p> <p>a. Identify information that the electromagnetic spectrum provides about the stars and the universe (e.g., chemical composition, temperature, age of stars, location of black holes, motion of celestial bodies)</p> <p>b. Evaluate the advantages/disadvantages of using different tools (e.g., spectroscope, different types of telescopes, probes) to gather information about the universe (e.g., background radiation, magnetic fields, discovery of previously unknown celestial bodies)</p>

Strand 6: Composition and Structure of the Universe and the Motion of the Objects Within It

2. Regular and predictable motions of objects in the universe can be described and explained as the result of gravitational forces	
Concept	Grade 9, 10, 11
<p style="text-align: center;">A.</p> <p>The apparent position of the Sun and other stars, as seen from Earth, change in observable patterns</p>	<p>Not assessed at this level</p>
<p style="text-align: center;">B.</p> <p>The apparent position of the moon, as seen from Earth, and its actual position relative to Earth change in observable patterns</p>	<p>Not assessed at this level</p>
<p style="text-align: center;">C.</p> <p>The regular and predictable motions of a planet and moon relative to the Sun explain natural phenomena, such as day, month, year, shadows, moon phases, eclipses, tides, and seasons</p>	<p><i>Scope and Sequence – Objects in the Universe and Their Motion</i></p> <ul style="list-style-type: none"> a. Relate units of time (i.e., day, month, year) to the regular and predictable motion of the planets and moons and their positions in the Solar system b. Explain seasonal phenomena (i.e., weather, length of day, temperature, intensity of sunlight) as a consequence of a planet's axial tilt as it rotates and a planet's orbital position as it revolves around the Sun c. Provide evidence that can be observed from Earth that supports the fact Earth rotates on its axis and revolves around the Sun d. Predict the moon rise/set times, phases of the moon, and/or eclipses when given the relative positions of the moon, planet, and Sun e. Explain how the gravitational forces, due to the relative positions of a planet, moon, and Sun, determine the height and frequency of tides
<p style="text-align: center;">D.</p> <p>Gravity is a force of attraction between objects in the solar system that governs their motion</p>	<p><i>Scope and Sequence – Objects in the Universe and Their Motion</i></p> <ul style="list-style-type: none"> a. Explain orbital motions of moons around planets, and planets around the Sun, as the result of gravitational forces between those objects

Strand 7: Scientific Inquiry

1. Science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning, and critical thinking			
Concept	Kindergarten	Grade 1	Grade 2
A. Scientific inquiry includes the ability of students to formulate a testable question and explanation, and to select appropriate investigative methods in order to obtain evidence relevant to the explanation	<i>Scope and Sequence - All Units</i> a. Pose questions about objects, materials, organisms and events in the environment b. Conduct a simple investigation (fair test) to answer a question	<i>Scope and Sequence - All Units</i> a. Pose questions about objects, materials, organisms, and events in the environment b. Plan and conduct a simple investigation (fair test) to answer a question	<i>Scope and Sequence - All Units</i> a. Pose questions about objects, materials, organisms and events in the environment b. Plan and conduct a simple investigation (fair test) to answer a question
B. Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations	<i>Scope and Sequence - All Units</i> a. Make qualitative observations using the five senses b. Make observations using simple tools and equipment (e.g., magnifiers/hand lenses, magnets, equal arm balances, thermometers) c. Measure length and mass using non-standard units d. Compare amounts/measurements	<i>Scope and Sequence - All Units</i> a. Make qualitative observations using the five senses b. Make observations using simple tools and equipment (e.g., magnifiers/hand lenses, magnets, equal arm balances, thermometers) c. Measure length, mass, and temperature using standard and non-standard units d. Compare amounts/measurements	<i>Scope and Sequence - All Units</i> a. Make qualitative observations using the five senses b. Make observations using simple tools and equipment (e.g., magnifiers/hand lenses, magnets, equal arm balances, thermometers) c. Measure length, mass, and temperature using standard and non-standard units d. Compare amounts/measurements
C. Evidence is used to formulate explanations	<i>Scope and Sequence - All Units</i> a. Use observations as support for reasonable explanations b. Use observations to describe relationships and patterns and to make predictions to be tested	<i>Scope and Sequence - All Units</i> a. Use observations as support for reasonable explanations b. Use observations to describe relationships and patterns and to make predictions to be tested	<i>Scope and Sequence - All Units</i> a. Use observations as support for reasonable explanations b. Use observations to describe relationships and patterns and to make predictions to be tested
D. Scientific inquiry includes evaluation of explanations (hypotheses, laws, theories) in light of scientific principles (understandings)	<i>Scope and Sequence - All Units</i> a. Compare explanations with prior knowledge	<i>Scope and Sequence - All Units</i> a. Compare explanations with prior knowledge	<i>Scope and Sequence - All Units</i> a. Compare explanations with prior knowledge

