6-8 - Updated Version 11/24/08

The Science Course Level Expectations document is an **updated** version to the April, 2005 K-12 Science Grade Level Expectations.

The GLEs will provide the framework for instruction and assessment for elementary and intermediate science courses.

Science Grade Level Expectations:

A Framework for Instruction and Assessment

The *Science Course Level Expectations* outline related ideas, concepts, skills and processes that form the foundation for understanding and learning science. It includes updates to the April, 2005 K-12 *Science Grade Level Expectations*. In addition, it provides a framework to bring focus to teaching, learning, and assessing science.

Since the Outstanding Schools Act of 1993, several documents have been developed prior to the 2005 K-12 *Grade Level Expectations* to aid Missouri school districts in creating curriculum that will enable all students to achieve their maximum potential. Those include:

- The *Show-Me Standards* which identify broad content knowledge and process skills for all students to be successful as they continue their education, enter the workforce, and assume civic responsibilities
- The *Framework for Curriculum Development* which provides districts with a "frame" for building curricula using the *Show-Me Standards* as a foundation
- The *Assessment Annotations for the Curriculum Frameworks* which identify content and processes that should be assessed at the local and state level

Essential content, aligned to state and national documents that support inquiry-based instruction, included in the Grade Level Expectations should be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations. Each Grade and Course Level Expectation is aligned to the Show-Me Content and Process Standards (1996). A Depth-of-Knowledge level will be assigned to each grade or course level expectation before formal adoption of this document. The Depth of Knowledge identifies the highest level at which the expectation will be assessed, based upon the demand of the GLE. Depth-of-Knowledge levels include: Level 1-recall; Level 2-skill/concept; Level 3-strategic thinking; and Level 4-extended thinking.

* Indicates that an item is essential to the curricula of the Course but will not be assessed at the State level. The indicated expectations should be taught and assessed locally.

Sources: National Science Education Standards (NRC); Project 2061 (AAAS) Benchmarks for Science Literacy and Atlas: Research related to science education (e.g., Driver's work re: misconceptions); Show Me Standards, Framework for Curriculum Development in Science, and MAP documents; National Assessment of Education Progress (NAEP) Science Framework; Curriculum documents from school districts and other states.

Important resources for districts' use as they develop curriculum and assessments and plan instruction include: the Project 2061 (AAAS) Benchmarks (online at http://www.project2061.org/tools/benchol/bolintro.htm) and ATLAS (a compendium of concept maps showing grade-level appropriateness, sequencing of expectations in order to build conceptual understanding, and connections across science strands); Young People's Images of Science and Making Sense of Secondary Science by Rosalind Driver et al. (both present research related to student misconceptions K-12); The National Science Education Standards (online at http://www.nap.edu/readingroom/books/nses/html/); How Students Learn Science (available from the National Research Council (The National Academies Press)

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. Science assessments based from GLE 2.0 will begin 2009-2010 school year.

	Kindergarten	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth
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
Strand 2 Force & Motion	Change in Position	Investigating Motion	Forces and Motion		Laws of Motion	Work and Simple Machines		Force, Motion, and Work	
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
Strand 4 Ecology	Weather and Seasons			Food Chains	Interactions among Organisms and their Environments		Ecosystems and Populations		
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
Strand 6 Universe	Objects in the Sky			Earth, Sun, and Moon		Solar System		Objects and Their Motion in the Solar System	
Strand 7 Scientific 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

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			
	Sixth	**Seventh**	**Eighth**
A **Objects, and the materials they are made of, have properties that can be used to describe and classify them**	*Scope and Sequence – Properties of and Changes in Matter* a. Identify 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		*Scope and Sequence – Physical and Chemical Properties and Changes of Matter* a. Identify 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
DOK	**a – 1, b – 2, c – 2, d – 2**		**a – 1, b – 2**
B **Properties of mixtures depend upon the concentrations, properties, and interactions of particles**	*Scope and Sequence – Properties of and Changes in Matter* 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		
DOK	**a – 2, b – 2, c – 3**		
C **Properties of matter can be explained in terms of moving particles too small to be seen without tremendous magnification**	*Scope and Sequence – Properties of and Changes in Matter* a. Describe 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		*Scope and Sequence – Physical and Chemical Properties and Changes of Matter* 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
DOK	**a – 1**		**a – 1**

