Grade 4 science GLEs

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
   A. Objects, and the materials they are made of, have properties that can be used to describe and classify them
      Scope and Sequence – Mixtures and Solutions
      a. Describe and compare the masses (the amount of matter in an object) 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. Identify situations where 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 “like” substances (materials that have specific physical properties) or mixtures of substances by using their characteristic properties
      Note that NAEP acknowledges the confusion between mass and weight and does not expect students to differentiate between the two (accepting either mass/weight interchangeably) until after grade 4

   B. Properties of mixtures depend upon the concentrations, properties, and interactions of particles
      Scope and Sequence – Mixtures and Solutions/ Changes on the Earth’s Surface
      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/solution (e.g., trail mix, conglomerate rock, salad, soil, salt water)
      d. Describe ways to separate the components of a mixture/solution by their properties (i.e., sorting, filtration, magnets, screening)

   I. Mass is conserved during any physical or chemical change
      Scope and Sequence – Mixtures and Solutions
      a. Observe that the total mass of a material remains constant whether it is together, in parts, or in a different state

2. Energy has a source, can be stored, and can be transferred but is conserved within a system
   A. Forms of energy have a source, a means of transfer (work and heat), and a receiver
      Scope and Sequence – Forms of Energy: Electrical Circuits
      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)
      b. Observe and describe the evidence of energy transfer in a closed series circuit (e.g., lit bulb, moving motor, fan)
      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)

   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 – Forms of Energy: Electrical Circuits
      a. Identify the evidence of energy transformations (temperature change, light, sound, motion, and magnetic effects) that occur in electrical circuits

Grade 4 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
   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 – Laws of Motion
      a. Classify different types of motion [straight line, curved, vibrating (back and forth)]
      b. Describe an object’s motion in terms of distance and time
2. Forces affect motion
   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
   Scope and Sequence – Laws of Motion
   a. Identify the forces acting on the motion of objects traveling in a straight line (specify that forces should be acting in the same line as the motion, provide examples)
   b. Describe and compare forces (measured by a spring scale in Newton’s) applied to objects in a single line.
   c. Observe and identify friction as a force that slows down or stops a moving object that is touching another object or surface
   d. Compare the forces (measured by a spring scale in Newton’s) required to overcome friction when an object moves over different surfaces (i.e., rough/smooth)
   B. Every object exerts a gravitational force on every other object
   Scope and Sequence – Laws of Motion
   a. Determine the gravitational pull of the Earth on an object (weight) using a spring scale
   D. Newton’s Laws of Motion explain the interaction of mass and forces, and are used to predict changes in motion
   Scope and Sequence – Laws of Motion
   a. Observe that balanced forces do not affect an object’s motion (need to clarify that balanced forces means no change in forces acting on an object)
   b. Describe how unbalanced forces acting on an object changes its speed (faster/slower), direction of motion, or both (need to clarify that unbalanced forces means any change in forces acting on an object)
   c. 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
   Energy: Electrical Circuits
   d. Predict the effects of an electrostatic force (static electricity) on the motion of objects (attract or repel)

Grade 4 Strand 3: Characteristics and Interactions of Living Organisms

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

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
   1. Organisms are interdependent with one another and with their environment
   Scope and Sequence: Interactions Among Organisms and Their Environment
   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. Identify and describe different environments (i.e. pond, forest, prairie) support the life of different types of plants and animals
   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 – Interactions among Organisms and their Environment
   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 green space)

2. Matter and energy flow through an ecosystem
   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 – Interactions among Organisms and their Environment
   a. Classify populations of organisms as producers and consumers by the role they serve in the ecosystem
   b. Differentiate between the types of consumers (herbivore, carnivore, omnivore, and detritivore/decomposer)
   c. Categorize organisms as predator or prey in a given ecosystem
3. Genetic variation sorted by the natural selection process explains evidence of biological evolution

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 – Change’s in the Earth’s Surface
a. Compare and contrast common fossils found in Missouri (i.e., trilobites, ferns, crinoids, gastropods, bivalves, fish, mastodons) to organisms present on Earth today

C. Natural selection is the process of sorting individuals based on their ability to survive and reproduce within their ecosystem

Scope and Sequence – Interactions among Organisms and their Environment
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. Identify 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.

Grade 4 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

A. The Earth’s crust is composed of various materials, including soil, minerals, and rocks, with characteristic properties

Scope and Sequence – Changes in the Earth’s Surface
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

C. The atmosphere (air) is composed of a mixture of gases, including water vapor, and minute particles

2. Earth’s systems (geosphere, atmosphere, and hydrosphere) interact with one another as they undergo change by common processes

A. The Earth’s materials and surface features are changed through a variety of external processes

Scope and Sequence - Changes in the Earth’s Surface
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/bodies of water on Earth (i.e., mountains, plains, 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/ bodies of water

d. Describe how erosion 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/ bodies of water

e. Relate the type of landform/water body to the process by which it was formed
3. Human activity is dependent upon and affects Earth’s resources and systems
   A. Earth’s materials are limited natural resource’s affected by human activity
   Scope and Sequence – Changes in the Earth’s Surface
   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)
   b. Propose ways to solve simple environmental problems (e.g., recycling, composting, ways to decrease soil erosion)
      that result from human activity

   Grade 4 Strand 6: Composition and Structure of the Universe and the Motion of the Objects Within It

   Grade 4 Strand 7: Scientific Inquiry

   1. Science understanding is developed through the use of science process skills, scientific knowledge,
      scientific investigation, reasoning, and critical thinking
   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 explanations (hypotheses)
   b. Recognize the characteristics of a fair and unbiased test
   c. Conduct a fair test to answer a question
   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. 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, force/weight to the nearest Newton
   d. Compare amounts/measurements
   e. Judge whether measurements and computation of quantities are reasonable
   C. Scientific inquiry includes evaluation of explanations (laws/principles, theories/models) in light of evidence (data)
      and scientific principles (understandings)
   See CLEs: This concept became C, as the previous concept was eliminated and the GLEs were moved to this
      concept, and redundancy was eliminated
   Scope and Sequence - All Units
   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
   c. Evaluate the reasonableness of an explanation
   d. Analyze whether evidence supports proposed explanations
   D. The nature of science relies upon communication of results and justification of explanations
   See CLEs: This concept became D, as the original C concept was eliminated
   Scope and Sequence - All Units
   a. Communicate the procedures and results of investigations and explanations through:
      ⇒ oral presentations
      ⇒ drawings and maps
      ⇒ data tables
      ⇒ graphs (bar, single line, pictograph)
      ⇒ writings
Grade 4 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
   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 – Forms of Energy: Electrical Circuits
      a. Design and construct an electrical device, 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
      Scope and Sequence – Mixtures and Solutions/Forms of Energy: Electrical Circuits
      a. Describe how new technologies have helped scientists make better observations and measurements for investigations (e.g., telescopes, magnifiers, balances, microscopes, computers, stethoscopes, thermometers)
   C. Technological solutions to problems often have drawbacks as well as benefits
      Scope and Sequence – Forms of Energy: Electrical Circuits/Laws of Motion/Interactions among Organisms and Their Environments
      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)

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
   A. People of different gender and ethnicity have contributed to scientific discoveries and the invention of technological innovations
      Scope and Sequence – All units
      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)
   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
      not assessed at this level

3. Science and technology affect, and are affected by, society
   A. People, alone or in groups, are always making discoveries about nature and inventing new ways to solve problems and get work done
      Scope and Sequence - All Units
      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)
      b. Work with a group to solve a problem, giving due credit to the ideas and contributions of each group member (Assess Locally)