Strand 7: Scientific Inquiry

1. Science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning, and critical thinking			
Concept	Kindergarten	Grade 1	Grade 2
E. The nature of science relies upon communication of results and justification of explanations	<i>Scope and Sequence - All Units</i> a. Communicate observations using words, pictures, and numbers	<i>Scope and Sequence - All Units</i> a. Communicate simple procedures and results of investigations and explanations through: oral presentations drawings and maps data tables graphs (bar, pictograph) writings	<i>Scope and Sequence - All Units</i> a. Communicate simple procedures and results of investigations and explanations through: oral presentations drawings and maps data tables graphs (bar, pictograph) writings

Refer to Missouri Department of Elementary and Secondary Education for materials that articulate standards for data recording and template for experimental design

Strand 7: Scientific Inquiry

1. Science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning, and critical thinking			
Concept	Grade 3	Grade 4	Grade 5
A. Scientific inquiry includes the ability of students to formulate a testable question and explanation, and to select appropriate investigative methods in order to obtain evidence relevant to the explanation	<i>Scope and Sequence - All Units</i> a. Pose questions about objects, materials, organisms, and events in the environment b. Plan and conduct a fair test to answer a question	<i>Scope and Sequence - All Units</i> a. Formulate testable questions and explanations (hypotheses) b. Recognize the characteristics of a fair and unbiased test c. Conduct a fair test to answer a question	<i>Scope and Sequence - All Units</i> a. Formulate testable questions and explanations (hypotheses) b. Recognize the characteristics of a fair and unbiased test c. Conduct a fair test to answer a question d. Make suggestions for reasonable improvements or extensions of a fair test
B. Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations	<i>Scope and Sequence - All Units</i> a. Make qualitative observations using the five senses b. Make observations using simple tools and equipment (e.g., hand lenses, magnets, thermometers, metric rulers, balances, graduated cylinders) c. Measure length to the nearest centimeter, mass using grams, temperature using degrees Celsius, volume using liters d. Compare amounts/measurements e. Judge whether measurements and computation of quantities are reasonable	<i>Scope and Sequence - All Units</i> a. Make qualitative observations using the five senses b. Make observations using simple tools and equipment (e.g., hand lenses, magnets, thermometers, metric rulers, balances, graduated cylinders, spring scale) c. Measure length to the nearest centimeter, mass using grams, temperature using degrees Celsius, volume to the nearest milliliter, weight to the nearest Newton d. Compare amounts/measurements e. Judge whether measurements and computation of quantities are reasonable	<i>Scope and Sequence - All Units</i> a. Make qualitative observations using the five senses b. Determine the appropriate tools and techniques to collect data c. Use a variety of tools and equipment to gather data (e.g., hand lenses, magnets, thermometers, metric rulers, balances, graduated cylinders, spring scales) d. Measure length to the nearest centimeter, mass to the nearest gram, volume to the nearest milliliter, temperature to the nearest degree Celsius, weight to the nearest Newton e. Compare amounts/measurements f. Judge whether measurements and computation of quantities are reasonable
C. Evidence is used to formulate explanations	<i>Scope and Sequence - All Units</i> a. Use quantitative and qualitative data as support for reasonable explanations b. Use data as support for observed patterns and relationships, and to make predictions to be tested	<i>Scope and Sequence - All Units</i> a. Use quantitative and qualitative data as support for reasonable explanations b. Use data as support for observed patterns and relationships, and to make predictions to be tested	<i>Scope and Sequence - All Units</i> a. Use quantitative and qualitative data as support for reasonable explanations b. Use data as support for observed patterns and relationships, and to make predictions to be tested

Strand 7: Scientific Inquiry

1. Science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning, and critical thinking			
Concept	Grade 3	Grade 4	Grade 5
<p style="text-align: center;">D.</p> <p>Scientific inquiry includes evaluation of explanations (hypotheses, laws, theories) in light of scientific principles (understandings)</p>	<p><i>Scope and Sequence - All Units</i></p> <p>a. Evaluate the reasonableness of an explanation</p> <p>b. Analyze whether evidence supports proposed explanations</p>	<p><i>Scope and Sequence - All Units</i></p> <p>a. Evaluate the reasonableness of an explanation</p> <p>b. Analyze whether evidence supports proposed explanations</p>	<p><i>Scope and Sequence - All Units</i></p> <p>a. Evaluate the reasonableness of an explanation</p> <p>b. Analyze whether evidence and scientific principles support proposed explanations</p>
<p style="text-align: center;">E.</p> <p>The nature of science relies upon communication of results and justification of explanations</p>	<p><i>Scope and Sequence - All Units</i></p> <p>a. Communicate simple procedures and results of investigations and explanations through: oral presentations drawings and maps data tables graphs (bar, single line, pictograph) writings</p>	<p><i>Scope and Sequence - All Units</i></p> <p>a. Communicate the procedures and results of investigations and explanations through: oral presentations drawings and maps data tables graphs (bar, single line, pictograph) writings</p>	<p><i>Scope and Sequence - All Units</i></p> <p>a. Communicate the procedures and results of investigations and explanations through: oral presentations drawings and maps data tables graphs (bar, single line, pictograph) writings</p>