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 -- Continued			
	Sixth	**Seventh**	**Eighth**
D **Physical changes in the state of matter that result from thermal changes can be explained by the Kinetic Theory of Matter**	*Scope and Sequence – Earth's Resources* 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)	*Scope and Sequence – Weather and Climate* 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)	*Scope and Sequence – Physical and Chemical Properties and Changes of Matter* 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 energy 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)
DOK	**a – 2**	**a – 2**	**a – 1, b – 2, c – 2**
E **The atomic model describes the electrically neutral atom**	Not assessed at this level		
DOK			
F **The periodic table organizes the elements according to their atomic structure and chemical reactivity**			*Scope and Sequence – Physical and Chemical Properties and Changes of Matter* a. Identify 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)
DOK			**a – 2**

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 -- Continued			
	Sixth	**Seventh**	**Eighth**
G **Properties of objects and states of matter can change chemically and/or physically**	*Scope and Sequence – Properties of and Changes in Matter* a. Identify and classify changes in matter as chemical and/or physical 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 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)		
DOK	**a – 2, b – 2, c – 2**		
H **Chemical bonding is the combining of different pure substances (elements, compounds) to form new substances with different properties**	Not assessed at this level		
DOK			

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 -- Continued			
	Sixth	**Seventh**	**Eighth**
I **Mass is conserved during any physical or chemical change**	*Scope and Sequence – Properties of and Changes in Matter* a. Demonstrate and provide evidence that mass is conserved during a physical change	*Scope and Sequence – Weather and Climate* a. Explain that the amount of matter remains constant while being recycled through the water cycle	*Scope and Sequence – Physical and Chemical Properties and Changes of Matter* 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) *Scope and Sequence – Rock Cycle and Plate Tectonics* b. Explain that the amount of matter remains constant while being recycled through the rock cycle *Scope and Sequence – Cells and Body Systems* c. Explain that the amount of matter remains constant while being recycled through food chains and food webs
DOK	**a – 2**	**a – 1**	**a – 2, b – 2, c – 2**

Strand 1: Properties and Principles of Matter and Energy

2. Energy has a source, can be stored, and can be transferred but is conserved within a system			
	Sixth	**Seventh**	**Eighth**
A **Forms of energy have a source, a means of transfer (work and heat), and a receiver**	*Scope and Sequence –- Forms of Energy: Light* 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 and explain 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 *Scope and Sequence – Forms of Energy: Sound* i. Describe how sound energy is transferred by wave-like disturbances that spread away from the source through a medium j. Describe how changes in energy cause changes in loudness and pitch of a sound k. 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)	*Scope and Sequence – Forms of Energy: Heat* a. Identify 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. Identify thermal energy is transferred as heat from warmer objects to cooler objects until both reach the same temperature (equilibrium) d. Identify 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 *Scope and Sequence – Forms of Energy: Electricity and Magnetism* 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	*Scope and Sequence – Physical and Chemical Properties and Changes of Matter* a. Recognize and describe how chemical energy is stored in chemical compounds (e.g., energy stored in and released from food molecules, batteries, nitrogen explosives, fireworks, organic fuels)
DOK	**a – 1, b – 2, c – 2, d – 2, e – 3, f – 1, g – 1, h – 2, i – 1, j – 3**	**a – 1, b – 2, c – 1, d – 1, e – 2, f – 1, g -2, h – 1, i – 2, j – 2, k – 2, l – 1, m – 2, n – 1**	**a – 1**

Strand 1: Properties and Principles of Matter and Energy

2. Energy has a source, can be stored, and can be transferred but is conserved within a system -- Continued			
	Sixth	**Seventh**	**Eighth**
B **Mechanical energy comes from the motion (kinetic energy) and/or relative position (potential energy) of an object**	Not assessed at this level		
DOK			
C **Electromagnetic energy from the Sun (solar radiation) is a major source of energy on Earth**	*Scope and Sequence – Forms of Energy – Light* a. Recognize and describe how energy from the Sun is transferred to Earth in a range of wavelengths and energy levels, including visible light, infrared radiation, and ultraviolet radiation *Scope and Sequence- Characteristics of Living Organisms* b. Recognize and apply the fact that energy from the Sun is the source of almost all energy used to produce the food for living organisms	*Scope and Sequence – Weather and Climate* a. Identify solar radiation as the primary source of energy for weather phenomena	
DOK	**a – 2, b – 1**	**a – 1**	
D **Chemical reactions involve changes in the bonding of atoms with the release or absorption of energy**	Not assessed at this level		
DOK			
E **Nuclear energy is a major source of energy throughout the universe**	Not assessed at this level		
DOK			