Refer to Missouri Department of Elementary and Secondary Education for materials that articulate standards for data recording and template for experimental design

Strand 7: Scientific Inquiry

1. Science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning, and critical thinking			
Concept	Grade 6	Grade 7	Grade 8
<p style="text-align: center;">A.</p> <p>Scientific inquiry includes the ability of students to formulate a testable question and explanation, and to select appropriate investigative methods in order to obtain evidence relevant to the explanation</p>	<p><i>Scope and Sequence - All Units</i></p> <ul style="list-style-type: none"> a. Formulate testable questions and hypotheses b. Recognize the importance of the independent variable, dependent variables, control of constants, and multiple trials to the design of a valid experiment c. Design and conduct a valid experiment d. Evaluate the design of an experiment and make suggestions for reasonable improvements or extensions of an experiment e. 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) 	<p><i>Scope and Sequence - All Units</i></p> <ul style="list-style-type: none"> a. Formulate testable questions and hypotheses b. Recognize the importance of the independent variable, dependent variables, control of constants, and multiple trials to the design of a valid experiment c. Design and conduct a valid experiment d. Evaluate the design of an experiment and make suggestions for reasonable improvements or extensions of an experiment e. Recognize that 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) f. Acknowledge there is no fixed procedure called "the scientific method", but some investigations involve systematic observations, carefully collected and relevant evidence, logical reasoning, and imagination in developing hypotheses and other explanations 	<p><i>Scope and Sequence - All Units</i></p> <ul style="list-style-type: none"> a. Formulate testable questions and hypotheses b. Recognize the importance of the independent variable, dependent variables, control of constants, and multiple trials to the design of a valid experiment c. Design and conduct a valid experiment d. Evaluate the design of an experiment and make suggestions for reasonable improvements or extensions of an experiment e. Recognize that 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) f. Acknowledge there is no fixed procedure called "the scientific method", but some investigations involve systematic observations, carefully collected and relevant evidence, logical reasoning, and imagination in developing hypotheses and other explanations
<p style="text-align: center;">B.</p> <p>Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations</p>	<p><i>Scope and Sequence - All Units</i></p> <ul style="list-style-type: none"> a. Make qualitative observations using the five senses b. Determine the appropriate tools and techniques to collect data c. Use a variety of tools and equipment to gather data (e.g., microscopes, thermometers, computers, spring scales, balances, magnets, metric rulers, graduated cylinders, stopwatches) d. 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 e. Compare amounts/measurements f. Judge whether measurements and computation of quantities are reasonable 	<p><i>Scope and Sequence - All Units</i></p> <ul style="list-style-type: none"> a. Make qualitative observations using the five senses b. Determine the appropriate tools and techniques to collect data c. Use a variety of tools and equipment to gather data (e.g., microscopes, thermometers, analog and digital meters, computers, spring scales, balances, metric rulers, graduated cylinders, stopwatches) d. Measure length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, force (weight) to the nearest Newton, temperature to the nearest degree Celsius, time to the nearest second e. Compare amounts/measurements f. Judge whether measurements and computation of quantities are reasonable g. Calculate the range and average/mean of a set of data 	<p><i>Scope and Sequence - All Units</i></p> <ul style="list-style-type: none"> a. Make qualitative observations using the five senses b. Determine the appropriate tools and techniques to collect data c. Use a variety of tools and equipment to gather data (e.g., microscopes, thermometers, analog and digital meters, computers, spring scales, balances, metric rulers, graduated cylinders, stopwatches) d. Measure length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, force (weight) to the nearest Newton, temperature to the nearest degree Celsius, time to the nearest second e. Compare amounts/measurements f. Judge whether measurements and computation of quantities are reasonable g. Calculate the range and average/mean of a set of data

Strand 7: Scientific Inquiry

1. Science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning, and critical thinking			
Concept	Grade 6	Grade 7	Grade 8
C. Evidence is used to formulate explanations	<i>Scope and Sequence - All Units</i> a. Use quantitative and qualitative data as support for reasonable explanations (conclusions) b. Use data as support for observed patterns and relationships, and to make predictions to be tested c. Recognize the possible effects of errors in observations, measurements, and calculations on the formulation of explanations (conclusions)	<i>Scope and Sequence - All Units</i> a. Use quantitative and qualitative data as support for reasonable explanations (conclusions) b. Use data as support for observed patterns and relationships, and to make predictions to be tested c. Recognize the possible effects of errors in observations, measurements, and calculations on the formulation of explanations (conclusions)	<i>Scope and Sequence - All Units</i> a. Use quantitative and qualitative data as support for reasonable explanations (conclusions) b. Use data as support for observed patterns and relationships, and to make predictions to be tested c. Recognize the possible effects of errors in observations, measurements, and calculations on the formulation of explanations (conclusions)
D. Scientific inquiry includes evaluation of explanations (hypotheses, laws, theories) in light of scientific principles (understandings)	<i>Scope and Sequence - All Units</i> a. Evaluate the reasonableness of an explanation (conclusion) b. Analyze whether evidence (data) and scientific principles support proposed explanations (hypotheses, laws, theories)	<i>Scope and Sequence - All Units</i> a. Evaluate the reasonableness of an explanation (conclusion) b. Analyze whether evidence (data) and scientific principles support proposed explanations (hypotheses, laws, theories)	<i>Scope and Sequence - All Units</i> a. Evaluate the reasonableness of an explanation (conclusion) b. Analyze whether evidence (data) and scientific principles support proposed explanations (hypotheses, laws, theories)
E. The nature of science relies upon communication of results and justification of explanations	<i>Scope and Sequence - All Units</i> a. Communicate the procedures and results of investigations and explanations through: oral presentations drawings and maps 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) graphs (bar, single line, pictograph) writings	<i>Scope and Sequence - All Units</i> a. Communicate the procedures and results of investigations and explanations through: oral presentations drawings and maps 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) graphs (bar, single line, pictograph) equations and writings	<i>Scope and Sequence - All Units</i> a. Communicate the procedures and results of investigations and explanations through: oral presentations drawings and maps 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) graphs (bar, single line, pictograph) equations and writings

Refer to Missouri Department of Elementary and Secondary Education for materials that articulate standards for data recording and template for experimental design

Strand 7: Scientific Inquiry

1. Science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning, and critical thinking	
Concept	Grades 9, 10, 11
<p style="text-align: center;">A.</p> <p>Scientific inquiry includes the ability of students to formulate a testable question and explanation, and to select appropriate investigative methods in order to obtain evidence relevant to the explanation</p>	<p><i>Scope and Sequence - All Units</i></p> <ul style="list-style-type: none"> a. Formulate testable questions and hypotheses b. Analyzing an experiment, identify the components (i.e., independent variable, dependent variables, control of constants, multiple trials) and explain their importance to the design of a valid experiment c. Design and conduct a valid experiment d. Recognize it is not always possible, for practical or ethical reasons, to control some conditions (e.g., when sampling or testing humans, when observing animal behaviors in nature) e. Acknowledge some scientific explanations (e.g., explanations of astronomical or meteorological phenomena) cannot be tested using the standard experimental "scientific method" due to the limits of the laboratory environment, resources, and/or technologies f. Acknowledge there is no fixed procedure called "the scientific method", but that some investigations involve systematic observations, carefully collected and relevant evidence, logical reasoning, and some imagination in developing hypotheses and other explanations g. Evaluate the design of an experiment and make suggestions for reasonable improvements
<p style="text-align: center;">B.</p> <p>Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations</p>	<p><i>Scope and Sequence - All Units</i></p> <ul style="list-style-type: none"> a. Make qualitative and quantitative observations using the appropriate senses, tools and equipment to gather data (e.g., microscopes, thermometers, analog and digital meters, computers, spring scales, balances, metric rulers, graduated cylinders) b. Measure length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, force (weight) to the nearest Newton, temperature to the nearest degree Celsius, time to the nearest second c. Determine the appropriate tools and techniques to collect, analyze, and interpret data d. Judge whether measurements and computation of quantities are reasonable e. Calculate the range, average/mean, percent, and ratios for sets of data f. Recognize observation is biased by the experiences and knowledge of the observer (e.g., strong beliefs about what should happen in particular circumstances can prevent the detection of other results)
<p style="text-align: center;">C.</p> <p>Evidence is used to formulate explanations</p>	<p><i>Scope and Sequence - All Units</i></p> <ul style="list-style-type: none"> a. Use quantitative and qualitative data as support for reasonable explanations (conclusions) b. Analyze experimental data to determine patterns, relationship, perspectives, and credibility of explanations (e.g., predict/extrapolate data, explain the relationship between the independent and dependent variable) c. Identify the possible effects of errors in observations, measurements, and calculations, on the validity and reliability of data and resultant explanations (conclusions)
<p style="text-align: center;">D.</p> <p>Scientific inquiry includes evaluation of explanations (hypotheses, laws, theories) in light of scientific principles (understandings)</p>	<p><i>Scope and Sequence - All Units</i></p> <ul style="list-style-type: none"> a. Analyze whether evidence (data) and scientific principles support proposed explanations (hypotheses, laws, theories) b. Evaluate the reasonableness of an explanation (conclusion)