Strand 1: Properties and Principles of Matter and Energy

2. Energy has a source, can be stored, and can be transferred but is conserved within a system -- Continued			
	Sixth	**Seventh**	**Eighth**
F **Energy can be transferred within a system as the total amount of energy remains constant (i.e., Law of Conservation of Energy)**		*Scope and Sequence – Energy Transformations* 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) b. Identify that, during an energy transformation, heat is often transferred from one object (system) to another because of a difference in temperature c. Recognize and describe how energy is not lost but conserved as it is transferred and transformed	*Scope and Sequence – Physical and Chemical Properties and Changes of Matter* 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
DOK		**a – 1, b – 1, c – 1**	**a – 1**

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			
	Sixth	**Seventh**	**Eighth**
A **The motion of an object is described as a change in position, direction, and speed relative to another object (frame of reference)**		*Scope and Sequence – Force, Motion, and Work* 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	
DOK		**a – 1, b – 1, c – 1, d – 2**	
B **An object that is accelerating is speeding up, slowing down, or changing direction**	Not assessed at this level		
DOK			
C **Momentum depends on the mass of the object and the velocity with which it is traveling**	Not assessed at this level		
DOK			

Strand 2: Properties and Principles of Force and Motion

2. Forces affect motion			
	Sixth	**Seventh**	**Eighth**
A **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**		*Scope and Sequence – Force, Motion, and Work* 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 Newton's) b. Compare the forces acting on an object by using a spring scale to measure them to the nearest Newton	
DOK		**a – 1, b – 2**	
B **Every object exerts a gravitational force on every other object**		*Scope and Sequence – Force, Motion, and Work* a. Explain every object exerts a gravitational force of attraction on every other object b. Recognize an object's weight is a measure of the gravitational force of a planet/moon acting on that object c. Compare the amount of gravitational force acting between objects (which is dependent upon their masses and the distance between them)	
DOK		**a – 1, b – 1, c – 2**	
C **Magnetic forces are related to electrical forces as different aspects of a single electromagnetic force**	Not assessed at this level		
DOK			

Strand 2: Properties and Principles of Force and Motion

2. Forces affect motion -- Continued			
	Sixth	**Seventh**	**Eighth**
D **Newton's Laws of Motion explain the interaction of mass and forces, and are used to predict changes in motion**		Scope and Sequence – Force, Motion, and Work a. Compare the effects of balanced and unbalanced forces (including magnetic, gravity, friction, push or pull) on an object's motion b. Explain that when forces (including magnetic, gravity, friction, push or pull) are balanced, objects are at rest or their motion remains constant c. Explain that a change in motion is the result of an unbalanced force acting upon an object d. Explain how the acceleration of a moving object is affected by the amount of net force applied and the mass of the object	
DOK		**a – 2, b – 1, c – 1, d – 1**	
E **Perpendicular forces act independently of each other**	Not assessed at this level		
DOK			

Strand 2: Properties and Principles of Force and Motion

2. Forces affect motion -- Continued			
	Sixth	**Seventh**	**Eighth**
F **Work transfers energy into and out of a mechanical system**		*Scope and Sequence – Force, Motion, and Work* 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 b. Calculate the amount of work done when a force is applied to an object over a distance ($W = F \times d$) 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 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 e. Evaluate simple machine designs to determine which design requires the least amount of effort force and explain why	
DOK		**a – 1, b – 1, c – 2, d – 1, e – 2**	

Strand 3: Characteristics and Interactions of Living Organisms

1. There is a fundamental unity underlying the diversity of all living organisms			
	Sixth	**Seventh**	**Eighth**
A **Organisms have basic needs for survival**	*Scope and Sequence – Characteristics of Living Organisms* 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)		*Scope and Sequence – Cells and Body Systems* a. Recognize that most plants and animals require food and oxygen (needed to release the energy from that food)
DOK	**a – 2**		**a – 1**
B **Organisms progress through life cycles unique to different types of organisms**	Not assessed at this level		
DOK			
C **Cells are the fundamental units of structure and function of all living things**	*Scope and Sequence – Characteristics of Living Organisms* a. Recognize all organisms are composed of cells, the fundamental units of life, which carry on all life processes		
DOK	**a – 1**		
D **Plants and animals have different structures that serve similar functions necessary for the survival of the organism**			*Scope and Sequence – Cells and Body Systems* 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)
DOK			a – 2
E **Biological classifications are based on how organisms are related**	*Scope and Sequence – Characteristics of Living Organisms* 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)		
DOK	**a – 2, b – 2**		