Strand 7: Scientific Inquiry

1. Science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning, and critical thinking	
Concept	Grades 9, 10, 11
<p style="text-align: center;">E.</p> <p>The nature of science relies upon communication of results and justification of explanations</p>	<p><i>Scope and Sequence - All Units</i></p> <p>a. Communicate the procedures and results of investigations and explanations through: oral presentations drawings and maps 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) graphs (bar, single, and multiple line) equations and writings</p> <p>b. Communicate and defend a scientific argument</p> <p>c. Explain the importance of the public presentation of scientific work and supporting evidence to the scientific community (e.g., work and evidence must be critiqued, reviewed, and validated by peers; needed for subsequent investigations by peers; results can influence the decisions regarding future scientific work)</p>

Refer to Missouri Department of Elementary and Secondary Education for materials that articulate standards for data recording and template for experimental design

Strand 8: Impact of Science, Technology and Human Activity

1. The nature of technology can advance, and is advanced by, science as it seeks to apply scientific knowledge in ways that meet human needs			
Concept	Kindergarten	Grade 1	Grade 2
<p style="text-align: center;">A.</p> <p>Designed objects are used to do things better or more easily and to do some things that could not otherwise be done at all</p>	<p><i>Scope and Sequence – Properties of Matter/Weather and Seasons</i></p> <p>a. Recognize some objects occur in nature (natural objects); others have been designed and made by people</p>	<p><i>Scope and Sequence – Properties of Matter/Weather and Seasons</i></p> <p>a. Recognize that some objects occur in nature (natural objects); others have been designed and made by people</p>	<p><i>Scope and Sequence – Forms of Energy: Sound</i></p> <p>a. Design and construct a musical instrument using materials (e.g., cardboard, wood, plastic, metal) and/or existing objects (e.g., toy wheels, gears, boxes, sticks) that can be used to perform a task (Assess Locally)</p>
<p style="text-align: center;">B.</p> <p>Advances in technology often result in improved data collection and an increase in scientific information</p>	<p><i>Scope and Sequence – Properties of Matter/Plants and Animals</i></p> <p>a. Describe how tools have helped scientists make better observations (i.e., magnifiers)</p>	<p><i>Scope and Sequence – Properties of Matter/Characteristics of Plants and Animals</i></p> <p>a. Describe how tools have helped scientists make better observations (e.g., magnifiers, balances, thermometers)</p>	<p><i>Scope and Sequence – Forms of Energy: Sound/Properties of Rocks and Soil</i></p> <p>a. Describe how tools have helped scientists make better observations, measurements, or equipment for investigations (e.g., magnifiers, balances, stethoscopes, thermometers)</p>
<p style="text-align: center;">C.</p> <p>Technological solutions to problems often have drawbacks as well as benefits</p>	<p>Not assessed at this level</p>		

Strand 8: Impact of Science, Technology and Human Activity

2. 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			
Concept	Kindergarten	Grade 1	Grade 2
<p style="text-align: center;">A.</p> <p>People of different gender and ethnicity have contributed to scientific discoveries and the invention of technological innovations</p>	Not assessed at this level		
<p style="text-align: center;">B.</p> <p>Scientific theories are developed based on the body of knowledge that exists at any particular time and must be rigorously questioned and tested for validity</p>	Not assessed at this level		

Strand 8: Impact of Science, Technology and Human Activity

3. Science and technology affect, and are affected by, society			
Concept	Kindergarten	Grade 1	Grade 2
<p style="text-align: center;">A.</p> <p>People, alone or in groups, are always making discoveries about nature and inventing new ways to solve problems and get work done</p>	<p><i>Scope and Sequence - All Units</i></p> <p>a. Identify a question that was asked, or could be asked, or a problem that needed to be solved when given a brief scenario (fiction or nonfiction of individuals solving everyday problems or learning through discovery)</p> <p>b. Work with a group to solve a problem, giving due credit to the ideas and contributions of each group member (Assess Locally)</p>	<p><i>Scope and Sequence - All Units</i></p> <p>a. Identify a question that was asked, or could be asked, or a problem that needed to be solved when given a brief scenario (fiction or nonfiction of individuals solving everyday problems or learning through discovery)</p> <p>b. Work with a group to solve a problem, giving due credit to the ideas and contributions of each group member (Assess Locally)</p>	<p><i>Scope and Sequence - All Units</i></p> <p>a. Identify a question that was asked, or could be asked, or a problem that needed to be solved when given a brief scenario (fiction or nonfiction of individuals solving everyday problems or learning through discovery)</p> <p>b. Work with a group to solve a problem, giving due credit to the ideas and contributions of each group member (Assess Locally)</p>
<p style="text-align: center;">B.</p> <p>Social, political, economic, ethical and environmental factors strongly influence, and are influenced by, the direction of progress of science and technology</p>	<p>Not assessed at this level</p>		
<p style="text-align: center;">C.</p> <p>Scientific ethics require that scientists must not knowingly subject people or the community to health or property risks without their knowledge and consent</p>	<p>Not assessed at this level</p>		
<p style="text-align: center;">D.</p> <p>Scientific information is presented through a number of credible sources, but is at times influenced in such a way to become non-credible</p>	<p>Not assessed at this level</p>		

Strand 8: Impact of Science, Technology and Human Activity

1. The nature of technology can advance, and is advanced by, science as it seeks to apply scientific knowledge in ways that meet human needs			
Concept	Grade 3	Grade 4	Grade 5
A. Designed objects are used to do things better or more easily and to do some things that could not otherwise be done at all	<i>Scope and Sequence – Investigating States of Matter/Earth, Sun, and Moon</i> a. Recognize some objects or materials (e.g., Sun, fire, ice, snow) occur in nature (natural objects); others (e.g., stoves, refrigerators, bulbs, candles, lanterns) have been designed and made by people to solve human problems and enhance the quality of life (manmade objects)	<i>Scope and Sequence – Forms of Energy: Electrical Circuits</i> a. Design and construct an electrical device, using materials and/or existing objects, that can be used to perform a task (Assess Locally)	<i>Scope and Sequence – Work and Simple Machines</i> a. Design and construct a machine, using materials and/or existing objects, that can be used to perform a task (Assess Locally)
B. Advances in technology often result in improved data collection and an increase in scientific information	<i>Scope and Sequence – Investigating States of Matter/Earth, Sun, and Moon/Plants</i> a. Describe how new technologies have helped scientists make better observations and measurements for investigations (e.g., telescopes, magnifiers, balances, microscopes, computers, stethoscopes, thermometers)	<i>Scope and Sequence – Mixtures and Solutions/Forms of Energy: Electrical Circuits</i> a. Describe how new technologies have helped scientists make better observations and measurements for investigations (e.g., telescopes, magnifiers, balances, microscopes, computers, stethoscopes, thermometers)	<i>Scope and Sequence – Work and Simple Machines/Water Cycle and Weather/Solar System/Classification of Plants and Animals</i> a. Describe how new technologies have helped scientists make better observations and measurements for investigations (e.g., telescopes, electronic balances, electronic microscopes, x-ray technology, computers, ultrasounds, computer probes such as thermometers)
C. Technological solutions to problems often have drawbacks as well as benefits	Not assessed at this level	<i>Scope and Sequence – Forms of Energy: Electrical Circuits/Laws of Motion/Interactions among Organisms and Their Environments</i> a. Identify how the effects of inventions or technological advances (e.g., different types of light bulbs, semiconductors/integrated circuits and electronics, satellite imagery, robotics, communication, transportation, generation of energy, renewable materials) may be helpful, harmful, or both (Assess Locally)	<i>Scope and Sequence – Simple Machines/Water Cycle and Weather/Solar System/Classification of Plants and Animals</i> a. Identify how the effects of inventions or technological advances (e.g., complex machinery, technologies used in space exploration, satellite imagery, weather observation and prediction, communication, transportation, robotics, tracking devices) may be helpful, harmful, or both (Assess Locally)

Strand 8: Impact of Science, Technology and Human Activity

2. 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			
Concept	Grade 3	Grade 4	Grade 5
<p style="text-align: center;">A.</p> <p>People of different gender and ethnicity have contributed to scientific discoveries and the invention of technological innovations</p>	<p><i>Scope and Sequence – All units</i></p> <p>a. Research biographical information about various scientists and inventors from different gender and ethnic backgrounds, and describe how their work contributed to science and technology (Assess Locally)</p>	<p><i>Scope and Sequence – All units</i></p> <p>a. Research biographical information about various scientists and inventors from different gender and ethnic backgrounds, and describe how their work contributed to science and technology (Assess Locally)</p>	<p><i>Scope and Sequence – All units</i></p> <p>a. Research biographical information about various scientists and inventors from different gender and ethnic backgrounds, and describe how their work contributed to science and technology (Assess Locally)</p>
<p style="text-align: center;">B.</p> <p>Scientific theories are developed based on the body of knowledge that exists at any particular time and must be rigorously questioned and tested for validity</p>	<p>Not assessed at this level</p>		