Strand 3: Characteristics and Interactions of Living Organisms

2. Living organisms carry out life processes in order to survive			
	Sixth	**Seventh**	**Eighth**
A **The cell contains a set of structures called organelles that interact to carry out life processes through physical and chemical means**	*Scope and Sequence – Characteristics of Living Organisms* a. Compare and contrast the following plant and animal cell structures: cell membrane, nucleus, cell wall, chloroplast, and cytoplasm b. Recognize the chloroplast as the cell structure where food is produced in plants and some unicellular organisms (e.g., algae, some protists)		*Scope and Sequence – Cells and Body Systems* a. Describe how the cell membrane helps regulate the transfer of materials in and out of the cell b. Identify the function of the chloroplast during photosynthesis
DOK	**a – 2, b – 1**		**a – 1, b – 1**
B **Photosynthesis and cellular respiration are complementary processes necessary to the survival of most organisms on Earth**	*Scope and Sequence – Characteristics of Living Organisms* a. Describe how plants use energy from the Sun to produce food and oxygen through the process of photosynthesis		*Scope and Sequence: Cells and Body Systems* a. Describe 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 b. Describe how 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) c. Describe the importance of the transport and exchange of oxygen and carbon dioxide to the survival of the organism
DOK	**a – 1**		**a – 1, b – 1, c – 1**

Strand 3: Characteristics and Interactions of Living Organisms

2. Living organisms carry out life processes in order to survive – Continued			
	Sixth	**Seventh**	**Eighth**
C **Complex multicellular organisms have systems that interact to carry out life processes through physical and chemical means**			*Scope and Sequence: Cells and Body Systems* 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
DOK			**a – 2, b – 2, c – 2, d – 2, d – 2, e – 2, f – 2, g – 2**
D **Cells carry out chemical transformations that use energy for the synthesis or breakdown of organic compounds**	Not assessed at this level		
DOK			

Strand 3: Characteristics and Interactions of Living Organisms

2. Living organisms carry out life processes in order to survive -- Continued			
	Sixth	**Seventh**	**Eighth**
E **Protein structure and function are coded by the DNA (Deoxyribonucleic acid) molecule**	Not assessed at this level		
DOK			
F **Cellular activities and responses can maintain stability internally while external conditions are changing (homeostasis)**			*Scope and Sequence – Cells and Body Systems* 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)
DOK			**a – 2**
G **Life processes can be disrupted by disease (intrinsic failures of the organ systems or by infection due to other organisms)**			*Scope and Sequence – Disease* a. Explain the cause and effect of diseases (e.g., AIDS, cancer, diabetes, hypertension) on the human body (locally assessed) b. Relate some common diseases (i.e., cold, influenza, strep throat, dysentery, fungal infections) to the organisms that cause them (bacteria, viruses, protests, fungi) c. Differentiate between infectious and noninfectious diseases d. Explain the role of antibiotics and vaccines in the treatment and prevention of diseases
DOK			**a – 2, b – 2, c – 2, d – 2**

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			
	Sixth	**Seventh**	**Eighth**
A **Reproduction can occur asexually or sexually**			*Scope and Sequence: Reproduction and Heredity* 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. Describe how flowering plants reproduce sexually
DOK			**a – 2, b – 1, c – 2, d – 2**
B **All living organisms have genetic material (DNA) that carries hereditary information**	Not assessed at this level		
DOK			
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**			*Scope and Sequence: Reproduction and Heredity* a. Identify chromosomes as cellular structures that occur in pairs that carry hereditary information in units called genes b. Recognize and describe how 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 and describe how 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)
DOK			**a – 1, b – 1, c – 1**

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 -- Continued			
	Sixth	**Seventh**	**Eighth**
D **There is heritable variation within every species of organism**			*Scope and Sequence – Reproduction and Heredity* a. Recognize and describe when asexual reproduction occurs, the daughter cell is identical to the parent cell (assuming no change in the parent genes) b. Recognize and describe 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
DOK			**a – 1, b – 1**
E **The pattern of inheritance for many traits can be predicted by using the principles of Mendelian genetics**	Not assessed at this level		
DOK			