Strand 8: Impact of Science, Technology and Human Activity

3. Science and technology affect, and are affected by, society			
Concept	Grade 3	Grade 4	Grade 5
<p style="text-align: center;">A.</p> <p>People, alone or in groups, are always making discoveries about nature and inventing new ways to solve problems and get work done</p>	<p><i>Scope and Sequence - All Units</i></p> <p>a. Identify a question that was asked, or could be asked, or a problem that needed to be solved when given a brief scenario (fiction or nonfiction of people working alone or in groups solving everyday problems or learning through discovery)</p> <p>b. Work with a group to solve a problem, giving due credit to the ideas and contributions of each group member (Assess Locally)</p>	<p><i>Scope and Sequence - All Units</i></p> <p>a. Identify a question that was asked, or could be asked, or a problem that needed to be solved when given a brief scenario (fiction or nonfiction of people working alone or in groups solving everyday problems or learning through discovery)</p> <p>b. Work with a group to solve a problem, giving due credit to the ideas and contributions of each group member (Assess Locally)</p>	<p><i>Scope and Sequence - All Units</i></p> <p>a. Identify a question that was asked, or could be asked, or a problem that needed to be solved when given a brief scenario (fiction or nonfiction of people working alone or in groups solving everyday problems or learning through discovery)</p> <p>b. Work with a group to solve a problem, giving due credit to the ideas and contributions of each group member (Assess Locally)</p>
<p style="text-align: center;">B.</p> <p>Social, political, economic, ethical and environmental factors strongly influence, and are influenced by, the direction of progress of science and technology</p>	<p>Not assessed at this level</p>		
<p style="text-align: center;">C.</p> <p>Scientific ethics require that scientists must not knowingly subject people or the community to health or property risks without their knowledge and consent</p>	<p>Not assessed at this level</p>		
<p style="text-align: center;">D.</p> <p>Scientific information is presented through a number of credible sources, but is at times influenced in such a way to become non-credible</p>	<p>Not assessed at this level</p>		

Strand 8: Impact of Science, Technology and Human Activity

1. The nature of technology can advance, and is advanced by, science as it seeks to apply scientific knowledge in ways that meet human needs	
Concept	Grades 6, 7, 8
<p style="text-align: center;">A.</p> <p>Designed objects are used to do things better or more easily and to do some things that could not otherwise be done at all</p>	<p><i>Scope and Sequence - All Units</i></p> <p>a. 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)</p>
<p style="text-align: center;">B.</p> <p>Advances in technology often result in improved data collection and an increase in scientific information</p>	<p><i>Scope and Sequence - All Units</i></p> <p>a. Identify the link between 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)</p>
<p style="text-align: center;">C.</p> <p>Technological solutions to problems often have drawbacks as well as benefits</p>	<p><i>Scope and Sequence - All Units</i></p> <p>a. 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) (Assess Locally)</p>

Strand 8: Impact of Science, Technology and Human Activity

2. 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	
Concept	Grades 6, 7, 8
<p style="text-align: center;">A.</p> <p>People of different gender and ethnicity have contributed to scientific discoveries and the invention of technological innovations</p>	<p><i>Scope and Sequence - All Units</i></p> <p>a. 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) (Assess Locally)</p>
<p style="text-align: center;">B</p> <p>Scientific theories are developed based on the body of knowledge that exists at any particular time and must be rigorously questioned and tested for validity</p>	<p><i>Scope and Sequence - All Units</i></p> <p>a. 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)</p> <p>b. Recognize explanations have changed over time as a result of new evidence</p>

Strand 8: Impact of Science, Technology and Human Activity

3. Science and technology affect, and are affected by, society	
Concept	Grades 6, 7, 8
<p style="text-align: center;">A.</p> <p>People, alone or in groups, are always making discoveries about nature and inventing new ways to solve problems and get work done</p>	<p>Not assessed at this level</p>
<p style="text-align: center;">B.</p> <p>Social, political, economic, ethical and environmental factors strongly influence, and are influenced by, the direction of progress of science and technology</p>	<p><i>Scope and Sequence - All Units</i></p> <p>a. 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)</p> <p>b. 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)</p>
<p style="text-align: center;">C.</p> <p>Scientific ethics require that scientists must not knowingly subject people or the community to health or property risks without their knowledge and consent</p>	<p>Not assessed at this level</p>
<p style="text-align: center;">D.</p> <p>Scientific information is presented through a number of credible sources, but is at times influenced in such a way to become non-credible</p>	<p>Not assessed at this level</p>