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

1. Organisms are interdependent with one another and with their environment			
	Sixth	**Seventh**	**Eighth**
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**	*Scope and Sequence – Ecosystems and Populations* 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		
DOK	**a – 2**		
B **Living organisms have the capacity to produce populations of infinite size, but environments and resources are finite**	*Scope and Sequence – Ecosystems and Populations* a. Identify populations within a community that are in competition with one another for resources b. Identify 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		
DOK	**a – 2, b – 2, c – 3**		
C **All organisms including humans and their activities cause changes in their environment that affect the ecosystem**	Not assessed at this level		
DOK			

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

1. Organisms are interdependent with one another and with their environment -- Continued			
	Sixth	**Seventh**	**Eighth**
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**	*Scope and Sequence – Ecosystems and Populations* 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 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 c. Describe possible solutions to potentially harmful environmental changes within an ecosystem		*Scope and Sequence – Disease* 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)
DOK	**a – 2, b – 3, c – 3**		**a – 2**

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

2. Matter and energy flow through an ecosystem			
	Sixth	**Seventh**	**Eighth**
A **As energy flows through the ecosystem, all organisms capture a portion of that energy and transform it to a form they can use**	*Scope and Sequence – Ecosystems and Populations* 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		
DOK	**a – 3, b – 2**		
B **Matter is recycled through an ecosystem**			*Scope and Sequence – Cells and Body Systems* a. Illustrate the oxygen/carbon dioxide cycles (including the processes of photosynthesis and cellular respiration) b. Describe the processes involved in the recycling of matter in the oxygen/carbon dioxide cycles
DOK			**a – 1, b – 1**

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			
	Sixth	**Seventh**	**Eighth**
A **Evidence for the nature and rates of evolution can be found in anatomical and molecular characteristics of organisms and in the fossil record**	*Scope and Sequence – Ecosystems and Populations* 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		
DOK	**a – 2**		
B **Reproduction is essential to the continuation of every species**	Not assessed at this level		
DOK			
C **Natural selection is the process of sorting individuals based on their ability to survive and reproduce within their ecosystem**	*Scope and Sequence – Ecosystems and Populations* 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		
DOK	**a – 2, b – 3**		

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			
	Sixth	**Seventh**	**Eighth**
A **The Earth's crust is composed of various materials, including soil, minerals, and rocks, with characteristic properties**	*Scope and Sequence – Earth's Resources* 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)		*Scope and Sequence – Rock Cycle and Plate Tectonics* 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
DOK	**a – 2**		**a – 2, b – 1, c – 1, d – 2**
B **The hydrosphere is composed of water (a material with unique properties), gases, and other materials**	*Scope and Sequence – Earth's Resources* a. Identify and describe 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)		
DOK	**a – 2**		
C **The atmosphere (air) is composed of a mixture of gases, including water vapor, and minute particles**		*Scope and Sequence – Weather and Climate* 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	
DOK		**a – 2, b – 2**	

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			
	Sixth	**Seventh**	**Eighth**
D	Not assessed at this level		
Climate is a description of average weather conditions in a given area over time			
DOK			

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			
	Sixth	**Seventh**	**Eighth**
A **The Earth's materials and surface features are changed through a variety of external processes**	*Scope and Sequence – Internal Processes and External Events* 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		
DOK	**a – 3, b – 2, c – 2, d – 2**		
B **There are internal processes and sources of energy within the geosphere that cause changes in Earth's crustal plates**	*Scope and Sequence – Internal Processes and External Events* a. Identify events (earthquakes, volcanic eruptions) and the landforms created by them on the Earth's surface that occur at different plate boundaries		*Scope and Sequence – Rock Cycle and Plate Tectonics* 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
DOK	**a – 2**		**a – 2, b – 2, c – 1**

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 -- Continued			
Concept	**Sixth**	**Seventh**	**Eighth**
C **Continual changes in Earth's materials and surface that result from internal and external processes are described by the rock cycle**			*Scope and Sequence – Rock Cycle and Plate Tectonics* 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)
DOK			**a – 2, b – 2, c – 2**
D **Changes in the Earth over time can be inferred through rock and fossil evidence**	*Scope and Sequence – Internal Processes and external Events* 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)		*Scope and Sequence – Rock Cycle and Plate Tectonics* 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)
DOK	**a – 2, b – 3**		**a – 1, b – 2**

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 -- Continued			
Concept	**Sixth**	**Seventh**	**Eighth**
E **Changes in the form of water as it moves through Earth's systems are described as the water cycle**		*Scope and Sequence – Weather and Climate* 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	
DOK		**a – 2, b – 2, c – 2**	

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 -- Continued			
Concept	**Sixth**	**Seventh**	**Eighth**
F **Climate is a description of average weather conditions in a given area due to the transfer of energy and matter through Earth's systems**		*Scope and Sequence – Weather and Climate* 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. Describe 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. Describe the significant changes in temperature and barometric pressure may cause dramatic weather phenomena (i.e., severe thunderstorms, tornadoes, hurricanes) g. Differentiate between weather and climate. h. Identify factors that affect climate (e.g., latitude, altitude, prevailing wind currents, amount of solar radiation)	
DOK		**a – 2, b – 2, c – 1, d – 1, e – 3, f – 1, g – 2, h – 1**	

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			
	Sixth	**Seventh**	**Eighth**
A **Earth's materials are limited natural resources affected by human activity**	*Scope and Sequence – Earth's Resources* 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 *Scope and Sequence – Internal Processes and External Events* 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) and propose possible solutions	*Scope and Sequence – Energy Transformations* a. Distinguish between renewable (e.g., geothermal, hydroelectric) and nonrenewable (e.g., fossil fuel) energy sources *Scope and Sequence – Weather and Climate* b. Provide examples of how the availability of fresh water for humans and other living organisms is dependent upon the water cycle	
DOK	**a – 2, b – 2, c – 3**	**a – 1, b – 2**	

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

1. The universe has observable properties and structure			
	Sixth	**Seventh**	**Eighth**
A **The Earth, Sun, and Moon are part of a larger system that includes other planets and smaller celestial bodies**		*Scope and Sequence – Objects and Their Motion in the Solar System* 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. Describe 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	
DOK		**a – 2, b – 2, c – 1**	
B **The Earth has a composition and location suitable to sustain life**		*Scope and Sequence – Objects and Their Motion in the Solar System* 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	
DOK		**a – 2, b – 2**	
C **Most of the information we know about the universe comes from the electromagnetic spectrum**		*Scope and Sequence – Objects and Their Motion in the Solar System* a. Explain that 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	
DOK		**a – 1, b – 2**	

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			
	Sixth	**Seventh**	**Eighth**
A **The apparent position of the Sun and other stars, as seen from Earth, change in observable patterns**		*Scope and Sequence – Objects and Their Motion in the Solar System* 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. Describe how, in the Northern Hemisphere, the Sun appears lower in the sky during the winter and higher in the sky during the summer d. Describe how, 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. Describe how the Sun is never directly overhead when observed from North America	
DOK		**a – 2, b – 1, c – 1, d – 1, e – 1**	

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 -- Continued			
	Sixth	**Seventh**	**Eighth**
B **The apparent position of the Moon, as seen from Earth, and its actual position relative to Earth change in observable patterns**		*Scope and Sequence – Objects and Their Motion in the Solar System* 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. Describe how the Moon rises later each day due to its revolution around the Earth in a counterclockwise direction c. Describe how 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. Describe how 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)	
DOK		**a – 2, b – 1, c – 1, d – 1, e – 2, f – 1**	

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 -- Continued			
	Sixth	**Seventh**	**Eighth**
C **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**		*Scope and Sequence – Objects and Their Motion in the Solar System* 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. Recognize and explain the phases of the moon are due to the relative positions of the Moon with respect to the Earth and Sun f. 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	
DOK		**a – 1, b – 1, c – 1, d – 2, e – 2, f – 2**	
D **Gravity is a force of attraction between objects in the solar system that governs their motion**		*Scope and Sequence – Objects and Their Motion in the Solar System* 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	
DOK		**a – 1, b – 1, c – 1**	

Strand 7: Scientific Inquiry

1. Science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning, and critical thinking			
	Sixth	**Seventh**	**Eighth**
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**	*Scope and Sequence - All Units* a. Formulate testable questions and hypotheses b. Identify and describe 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)	*Scope and Sequence - All Units* a. Formulate testable questions and hypotheses b. Identify and describe 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	*Scope and Sequence - All Units* a. Formulate testable questions and hypotheses b. Identify and describe 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
DOK	**a – 2, b – 2, c – 4, d – 3, e – 2**	**a – 2, b – 2, c – 4, d – 3, e – 2, f – 1**	**a – 2, b – 2, c – 4, d – 3, e – 2, f – 1**