Strand 8: Impact of Science, Technology and Human Activity

1. The nature of technology can advance, and is advanced by, science as it seeks to apply scientific knowledge in ways that meet human needs	
Concept	Grades 9, 10, 11
A. Designed objects are used to do things better or more easily and to do some things that could not otherwise be done at all	Not assessed at this level
B. Advances in technology often result in improved data collection and an increase in scientific information	<i>Scope and Sequence - All Units</i> a. Recognize the relationships linking technology and science (e.g., how technological problems may create a demand for new science knowledge, how new technologies make it possible for scientists to extend research and advance science)
C. Technological solutions to problems often have drawbacks as well as benefits	<i>Scope and Sequence - All Units</i> a. Identify and evaluate the drawbacks (e.g., design constraints, unintended consequences, risks) and benefits of technological solutions to a given problem (e.g., damming a river for flood control, using pesticides to eliminate mosquitoes, genetic engineering of cells, use of satellite communications to gather information)

Strand 8: Impact of Science, Technology and Human Activity

2. 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	
Concept	Grades 9, 10, 11
<p style="text-align: center;">A.</p> <p>People of different gender and ethnicity have contributed to scientific discoveries and the invention of technological innovations</p>	<p><i>Scope and Sequence - All Units</i></p> <ul style="list-style-type: none"> a. Recognize contributions to science are not limited to the work of one particular group, but are made by a diverse group of scientists representing various ethnic and gender groups b. Recognize gender and ethnicity of scientists often influence the questions asked and/or the methods used in scientific research and may limit or advance science knowledge and/or technology
<p style="text-align: center;">B.</p> <p>Scientific theories are developed based on the body of knowledge that exists at any particular time and must be rigorously questioned and tested for validity</p>	<p><i>Scope and Sequence - All Units</i></p> <ul style="list-style-type: none"> a. Identify and describe how explanations (hypotheses, laws, theories) of scientific phenomena have changed over time as a result of new evidence (e.g., model of the solar system, basic structure of matter, structure of an atom, Theory of Plate Tectonics, Big Bang and nebular theory of the Universe, explanation of electric current) b. Identify and analyze current theories that are being questioned, and compare them to new theories that have emerged to challenge older ones (e.g., Theory of Evolution, theories of extinction, global warming) (Assess Locally)

Strand 8: Impact of Science, Technology and Human Activity

3. Science and technology affect, and are affected by, society	
Concept	Grades 9, 10, 11
<p style="text-align: center;">A.</p> <p>People, alone or in groups, are always making discoveries about nature and inventing new ways to solve problems and get work done</p>	<p>Not assessed at this level</p>
<p style="text-align: center;">B.</p> <p>Social, political, economic, ethical and environmental factors strongly influence, and are influenced by, the direction of progress of science and technology</p>	<p><i>Scope and Sequence - All Units</i></p> <ul style="list-style-type: none"> a. Analyze the roles of science and society as they interact to determine the direction of scientific and technological progress (e.g., prioritization of and funding for new scientific research and technological development is determined on the basis of individual, political and social values and needs; understanding basic concepts and principles of science and technology influences debate about the economics, policies, politics, and ethics of various scientific and technological challenges) b. Identify and describe major scientific and technological challenges to society and their ramifications for public policy (e.g., global warming, limitations to fossil fuels, genetic engineering of plants, space and/or medical research) c. Analyze and evaluate the social, political, economic, ethical, and environmental factors affecting progress toward meeting major scientific and technological challenges (e.g., limitations placed on stem-cell research or genetic engineering, introduction of alien species, deforestation, bioterrorism, nuclear energy, genetic counseling, computer technology)
<p style="text-align: center;">C.</p> <p>Scientific ethics require that scientists must not knowingly subject people or the community to health or property risks without their knowledge and consent</p>	<p><i>Scope and Sequence - All Units</i></p> <ul style="list-style-type: none"> a. Identify and evaluate the need for informed consent in experimentation b. Identify the ethical issues involved in experimentation (i.e., risks to organisms or environment) c. Identify and evaluate the role of models as an ethical alternative to direct experimentation (e.g., using a model for a stream rather than pouring oil in an existing stream when studying the effects of oil pollution)
<p style="text-align: center;">D.</p> <p>Scientific information is presented through a number of credible sources, but is at times influenced in such a way to become non-credible</p>	<p><i>Scope and Sequence - All Units</i></p> <ul style="list-style-type: none"> a. Evaluate a given source for its scientific credibility (e.g., articles in a new periodical quoting an "eye witness", a scientist speaking within or outside his/her area of expertise) b. Explain why accurate record-keeping, openness, and replication are essential for maintaining an investigator's credibility with other scientists and society