Strand 7: Scientific Inquiry

1. Science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning, and critical thinking -- Continued			
	Sixth	**Seventh**	**Eighth**
B **Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations**	*Scope and Sequence - All Units* 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	*Scope and Sequence - All Units* 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	*Scope and Sequence - All Units* 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
DOK	**a – 1, b – 2, c – 1, d – 1, e – 2, f – 3**	**a – 1, b – 2, c – 1, d – 1, e – 2, f – 3, g – 1**	**a – 1, b – 2, c – 1, d – 1, e – 2, f – 3, g – 1**

Strand 7: Scientific Inquiry

1. Science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning, and critical thinking--Continued			
	Sixth	**Seventh**	**Eighth**
C **Scientific inquiry includes evaluation of explanations (laws/principles, theories/models) in light of evidence (data) and scientific principles (understandings)**	*Scope and Sequence - All Units* 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. Determine the possible effects of errors in observations, measurements, and calculations on the formulation of explanations (conclusions) d. Evaluate the reasonableness of an explanation (conclusion) e. Analyze whether evidence (data) and scientific principles support proposed explanations (hypotheses, laws, theories)	*Scope and Sequence - All Units* 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. Determine the possible effects of errors in observations, measurements, and calculations on the formulation of explanations (conclusions)) d. Evaluate the reasonableness of an explanation (conclusion) e. Analyze whether evidence (data) and scientific principles support proposed explanations (hypotheses, laws, theories)	*Scope and Sequence - All Units* 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. Determine the possible effects of errors in observations, measurements, and calculations on the formulation of explanations (conclusions d. Evaluate the reasonableness of an explanation (conclusion) e. Analyze whether evidence (data) and scientific principles support proposed explanations (hypotheses, laws, theories)
DOK	**a – 2, b – 2, c – 2, d – 3, e -2**	**a – 2, b – 2, c – 2, d – 3, e -2**	**a – 2, b – 2, c – 2, d – 3, e -2**
D **The nature of science relies upon communication of results and justification of explanations**	*Scope and Sequence - All Units* 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	*Scope and Sequence - All Units* 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	*Scope and Sequence - All Units* 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
DOK	**a – 2**	**a – 2**	**a – 2**

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			
	Sixth	**Seventh**	**Eighth**
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**	*Scope and Sequence - All Units* 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)		
DOK	**a – 2**	**a – 2**	**a – 2**
B **Advances in technology often result in improved data collection and an increase in scientific information**	*Scope and Sequence - All Units* 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)		
DOK	**a – 2**	**a – 2**	**a – 2**
C **Technological solutions to problems often have drawbacks as well as benefits**	*Scope and Sequence - All Units* 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)		
DOK	**a – 2**	**a – 2**	**a – 2**

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			
	Sixth	**Seventh**	**Eighth**
A **People of different gender and ethnicity have contributed to scientific discoveries and the invention of technological innovations**	*Scope and Sequence - All Units* 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)		
DOK	**a – 2**	**a – 2**	**a – 2**
B **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**	*Scope and Sequence - All Units* a. Describe 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) b. Describe explanations have changed over time as a result of new evidence		
DOK	**a – 2, b – 2**	**a – 2, b – 2**	**a – 2, b – 2**

Strand 8: Impact of Science, Technology and Human Activity

3. Science and technology affect, and are affected by, society			
	Sixth	**Seventh**	**Eighth**
A	Not assessed at this level		
People, alone or in groups, are always making discoveries about nature and inventing new ways to solve problems and get work done			
DOK			
B	*Scope and Sequence - All Units*		
Social, political, economic, ethical and environmental factors strongly influence, and are influenced by, the direction of progress of science and technology	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) 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)		
DOK	**a – 2, b – 3**	**a – 2, b – 3**	**a – 2, b – 3**
C	Not assessed at this level		
Scientific ethics require that scientists must not knowingly subject people or the community to health or property risks without their knowledge and consent			
DOK			
D	Not assessed at this level		
Scientific information is presented through a number of credible sources, but is at times influenced in such a way to become non-credible			
DOK			